

Revised Forest Management Guide for Conserving Biodiversity
at the Stand and Site Scales

DRAFT

NOTE TO READER:

For ease of navigating this document, you can open the navigation pane by clicking on the bookmark icon (🔖) in Adobe.

To facilitate your review of this draft revised guide, a change and rationale (C&R) document is provided which directly follows the guide in this document. You can click on the '(rationale)' link for a specific piece of direction in the draft revised guide and it will automatically locate you to the associated rationale for that piece of direction in the C&R document. Pressing Alt + Left Arrow will return you to the draft revised guide.

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EXECUTIVE SUMMARY

The Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (the Stand and Site Guide) is one of a series of guides used by forest managers when planning and implementing operations involving harvest, renewal, tending, or the construction and use of roads, and landings on crown land in Ontario. The overall objective of this guide is to contribute to the sustainable management of Crown forests through the maintenance of their long-term health. A key aspect of this objective is the conservation of biodiversity.

The stand and site guide uses a combination of coarse and fine filters (with consideration for adverse impacts on other values, silvicultural limitations, and efficiency of implementation) to address the conservation of biodiversity. Coarse filters create a diversity of ecosystem conditions through space and time, based on the concept of emulating natural patterns and processes, to provide habitat for the majority of native species of plants and animals. Fine filters are applied when the ecological requirements of a particular species or value may not be adequately addressed by coarse filters alone, or when societal and/or economic aspects of sustainable development require more or less habitat than coarse filters alone would provide.

Both coarse and fine filter direction is based on a strong foundation of scientific knowledge and operational experience. The best available information was compiled from thorough review of relevant literature and discussions with experienced researchers and practitioners. This information, and how it was used in the development of the guide, is summarized in a companion document (Background and Rationale for Direction). Where information was incomplete and/or ambiguous, a conservative approach was taken through judicious application of the precautionary principle. The direction in the guide can be thought of as an informed hypothesis. Direction associated with a high degree of uncertainty is identified as a high priority for testing within an effectiveness monitoring program that is an integral part of an adaptive management framework.

Direction is provided as a standard, guideline, or best management practice. Standards are mandatory and must be followed as written. Guidelines are also mandatory but enable professional judgement and/or local knowledge to implement. Best management practices may also be provided. These practices are not mandatory, however, implementation is generally considered to help achieve the overall objectives of the associated standard and/or guideline.

The direction applies to a wide variety of forest management operations including harvest, renewal, tending, and access. The bulk of the direction is applied during operational planning and/or implementation with some notable linkages to strategic decision making.

Sections 1 and 2 provide an introduction to the guide, an explanation of the relationship between this guide and other forest management guides, and a description of how this

guide will be implemented over the coming years. Section 3 provides coarse and fine filter direction that addresses habitat composition and pattern at stand to multi-stand scales. Section 4 addresses site-specific values that require fine filter direction to mitigate potentially adverse effects of regular forest operations. Aquatic, wetland and shoreline forest values, special habitat features, and habitat for species at risk, are addressed through the development of operational prescriptions and conditions for areas of concern or conditions on operations. Section 5 addresses the construction of access roads and water crossings, soil and productive forest conservation, and the spread of invasive species. Section 6 provides applicable direction for salvage and biofibre harvests. Section 7 describes the Ministry's approach to effectiveness monitoring.

SOMMAIRE

Le Guide de gestion forestière pour la conservation de la biodiversité à l'échelle du peuplement et du site (le Guide sur les peuplements et les sites) fait partie d'une série de guides utilisés par les gestionnaires forestiers lors de la planification et de la mise en œuvre d'activités de récolte, de renouvellement, d'entretien ou de construction et d'utilisation de routes et de débarquements sur les terres de la Couronne en Ontario. L'objectif général de ce guide est de contribuer à la gestion durable des forêts de la Couronne par le maintien de leur santé à long terme. Un aspect clé de cet objectif est la conservation de la biodiversité.

Le Guide sur les peuplements et les sites fait appel à une combinaison de filtres « grossiers » et « fins » (en tenant compte des effets négatifs sur d'autres valeurs, des limites sylvicoles et de l'efficacité de la mise en œuvre) pour aborder la conservation de la biodiversité. Fondés sur le concept d'imitation de modèles et de processus naturels, les filtres grossiers font ressortir une diversité de conditions écosystémiques afin de fournir un habitat à la majorité des espèces indigènes de plantes et d'animaux. Quant aux filtres fins, ils sont appliqués lorsque les besoins écologiques d'une espèce ou d'une valeur particulière ne peuvent pas être satisfaits adéquatement par les filtres grossiers seuls, ou lorsque les aspects sociétaux et/ou économiques du développement durable nécessitent plus ou moins d'habitat que les filtres « grossiers » seuls fourniraient.

Les approches de filtrage grossier et de filtrage fin reposent sur une solide base de connaissances scientifiques et d'expérience opérationnelle. Les meilleurs renseignements disponibles ont été compilés à partir d'un examen approfondi de la littérature pertinente et de discussions avec des chercheurs et des praticiens expérimentés. Ces renseignements et la façon dont ils ont été utilisés dans l'élaboration du guide sont résumés dans un document d'accompagnement (renseignements généraux et justification concernant l'orientation). Lorsque les renseignements étaient incomplets ou ambigus, une approche prudente a été adoptée en appliquant judicieusement le principe de précaution. L'orientation du guide peut être considérée comme une hypothèse éclairée. L'orientation associée à un degré élevé d'incertitude est considérée comme une priorité élevée pour la mise à l'essai dans le cadre d'un programme de surveillance de l'efficacité qui fait partie intégrante d'un cadre de gestion adaptative.

L'orientation est fournie à titre de norme, de ligne directrice ou de pratique de gestion exemplaire. Les normes sont obligatoires et elles doivent être suivies telles qu'elles sont rédigées. Les lignes directrices sont également obligatoires, mais elles permettent d'exercer un jugement professionnel ou de mettre en œuvre des connaissances locales. Des pratiques de gestion exemplaires peuvent aussi être fournies. Ces pratiques ne sont pas obligatoires, mais nous recommandons de les mettre en œuvre comme une façon d'aider à atteindre les objectifs généraux de la norme ou des lignes directrices connexes.

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L'orientation s'applique à une grande variété d'activités de gestion forestière, y compris la récolte, le renouvellement, l'entretien et l'accès. La majeure partie de l'orientation est appliquée lors de la planification ou de la mise en œuvre des activités et elle est étroitement liée à la prise de décisions stratégiques.

Les sections 1 et 2 fournissent une introduction au guide, une explication de la relation entre ce guide et d'autres guides de gestion forestière et une description de la façon dont ce guide sera mis en œuvre au cours des prochaines années. La section 3 fournit des approches de filtrage grossier et de filtrage fin qui traitent de la composition et du modèle de l'habitat à l'échelle du peuplement et de plusieurs peuplements. La section 4 traite des valeurs propres au site qui nécessitent une approche de filtrage fin pour atténuer les effets potentiellement négatifs des opérations forestières régulières. Les valeurs des forêts aquatiques, humides et riveraines, les caractéristiques particulières de l'habitat et l'habitat des espèces en péril sont prises en compte au moyen de prescriptions et de conditions opérationnelles élaborées pour les secteurs préoccupants ou les conditions d'exploitation. La section 5 traite de la construction de routes d'accès et de franchissements de cours d'eau, de la conservation des sols et des forêts productives et de la propagation des espèces envahissantes. La section 6 présente des orientations applicables aux récoltes de récupération et de biofibres. La section 7 décrit l'approche du Ministère en matière de surveillance de l'efficacité.

1.0 INTRODUCTION

1.1 Purpose of the Stand and Site Guide

The Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (the stand and site guide) is one of a series of forest management guides used by forest managers when planning and implementing forest management operations. In order to protect or enhance environmental, recreational, and cultural heritage values, the series of guides provides direction to assist forest managers to decide. For example, what areas of forest to harvest (and equally important, what areas not to harvest), how large the harvest areas should be, and what harvesting and regeneration practices to use. Consistent with the *Crown Forest Sustainability Act, 1994* (CFSA), the overall objective of this guide is to contribute to the sustainable management of Crown forests through the maintenance of their long-term health. A key aspect of this objective is the conservation of biodiversity. Conservation has been defined as the maintenance of the Earth's resources that sustain ecosystem, species and genetic diversity and the processes that sustain them which may or may not involve the sustainable use of biological resources (Ontario Biodiversity Council 2011). The purpose of the stand and site guide is to provide direction on planning and conducting forest operations at the stand and site level (i.e., 10s of m² to 100s of km²), so that forest biodiversity will be conserved and Ontario's forests will remain healthy and sustainable. The Forest Management Guide for Boreal Landscapes and the Forest Management Guide for Great Lakes-St. Lawrence Landscapes (the Landscape Guides) provide direction on conserving biodiversity, and hence sustaining forest health, at the landscape scale (i.e., 10,000s of km²).

These two guides are linked, both philosophically and literally within the text of each guide. The Landscape Guides (and the Stand and Site Guide to some extent) are applied at the beginning of the forest management planning process and helps planning teams set the strategic direction for the entire forest management unit, in the context of surrounding forest management units. This strategic direction provides the background when planning teams develop operations specific to the forest management unit, through the implementation of the stand and site guide.

As with all forest management guides, the mandate of this document is limited to the managed forest within Crown lands in Ontario. The direction provided may also be helpful when managing other Crown forests outside of the managed forest area and private forest lands. ([rationale](#))

1.2 Content of the Stand and Site Guide

1.2.1 Organization

Section 1 describes the organization of the guide, defines commonly used terms, describes the Ministry's broad approach to the conservation of biodiversity and an

overview of the guide's legislative and policy context, climate change considerations, pilot testing and socio-economic impact analysis.

Section 2 provides an explanation of the relationship between this guide and other forest management guides, and how this guide will be implemented over the coming years.

Section 3 serves as the link to the Landscape Guides, beginning where the Landscape Guides end and dealing with management considerations at the stand, multi-stand, and meso-landscape scales. Specific details include consideration of coarse filters (Section 3.2) and fine filters (Section 3.3). The coarse filter direction builds on concepts introduced in the Landscape Guides, most notably, that the diversity of habitats required by a broad range of species can be produced by manipulating composition, pattern, and structure. Section 3 also describes how the coarse filter provides, or needs to be modified to provide (fine filters), habitat for species including white-tailed deer, moose, and other species of special interest.

Section 4 addresses site-specific values and important ecological features that require fine filter direction to mitigate potentially adverse effects of regular forest operations. This direction often requires the development of operational prescriptions and conditions to be implemented within an area of concern (AOC), or conditions on operations. Aquatic, wetland, and shoreline forest values are addressed in Section 4.1. Other special habitats (e.g., bird nests, dens) are included in Section 4.2, and species at risk are discussed in Section 4.3.

Section 5 discusses the construction of access roads and water crossings (Section 5.1), soil and productive forest conservation (including rutting, soil compaction, erosion, nutrient loss, and loss of productive forest area) (Section 5.2), and the spread of invasive species (Section 5.3).

Where recent natural disturbance areas will be harvested, Section 6.1 provides applicable direction for salvage operations. Restrictions on biofibre harvesting are addressed in Section 6.2.

Section 7 discusses the Ministry's approach to monitoring the effectiveness of the Stand and Site Guide, a requirement of the Forest Operations and Silviculture Manual, which sets out the procedures for the evaluation of forest management in Ontario.

A number of appendices provide further detail or an explanation of the concepts or directions included in Sections 3 to 6. A glossary of selected terms used in this document is included.

A separate document (Background and Rationale for Direction) provides the scientific background and rationale supporting the standards, guidelines, and best management practices. This document is available in electronic format at <https://www.ontario.ca/page/forest-management-guides>. ([rationale](#))

1.2.2. Direction characterization

In this guide, direction is provided as a standard, guideline, or best management practice. Standards are mandatory direction and must be followed as written; there is no flexibility for interpretation on the part of guide users. Guidelines are also mandatory direction (i.e., must be followed) that may require professional judgement and/or local or Indigenous knowledge, within the constraints set out in the guideline, to be applied appropriately at the local level. For some direction, best management practices are also provided. These practices are not mandatory (i.e., there is no requirement to use any of the best management practices), however, implementation may help to achieve the overall objectives of the associated standard(s) and/or guideline(s).

When incorporating standards, guidelines, or best management practices into operational prescriptions and conditions for areas of concern (AOCs) or conditions on operations, planning teams may choose alternative wording to improve clarity and ensure effective and efficient implementation based on local circumstances, as long as the full intent of the direction will be achieved. Proposed alterations will be developed in consultation with the Ministry.

In some cases, guidelines include words or phrases such as ‘normally’, ‘with Ministry notification’, ‘with Ministry approval’ or ‘unless approved by the Ministry’, and ‘extraordinary circumstances’, to reflect the authors’ appreciation that situations may be encountered when the guideline cannot be implemented exactly as written. The word ‘normally’ is used to indicate that the authors believe the guideline can be applied in the vast majority of situations. In some cases, flexibility is incorporated into a guideline by permitting activities in an operational prescription or condition for an AOC or a condition on operations to be undertaken with Ministry notification or approval. This provides the opportunity for local Ministry and forest licensee staff to develop local solutions for specific activities that would otherwise be considered as a deviation from direction. In rare occasions, deviation from direction may be unforeseeable and unavoidable. These situations may be considered extraordinary circumstances and the operational prescription or condition for an AOC or a CRO may be amended to permit a prohibited activity and not be considered an exception to this guide.

The requirement for Ministry notification versus approval is based on the potential risk of implementing the activity in question on the individual identified value or important ecological feature. For example, activities associated with operational prescriptions or conditions in an AOC or conditions on operations in a forest management plan (FMP) for a species at risk require Ministry approval. The procedure for implementing activities requiring Ministry notification or approval in operational prescriptions or conditions in an AOC or conditions on operations in the FMP can be found in Appendix 1b.

The extraordinary circumstances clause is explained in the glossary and is to be interpreted as instructions, and not intended to be copied directly from the guide into an

FMP. Where such a limited form of variation is permitted, the variation must not result in operations that would be inconsistent with the objective of the guideline as stated.

[\(rationale\)](#)

1.2.3. Exceptions

Direction in the approved forest management guides is used during the development of FMPs as required by the *Forest Management Planning Manual* (FMPM). Situations may arise in which planning teams may wish to deviate from a specific standard or guideline (i.e., operational prescription or condition for an area of concern, condition on operations for an important ecological feature). This deviation from specific direction will be considered an exception and documented as such in the FMP. Details of the exception need to:

- Minimize the degree of deviation from the standard or guideline
- Include measures to minimize or mitigate potential adverse effects on the value or feature in modified activities in a prescription and/or conditions for an AOC, or conditions on operations that deviate from direction in this guide
- Be agreed upon by the sustainable forest licensee and the Ministry

Inclusion of an exception in an FMP requires the development of an exceptions monitoring program as per the FMPM. This program will monitor the effectiveness of the operational prescription or condition for an area of concern or condition on operations for an important ecological feature that differs from that in the guide. The details of the monitoring program are normally customized to the nature of the exception, the degree of deviation from the standard or guideline, and the specific reason and/or circumstances that lead to exception being included. When developing an exceptions monitoring program, consider the following:

- What is the question that needs to be answered, and will the planned monitoring program answer that question?
- Can the monitoring results contribute to informing the review and/or revision of current guide direction?
- What role can standard monitoring (e.g., compliance) play?
- Is anyone else investigating a similar question?

Timing of operations occurring as part of the exception may be imminent (e.g., values encountered during active forest operations). In these cases, the Ministry will work with the sustainable forest licensee to finalize the exceptions monitoring program within a reasonable timeframe so as not to unduly delay operations.

Unless part of a larger, more comprehensive regional or provincial-based exceptions monitoring program initiated and undertaken by the Ministry, monitoring programs undertaken by individual sustainable forest licensees will normally have inadequate sample sizes to support a statistically valid design and analyses. However, in the interest of active adaptive management, results of the monitoring program and

associated reporting are intended to indicate to the Ministry whether a more rigorous evaluation may be required to inform the review and revision of direction in this guide.

Sustainable forest licensees are encouraged to seek partnerships with the science community (e.g., government, academia, research institutes) when developing exceptions monitoring program strategies and assessment methodologies. They are also encouraged to consult with local Ministry staff and the guide leads with the Ministry's Forest Management Policy Section, as they may be aware of past or existing monitoring programs that have been established to answer a similar question.[\(rationale\)](#)

1.3 Conserving forest biodiversity

1.3.1 The coarse and fine filters

There are hundreds of species of vertebrates in the boreal and Great Lakes - St. Lawrence forest regions of Ontario (see Holloway et al. 2004) and invertebrate species are likely to number in the tens of thousands. Thus, a species-by-species approach to the provision of wildlife habitat and the conservation of biodiversity is impossible in the context of forest management. However, this might be achieved through the hierarchical application of standards and guidelines that is judiciously selected to act as coarse and fine filters.

The concept of coarse and fine filters was popularized by Hunter (1990) and is illustrated in Figure 1a. In order to manage Ontario's forests to reflect society's ecological, social, and economic expectations, Ontario relies on a nested coarse and fine filter approach to meet wildlife habitat needs and provide healthy forests (see Hunter 1990 and Naylor 1998). The Stand and Site Guide builds upon this approach. The coarse filter component creates a diversity of ecosystem conditions through space and time, in turn providing habitat for the majority of native species. A series of fine filters is then used, if necessary, to modify the results of applying the coarse filter. A fine filter may be required for one of two reasons: 1) the societal and/or economic aspects of sustainable development require more or less habitat than would be provided by nature, or 2) the ecological requirements of a particular species or value are not addressed or accommodated sufficiently through application of the coarse filter alone, in some cases because the proposed actions cannot completely mimic natural events. The extent to which the first type of fine filter is applied will vary across the province, depending on local forest conditions and societal expectations. Both the coarse and fine filters are applied at all scales, from the landscape to the site level.

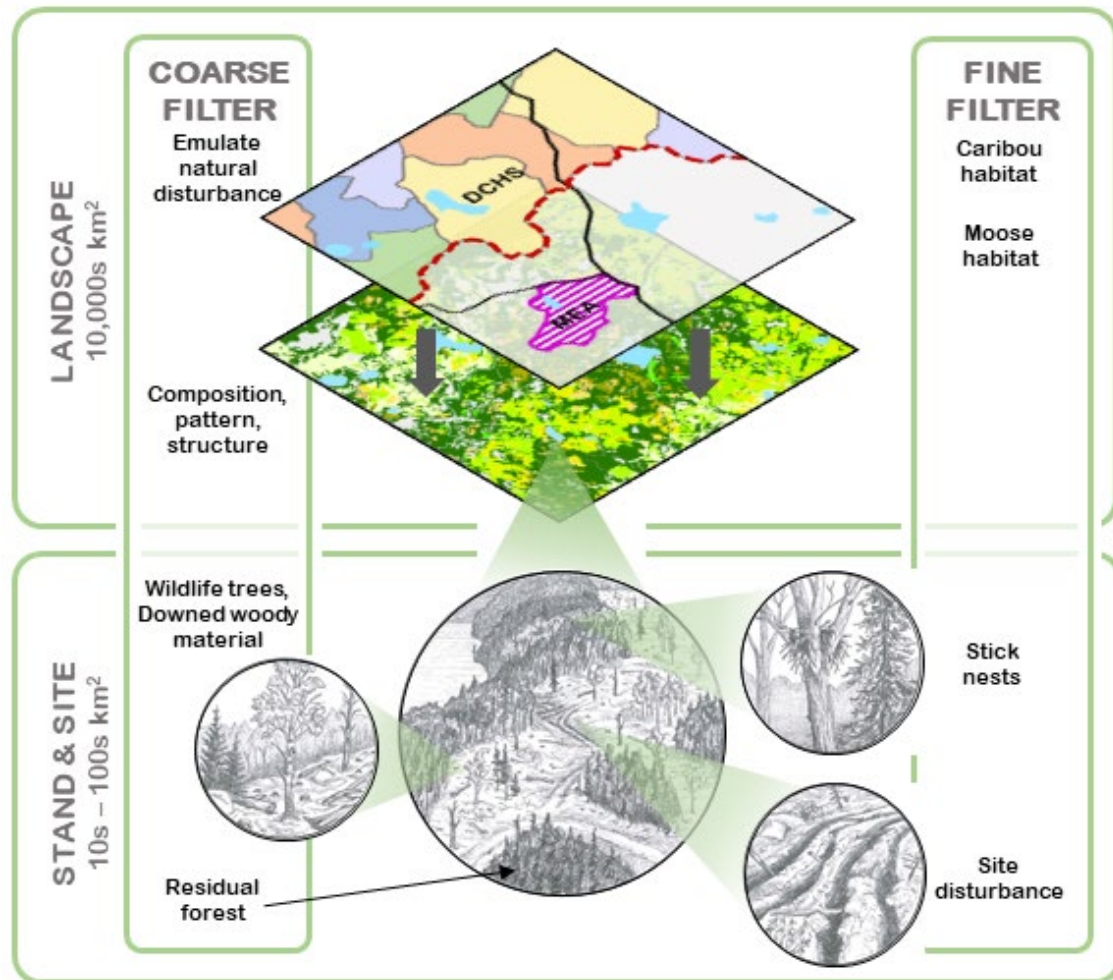


Figure 1a. A conceptual illustration showing the relationship between coarse and fine filters in habitat management. A coarse filter operates at a variety of spatial scales to: provide habitat for a very broad range of wildlife, support interactions among species, and facilitate ecosystem processes. A fine filter may be required for species whose needs are not captured by the coarse filter or to mitigate adverse effects. Biodiversity is most likely to be conserved by hierarchical application of both filters on the landscape. (Figure by Jodi Hall)

In designing a coarse filter, the most desirable mix of ecosystem conditions to include must be determined. One of the principles of the CFSA provides direction on what to consider as the coarse filter (i.e., a mix based on nature), as well as what fine filters to develop.

The long-term health and vigor of Crown forests should be provided for by using forest practices that, within the limits of silvicultural requirements, emulate natural disturbances and landscape patterns [coarse filter] while minimizing adverse effects on plant life, animal life, water, soil, air and social and economic values, including recreational values and heritage values [fine filters] (CFSA s. 2(3)2).

In Ontario, the emulation of natural disturbances and landscape patterns is used as the basis of the coarse filter. The many values that a forest provides, as identified in this principle (e.g., plant life, animal life, water, soil), are the topics of the series of fine filters.

The predominant natural disturbance in Ontario's boreal forest has been wildfire, while a combination of fire, wind, and insect outbreaks play a role in the development of the Great Lakes - St. Lawrence forest region. In the Landscape Guides, Ontario's forest landscape is designed through application of the coarse filter by addressing three key prescriptive indicators: pattern, composition, and structure. At this scale, only a few fine filters are applied to provide for or evaluate the landscape-scale habitat requirements of one or more species such as woodland caribou, white-tailed deer, and moose.

While the direction in the Stand and Site Guide is also based on the emulation of natural disturbances as the coarse filter, it contains many more fine filters that are used at the stand and site scales to address the forest conditions and habitat needs of a number of species as expected by society and directed by the CFSA.

The fine filter direction in this guide primarily addresses the habitat needs of individual species. This is not to suggest that habitat is the predominant or only limiting factor for these species. For instance, the guide also includes timing restrictions intended to minimize disturbance of animals during key phases of their life cycle. Other programs within the Ministry address factors that may influence the health and size of wildlife populations.

Furthermore, not all species require a fine filter to ensure their continued existence. For example, based on research, it is believed that southern flying squirrel habitat (mature tolerant hardwood forests) can be maintained by application of the coarse filter at the landscape scale. Applying the stand-scale coarse filter provides a sufficient quantity of cavity trees and mast trees without any further species-specific fine filter direction.

Similarly, the general habitat needs of moose can normally be addressed through the landscape-scale coarse filter, sufficiently maintaining moose populations at natural densities. Because of their value to society, however, and to help meet targets from other Ministry programs, moose may require fine filter direction at the stand scale to ensure that the correct type, amount, and quality of habitat (e.g., winter thermal cover, security cover) is available in the proper location.

Forest management does have some impacts and effects that do not occur in nature and these are also addressed through fine filters. For instance, rutting and soil compaction can occur during forest management operations on some sites in some conditions. They do not emulate a natural disturbance and cannot be prevented through the coarse filter. Fine filter direction, however, can be used to minimize or mitigate their impact on the forest ecosystem.

The coarse and fine filter approach to wildlife habitat management has existed for some time and has been implemented in most parts of Ontario. It is, however, quite different from the featured species approach used extensively in the past and it will take some time before all forest planners and operators are entirely familiar with it and understand it fully.

A list of the scientific name of species referred to in the Stand and Site Guide can be found in Appendix 1.2c. [\(rationale\)](#)

1.3.2 Learning from the past and preparing for the future

The Ministry uses an adaptive management framework to address uncertainty associated with how the natural world works and how our actions affect it. Adaptive management is an iterative cycle of continual improvement, where policy, developed based on the best available scientific information, is treated as hypotheses, and monitoring of the policy, as it is implemented, forms part of the evaluation of the hypotheses. This interface between science and policy forms the foundation of forest management guide development and testing. When required, guides are revised based on the new knowledge and lessons learned from implementation and evaluation, or from new science and technology.

Direction in the Stand and Site Guide is based on a thorough review of the relevant scientific literature, as well as the expert opinion of researchers and advice from practitioners, Indigenous communities, and stakeholders. When information is limited and/or opinions vary, the guide relies on the precautionary principle and conservative direction is prescribed. Direction with a high degree of uncertainty is identified as high priority for testing through an effectiveness monitoring program (see Section 7). The results of this monitoring program, along with other sources of information, will be used during periodic reviews of the Stand and Site Guide to help determine when the guide needs to be revised. [\(rationale\)](#)

1.4 Legislative and policy context

The overall context for forest management in Ontario is based on the Policy Framework for Sustainable Forests. The framework sets broad direction for forest policy and makes forest sustainability the primary objective of forest management.

The CFSA is the core legislation governing forest management on Crown land in Ontario. The CFSA defines sustainability as long-term Crown forest health, and reflects the broad direction set out in the Policy Framework for Sustainable Forests.

As noted in the discussion of coarse and fine filters in Section 1.3.1, the direction to emulate natural disturbances and landscape patterns is based on one of the principles of the CFSA. The CFSA also requires the development and distribution of four regulated

manuals, two of which give legal context to the forest management guides. The FMPM requires that forest management guides be used during the preparation of an FMP. Similarly, the *Forest Operations and Silviculture Manual* (FOSM) lists the various policies, including the forest management guides, that relate to forest operations on Crown land.

For purposes of monitoring compliance, it is important to realize that the approved FMP is the legal instrument against which forest operations are assessed. What occurs on the ground is assessed against what is written in the approved FMP, not what is found in the Stand and Site Guide. Therefore, the FMPM requires that direction in this guide that is relevant to specific locations and operations is incorporated into the appropriate products of the FMP.

The FOSM describes the approach to effectiveness monitoring for approved forest management guides, the continuation of scientific studies to assess the effectiveness of the guides and identify areas of critical uncertainty, and the maintenance of the Provincial Forest Technical Committee that acts as a review board for the content of, and changes to, forest management guides. The FOSM requires that forest management guides be reviewed at least once every ten years and, when necessary, revised reflecting up-to-date scientific, practitioner, Indigenous, and stakeholder knowledge, as well as advances in technology and operational practices. Additionally, the FOSM requires that the most recent versions of forest management guides be posted on a publicly accessible website.

The Ministry is required to provide opportunities for public review of draft forest management guides on the Environmental Registry of Ontario under the *Environmental Bill of Rights Registry, 1994* (EBR).

There is also other provincial and federal legislation that must be followed during forest operations. Only those that are most relevant to the direction in this guide will be mentioned in the remainder of this section. These pieces of legislation form part of the rationale behind the development of the specific direction in this guide. If there are inconsistencies or gaps between federal or provincial legislation and the direction in the Stand and Site Guide, however, the legislation will always take precedence.

Direction for the protection of species at risk that are most likely to be encountered during, and adversely affected by, forest operations in Ontario is included in Section 4.3. A list of all species at risk (at time of guide development) is included in the Background and Rationale for Direction. The *Crown Forest Sustainability Act* was amended in 2020 to include Section 47.1, which excludes persons conducting forest operations in a Crown forest in accordance with an approved FMP from clause 9 (1) (a) and subsection 10 (1) of the *Endangered Species Act, 2007* (ESA)), provided they are conducted on behalf of the Crown or under the authority of a forest resource licence. The CFSA forest policy framework, including the associated forest manuals and guides, protects species

at risk. The Ministry will continue to incorporate species at risk direction into forest management guides, as appropriate, based on science and other information.

The provincial *Fish and Wildlife Conservation Act, 1997* contains requirements related to similar topics covered in various sections of this guide (e.g., the protection of bird nests and bear dens). The direction in this guide is not intended to replace or address all of the legal requirements of the *Fish and Wildlife Conservation Act, 1997*.

The *Occupational Health and Safety Act, 1979* must be followed by all employers and employees in Ontario. The section of this guide that is most relevant to this act is Section 3.2.3.1, relating to direction on retaining wildlife trees during harvest operations. Direction in this section focuses on the retention of wildlife trees that will normally not be a worker safety hazard as defined in the Act. However, given the variability in operating conditions across the province, forest workers must ultimately use their judgment to identify potential safety hazards and work in a manner that complies with the requirements of the Act.

The *Aggregate Resources Act, 1990* applies to the development and use of gravel pits and aggregate extraction. Restrictions on the construction and use of forestry aggregate pits and wood storage yards are described for site-specific values in Section 4 of this guide.

The federal *Fisheries Act, 1985* is addressed by direction covered in Section 4.1 (aquatic and wetland habitats and shoreline forests) and Section 5.1 (access roads and water crossings) of this guide.

The provisions of the *Invasive Species Act, 2015*, which regulates invasive species to prevent their introduction and spread and to support detection, control and eradication efforts, are addressed in Section 4.1.3 (wetlands), 4.3 (species at risk), and Section 5.3. (invasive species).

The topic of bird nest sites is covered in Section 4.2.2 and Section 4.3.7 and is designed to address the provisions of the federal *Migratory Birds Convention Act, 1994* and the provincial *Fish and Wildlife Conservation Act, 1997*.

The direction in this guide reflects the principles and concepts of various strategic policy documents, such as the government's Ontario Biodiversity Strategy and the Ministry's Naturally Resourceful strategic direction, Policy Framework for Sustainable Forests, and Integrated Science Action Plan.

This guide also incorporates considerations from other policy documents, to the extent appropriate, that represent advice to government. For example, the guide provides direction that addresses the stand and site level habitat objectives identified for forest-dwelling priority species in the draft Ontario Landbird Conservation Plans, developed for Bird Conservation Regions (BCR) 8 and 12 by Ontario Partners in Flight. The guide also requires that the submission, review, and approval of water crossings under the authority of the CFSA will comply with the requirements of the Ministry of Natural

Resources and Forestry/Fisheries and Oceans Canada Protocol for the Review and Approval of Forestry Water Crossings. [\(rationale\)](#)

1.5 Pilot testing

The FOSM requires that effectiveness and efficiency be applied as concepts to policy development, review, and revision. As part of the development of the revised Stand and Site Guide, pilot testing of some of the new or revised direction was undertaken. The objective of the pilot testing was to assess the effectiveness and efficiency in application of the new or revised direction prior to approval and implementation. Pilot testing of the draft revised guide ensured that some of the new or revised direction could be interpreted by forest practitioners, to develop operational prescriptions and conditions for areas of concern (AOC), and/or conditions on operations.

In addition to seeking the advice of experienced forest management planning professionals in the development of any new or revised direction, pilot testing exercises were undertaken to inform the direction development process and to improve the clarity of the direction.

Some initial pilot testing was conducted by the Ministry as part of the socio-economic impact analysis (see Section 1.6). New and revised descriptions and operational prescriptions for AOCs were interpreted and mapped using available inventories and mapping software. This process also included reclassifying the potential sensitivity of standing and flowing water features in accordance with the revised guide direction. Reclassification of these water layers was done by assigning revised potential sensitivities based on water feature attributes generated by the water classification tool (e.g., water features classified as “streams-small” from the water classification tool output would be classified as low potential sensitivity under the revised guide direction).

Application and assessment of the draft revised rutting coverage direction for selection and shelterwood silviculture systems, and commercial thinning was pilot tested in the Nipissing and French-Severn Forests for both effectiveness and practicality of field application. The revised direction was changed from an areal to a distance-based coverage approach to better facilitate assessment for compliance. The original distance-based assessment for quantifying rutting coverage considered (maximum 200 m of ruts for 300 m of extraction trail) was tested in heavily rutted hardwood shelterwood harvest blocks where rutting coverage was deemed to be not acceptable. It was determined that this assessment (200 m in 300 m) would not be effective because it resulted in the coverage of rutting not exceeding the threshold limit. It was also difficult to assess a contiguous segment of extraction trail using this assessment. Issues with this proposed original assessment were identified and corrected by establishing a threshold length of rutted extraction trail for a given area (900 m in 20 ha). A pilot testing exercise of the alternative distance-based assessment determined that this threshold would be more

effective at limiting unacceptable site damage during operations and could be used to track rutting as operations progressed. ([rationale](#))

1.6 Socio-economic impact analysis

The FOSM requires that the Ministry consider economic impacts in the development, review, and revision of the forest management guides to ensure they achieve their objectives without unnecessary burden (restrictions, workload). Prior to the approval of this direction, a socio-economic impact analysis was undertaken. The analysis was intended to quantify changes in wood supply and wood costs to the forest industry associated with the new or revised direction, compared to the baseline existing direction.

While the socio-economic analysis focused on wood supply and wood costs to the forest industry, the socio-economic implications to other forest users were considered throughout the development of the direction. Similarly, other factors such as reduction of the land base and operational restrictions were addressed through creating effective, yet efficient, direction. Impacts on other sectors of the economy are also considered as part of the larger forest management planning process.

Socio-economic impacts were explored for new or revised direction in this guide anticipated to potentially have a significant impact on wood supply and/or wood costs (e.g., AOCs for standing and flowing waters, bird nest sites, and species at risk). A detailed spatial analysis was conducted on five management units (Algoma Forest, Bancroft-Minden Forest, Boundary Waters Forest, French-Severn Forest, and Trout Lake Forest) in the managed forest.

The results of the analysis suggested that, compared to the baseline current guide direction, the new or revised direction will result in an overall minor positive impact on wood supply (e.g., increased available harvest area) and wood costs (e.g., reduced FMP production and operational costs) for the forest industry. Changes to AOC prescriptions for flowing water features resulted in the most significant potential increase in wood supply. Based on the analysis of the Boundary Waters Forest, the revised classification of potential sensitivity of streams resulted in estimated 15% reduction in area subject to water-related AOC operational prescriptions (modified operations and reserves). Permitting clearcut harvest to shore along one side of some streams is also anticipated to result in a potential modest increase in available harvest area. Reduced AOC dimensions for some bird nest sites and species at risk should also result in a small increase in available harvest area and operational flexibility. This increase would be slightly offset by proposed increased AOC dimensions for four species at risk, however, known occurrences of these species in the managed forest are very rare. New fine filter direction for nine species at risk will reduce available harvest area and operational flexibility (e.g., overlapping seasonal timing restrictions).

Reduced new branch road and existing road use restrictions in some bird nest site and species at risk AOCs, simplified bird nest classification, and removal of the requirement for an Environmental Impact Study for provincially significant wetlands, are anticipated to result in potentially reduced wood costs (by reducing FMP production and road construction costs) and increased operational flexibility. These cost reductions would be slightly offset by new fine filter direction for high-risk self-sustaining trout lakes and conditions on road construction in wetlands (e.g., potential additional cross drainage infrastructure), which are anticipated to increase road planning, construction, and access control costs.

It is acknowledged that the socio-economic analysis undertaken for this guide did not include/account for new values found and reported by forest industry and the Ministry and thus is not able to fully assess the potential socio-economic implications of the new or revised direction in this guide. ([rationale](#))

1.7 Climate change considerations

1.7.1 Climate change and impacts on Ontario's forests

Ontario's climate has changed and is projected to continue to change at a more rapid rate during this century than has been observed in the past. Ontario's annual mean temperature has increased by 1.3°C from 1948 to 2016 and annual precipitation has increased by 9.7% between 1948 and 2012 (Bush and Lemmen 2019). The online data portal <https://climatedata.ca/> provides future climate projections (based on shared socio-economic pathway (SSP) scenarios used in the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report (AR6)) and historical climate data at spatial scales appropriate for regional-level analysis across the province. Annual mean temperature and precipitation are predicted to continue to increase spanning the range of available emission scenarios from low (RCP 2.6 corresponding to SSP1-2.6) to medium (RCP4.5 corresponding to SSP2-4.5) to high (RCP 8.5 corresponding to SSP5-8.5) emission scenarios (see projections in Bush and Lemmen 2019 and McDermid et al 2015). Additionally, a warmer climate is projected to increase the frequency and intensity of some weather extremes across Ontario (Bush and Lemmen 2019, Notaro et al 2014, Burnett et al 2003).

A changing climate may significantly affect the functioning and productivity of terrestrial ecosystems by introducing southern competitors, pathogens, and invasive species, altering phenology and physiology, and acting synergistically with other processes including habitat fragmentation and natural disturbances (Varrin et al 2007, Columbo 2008, Nituch and Bowman 2013). Additionally, climate change may potentially impact the functioning and productivity of aquatic ecosystems by altering hydrological cycles as a result of changes in air and water temperature, frequency and amount of precipitation, evaporation rates, and ice and snow cover levels (Dove-Thompson et al 2011, Chu 2015). However, the magnitude and nature of potential impacts of climate change is

difficult to predict due to the variable responses of and complex interactions between organisms at multiple scales in forests (Lawler et al 2010).

1.7.2 Addressing climate change in the Stand and Site Guide

Healthy, resilient forests are best able to resist and adapt to climate change impacts (Millar et al 2007, Thompson et al 2009). Resilience is the ability of ecosystems to persist and recover from disturbance by maintaining their structure and function (Holling 1973). Ontario's sustainable forest management framework has been designed to ensure a healthy, and therefore, resilient forest. Paramount to that framework is the CFSA that directs the conservation of large, healthy, diverse and productive Crown forests and their associated ecological processes and biological diversity. Building from this foundation, the forest management guides, which are required to be used by each planning team when they develop an FMP, describe in more detail the objectives (e.g., diverse range of forest types and ages) and practices (e.g., conserve soil and water resources) that are consistent with a healthy, resilient forest. Our current benchmark for comparison will continue to be the primary forest state created by natural disturbance. If evidence is presented suggesting an alternate forest condition that is more resistant and/or resilient to climate change, the benchmark may change.

The objective of the forest management guides that address biodiversity (i.e., Landscape and Stand and Site Guides) is to maintain or enhance biodiversity and biodiversity is generally expected to be at a level consistent with a historic natural disturbance driven ecosystem. Because there is sufficient evidence supporting an accelerated rate of climate change, which may have implications on applying direction in these guides, there is an expectation that it will be addressed.

Direction in the Stand and Site Guide continues to be consistent with the concept that maintaining and enhancing biodiversity at multiple scales will support the delivery of ecosystem goods and services, and/or maintain ecosystem resilience in the face of stresses such as climate change (Fischer et al 2006, Thompson et al 2009, 2011, Thompson 2011, Mace et al 2012). Subject experts support the guide's underlying coarse filter approach (based on the principle of emulating natural disturbance) in maintaining ecosystem resilience and resistance, and thus adapting to the anticipated stresses associated with climate change. Additionally, sustainably managed forests play an important role in mitigating climate change by sequestering and storing carbon within soils, forest biomass, and long-lived wood products. Direction that aims to sustain forest ecosystem biodiversity, health, and productivity in this guide supports maintaining or enhancing the forest carbon sink, which may offset fossil fuel emissions if net primary productivity (e.g., vegetation renewal and growth) exceeds decomposition (e.g., decay, disturbance, soil respiration). However, direct impacts of the direction in this guide on the sequestration and storage of carbon in Ontario forests are likely immeasurable.

While the Stand and Site Guide has adopted an approach that supports ecosystem resilience to climate impacts, it has also taken climate change adaptation into account.

Examples of where specific direction in this guide has integrated flexibility to be adaptive to future climate conditions include:

- Deer and moose may be affected by climate change either directly through changes in health and/or behaviour or indirectly through changes in habitat, food supply, and/or predation. The direction for winter cover in deer winter concentration areas (Section 3.3.1) differentiates between mild and severe winter cover, and requirements for access cover have been simplified considering predicted reductions in snow cover as a result of climate change. Given potential stresses associated with climate change (e.g., heat stress) on moose, the guide provides direction on optimal distance-to-cover, patch size, and composition for summer thermal cover, and proximity of moose aquatic feeding areas to summer thermal cover in moose emphasis areas.
- Forecasted impacts of climate change may alter aquatic ecosystems across the managed forest; habitat for cold water species is expected to be most significantly (adversely) affected (Minns et al 2009, Dove-Thompson et al 2011, Chu and Fisher 2012, Chu 2015, Lynch et al 2016). Consistent with the concept of maintaining ecosystem resistance and resilience to help address climate change (Millar et al 2007, Thompson et al 2009, Rist and Moen 2013), direction in this guide (Section 4.1) continues to promote the management of shoreline areas to maintain habitat diversity and complexity, including creation of some early successional shoreline forest for beavers (beaver activity may help mitigate some adverse effects of climate change on aquatic systems; see Hood and Bayley 2008). However, since climate change projections suggest significant effects on water temperature and the supply of coldwater habitats, efforts to further emulate natural patterns of disturbance along streams (with subsequent temporary removal of shade-producing tree cover) must be done in a manner that does not exacerbate predicted increases in thermal stress (see Section 4.1.2). In addition, cold groundwater inputs associated with hydrological connections may become increasingly important in providing critical thermal refugia in cold water streams if water temperatures rise as predicted. Thus, enhanced direction for hydrological connections (see Section 4.1.4) may also assist in mitigating effects of climate change.
- Potential changes in precipitation and water surface temperatures associated with climate change are likely to impact fish species distribution, assemblages, phenology, abundance, growth, recruitment, and genetics (Dove Thompson et al 2011, Alofs et al 2014, Lynch et al 2016). Climate change induced increases in water temperature may influence the timing of fish spawning (Harrod 2016, Sparks et al 2019). Thus, timing restrictions for in-water work to protect fish and fish habitat in this guide enable adjustment of dates based on local knowledge of timing of fish reproductive periods.
- Projected climate change may shift habitat suitability at the landscape scale. Travel and dispersal corridors at the stand and site scale enable movement of

wildlife and provide for seasonal migration, reproduction, feeding, and cover and facilitate persistence and post-disturbance recolonization of plant species. Corridors can also promote the movement of individuals between different populations, increasing gene flow. Direction for maintaining habitat suitability of shoreline forest in Section 4.1 focuses on retaining some shoreline forest as travel and dispersal corridors.

- Climate change projections suggest more evapotranspiration and less snow fall which may result in future drying of wetlands and reduced hydroperiod in woodland pools. Direction for non-forested wetlands and woodland pools (Section 4.1.3) ensures operations maintain hydrological flow within and/or adjacent to these aquatic features and avoid interrupting surface and groundwater inputs. Furthermore, continued management of shoreline forest for beavers may help offset some of the forecasted effects of climate change on wetlands.
- Direction for bird nest sites (Section 4.2.2) frequently includes restrictions on operations during specific time periods (e.g., the critical breeding period). The most recent nest record data has been used to refine (if necessary) the critical breeding period to reflect changes in nesting behaviour because of climate change. Furthermore, because the chronology of life history events may vary across the managed forest and may change through time because of changing climate, direction specifies that local knowledge may be used to adjust these dates.
- The potential for increased occurrence of freeze/thaw, mid-winter thaw, and extreme precipitation events may require the implementation of practices to maintain road functional and environmental performance. The direction for road construction and maintenance (Section 5.1.1) includes best management practices (e.g., water management in winter, increased road surface and cross drainage) that will facilitate adaptation to the potential risks of climate change on new and existing resource roads and infrastructure.
- Climate change predictions suggest milder winters, which may result in more harvesting during unfrozen conditions. The guide recommends strategies and techniques, that help to minimize the potential for site disturbance in these conditions.
- Given that the frequency of wildfire and wind disturbances is expected to increase with climate change, the guide provides direction on how to salvage harvest naturally disturbed stands (Section 6.1) with due ecological considerations at the stand and site scales.

To address the uncertainty of these adaptation options for the non-stationary conditions likely to be created by a changing climate, the guide has adopted an adaptive

management approach. The implementation of developed direction is monitored and management strategies and policies are potentially altered to address ongoing and predicted changes. The Ministry undertakes a program of effectiveness monitoring for the Stand and Site Guide to ensure that the direction is effective. The Ministry also considered the latest science during the reviews of Stand and Site Guide, including climate change research. The Ministry continues to improve its understanding of climate change and its effect on Ontario's Crown forests working with other agencies and partners on research studies and sharing information. As a component of the guide review process, direction has been and may continue to be adapted to reflect this improved understanding over time to ensure the long-term health of Ontario's Crown forests.

1.7.3 Direction flexibility to address climate change

The challenge in developing guide direction that is responsive to climate change for Ontario's Crown forests is that there is little consensus as to the magnitude of the effect that climate change will have. Furthermore, as with most ecosystems, it is unlikely that this uncertainty will be resolved anytime soon (Schindler and Hilborn 2015). Accepting and incorporating this uncertainty in the guide is achieved by adding sufficient flexibility to enable practitioners to adapt their practices to unanticipated outcomes of climate change (see also Millar et al 2007, Joyce et al 2009, Lawler et al 2010, Messier et al 2016).

To adapt to unforeseen conditions or potential issues associated with climate change, deviation from specific standards or guidelines associated with an area of concern or conditions on operations for an important ecological value may be permitted provided:

- The deviation from the specific direction is identified as an exception in the FMP and exceptions monitoring is undertaken as per the FMPM (see Section 1.2.3)
- Appropriate rigour is used in determining the need to deviate from the direction and predicting the potential impact of the deviation ([rationale](#))

1.8 Ministry's Statement of Environmental Values

In 2020, the Ministry revised its Statement of Environmental Values under the Environmental Bill of Rights. The Statement of Environmental Values is a document that describes how the purposes of the Environmental Bill of Rights are to be considered whenever decisions that might significantly affect the environment are made by the Ministry. The Ministry has considered its Statement of Environmental Values during the development of the Stand and Site Guide. This document is intended to reflect the direction set out in the Statement of Environmental Values and to further the objectives of managing Ontario's natural resources on a sustainable basis. ([rationale](#))

2.0 INTEGRATION AND IMPLEMENTATION

2.1 Integration

The Stand and Site Guide is part of a series of forest management guides that collectively direct sustainable forest management practices. It is necessary to consider the direction in the other guides while implementing this guide. This is particularly valid for the Landscape Guides. In general, the Landscape Guides provide direction to assist with strategic objective setting for a forest management plan; it also provides context for the Stand and Site Guide, which addresses more operational topics. For some topics, however, the implementation of these two guides during forest management planning requires a more iterative approach.

For instance, the identification of some forest values and the steps required to protect or enhance them (as described in Section 4) provides important context for the most effective implementation of the Landscape Guide (i.e., identification and placement of large landscape patches (LLPs)) and Section 3 of the Stand and Site Guide. Similarly, transition from strategic to operational planning is facilitated in Section 3 of this guide by using the same terminology introduced in the Landscape Guides. Links between these two guides are included within the text of each document.

The Stand and Site Guide also contains references to information provided in the *Silviculture Guide* and the *Ontario Tree Marking Guide*; the *Forest Management Guide for Cultural Heritage Values*; and the *Management Guidelines for Forestry and Resource-based Tourism* - the remaining three forest management guides used during forest management planning. With respect to the *Silviculture Guide*, the implementation of the direction in this guide in a particular location may need to consider the planned silviculture treatment(s) for that same area. This is most likely to occur when implementing a guideline in which professional expertise and local circumstances will determine exactly how the requirement will be met or deciding whether to follow one or more of the best management practices. ([rationale](#))

2.2 Implementation

The Stand and Site Guide must be used in the preparation of ten-year forest management plans beginning with plans that come into effect on or after April 1, 2029 in accordance with the requirements of the FMPM.

Planning teams may choose to amend their current FMPs to incorporate any or all of the new or revised direction in this guide as it reflects the latest scientific and technological knowledge. The decision to incorporate this guide direction or continue to follow the direction used when the plan was originally written will be made locally to reflect the circumstances, scale, and reason for the proposed amendment.

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Contingency plans that come into effect on or after April 1, 2029 will be prepared in accordance with this guide.

Where direction in this guide overlaps with direction in the current Silviculture Guide or tree marking guide (e.g., wildlife tree and cavity tree retention), this guide takes precedence. The direction in this guide reflects more recent scientific findings, current knowledge of sustainable forest management, and the direction in other more recent guides (e.g., Landscape Guides). ([rationale](#))

3.0 CONSERVING BIODIVERSITY – Management at the stand, multi-stand, and meso-landscape scales

3.1 Introduction and linkage to landscape-level direction

The goal of Section 3 is to provide direction that conserves biodiversity at all spatial scales. The direction is complimentary in that this is one of many sources of direction related to the achievement of this goal.

As described in Section 1, the coarse and fine filter approach forms the basis for conserving ecosystems and their related biodiversity. Application of the coarse and fine filter approach requires consideration of composition, structure, and function at a variety of spatial scales ranging from large landscapes (10,000s km²) to individual sites (10s m²). Although an individual piece of direction may be applied at a specific scale, it is difficult to assign the effect to a single scale. The aggregation of actions at the smallest scale affects achievement at the largest scale. Similarly, objectives for the largest scale provide important context for actions at the smallest scale.

The direction in this section is meant to provide context to, and nest within, strategic direction resulting from applying landscape level guides and objectives. In some cases (e.g., Section 3.3) the direction in this guide is only applied after a specific decision has been made at the landscape scale. While the direction in this guide has been integrated into landscape scale direction (e.g., scale of pattern assessment), it is critical that the practitioner maintain this integrative thinking in all decision making. Integrative thinking requires silviculture prescription decision making in the context of landscape objectives for each forest type (i.e., what is the forest level target for hardwood, mixedwood, and conifer), the contribution of previous treated sites to these targets, and the amount and characteristics of remaining sites where similar decisions are yet to be made. A lack of integrative thinking, particularly during operational implementation (e.g., silviculture decision-making), could easily lead to decisions at stand or site scale that limit or even preclude achievement at the landscape scale.

Section 3 includes direction related to the composition, structure, and function of forested ecosystems. Composition refers to the different elements, or groups of elements, represented in an ecosystem, and their relative abundance. Structure is driven by the composition, the arrangement, and the proportion of different elements. Function refers to how each element in the ecosystem interacts based on its life-cycle events. Section 3.2 addresses composition and structure (including pattern), while Section 3.3 provides fine filter direction related to function as wildlife habitat. ([rationale](#))

3.2 Applying the Coarse Filter

3.2.1 Composition

To be able to describe the composition of an ecosystem it is necessary to develop classes, or groupings, of various elements. For forested ecosystems, a very coarse classification might be land and water. A slightly finer classification might be forested land, non-forested land, wetlands, and open water.

The Landscape Guides provide direction based on a classification defined by forest type (i.e., species and associations), age, and the combination of the two. Age is based on ecosystem development stages (e.g., Holloway et al 2004) and forest type is based on aggregations of forest units. A forest unit is a classification system that aggregates forest stands for management purposes that will normally have similar species composition, will develop in a similar manner (both naturally and in response to silviculture treatments), and will be managed under the same silviculture system. Forest stands are an aggregation of trees occupying a specific area that are sufficiently uniform in species, age, and arrangement to be distinguishable from an adjacent aggregation of trees.

The composition indicators in the Landscape Guides are at an appropriate resolution for planning composition at the strategic landscape scale and will generally provide for the conservation of all common forest types. At the stand and site scale, there may be uncommon forest types that are not well represented by the forest unit classification, and thus require individual consideration. As well, the diversity of species within a forest unit may change over time while the overall forest unit area stays within the desired range. A change in species diversity within a forest unit, or a reduction in area by forest type, is not necessarily negative if the trend is in a desirable direction. The desirable direction is based on strategic decisions (e.g., increase white pine in mixedwood forest types). The following direction is intended to complement landscape level direction by addressing composition at a finer resolution. ([rationale](#))

Direction

Standards

- When developing management direction, develop an objective and desired level for each individual forest unit. The sum of desired levels for all forest units will be consistent with any grouped composition targets (e.g., upland conifer). ([rationale](#))

Guidelines

- Where there is not a strategic decision to do otherwise, select harvest, renewal, and tending treatments that maintain existing tree species diversity at the forest unit level. ([rationale](#))
- Develop conditions on operations to maintain S1, S2, and S3 Natural Heritage Information Centre vegetation communities, Significant Ecological Areas, or rare

vegetation communities identified by the Ministry, which are likely to occur in areas of planned operations. A list of any rare vegetation communities will be provided by the Ministry prior to completion of the management direction.
[\(rationale\)](#)

Best management practices

- Develop strategies to maintain or move average species composition by forest unit in a desirable direction. For example:
 - Consider the effect of typical silviculture prescriptions on future species composition and include that information in site-level prescription setting
 - Ensure the silvicultural ground rules include options to create the full range of observed/desirable species composition by forest unit
 - When selecting stands for harvest, ensure the average species composition of allocated stands does not deviate significantly from the forest unit average [\(rationale\)](#)
- Planning teams should consider developing operational prescriptions and conditions for an area of concern for rare vegetation communities that would be difficult for operators to identify, if their geographic location is known prior to operations commencing.

3.2.2 Pattern

Sections 3.2.2.2 and 3.3 provide stand level pattern direction to be applied when completing detailed harvest area planning and implementation. Detailed harvest area planning (i.e., cutblock design) includes determining the shape of the outer boundary and delineating or describing any areas within the harvest boundary where modified harvest or no harvest will occur. Included in this process is the identification of AOCs, which may influence the amount and location of harvested, unharvested, or modified harvest areas. Implementation is the actual cutting of trees where local decisions about where to harvest (or not) can be made within the confines of the harvest boundary and the prescription for the site.

The pattern direction to be applied to a specific harvest area depends on the management intent for the area and the silviculture system used. Direction in Section 3.3 will apply when an area with a species-specific emphasis has been identified (normally through development of the management direction). Section 3.2.2.2 applies where a species-specific emphasis has not been identified. Identification of any areas with species-specific emphasis is an iterative process involving application of both landscape-level direction and the direction in Section 3.3 of this guide. Areas where species-specific, fine filter direction is applied should only be chosen from candidate areas as described in the introductory paragraphs of Sections 3.3.1 and/or 3.3.2, and will be consistent with the management direction. [\(rationale\)](#)

3.2.2.1 Defining residual forest

Where stand-replacing wildfire is the predominant agent of natural disturbance (e.g., boreal forest), the post-fire environment is composed of a spatially complex array of burn intensities ranging from severely burnt to unburnt due to varying local conditions including fire behaviour, vegetation, and topography. The patches of undisturbed forest that remain within a wildfire perimeter are sometimes referred to as fire refugia, remnants, skips or biological legacies. However, the term residual forest is used in this guide.

To emulate natural disturbance pattern and forest age class heterogeneity, residual forest patches are retained during harvest operations to maintain the diversity of habitat for native plants and wildlife that depend on this mosaic of forest conditions. Stand replacing fire can enhance biodiversity by creating habitat for species that require early successional and open conditions. Conversely, forest residual patches provide habitat islands within a highly disturbed environment for forest-dwelling species that require conditions such as a continuous tree canopy, large diameter trees, standing and downed dead wood, and deep litter layers.

Residual forest is ecologically important in stand replacing disturbances because it supports the survival and local persistence of plants and animals during and immediately post-fire, as well as the recolonization (e.g., source of dispersal) of a disturbed area during the years and decades of post-fire recovery. Thus, the ecological functioning of residual forest continues long after the time of disturbance.

In the Great Lakes - St. Lawrence forest region, natural disturbance agents, such as ground fires, wind, ice, insects, and disease, create small-scale gaps in the overstory canopy. Harvesting attempts to emulate this relatively continuous, periodic gap phase condition by removing overstory trees individually or in small groups. This partial harvesting aims to maintain the continuous provision of habitat features associated with closed-canopy successional stages within managed stands for mature forest-dwelling plant and animal species.

To understand the various pieces of direction that refer to residual forest, it is important to understand the definition of residual forest and how it is used.

Conceptual definition:

Residual forest is a forested patch that generally functions more as habitat for wildlife that inhabit older forest than as habitat for wildlife that inhabit younger forest. The words older and younger are used in a relative sense. Residual forest is not synonymous with mature, old, or old growth forest. Residual forest can also include some immature (i.e., neither young nor old) forest. The Landscape Guides provides specific direction related to the pattern and amount of mature, old, and old growth forest.

Residual forest, as defined in this guide, is not to be confused with the common use of the term “residual” (e.g., residual stocking, residual basal area, residual tree spacing) to describe post-harvest retention objectives in partial harvest systems.

Quantifiable definition:

There are six quantifiable criteria used to assess residual forest. The criteria vary depending on the status of the stand being evaluated. For example, recently harvested stands and stands planned for harvest require a higher canopy closure than stands that have not been recently harvested or are of natural origin.

Table 3.2a. Quantifiable definition of residual forest (each of the six criteria must be met for a stand to be considered residual forest).

Stand criteria	Stand status		
	Not planned for harvest		Planned for harvest
	Natural origin or ≥20 yrs since harvest	Recent harvest (<20 yrs)	
1. Condition	Crown ¹ productive forest (Polytype = FOR and established/free-to-grow)		
2. Height/Age	≥10 m <u>or</u> ≥35 years		
3. Minimum size patch	0.1 ha		
4. Canopy closure	n/a	≥50% based on dominant/codominant trees	
5. Sub-stand pattern	n/a	Sub-stand pattern will resemble older forest with small gaps rather than mixture of discrete young and old forest patches. Ideally, space trees uniformly. However, moderate concentration to facilitate operations is acceptable. Refer to Figure 3.2a for conceptual portrayal of acceptable and unacceptable sub-stand patterns.	
6. Composition	n/a	n/a	Unless otherwise specified in FMP (e.g., SGR for harvest area, AOC prescription, conditions on regular operations), residual forest will normally have species composition and average stem diameter and quality similar to pre-harvest stand.

¹ Available and unavailable forest

The criteria above allow for the determination of whether an existing stand (unharvested or recently harvested or the result of a planned harvest) will meet the definition of residual forest. In the case of a planned harvest, these criteria do not determine if the planned prescription is silviculturally appropriate or will create a future forest condition that is consistent with broader composition objectives. Refer to the FMPM and

Silviculture Guide for further direction on acceptable treatments and applicability of silvicultural ground rules (SGR).

Canopy closure is used to define residual forest and desirable stand structure for many AOC operational prescriptions (Section 4) because it is a good reflection of habitat suitability for many forest-dwelling species of wildlife. However, canopy closure is generally more difficult to assess in the field than many standard mensurative parameters such as basal area. Thus, to assist in both implementation of the direction and compliance monitoring, planning teams may wish to develop locally-appropriate translations between canopy closure and more easily measured attributes of stand structure. For example, in marked selection or shelterwood harvests, canopy closure targets can be translated into a basal area prescription (e.g., a residual basal area of 16 m²/ha will produce a canopy closure of about 50% in a typical white pine regeneration cut). For unmarked partial harvests, canopy closure targets can be translated into a prescription outlining the spacing of trails and the intensity of stem removal between trails (e.g., in upland forests, 7 m wide machine trails spaced 30 m apart with removal of 1 in 4 stems within a boom's reach of the trail will normally produce a 50% canopy closure if initial stocking is $\geq 80\%$).

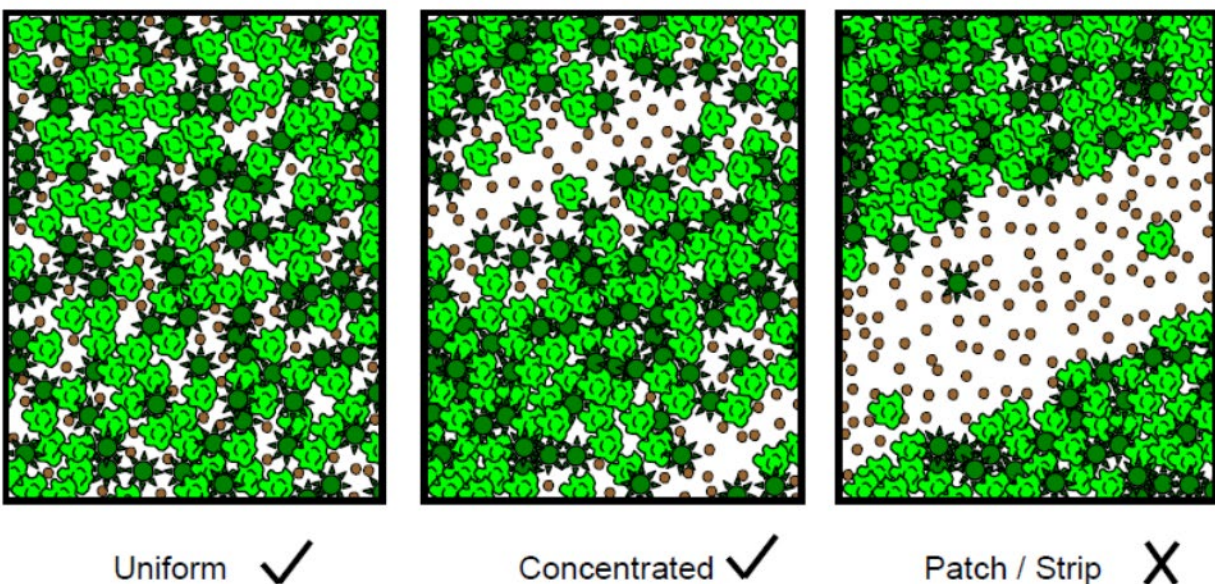


Figure 3.2a. Conceptual portrayal of acceptable (uniform and concentrated) and unacceptable (patch/strip) sub-stand patterns associated with residual forest (Note: This figure is not necessarily to scale and should not be construed as providing specific advice on maximum opening size or any other metric). [\(rationale\)](#)

3.2.2.2 Coarse filter pattern emulation and finalizing the harvest area boundary during operational planning

Although the process is more iterative than linear, this section is normally applied after the spatial delineation of AOCs for planned harvest areas. The goal of this section is to create a stand and multi-stand harvest pattern similar to that created by natural

disturbances and consistent with strategic objectives (including a natural landscape pattern). The zonal approach (e.g., 500 ha circle) is based on identifying natural pattern without requiring the arbitrary determination of a patch or disturbance boundary.

Direction

The standards and guidelines in this section only applies to areas harvested using the clearcut silviculture system. Clearcut harvest areas where the forest immediately following harvest is considered established and greater than 3 m in height are exempt. All stages of selection and shelterwood management are exempt. Where the inventory does not contain sufficient data to assess the applicability of these exemptions, verification will be required prior to completing the harvest.

Section 3.2.2.2 will be applied in areas where a species-specific emphasis has not been identified. When operating within a defined area with a species-specific emphasis (caribou mosaic, deer emphasis area, moose emphasis area, etc.) refer to the Landscape Guide and/or Section 3.3, for operational planning direction in these areas.

Implementation of the standards and guidelines in this section will be consistent with the achievement of biodiversity objectives. If implementation of any of the direction will compromise achievement of geographically specific (e.g., habitat) or broad landscape level (e.g., pattern) biodiversity objectives, the achievement of biodiversity objectives will take priority over this direction. Any required modification of this direction to ensure consistency with biodiversity objectives will be described in the FMP. The degree and geographic scope of modification will be limited to that required for consistency with biodiversity objectives.

The direction in this section will be implemented using regular FMP products (e.g., selection of harvest, renewal, and tending areas) and conditions on regular operations. ([rationale](#))

Conditions on regular operations

Guidelines

- Operational planning will normally follow stand boundaries and/or natural features. ([rationale](#))
- Operational planning will ensure that any point within a planned clearcut harvest area will have at least 25 ha of mapped residual forest within a 500 ha circle about that point.
 - Mapped residual forest includes;
 - Unallocated stands or portions of stands that meet the definition of residual forest
 - Stands or portions of stands scheduled for harvest that will retain residual forest

- Residual forest within AOCs associated with known values
 - Additional mapped residual forest that is required during operational planning will be preferentially retained so it is connected to the shoreline of a lake, pond, river, or stream that is within, or directly adjacent (i.e., <200 m) to, the planned harvest area with a preference for areas of hydrological connection between terrestrial and aquatic ecosystems (e.g., recognizable linear features that channel ephemeral surface and/or shallow groundwater flows to lakes, ponds, rivers, or streams). Otherwise, additional mapped residual may be connected to known values, located to encompass uncommon forest types, or located consistent with expected disturbance behavior.
 - A minimum of 5 ha of the mapped residual within any 500 ha circle will belong to a patch greater than 5 ha¹. ([rationale](#))
- Implementation of the harvest plan will ensure that any point within a new clearcut harvest area will have at least 0.5 ha of residual within a 50 ha circle about that point. Develop a condition on regular operations for areas where this residual is not mapped in advance. ([rationale](#))
- Mapped residual that is not serving any other purpose (e.g., AOC, specific habitat function), and would otherwise be available for harvest, can be moved during operational implementation provided;
 - The other standards and guidelines in this section are respected
 - The planned harvest area is not exceeded
 - The FMP (e.g., map, data product) specifically identifies those mapped residual polygons that are eligible for movement.
 - Appropriate conditions on regular operations are developed to facilitate movement

Movement of mapped residual that is identified in the FMP as movable will not normally require an amendment, revision, or special reporting. ([rationale](#))

¹ The 5 ha requirement can be satisfied by a single 5+ ha patch completely contained within the 500 ha assessment area, a single 5+ ha patch partially within the circle with at least 5 ha within the assessment area, or several 5+ ha patches partially within the 500 ha assessment area whose combined area within the assessment area is at least 5 ha. Refer to Appendix 3.2a for graphic examples.

Best management practices

- When measuring achievement of direction requiring a 50 ha or 500 ha moving window analysis, use a point spacing or grid cell size of no more than 50 m.
- When locating unmapped residual forest (i.e., 50 ha), give preference to locations connected to habitat features encountered during operations (e.g., bird nests, furbearer dens, woodland pools). When additional habitat features are not encountered, give preference to uncommon forest types, locations connected to

known values (e.g., water, nests), or located consistent with expected natural disturbance behaviour. ([rationale](#))

3.2.2.3 Catchment considerations

A catchment (e.g., watershed) is the area of land that drains water to a given point. The term catchment is somewhat vague as it could describe an area of a few hectares that drains into a small intermittent stream or several thousand km² that feeds a large river.

The removal of forest cover, by either a natural disturbance or as a result of forest management, has the potential to cause catchment scale hydrochemical effects such as changes in water yield and export of nutrients and other elements (e.g., Ca, NO₃, K, dissolved organic carbon (DOC), and associated metals such as Hg) by temporarily altering evapotranspiration, infiltration, overland flow, and sub-surface flow. The amount of cover removed, the pattern of removal, and the characteristics of the catchment can influence the magnitude of these effects and the subsequent response by the biological communities.

During the revision of this guide, careful consideration was given to catchment scale effects of forest management and the need for additional direction. The variability in catchment-scale effects of forest harvesting on the long-term depletion of calcium and short-term, post-disturbance export of mercury and inconclusive research documenting how forest management operations interact with other factors (e.g., catchment geology, topography, precipitation patterns, extended periods of drought, acid precipitation) make it difficult to quantitatively define generalized mitigation (if needed). Given the current understanding of these effects, the application of related coarse and fine filter direction (natural landscape pattern, minimizing site damage, retention of residual forest, protection of hydrological connections, etc.) is thought to adequately address catchment scale effects and therefore explicit catchment direction is not prescribed. This hypothesis will continue to be examined through guide effectiveness monitoring (Section 7) and is further explained in the Background and Rationale for Direction that accompanies this guide. ([rationale](#))

3.2.3 Structure

Section 3.2.3 provides direction related to the amount and distribution of wildlife trees (3.2.3.1) and downed woody material (3.2.3.2).

3.2.3.1 Wildlife trees

Following a fire or other natural disturbance (e.g., windstorm), or as a result of natural forest succession, a combination of live, dying, and dead trees provides structure and special habitat features for wildlife. The structures and special habitat features preferred by wildlife vary widely. Trees retained during forest operations, with the intent to provide structure and features beneficial to wildlife in general, and for specific species, groups or communities, are collectively referred to as wildlife trees. Wildlife trees can include

standing live, dying, or safe dead (including trees killed by stubbing, girdling or tending operations) trees.

Living wildlife trees retained during forest operations will typically be healthy, windfirm, and long-lived. Although, some living wildlife trees will fall shortly after harvest, it is anticipated that some of them will become sources of standing dead and downed wood in 20 to 40 years. Dying trees will visually be in decline and may exhibit:

- Dead branches
- Dead or discolored foliage
- Evidence of disease and/or internal decay (e.g., fungal conks)
- Significant damage to stem (e.g., large crack or seam)
- Recent excavation activity

Dying trees will provide potential cavity nesting and foraging substrates in the near future and are anticipated to become sources of standing dead and downed wood in 10 to 20 years.

Dead trees (including stubs) will be standing in various stages of decay to provide immediate potential cavity nesting and foraging trees. They can become sources of downed wood in 0 to 10 years or remain standing for some time if structural decay is delayed (e.g. reduced fungal metabolic activity due to reduced moisture content following death).

Standing dead or dying trees are sometimes referred to as snags (or snag trees). However, this term is not used in the Stand and Site Guide, except in the supporting documentation, because it is defined very differently in ecological and health and safety contexts.

While it is desirable to retain standing dead trees as wildlife trees, such trees will only be kept if it is deemed safe to do so. Trees that are lowered to the ground for safety considerations will not contribute to the achievement of wildlife tree direction.

Some wildlife trees have special significance including cavity trees, supercanopy trees, veteran trees, mast trees, scattered conifers, diversity trees, or stubs. Cavity trees, which can be living, dead or dying, have existing cavities in the trunk or on main limbs, or characteristics suggesting they may develop cavities in the near future (e.g., fungal conks). Supercanopy trees are large, living, individual trees that tower over the forest canopy. Veteran trees are living trees retained during all phases of forest operations that are likely to grow for at least part of another rotation and become future supercanopy trees. Living mast trees produce crops of acorns or other edible fruits. Scattered conifer trees in hardwood stands and scattered hardwood trees in conifer stands are of value to some wildlife for nesting, roosting and refuge. Diversity trees include tree species that are uncommon in a local area. Stubs are trees killed by cutting at least 3 m up the trunk. The portion of the tree above the stubbing cut is available for harvest.

A single wildlife tree with more than one special attribute can be counted towards achieving multiple pieces of direction. For example, a large oak tree could be identified and counted as a mast tree, a cavity tree, and a supercanopy tree, provided it has the appropriate characteristics. However, a wildlife tree with multiple special attributes only counts as one tree with respect to the numbers of wildlife trees required for retention (e.g., the 25 stems/ha requirement for white/red pine seed tree harvest).

Definitions and further information on each category and/or attribute of a wildlife tree used in the standards, guidelines, and best management practices are provided in the Background and Rationale for Direction, which includes illustrative examples of different types of wildlife trees. For additional information on identifying and choosing wildlife trees, refer to the *Ontario Tree Marking Guide*.

Direction

All wildlife trees must be ≥ 10 cm dbh and ≥ 3 m in height. The minimum dbh for 'large' wildlife trees is ≥ 25 cm (trees ≥ 38 cm dbh are preferred). The minimum dbh for cavity trees, mast trees, veteran trees, and scattered conifers is ≥ 25 cm (trees ≥ 38 cm dbh are preferred). However, mast trees as small as 10 cm dbh may be retained if only ironwood mast trees are available. Supercanopy trees will generally be ≥ 60 cm dbh.

Because the trees or stems desirable as wildlife trees may not always be present, all of the standards and guidelines in this section include the provision 'when available'. For example, in situations where the trees or stems available for retention are too small to meet the minimum size thresholds in the direction, trees or stems representing the largest diameters in any given harvest location will be used as a substitute.

To account for stubs, safe dead trees, trees that fork below breast height, and coppice growth, the direction often refers to wildlife trees as 'stems'. When ≥ 10 stems occur over an area < 0.1 ha this will be considered a clump and the stems will count for no more than 10 wildlife trees. This clumping rule does not apply when assessing the maximum allowable number of wildlife trees retained. In a clearcut harvest area, any uncut or partially cut area ≥ 0.1 ha that meets the definition of residual forest (3.2.2.2) will not contribute to individual wildlife tree requirements.

The direction as provided will be applied during any harvest operation (including commercial thinning) based on the dominant silviculture system in use and/or particular stage of management when harvesting the mature forest.

Much of the direction is presented in the context of retention of an 'average' number of wildlife trees. In this section, unless otherwise specified, the average number of wildlife trees, or specific type of wildlife trees, will be in reference to any given 10 ha area within an operational block where harvest has occurred, or for the entire operational block when the operational block is less than 10 ha. When following the direction in this section, note that the direction excludes the physical area taken up by roads, landings, and roadside work areas.

During operations, trees may be encountered that contain or are adjacent to transient habitat features (e.g., occupied bird nests). Such trees can be retained as wildlife trees. For further direction on bird nests, see Section 4.2.2.

Appendix 3.2b includes graphical examples of post-harvest stand structure created by application of the wildlife tree direction for the various silviculture systems and/or particular stage of management.

The direction in this section will be implemented using conditions on regular operations. [\(rationale\)](#)

i) Clearcut silviculture system

In the clearcut silviculture system, most of the overstory trees are removed over a short period of time to create a fully exposed microenvironment for the establishment of a new even-aged stand. Usually, this occurs as a 'one-pass' operation, but additional 'passes' can occur. Under the clearcut silviculture system, the direction pertaining to wildlife trees is applicable primarily during harvest operations.

In addition to a minimum density of wildlife trees, a maximum density of wildlife trees is prescribed for the clearcut silviculture system. The maximum number of wildlife trees direction builds upon that found in the Silviculture Guide related to quantity of post-harvest residual trees to be retained. Similar to the direction in the Silviculture Guide, the density of wildlife trees retained must not compromise the success of the prescribed silvicultural ground rule. In some cases, a silvicultural ground rule change may be required (and reported in the annual report in accordance with the FIM) between completion of harvest and establishment to reflect actual post-harvest conditions within the context of the relative shade tolerance of the target renewal species and the forest level composition objectives in the management direction for the management unit.

Conditions on regular operations

Standards

- Retain an average of ≥ 25 stems/ha. [\(rationale\)](#)

Guidelines

- Retain a relatively even mix of ≥ 10 (average) large living, dying, and safe dead trees (including large stubs)/ha with a minimum of 5 large living and/or dying trees/ha unless with Ministry approval (see Appendix 1b). Specifically:
 - Retain an average of ≥ 1 supercanopy tree/2 ha
 - Retain all reasonably identifiable large, living, hollow 'chimney' trees

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- Retain all reasonably identifiable living trees with pileated woodpecker nest or roost cavities
 - Focus remaining large tree retention on other cavity trees (living, dying, or safe dead), veteran trees, mast trees and diversity trees ([rationale](#))
- Wildlife trees that fall to the ground, or are purposely felled for worker safety reasons, will be retained on site to become downed woody material (see Section 3.2.3.2) unless with Ministry approval (see Appendix 1b). ([rationale](#))
- Retain an average of at least 10 well-dispersed, individual stems/ha: the remaining stems may occur in clumps. ([rationale](#))
- Large stems/stubs (i.e., ≥ 25 cm dbh) retained to meet wildlife tree requirements will not be knocked down during renewal and tending treatments unless required for safety reasons or unless approved by the Ministry (see Appendix 1b). ([rationale](#))
- The density of living wildlife trees for any given one hectare area, when composed predominantly of poplar and/or white birch, will not exceed:
 - 100 stems/ha > 15 cm dbh where any of the target species in the silviculture ground rule are very shade intolerant to shade intolerant (e.g., jack pine, poplar, red pine and white birch)
 - 150 stems/ha > 15 cm dbh where target species in the silviculture ground rule are moderately shade tolerant to shade tolerant (e.g., black spruce, white pine, yellow birch, red oak, eastern white cedar, white spruce) ([rationale](#))
- If intentional residual tree manipulation (e.g., felling unmarketable trees or tops at the stump) to achieve minimum post-harvest light requirements is acceptable in the approved FMP, it will be implemented in a way as to not impede future silviculture operations or compromise the ability of a site to achieve the regeneration standards associated with the assigned silvicultural ground rule. ([rationale](#))

Best management practices

- Avoid knocking down standing wildlife trees < 25 cm dbh during renewal and tending treatments. ([rationale](#))
- To the extent practical and feasible, 'stub' some wildlife trees:
 - i. to a height of ≥ 3 m (5 m is preferred);
 - ii. do not stub trees with existing cavities (however, it is acceptable to stub a tree with cavities below the stubbing height) or trees that provide other functions (e.g., veteran trees, dead trees, seed trees);
 - iii. all boreal tree species can be stubbed, but the preferred species are jack pine and black spruce; and

iv. stub up to 20 trees/ha in areas that are predominantly jack pine and/or black spruce. [\(rationale\)](#)

- To the extent practical and feasible, scatter stubs throughout clearcut. [\(rationale\)](#)
- Preferred species to retain as large trees are aspen, red oak, white pine, red pine, white spruce, hemlock, cedar, or any species that are uncommon in the local area, if consistent with silviculture objectives. [\(rationale\)](#)
- Large trees providing existing nesting or denning sites are preferred as cavity trees (see also the *Ontario Tree Marking Guide*). [\(rationale\)](#)
- Where practical and feasible, to minimize the potential for post-harvest blowdown of wildlife trees, operators are encouraged to consider windfirmness when leaving any tree:
 - Preferentially retain windfirm species which are generally ordered as:
 - Most windfirm: white pine, red pine, red oak
 - Moderately windfirm: cedar, red maple, white spruce, white birch, aspen, jack pine
 - Least windfirm: black spruce, balsam fir
 - Preferentially retain trees located on lower-middle slopes over trees located on upper slopes and ridge crests
 - Avoid retaining trees on shallow or wet soils or stub trees in these areas to reduce blow-down risk
 - Preferentially retain trees that are pre-adapted to open-growing conditions [\(rationale\)](#)

ii) Selection silviculture system; shelterwood silviculture system (preparatory and regeneration cuts, irregular shelterwood cuts)

Selection, shelterwood preparatory and regeneration cuts, and irregular shelterwood cuts leave dozens to hundreds of trees/ha. Thus, there is no requirement to retain 25 stems/ha. Instead, wildlife tree retention focuses on trees of special value to wildlife such as cavity trees, mast trees, scattered coniferous trees, and supercanopy trees. Selection of individual trees will generally follow direction in the *Ontario Tree Marking Guide*.

Conditions on regular operations

Standards

- Retain an average of ≥ 10 living cavity trees:
 - Retain ≥ 5 living and/or dying cavity trees on each ha

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- Retain all reasonably identifiable living trees with pileated woodpecker nest or roost cavities
- Retain all reasonably identifiable large living (≥ 50 cm dbh) hollow 'chimney' trees encountered ([rationale](#))

Guidelines

- Retain as many large, safe dead trees as practical and feasible. ([rationale](#))
- Wildlife trees that fall to the ground, or are purposely felled for worker safety reasons, will be retained on site to become downed woody material (see Section 3.2.3.2) unless with Ministry approval (see Appendix 1b). ([rationale](#))
- Wildlife trees will generally be well dispersed. In shelterwood preparatory and regeneration cuts, retain at least half as individual stems; the remaining wildlife trees may occur in clumps. ([rationale](#))
- Retain an average of ≥ 10 mast trees/ha, unless approved by the Ministry (see Appendix 1b). ([rationale](#))
- Retain an average of ≥ 10 scattered coniferous trees/ha. ([rationale](#))
- Retain an average of ≥ 1 supercanopy tree/ha. ([rationale](#))

Best management practices

- Reasonable efforts will be made to avoid knocking down standing trees retained as wildlife trees during renewal and tending. ([rationale](#))

iii) Shelterwood removal cuts; white/red pine seed tree cuts

Shelterwood removal cuts and white/red pine seed tree cuts leave fewer residual trees/ha than selection or shelterwood preparatory or regeneration cuts. Thus, a minimum density of wildlife trees is prescribed. In addition, retention focuses on trees of special value to wildlife such as cavity trees, veteran trees, and supercanopy trees. Selection of individual trees will generally follow direction in the *Ontario Tree Marking Guide*.

Conditions on regular operations

Standards

- Retain an average of ≥ 25 stems/ha. ([rationale](#))
- Retain an average of ≥ 10 veteran trees/ha with a minimum of 5 veteran trees on each ha. ([rationale](#))

Guidelines

- Retain an average of ≥ 10 living cavity trees or large stubs/ha:
 - Retain ≥ 5 living and/or dying cavity trees on each ha
 - If the number of living cavity trees available is < 10 /ha (i.e., living cavity trees retained during the preparatory and/or regeneration cut have since died), then retain as many as are available and supplement with living trees with high potential to develop into cavity trees (e.g., hardwoods with conks (evidence of advanced heart rot), conifers classed as unacceptable growing stock)
 - Retain all reasonably identifiable living trees with pileated woodpecker nest or roost cavities
 - Retain all reasonably identifiable large living (≥ 50 cm dbh) hollow ‘chimney’ trees encountered ([rationale](#))
- Retain as many safe dead trees as practical and feasible. ([rationale](#))
- Wildlife trees that fall to the ground, or are purposely felled for worker safety reasons, will be retained on site to become downed woody material (see Section 3.2.3.2) unless with Ministry approval (see Appendix 1b). ([rationale](#))
- Retain an average of at least 10 well-dispersed, individual stems/ha: the remaining stems may occur in clumps. ([rationale](#))
- Retain an average ≥ 1 supercanopy tree/ha. ([rationale](#))

Best management practices

- Reasonable efforts will be made to avoid knocking down standing trees retained as wildlife trees during renewal and tending. ([rationale](#))
- To the extent practical and feasible, ‘stub’ some wildlife trees:
 - i. to a height of ≥ 3 m (5 m is preferred).
 - ii. trees with existing cavities above the stubbing height or trees that provide other functions (e.g., mast trees, seed trees, veteran trees, supercanopy trees) should not be stubbed.
 - iii. all tree species can be stubbed. ([rationale](#))
- Large trees providing existing nesting or denning sites are preferred as cavity trees (see also the *Ontario Tree Marking Guide*). ([rationale](#))

3.2.3.2 Downed woody material

Downed woody material (DWM) contributes to the biodiversity, long-term productivity and health of forest ecosystems. DWM influences forest ecosystem species abundance and richness by providing shelter, cover, subnivean travel routes, foraging and basking sites, modified microclimate, and substrates for regeneration and growth. Decaying

wood also provides humus and soil organic matter that contributes to soil development and nutrient cycling.

Wildlife species associated with decaying wood may be affected by forest management activities as wildlife species-specific associations are linked to DWM characteristics including species, decay class, and size. The role and temporal supply of DWM is closely linked in form and function to 'wildlife trees' (Section 3.2.3.1). In managed forests, retention of existing and future recruitment of DWM from retention of wildlife trees that eventually fall to ground is required to achieve DWM retention objectives. Downed wood structures that exist prior to harvest provide important temporal connectivity allowing pre-harvest organisms to persist in the post-harvest environment.

Direction

For the purposes of this guide, DWM refers to wood above the soil and on the ground: coarse woody material refers to sound and rotting branches, boles, logs, and stumps, generally ≥ 7.5 cm in diameter at the small end; fine woody material refers to stems and twigs generally 2.0-7.5 cm in diameter at the small end.

The direction in this section will be implemented using conditions on regular operations and does not apply to salvage harvest (see Section 6.1). [\(rationale\)](#)

Conditions on regular operations

Guidelines

- Stems retained as wildlife trees (Section 3.2.3.1) that fall down or are felled for worker safety reasons to become DWM will be left on site unless with Ministry approval (see Appendix 1b). Moving such trees for silviculture purposes is permitted. [\(rationale\)](#)
- Downed trees (or pieces of trees) present prior to harvest will be left on site (moving such trees for silviculture purposes is permitted); where windstorms or other natural events (e.g., snow, ice) have recently caused damage to stands, trees leaning and downed by the recent disturbance, which normally would have been available for harvest, may be harvested and utilized. [\(rationale\)](#)

Best management practices

- During all stages of forest operations, mitigative measures should be considered to minimize the:
 - Crushing of large, downed logs;
 - Smothering of coarse woody material by fine woody material or soil; and
 - Windrowing of DWM. Where long windrows do occur, breaks should be provided to allow animals, other forest users, and operations unobstructed access routes. A 10 m break for every 100 m of windrow is a good target. [\(rationale\)](#)

- Retain as many unmerchantable logs or portions of logs (especially in large diameter classes) on site as logging method and silviculture objectives will permit. ([rationale](#))
- Dead trees present prior to harvest, including those lowered to the ground for safety considerations, should be left on site (only safe dead trees will remain standing). ([rationale](#))

3.3 Fine filter adjustments

The management of some species of wildlife requires special consideration at a landscape scale as well as at stand and site scales. These species, particularly the cervids, also tend to have high socioeconomic value and have historically been the focus of specific habitat management strategies in Ontario, and other jurisdictions. For these species, general principles regarding their habitat requirements will be applied at landscape and stand and site scales in specific, identified portion(s) of a forest management unit. Other relevant planning or administrative boundaries (e.g., cervid ecological zones, wildlife management units) will also be considered.

In the Landscape Guide, direction is provided on how planning teams will identify areas of the forest management unit that are required to meet targets for Landscape Guide pattern indicators. These areas may be identified as large landscape patches (LLPs), which are an appropriate scale and will normally be used when a decision has been made to emphasize habitat management for species addressed in this section. The coarse filter indicators (pattern, structure, composition, and abundance), the management direction, and the directional statements will normally be the basic information used to help identify an area (e.g., LLPs) where an emphasis on habitat management for species in this section will be applied. With respect to the cervids, it will usually be appropriate to consider applying direction for a single species; however, in some areas it may be appropriate to manage and provide habitat for more than one species. Such decisions will normally be based on an assessment of ecological conditions of the local landscape, including the present and desired forest condition. To achieve habitat objectives for the species in this section, habitat may be maintained (while still allowing forest operations to occur), retained (which generally implies a deferral of forest operations), or created (through the application of silviculture practices to change the existing pattern or structure). Application of the direction in sections 3.3.1, 3.3.2, and 3.3.3 will be documented in a forest management plan as part of regular planning products (e.g., selection of areas for harvest, renewal, and tending) and through the development of conditions on operations specific to the maintenance, retention, or creation of habitat.

In this section, the reference to ‘stands’ generally implies a ‘patch’, or a grouping of forest stands, that may have different cover typing but are intended to meet the intent of the direction.

Forest operations and habitat management for cervids and other large mammals are often intricately linked to forest roads. The specific linkages between the FMPM requirements for a use management strategy for each existing and new road or road network, and the objectives and management direction used to emphasize habitat for a species, will be considered when implementing the standards, guidelines, and best management practices in this section. In addition, road planning, construction, maintenance, and decommissioning activities described in Section 5.1 will also be considered. ([rationale](#))

3.3.1 White-tailed deer

LLPs within the forest management unit with an objective to emphasize white-tailed deer (also referred to in this guide simply as 'deer') habitat will be identified as deer emphasis areas (DEAs) during development of the management direction. See Notes at end of Section 3.3.1 for definitions of **bolded** terms.

In cervid ecological zones with moderate or high deer population objectives, deer winter concentration areas (**stratum I** and **stratum II** habitat) will normally be identified as winter DEAs.

Winter DEAs will be mapped, and stratum I and stratum II will be delineated, using the methodology described by Buss et al. (1998) (Figure 3.3a). Where stratum I and II have not been differentiated, and to apply direction provided, long term average local snow depth should be considered when developing winter cover habitat targets. If it is unlikely that the local average snow depth (long-term measurements from local snow stations) will exceed 50 cm, winter cover habitat targets that are in alignment with stratum II should be emphasized for the entirety of the winter DEA. However, where local snow depths exceed 50 cm, stratum I habitat should be delineated, and winter cover targets in alignment with stratum I direction should be applied in the appropriate area.

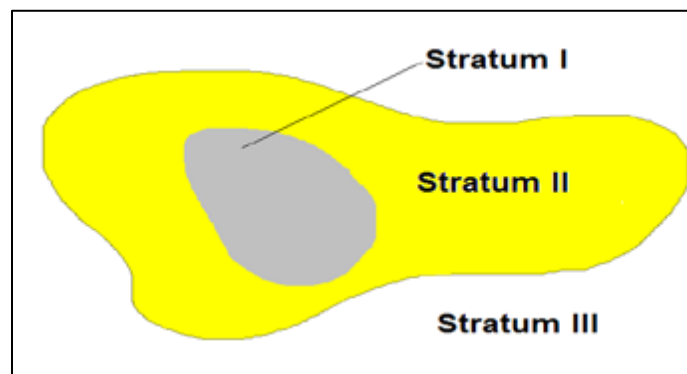


Figure 3.3a. Deer winter concentration area.

In cervid ecological zones with moderate to high and high deer population objectives, and considering local deer populations when information is available, LLPs delineated as **stratum III** will normally be identified as non-winter DEAs.

Where stratum II has been identified but does not differ significantly from stratum III the direction for winter DEAs should only be applied within stratum I.

When a deer population is exceeding its local population objective contributing to chronic negative ecological impacts and/or has been identified as an issue relative to population objectives in the cervid ecological framework, the following direction may be omitted or modified for one or more DEAs within a forest management unit.

Direction

Application of direction for DEAs should not compromise the achievement of the strategic landscape pattern and landscape class composition targets.

Strategic planning direction applies only to winter DEAs that contain a sufficiently large area of Crown forest to make implementation of this direction practical and feasible. The threshold will be determined locally based on discussions between the Ministry and the SFL (i.e., enough Crown forest within winter DEAs to allow for a relatively even flow of harvest activities through time to create browse producing habitats in proximity to cover).

Operational planning direction does not apply to winter DEAs where the interspersed Crown and private ownerships makes it impractical or infeasible to implement the direction. DEAs where this applies will be determined locally based on discussions between the Ministry and the SFL (i.e., enough Crown forest within winter DEAs to be able to meet the winter patch size and cover to cover distance requirement).

Direction in this section will be implemented using regular FMP products and conditions on operations applied to DEAs. ([rationale](#))

i) Winter deer emphasis areas

Description of value

Mapped winter deer emphasis areas (i.e., stratum I and II) identified by the planning team, following direction provided in strategic planning.

Strategic planning

Guidelines

- To maintain a relatively uniform supply of browse-producing habitat through time:
 - For each winter DEA, develop long-term targets (i.e., 100 years) that promote a relatively uniform area of selection cuts, shelterwood preparatory/regeneration cuts, and clearcuts within each 10-year planning period
 - If the existing forest condition does not currently support harvest levels consistent with the long-term targets, show movement toward the long-term targets ([rationale](#))
- For each winter DEA, if the amount of **severe winter cover (SWC)** or **mild winter cover (MWC)** in stratum I or II is insufficient to meet retention requirements during operational planning (see below), develop long-term targets to increase the amount of the appropriate type of winter cover, and show movement toward these long-term targets. ([rationale](#))

Conditions on regular operations

Guidelines

- Harvest, renewal, and tending operations within winter DEAs will result in the following distribution of patches of **SWC**, **MWC**, **security cover** and **access cover**:
 - To maximize the area used by deer, any point within winter DEAs will be within 300 m of a mapped winter cover patch of **SWC** or **MWC** (i.e., 600 m cover-to-cover distance) that is ≥ 5 ha in size for MWC and ≥ 10 ha for SWC. Based on this spatial arrangement, approximately 10-15% of the winter DEA will be winter cover
 - At least 75% of winter cover patches in stratum I and 25% of winter cover patches in stratum II will be SWC
 - Harvest, renewal, and tending operations within SWC or MWC will maintain desired species composition, canopy closure, and stand height (see Notes)
 - Where no mapped winter cover patches are available that meet the criteria identified the best available winter cover patch will be retained to meet cover-to-cover requirements
 - To enhance access to browse, any point within planned clearcuts within stratum I or II will be within 100 m of a mapped patch of **security cover** ≥ 2.5 ha in size (i.e., maximum cover-to-cover distance of 200 m)
 - Within stratum I and II, if residual canopy closure will be $< 30\%$ in selection cuts, shelterwood preparatory/regeneration cuts, and clearcuts, retain ≥ 10 living conifers/ha that are ≥ 10 m tall to provide **access cover**. Based on availability, at a minimum, conifer will be retained in 2-3 clumps of a minimum of 3-5 trees with touching crowns (this also fully addresses scattered conifer tree direction for hardwood selection and shelterwood

preparatory/regeneration cuts and partially addresses wildlife tree direction for clearcuts in Section 3.2.3.1) ([rationale](#))

Best management practices

- Where practical and feasible and consistent with applicable silvicultural ground rules, schedule harvest operations within stratum I and II for the winter season. ([rationale](#))
- Within stratum I and II, to the extent possible:
 - Maintain conifer canopy closure along known travel routes and in, or adjacent to, suitable night and day bedding areas, such as hemlock ridges and 'knobs' with south-facing slopes. In these areas, maintenance of conifer canopy closure of 80% is desirable, although 60% is often adequate when the conifer species are cedar or hemlock, and trees are 10 m or more in height; clusters of 3-5 conifers with branches touching is desirable.
 - Maintenance of conifer canopy closure along known travel routes and in, or adjacent to, suitable night and day bedding areas should be prioritized to areas in stratum II immediately adjacent to stratum I to account for shifts in deer use patterns (i.e., the area of the yard identified as stratum I will likely change over time). ([rationale](#))

Conditions on roads, landings, forestry aggregate pits, and wood storage yards

Standards

- New roads, landings, forestry aggregate pits, and wood storage yards will not be constructed within SWC or MWC if their construction will result in a contiguous patch area <5 ha (MWC) or <10 ha (SWC). ([rationale](#))

Guidelines

- When in alignment with short and long-term browse and habitat targets, new primary roads will not be constructed within stratum I. ([rationale](#))

ii) Non-winter deer emphasis areas

Description of value

Mapped non-winter deer emphasis areas (i.e., stratum III) identified by the planning team, following direction provided in strategic planning.

Conditions on regular operations

Guidelines

- To enhance access to forage, any point within planned clearcuts will be within 100 m of a patch of **security cover** ≥ 1 ha in size (i.e., maximum cover-to-cover distance of 200 m). ([rationale](#))
- In northwestern Ontario, if operations are proposed in bur oak stands, or in stands which contain bur oak trees, maintain the bur oak component. See sections 3.2.1 (rare vegetation communities) and 3.2.3.1 (wildlife trees). ([rationale](#))

Best Management Practices

- To create semi-permanent openings valuable to deer, old roads, landings, forestry aggregate pits, and wood storage yards should not be artificially regenerated with forest stands. Seeding with a mixture of non-invasive (preferably native) grasses and forbs that provide cool- season forage will enhance value to deer. ([rationale](#))
- In selection cuts and shelterwood preparatory and regeneration cuts, preferentially retain hard mast-producing trees, especially red, white, and bur oaks as mast trees. ([rationale](#))
- In clearcuts and shelterwood removal cuts, preferentially retain hard mast-producing trees, especially red, white, and bur oaks, as large wildlife trees (conventional clearcuts) or veteran trees (seed tree clearcuts and shelterwood removal cuts). ([rationale](#))

Notes

Stratum I is the part of a deer concentration area (or yard) normally used during severe winter conditions. Stratum I is normally delineated when average snow depth exceeds 46-50 cm. Stratum I and stratum II comprise the winter DEA

Stratum II is the part of a deer concentration area (or yard) normally used during mild to severe winter conditions. Stratum II is delineated prior to snow depths reaching 20 cm. Stratum II along with stratum I, comprises the winter DEA

Stratum III is the area occupied by deer throughout the year. The area within stratum III comprises the non-winter DEA

Security cover is provided by any vegetation that conceals a standing or bedded deer from predators or humans and includes forest stands ≥ 2 m tall (or $\geq$ sapling development stage), brush and alder (BSH), and treed wetlands (TMS) ([rationale](#))

Access cover is small patches of conifer trees (at least 3-5 stems) that are ≥ 10 m tall and retained at a minimum of 2-3 clumps with touching crowns that moderate snow depth, permitting deer to access surrounding browse ([rationale](#))

Severe winter cover (SWC) is generally used when deer are in snow depths that severely restrict movement (≥ 38 cm). SWC includes forest stands with ≥ 70 -80% (70%; high value snow interception tree species, 80%; low value snow interception tree species) canopy closure and a height of ≥ 10 m. In order to improve the ability to map winter cover, ground truthing or comparable activities may be necessary. Local knowledge of habitat use may be used to adjust this definition.

- When accurate estimates of conifer canopy closure are not available in planning inventories, it may be assumed that SWC will be provided by:
 - Well-stocked stands (i.e., DEVSTAGE < PREPCUT or SEEDCUT or FIRSTCUT or LASTCUT) with $\geq 70\%$ of the stocking comprised of conifers if the conifer component is dominated by **high value** snow interception tree species (i.e., % balsam fir + cedar + hemlock + white spruce $\geq$ % black spruce + jack pine + red pine + white pine) or with $\geq 80\%$ of the stocking comprised of conifers if the conifer component is dominated by **low value** snow interception tree species (i.e., % balsam fir + cedar + hemlock + white spruce < % black spruce + jack pine + red pine + white pine)
- When accurate estimates of height are not available in planning inventories, stands ≥ 35 years old may be considered acceptable

Mild winter cover (MWC) is generally used when deer are in snow depths that moderately restrict movement (18-38 cm). MWC includes forest stands with at least 50-80% (minimum of 50%; high value snow interception tree species, minimum of 60%; low value snow interception tree species) conifer canopy closure and a height of ≥ 10 m. In order to improve the ability to map winter cover, ground truthing or comparable activities may be necessary. Local knowledge of habitat use may be used to adjust this definition.

- When accurate estimates of conifer canopy closure are not available in planning inventories, it may be assumed that MWC will be provided by:
 - Well-stocked stands with 50-70% of the stocking comprised of conifers if the conifer component is dominated by **high value** snow interception tree species or 60-80% of the stocking comprised of conifers if the conifer component is dominated by **low value** snow interception tree species.
 - Moderately-stocked stands (e.g., DEVSTAGE = PREPCUT or SEEDCUT) with $\geq 70\%$ of the stocking comprised of conifers if the conifer component is dominated by **high value** snow interception tree species or with $\geq 80\%$ of the stocking comprised of conifers if the conifer component is dominated by **low value** snow interception tree species

- When accurate estimates of height are not available in planning inventories, stands ≥ 35 years old may be considered acceptable

High value snow interception tree species include hemlock, cedar, white spruce, and balsam fir

Low value snow interception tree species include white pine, red pine, jack pine, and black spruce.

3.3.2 Moose

Moose require a landscape that is a mosaic of browse and forage-producing habitats (early successional forest), aquatic feeding areas (shallow aquatic habitats with abundant submerged and emergent vegetation), summer thermal cover (treed and shrub wetlands, mid to late successional lowland conifer forest), and winter thermal cover (mid to late successional conifer and mixedwood forest). Application of the coarse filter direction in the Landscape Guides and this guide is assumed to produce a habitat mosaic with comparable suitability to landscapes arising from natural disturbance processes. However, to achieve moose habitat and socio-economic objectives, the fine filter direction described in this section may be applied in some portions of moose range.

The proportion of the forest management unit required to achieve moose habitat and social-economic objectives will be determined during the strategic planning phase of the development of the FMP. When selecting areas for application of the fine filter moose direction consider the following when available:

- Direction for moose habitat in the Cervid Ecological Framework;
- Moose population objectives* and estimates;
- Moose habitat availability and forest structure;
- Consultation recommendations

* When moose population objectives have not been formally developed (i.e., Algonquin Park) refer to the over-arching population guidance by cervid ecological zone in the Cervid Ecological Framework.

The following direction focuses on providing moose habitat both in amount and arrangement in identified areas by using a suite of tools that address both the amount and arrangement of seasonal habitat needs and addresses the pressure of renewal, tending, and access on moose populations. See Notes at the end of Section 3.3.2 for definitions of **bolded** terms.

Direction

Direction in this section will be applied in Large Landscape Patches (LLPs) specifically identified for the emphasis of moose habitat (moose emphasis areas; MEAs) during development of the management direction. Potential LLPs where moose habitat

management will be emphasized will normally include those areas within forest management units:

- That overlap wildlife management units (WMUs) in moose range as defined in the cervid ecological framework (cervid ecological zones: B, C1, C2, D1, and D2). Focus selection in WMUs where the current population is below the population objective range, near the bottom of the range, or is trending downward
- That have the potential to support moose based on habitat carrying capacity modeling. For information on the moose model used; see Ontario's Landscape Tool (OLT), Science and Information Package "M" and Section 3.3.2 in the background and rationale document)
- That are generally $\geq 10,000$ ha in size, smaller MEAs may be considered to a minimum of 2,000 ha
- Where the objective from the Landscape Guides is to maintain a fine-textured landscape
- With no existing access or low level of existing access relative to the management unit
- That do not have Crown Land Use Policy Atlas (CLUPA) restrictions that would conflict with MEA direction
- That do not overlap with deer emphasis areas or areas of the management unit where deer are the more established cervid due to the potential for parasite transmission

Potential MEAs will be identified and considered, and those selected based on achievement of moose objectives will be included in the strategic planning of the FMP. Applying the fine filter moose direction will not compromise achievement of the strategic landscape pattern (i.e., mature and old forest texture) and landscape class composition targets.

Locations of moose emphasis areas are not intended to shift entirely between planning cycles, however, to monitor the achievement of moose objectives identified in the FMP, it is recommended to re-evaluate selected MEAs at each planning term (i.e., 10-year planning cycle). When developing the management direction, it is recommended to model habitat objectives for a minimum of 40 years.

The operational planning direction in this section will be implemented using regular FMP products and conditions on operations applied to MEAs selected following the strategic direction during the strategic planning phase. ([rationale](#))

i) Strategic planning

Guidelines

- Within MEAs, manage the landscape to maintain an optimal mosaic of food and cover for moose and minimize access to promote moose populations. In addition to the strategic direction below, for each MEA, apply the operational planning direction, for harvest, renewal, tending, and roads as provided below. ([rationale](#))
- To maintain an optimal landscape-level mosaic for food and cover for moose, each MEA will be comprised of:
 - Within Boreal Landscape Guide regions:
 - 5-20% forest (all PFTs) <20 years old
 - 2.5-15% **hardwood forest** (PFT = POP, BWT, or TOL) ≥10 m tall
 - 10-30% **mixedwood forest** (PFT = MIX) ≥10 m tall
 - 10-20% **upland conifer forest** (PFT = MCU, PJK, or PWR) ≥10 m tall
 - 0.5-2.0% **lowland conifer forest** (PFT = MCL) ≥10 m tall
 - Within Great Lake-St. Lawrence Landscape Guide regions:
 - 0.5-10% forest (all PFTs) <20 years old
 - 20-50% **hardwood forest** (PFT = POP, BWT, or TOL) ≥10 m tall
 - 5-20% **mixedwood forest** (PFT = MIX) ≥10 m tall
 - 10-30% **upland conifer forest** (PFT = MCU, PJK, or PWR) ≥10 m tall
 - 0.5-5% **lowland conifer forest** (PFT = MCL) ≥10 m tall

When accurate estimates of height are not available in planning inventories, stands ≥35 years of age may be considered acceptable as a replacement for 10 m in height.

Strategic planning will maintain MEAs within these ranges (or show movement toward these ranges if currently outside the ranges). Modifications to these objectives based on current or desired future forest conditions, consideration of other forest objectives, or compelling socio-economic considerations will be rationalized within the FMP. For definitions of **hardwood**, **mixedwood**, **upland** and **lowland conifer forest**, see Notes section below. Definitions may be adjusted by planning teams and rationalized in the FMP to more appropriately reflect local conditions. ([rationale](#))

- To minimize access to promote moose populations, strategic planning will include objectives for road planning that are in alignment with direction provided in the operational prescriptions for harvest, renewal, tending, and roads in the operational planning direction (see below). ([rationale](#))

ii) Operational planning

Description of value

Mapped moose emphasis areas identified by planning team, following direction provided during strategic planning.

Conditions on regular operations

Guidelines

- Manage each MEA to maintain a preferred mosaic of food and cover for moose, and minimize access by implementing objectives identified during strategic planning. ([rationale](#))
- To enhance access to browse within MEAs, when forest structure permits, any point within planned clearcuts will be within 200 m of a mapped patch of **security cover** at least 2.5 ha in size (i.e., maximum cover-to-cover distance of 400 m). ([rationale](#))
- To maximize the amount of a MEA used by moose, when forest structure permits, any point within a MEA (excluding water) will be within 750 m of a mapped patch of **summer thermal cover (STC)** (i.e., maximum cover-to-cover distance of 1,500 m) that is at least 2.5 ha in size. At least 25% of the mapped patches retained as STC will be lowland conifer forest ≥ 10 m tall (or ≥ 35 years old if reliable estimates of height are not available). ([rationale](#))
- To maximize the area used by moose, when forest structure permits, any point within a MEA (excluding water) will be within 550 m of a mapped patch of **Winter Thermal Cover (WTC)** (i.e., 1,100 m cover-to-cover distance) that is at least 10 ha in size. ([rationale](#))
- Renewal and tending prescriptions will have regard for the availability of moose browse over the short and long term and will be consistent with creating future stand compositions that will maintain moose habitat categories within their optimal ranges. ([rationale](#))

Best management practices

- When selecting patches of security cover, summer thermal cover, and winter thermal cover, retain patches that provide for a range of cover-to-cover distances for the specific cover type (i.e., avoid selecting patches that are always the maximum distance apart by cover type).
- When identifying patches of winter thermal cover, avoid selecting narrow patches.

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- Preferentially retain patches of **STC** that are at least 5 ha in size and within 200 m of moose aquatic feeding areas (MAFAs) (especially class 3 or 4 MAFAs (based on the methodology described by Ranta 1998) >4 ha in size).
- Develop silvicultural strategies for creating high-value feeding habitat along selected edges of operations such as cover patches and manage these sites as high-browse production sites.
- When applying herbicides on rich mixedwood sites, use hand application methods (i.e., backpack sprayer) to avoid spraying shrubs that are preferred by moose as browse (e.g., dogwood, willow, mountain ash) and are not directly competing for resources with crop trees. ([rationale](#))

Conditions on roads, landings, forestry aggregate pits, and wood storage yards

Standards

- New roads will not split stands retained as winter or summer cover (unless the remnant stands still meet minimum patch size requirements). ([rationale](#))

Guidelines

- During strategic planning, areas of no to low road density will be preferred in selection of MEAs. ([rationale](#))
- To facilitate the achievement of moose habitat objectives, the re-use of existing roads and roadbeds will be preferred. When not available, new branch and operational roads will be permitted within the MEA with road use management strategies that are consistent with maintaining low levels of access. ([rationale](#))
- During the use of roads required for harvest, renewal, and tending activities, access restrictions techniques will be identified based on local experience, considering access requirements needed to ensure forest operations are dispersed through space and time and to conduct post-harvest silviculture. ([rationale](#))
- Road use management strategies that align with MEA objectives will include decommissioning strategies and/or locally appropriate access restrictions. Road use management strategies will be documented in the FMP. ([rationale](#))

Best management practices

- To the extent practical and feasible, decommissioning opportunities of existing roads within MEAs will be documented in the road use management strategies. ([rationale](#))

- When existing road density (all roads) exceeds 0.2 km/km² within a MEA, to the extent practical and feasible, the density of existing roads should be decreased to <0.2 km/km² using locally appropriate access restrictions or decommissioning activities. ([rationale](#))
- To the extent practical and feasible, new roads should not be located within 100 m of class 3 or 4 MAFAs (based on the methodology described by Ranta 1998) that are ≥4 ha in size. ([rationale](#))

Notes

Hardwood forest is defined as productive forest dominated by hardwood tree species (normally the POP, BWT, and TOL provincial forest types (PFT); northwest region forest units: PODOM, BWDOM, OTHHD; northeast region forest units: PO1, BW1, LH1; GLSL forest units: PO, BW, BY, OAK, HDSL2, HDSL1, HDUS) ([rationale](#))

Mixedwood forest is defined as productive forest dominated by a mix of hardwood and conifer tree species (normally the MIX PFT, northwest region forest units: HRDOM, HRDMX, CONMX; northeast region forest units: MW1, MW2, GLSL forest units: LMMW, MWUS, MWD, MWR) ([rationale](#))

Upland conifer forest is defined as productive forest on upland sites dominated by conifer tree species (normally the MCU, PWR, and PJK PFT; northwest region forest units: PWDOM, PRDOM, PRWMX, UPLCe, SBDOM, SBMX1, PJMX1, BFDOM, PJDOM, northeast region forest units: PR1, PRW, PJ2, SP1, SF1, PJ1; GLSL forest units: PR, PWUS4, PWOR, PWUSC, PWUSH, PWST, PJ2, HE, SP1, SF, PJ1) ([rationale](#))

Lowland conifer forest is defined as forest on moist to wet or organic soils on lowland sites dominated by conifer tree species (normally the MCL PFT; northwest region forest units: OCLOW, SBLOW; northeast region forest units: BOG, SB1, LC1; GLSL forest units: CE, SB, LC) ([rationale](#))

Security cover (SC) is provided by any vegetation that conceals a standing or bedded moose from predators or humans and includes forest stands ≥2 m tall (or ≥10 years old if reliable estimates of height are not available), brush and alder (BSH), and treed wetlands (TMS) ([rationale](#))

Summer thermal cover (STC) is considered to be represented by:

- **Well-stocked** lowland conifer forest that is ≥10 m tall (or ≥35 years old if reliable estimates of height are not available).
- Wetlands identified as brush and alder (BSH) or treed wetland (TMS).

- If local knowledge of habitat is used to adjust this definition, rationale must be documented in the FMP ([rationale](#))

Well-stocked refers to stands that have not received a recent shelterwood regeneration (DEVSTAGE = SEEDCUT), release (DEVSTAGE = FIRSTCUT), or removal cut (DEVSTAGE = LASTCUT) or that are not otherwise identified as low stocking (DEVSTAGE = LOWNAT or LOWMGMT) ([rationale](#))

Winter thermal cover (WTC) is considered to be represented by:

- **Well-stocked** upland conifer forest that is ≥ 10 m tall (or ≥ 35 years old if reliable estimates of height are not available) with $\geq 60\%$ canopy closure
- If local knowledge of habitat is used to adjust this definition, rationale must be documented in the FMP ([rationale](#))

3.3.3 Other species

Generally, special strategies and operational prescriptions to address unique objectives will be applied to areas that have been identified and delineated as LLPs through application of the Landscape Guide. Planning teams can then select the specific strategies and forest operation prescriptions that will apply to these LLPs or other identified areas with unique objectives.

Unique objectives regarding forest cover at the landscape scale will usually modify: the patterns of composition and structure of harvest and retention patches (Sections 3.2.1 and 3.2.2); maintenance and creation of structure within areas of operations (Section 3.2.3); and other operational considerations (Section 5).

Situations may arise when FMP planning teams identify areas of the forest management unit that require special and specific direction to address unique objectives. These areas may be for a species or community (wildlife or vegetation) and where use of operational prescriptions and conditions for an AOC is inadequate or inappropriate because of scale. When existing forest management guides do not provide direction on how to manage forest cover to address such unique objectives, planning teams may choose to craft special strategic and operational strategies and prescriptions. For example, in areas where elk occur, planning teams may identify management objectives for elk habitat in some LLPs or emphasis areas.

For each LLP or other area identified as having unique management objectives, a brief synopsis of the effects of forest management on the feature, land use, or value being managed should be prepared and available as resource information. ([rationale](#))

4.0 CONSERVING BIODIVERSITY – Management of site-specific habitats

Section 4.0 provides direction designed to assist in the conservation of biodiversity by maintaining the suitability of habitats and habitat features that are used by numerous animal and plant species and that are associated with specific geographic locations. Aquatic and wetland habitats and associated shoreline forest are addressed in Section 4.1. Special habitat features such as birds' nests and dens are considered in Section 4.2. Section 4.3 provides direction for the habitat of species at risk that is not already covered by direction in the Landscape Guide or other sections of the Stand and Site Guide.

In Sections 4.1 to 4.3, when forest management activities may adversely affect a value or important ecological feature (as defined in the FMPM), mitigative direction is prescribed. For values, direction is addressed through operational prescriptions and conditions for areas of concern (AOCs). A value is considered to be a known value when sufficient information to describe its geographic location and its basic features exist. Direction for defining, collecting, reporting, confirming, verifying, updating, and providing values information for the preparation and implementation of an FMP is documented in the *Forest Information Manual* (FIM). To maintain or protect important ecological features or to implement specific operational direction, mitigation is addressed through conditions on operations (conditions on regular operations for harvest, renewal, and tending operations and conditions on roads, landings, forestry aggregate pits, and wood storage yards). With the exception of important ecological features related to species at risk, important ecological features addressed by conditions on operations do not have to be documented and reported following the process outlined in the FIM.

Values or important ecological features considered in this section may be identified and reported by the Ministry or other government staff, SFL holders and their operators, non-government organizations, third parties, other resource users, or the public. For values addressed through operational prescriptions and conditions for AOCs, it is the responsibility of the Ministry to confirm that the information about any new value is accurate and meets the standards outlined in the FIM before it is considered to be a known value and subject to the direction in this section. For important ecological features addressed through conditions on operations, it is the responsibility of operations staff that encounter the feature to confirm the identity of the feature and apply the appropriate direction in this section. In the case of species at risk important ecological features, it would also be the responsibility of the SFL holder to notify the Ministry following the process outlined in the FIM.

Many values, such as permanent streams and osprey nests, will be known in advance of operations and will be identified on values maps. Application of the direction in this section for these known values is relatively straightforward. However, many features

and values, such as woodland pools and hawk nests, will typically be discovered during operations. In some cases, despite due diligence, these features and values may not be identified until some operations have been conducted within their vicinity in a manner that may not be consistent with prescribed direction. In these cases, reasonable efforts will be made to ensure that subsequent activities comply with the direction in this section.

In some situations, multiple operational prescriptions and conditions for areas of concern and/or conditions on operations will overlap. In these cases, the most restrictive direction will be applied unless otherwise rationalized in the FMP and approved by the Ministry. In these instances, when a change from a standard or guideline is desired by the planning team an individual AOC prescription or condition on operations will be developed and will be documented as an exception in the FMP. The intent of the exception would be to allow for deviation from a standard or guideline to allow for a specific activity or activities while minimizing adverse effects on the value or feature.

Multiple known AOCs of the same or different values within a specific area may influence the achievement of management objectives for a given management zone. Planning teams may need to consider the impacts of these values when determining the strategic intent of management zones during the forest management planning process. Strategies to address potential conflicts may include changes to either the strategic direction or timing of the management zone in question.

Direction in Sections 4.1 to 4.3 frequently place restrictions on the construction of new roads. In the context of this guide, existing roads that are rebuilt so they can support an increased volume of traffic (e.g. a winter road upgraded to an all-season road, an operational road upgraded to a branch or primary road, a branch road upgraded to a primary road) are considered to be new roads.

Direction in Sections 4.1 to 4.3 frequently places restrictions on hauling or other forestry-related traffic. Unless otherwise specified, this direction applies to operational roads and any other roads that are used primarily by the forest industry. It is not intended to be applied to municipal roads or provincial highways.

Direction in Sections 4.1 to 4.3 often specifies the forest structure to be retained within AOCs to protect the associated value. Harvest, renewal, and tending operations used to generate this structure will, to the extent practical and feasible, emulate the natural dynamics of the forest type within the AOC while acknowledging silviculture limitations, the scale of application, and other overriding ecological considerations such as objectives for forest composition (see Section 3.2.1).

In some cases, direction requires the retention of mature or residual forest adjacent to permanent or enduring values or important ecological features including lakes and streams, and special habitat features (e.g. nests or dens) used by species showing site fidelity. Management of shoreline areas based on emulating a natural disturbance approach with creation of some early successional shoreline forest should continue to

be promoted as an appropriate management strategy. Riparian forests can experience a loss of structural and functional heterogeneity without stand-replacing disturbances which can result in reduced natural range of biodiversity than would otherwise exist. Thus, direction in Section 3.2.2 and 4.1.2 for riparian zones enables some modified harvest within shoreline habitat to maintain habitat suitability and productive capacity, assuming an FMP has incorporated this flexibility. For nest and den sites for which direction requires the retention of mature or residual forest immediately surrounding the value (e.g., bald eagle nest, wolf den), regular updating of values information (following the process outlined in the FIM) may determine when these features no longer exist or require protection and regular operations can be conducted in the area.

[\(rationale\)](#)

4.1 Maintaining ecological functions of aquatic and wetland ecosystems and shoreline forest including habitat suitability and productive capacity

Within the managed forest, lakes, ponds, rivers, streams, wetlands, and associated shoreline forest represent habitat for about 100 species of fish, more than 200 species of birds, mammals, reptiles, and amphibians, and thousands of species of invertebrates and vascular and nonvascular plants. Moreover, about two-thirds of all species at risk that occur within the managed forest use aquatic and/or wetland habitats. From a social and economic perspective, these ecosystems are especially significant because they, or the species that occupy them, support commercial, recreational, and Indigenous fisheries, trapping, waterfowl hunting, and other water-based recreation and tourism. For many Indigenous communities in Ontario, the protection and conservation of water is not only a matter of ecological importance, but a matter of preserving their cultural and spiritual identity. Their relationship with water is sacred as it sustains and connects all life.

Forest management operations can potentially change the composition or structure, and thus ultimately the function, of aquatic ecosystems, either through direct physical disturbance (e.g., installation of water-crossing structures) or by altering the linkage between terrestrial and aquatic ecosystems (e.g., altering the amount of, or pathways for, surface runoff). Such changes may reduce the suitability of aquatic and wetland ecosystems for a wide range of aquatic and semiaquatic plants and animals. At a watershed- or catchment-scale, forest management operations can influence the quantity and quality of water entering aquatic ecosystems. The extent to which these hydrological changes adversely affect the ecological function of aquatic ecosystems is quite variable, depending largely on the characteristics of individual catchments. Catchment-scale effects are addressed through the application of related coarse and fine filter direction (natural landscape pattern, minimizing site damage, retention of residual forest, protection of hydrological connections, etc.) see section 3.2.2.3. Groundwater is an important component of the hydrological cycle in forest ecosystems and has a significant effect on aquatic habitats and their biota, see section

4.2.1. At a finer scale, operations within or adjacent to aquatic and wetland ecosystems may potentially result in sediment entering aquatic features, damage to shorelines or stream banks, modification of the hydrological regime, changes to thermal regime, obstruction of fish passage, or alteration of inputs of coarse and fine organic material, with subsequent effects on fish and other species.

Under section 35(1) of the *Fisheries Act* (R.S.C., 1985, c. F-14), “No person shall carry on any work, undertaking or activity that results in the death of fish or the harmful alteration, disruption or destruction of fish habitat.” Moreover, under section 36(3) of the *Fisheries Act*, “no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water”. [The *Fisheries Act* (section 20) also prohibits the obstruction of fish passage. Section 5.1.2 provides direction on the design of water crossings to facilitate fish movement.]

While the following sections address a broad range of ecological functions, much of the focus is on mitigating potential effects of forest management operations in shoreline areas on water quality, fish, and fish habitat, especially those associated with input of sediment.

The *Fisheries Act* defines fish and fish habitat very broadly. Fish includes:

- parts of fish,
- shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and
- the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans, and marine animals.

Fish habitat means water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas.

This guide adopts a conservative approach and provides protection to all standing and flowing waters, as well as the features that provide hydrological connection to terrestrial habitats (i.e., linear features that channel ephemeral surface and/or shallow groundwater flows to lakes, ponds, rivers, or streams).

Forest management operations adjacent to aquatic and wetland ecosystems may also alter the composition or structure of associated shoreline forest. Harvesting may have negative consequences for wildlife species such as bald eagles, wood ducks, and moose that use mature shoreline forest that provides food, cover, or travel corridors. In contrast, harvesting may have positive consequences for wildlife species such as common yellowthroats, eastern kingbirds, and beavers that use early to mid-successional shoreline forest (dozens of other species also benefit from the wetlands created by beavers). Thus, at a landscape scale, the habitat requirements of the greatest number of shoreline-inhabiting species will be met when shoreline forest

occurs in a variety of ages and patterns. Sections, 4.1.1, and 4.1.2 provide direction to create a mosaic of shoreline forest conditions that will sustain these many ecological functions. ([rationale](#))

Direction

The proposed direction continues to use a risk management approach to guide efforts to mitigate the effects of forest operations on fish and fish habitat. Under this approach, appropriate mitigation is a function of risk, where risk is defined by the scale of potential negative effects and the sensitivity of fish and fish habitats. Direction in Section 4.1 adopts these guiding principles. Direction is more restrictive when operations have a higher potential for negative effects or when fish or fish habitats are likely to be more sensitive to potential effects. The potential for negative effects is based largely on the amount of site disturbance (e.g., road construction normally has a greater potential for negative effects than timber harvesting) and the amount of canopy removal (e.g., clearcutting has a greater potential for negative effects than selection cutting) associated with operations.

Direction is generally more restrictive for large aquatic features (assumed to have more complex aquatic communities) and for those supporting fish more likely to be affected by changes in shoreline vegetation.

This guide not only permits, but encourages, management in shoreline areas, primarily to meet the ecological objectives noted above. However, in some situations, socio-economic considerations may override this direction and result in different prescriptions for shoreline areas. For example, archaeological sites and other areas of high cultural value are frequently associated with shorelines. These values may be protected by reserves up to 200 m in width (see the *Forest Management Guide for Cultural Heritage Values*). Moreover, large lakes and rivers are often associated with resource-based tourism. Planning teams may decide to retain unharvested forest along shorelines to maintain visual aesthetics (see the *Management Guidelines for Forestry and Resource-based Tourism*). Alternatively, planning teams may decide to not harvest shoreline forest in specific areas where an Indigenous community has traditionally collected medicinal plants.

The following sections provide direction for standing waters (lakes and ponds) (Section 4.1.1), flowing waters (rivers and streams) (Section 4.1.2), wetlands (Section 4.1.3), hydrological connections (Section 4.1.4), and self-sustaining lake and brook trout lakes (Section 4.1.5).

The following conditions on regular operations will be followed during any work around water features in the following sections including lakes, ponds, rivers, and streams and open water wetlands (woodland pools, mapped fens and marshes). See Notes at end of Section 4.1 for definitions of **bolded** terms. ([rationale](#))

Description of value

All lakes, ponds, rivers, and streams as defined in Sections 4.1.1, and 4.1.2.

Conditions on regular operations

Standards

- No harvest, renewal, or tending operations are permitted within the AOC associated with a water feature that will result in damage to littoral zones, shorelines, beds, banks and associated stabilizing vegetation, or deposition of sediment within lakes, ponds, rivers, or streams. Operations specifically prohibited within the AOC include:
 - Machine travel/site disturbance within the inner 3 m of the AOC
 - Felling of trees into water features or the inner 3 m of the AOC. Trees accidentally felled into water features will be left where they fall.
 - Disturbance of the forest floor that leaves ruts (especially those that channel water into a water feature) or a significant area of exposed mineral soil between the height of land and the water feature or within the inner 15 m of the AOC (see Section 5.2, Figure 4.1a), whichever is less. Ruts and significant patches of exposed mineral soil will be promptly rehabilitated to prevent sediment from entering a water feature. Patches of mineral soil exposed by natural events are excluded. ([rationale](#))

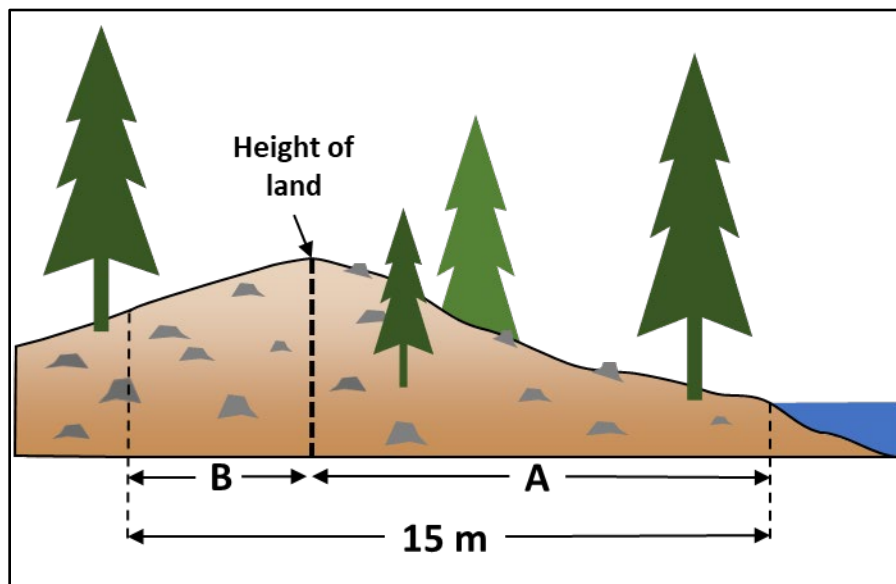


Figure 4.1a. Illustration depicting height of land. No ruts or exposed mineral soil would be permitted to be left in area A of the AOC. There is a lower risk of sediment entering the water feature in area B (back slope) of the AOC as it slopes away from the water feature.

- No contamination of lakes, ponds, rivers, or streams by a **deleterious substance** is permitted. Specifically, no equipment maintenance (e.g., washing or changing oil) is permitted within 30 m of HPS lakes, ponds, rivers, or streams and within 15 m of LPS ponds and streams. ([rationale](#))
- Application of pesticides is permitted (provided the product label permits) within the AOC as per the following:
 - Aerial application of pesticides for renewal, tending, or protection is permitted within the AOC but will follow the *Ontario Ministry of Environment/Ontario Ministry of Natural Resources Buffer Zone Guidelines for Aerial Application of Pesticides in Crown Forests of Ontario* (1992)
 - Machine-based ground application of herbicides for renewal, tending, or roadside brush control is permitted within the AOC; spray buffer zones will be 30 m for significant areas and 60 m for sensitive areas
 - Hand-based ground application of herbicides (e.g., backpack sprayers) is permitted within the AOC; by applying a 3 m spray buffer
 - All spray buffer zones will be measured from the edge of the water feature
 - If increased buffers are required as per product label direction, increased buffer distances will follow manufacturer's application requirements([rationale](#))

Guidelines

- Within shoreline AOCs, the direction for retention of wildlife trees in harvest areas (see Section 3.2.3) will be followed with the specification to retain at least two living trees per 10 m of shoreline as a potential source of future aquatic coarse woody material preferably with the following characteristics:
 - Dominant or co-dominant crown position (generally ≥15 m tall)
 - Close to the shoreline (ideally within ½ the height of the tree)
 - Leaning toward the water
 - Not directly adjacent to other retained wildlife trees
 - Conifers are preferred (but a mix of conifers and hardwoods is acceptable)([rationale](#))
- Additional wildlife tree retention will focus on living trees with preferential retention of windfirm trees that provide the following special habitat features for wildlife:
 - Supercanopy trees (all forest units) of value to eagles and ospreys such as white and/or red pine (and trembling aspen in the boreal forest)
 - Large living hardwood trees with existing cavities or the potential to develop cavities (all forest units)
 - Scattered coniferous trees (selection forest units) or veteran trees (clearcut and shelterwood forest units) ([rationale](#))

Best management practices

- Machine travel should be minimized within the inner 15 m of the AOC. ([rationale](#))
- Piling of felled trees should be minimized within the inner 15 m of the AOC. ([rationale](#))
- Removal or damage of sapling-sized trees (<10 cm dbh) and shrubs within the inner 3 m of the AOC should be minimized. ([rationale](#))

Notes

Deleterious substance: Any substance, as defined by the *Fisheries Act*, that if added to water, makes the water deleterious to fish or fish habitat; or any water containing a substance in such quantity or concentration or has been changed by heat or other means, that if added to water makes that water deleterious to fish or fish habitat. Note that sediment is considered a deleterious substance. Note that this is a summary of the definition from the *Fisheries Act*.

4.1.1 Standing waters: lakes and ponds

Standing waters include lakes and ponds. Lakes and ponds represent important habitat for thousands of species of aquatic and semiaquatic plants and animals. This includes more than 80 species of mammals, birds, reptiles, and amphibians, ranging from numerous species of turtles and waterfowl to aquatic furbearers, such as beavers and river otters, and more than 80 species of fish. Deep oligotrophic lakes are especially important for cold water fish such as lake trout. Because of their shallow depth, ponds are extremely productive habitats, especially for aquatic furbearers and waterfowl, including numerous species of conservation priority. ([rationale](#))

Direction

For operational simplicity, polygons in the OHN (Ontario Hydrological Network) (or most current data source) that are ≥ 8 ha in size are classified as lakes. Polygons in the OHN and unmapped bodies of open water ($\leq 25\%$ of surface area covered by emergent vegetation) encountered during operations that are ≥ 0.5 and < 8 ha in size are classified as ponds.

All standing waters are important components of fish habitat and are addressed through the AOC planning process. Direction for maintaining habitat suitability and productive capacity of lakes and ponds and associated shoreline forest focuses on:

- Minimizing the risk of sedimentation
- Providing future inputs of coarse woody material
- Mitigating the effects of harvesting on water temperature, water circulation, and inputs of fine organic material

- Mitigating the effects of forest management operations on hydrological linkages between aquatic and terrestrial ecosystems
- Maintaining some shoreline forest as residual habitat and dispersal corridors
- Managing some shoreline forest to create some early to mid-successional riparian habitat ([rationale](#))

Description of value

Lakes are:

- Bodies of moderate-to-deep standing water typically characterized by relatively stable shorelines, limited deposition of sediments, low turbidity, stable water levels, and long flushing rates
- Defined by the *Ontario Wetland Evaluation System* as areas of open water greater than 8 ha in size and, at some point, greater than 2 m deep
- Mapped open water polygons (POLYTYPE = WAT) that are not rivers
- Considered to have a high potential sensitivity (HPS) to forest management operations.

Ponds are:

- Bodies of shallow (generally <2 m deep), open water ($\leq 25\%$ of surface area covered by emergent vegetation) between 0.5 - 8 ha in size.
- Considered shallow open water wetlands by the *Canadian Wetland Classification System* and marshes by the *Ontario Wetland Evaluation System*. The potential sensitivity to forest management operations of ponds ranges from high to low.
- Mapped open water polygons (POLYTYPE = WAT) or unmapped open water features ($\leq 25\%$ of surface area covered by emergent vegetation) encountered during operations that are not rivers
- Considered to have a low potential sensitivity (LPS) to forest management operations unless:
 - Known to contain trout (or other cold-water species) or fish that are species at risk, or
 - Connected to one or more HPS streams

In these cases, ponds are considered HPS features.

Bodies of open water less than 0.5 ha that are connected to streams are treated as part of the streams (Section 4.1.2). Bodies of open water greater than 0.5 ha associated with mapped wetlands are treated as part of the mapped wetlands (Section 4.1.3).

Temporary bodies of open water less than 0.5 ha not associated with streams or mapped wetlands are considered to be woodland pools (Section 4.1.3).

The width of the AOC is based on potential sensitivity and slope as follows:

Lakes and HPS ponds:

- 30 m for 0 - 15% slopes

- 50 m for >15 - 30% slopes
- 70 m for >30 - 45% slopes
- 90 m for >45% slopes.

LPS ponds:

- 15 m for 0 - 15% slopes
- 25 m for >15 - 30% slopes
- 35 m for >30 - 45% slopes
- 45 m for >45% slopes.

The AOC is measured in the field from the edge of vegetation communities capable of providing an effective barrier to the movement of sediment. This will normally be those communities dominated by trees (i.e., $\geq 25\%$ canopy cover of trees), or tall (≥ 1 m high) woody shrubs such as alder or willow, or low woody evergreen shrubs such as Labrador tea or leatherleaf, or with a continuous mat of sphagnum mosses (i.e., not disjunct patches). For mapping purposes, the AOC may be measured from the edge of polygons identified as FOR, TMS, or BSH in the forest resources inventory. If the inner edge of the AOC will be ≥ 300 m from the shoreline of a lake or pond when these criteria are used, an AOC is not required adjacent to those sections of shoreline, unless the intervening wetland is known to provide components of fish habitat for which there is a high species' dependence (e.g., spawning habitat).

In some cases, the height of land (as defined in the glossary) may occur within the 30-90 m AOC for HPS lakes and ponds or the 15-45 m AOC for LPS ponds. In these instances, certain activities such as harvesting and road construction may occur within the AOC beyond the height of land, provided all other standards and guidelines for these features are followed. ([rationale](#))

Operational prescription for the area of concern

Standards (see Figures 4.1b and 4.1c)

- Harvest, renewal, and tending operations are permitted within the AOC subject to the following conditions:
 - Harvest, renewal, and tending operations will follow the conditions on regular operations for working around water (see Section 4.1)
 - $\geq 50\%$ of the area of the AOC (based on delineation of the AOC around the entire water feature, both inside and outside the harvest area) associated with small lakes (≥ 8 and < 100 ha) and HPS ponds, $\geq 75\%$ of the area of the AOC associated with medium lakes (≥ 100 and $< 1,000$ ha), and $\geq 90\%$ of the area of the AOC associated with large lakes ($\geq 1,000$ ha) will be retained as forest that meets the definition of residual (see Section 3.2.2)
 - Harvest that retains forest that does not meet the definition of residual (e.g., conventional clearcutting) is permitted within the AOC:
 - Where slope to the water feature is $\leq 30\%$

- Beyond the height of land (i.e., portion of the AOC that slopes away from the lake/pond) within the 30-90 m AOC for HPS lakes and ponds or the 15-45 m AOC for LPS ponds, provided all other standards and guidelines for these features are followed including the maintenance of at least 30 m of residual shoreline forest on sections of HPS lakes and ponds identified for the retention of forest that meets the definition of residual. [\(rationale\)](#)

Guidelines

- Some or all of the requirements for the retention of residual forest within the AOC may be met by residual shoreline forest outside the harvest area, residual shoreline forest retained in overlapping AOCs, or residual shoreline forest retained in areas with steep slopes (>30%). Additional requirements for residual shoreline forest may be met by retaining residual shoreline forest:
 - To maintain the suitability of special habitats associated with lakes and ponds. For example, preferentially retaining residual shoreline forest:
 - Associated with recharge areas associated with brook trout spawning sites (see Section 4.2.1)
 - Adjacent to moose aquatic feeding areas (MAFAs) (see Section 4.2.4), especially in specific areas (e.g., LLPs) identified for enhanced moose management
 - Where there is a high potential for hydrological connections between terrestrial and aquatic ecosystems that channel ephemeral surface and/or shallow groundwater flows to lakes, ponds, rivers, or streams (see Section 4.1.4). The Ministry's hydrological flow accumulation modelling spatial product, which identifies the potential locations of hydrological connections (flowpaths), is available on the Natural Resources Information Portal (NRIP) for the managed forest.
 - To maintain internal and external connectivity. Within the AOC, a relatively continuous corridor (average width of gaps <50 m; maximum width of gaps <200 m) of residual forest at least 30 m wide retained along at least 1 side of each HPS lake or pond to connect special habitat features (e.g., osprey nests, MAFAs) associated with the lake or pond and link with residual forest on connected lakes, ponds, rivers, and streams.
 - To emulate natural disturbance patterns. For example, preferentially retaining residual shoreline forest:
 - On the leeward side of a lake or pond
 - Comprised of forest types with lower fire susceptibility (e.g., lowland conifer)
 - Where there is an opportunity to incorporate it into a larger patch of residual forest (see Section 3.2.2)
 - That has the highest likelihood of being windfirm. [\(rationale\)](#)

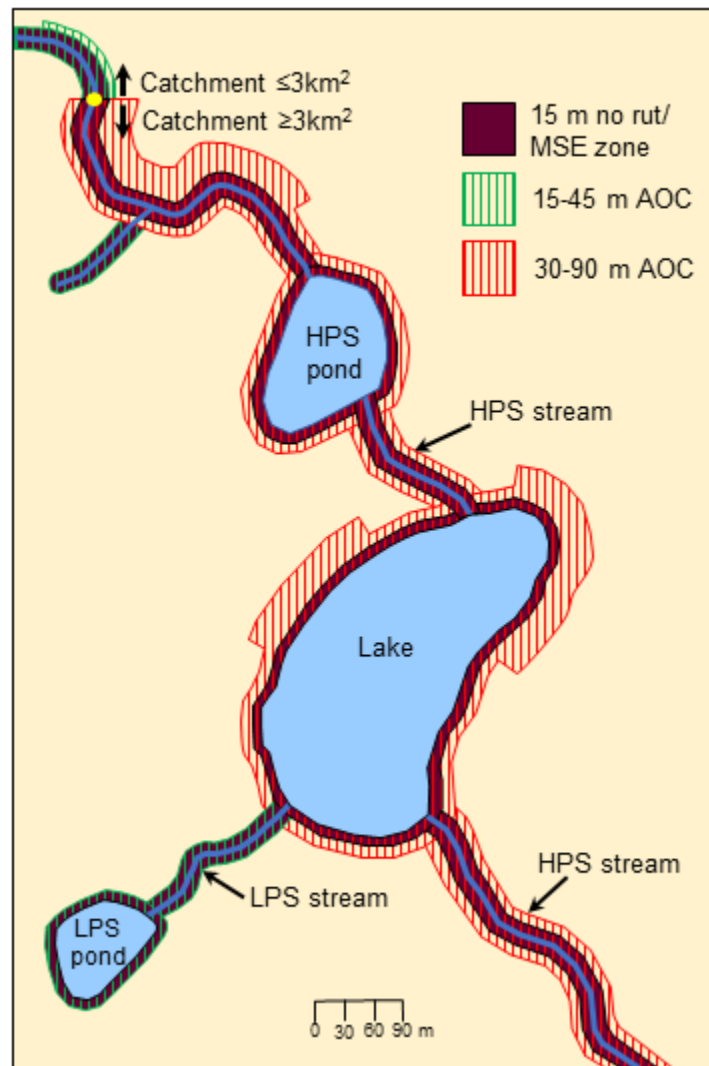


Figure 4.1b. Layout of areas of concern (AOC) and 15 m no rut or significant mineral soil exposure (MSE) zones around lakes, ponds, and streams. Ponds and streams with high (HPS) or low (LPS) potential sensitivity to forest management operations are identified (see Sections 4.1.1 and 4.1.2).

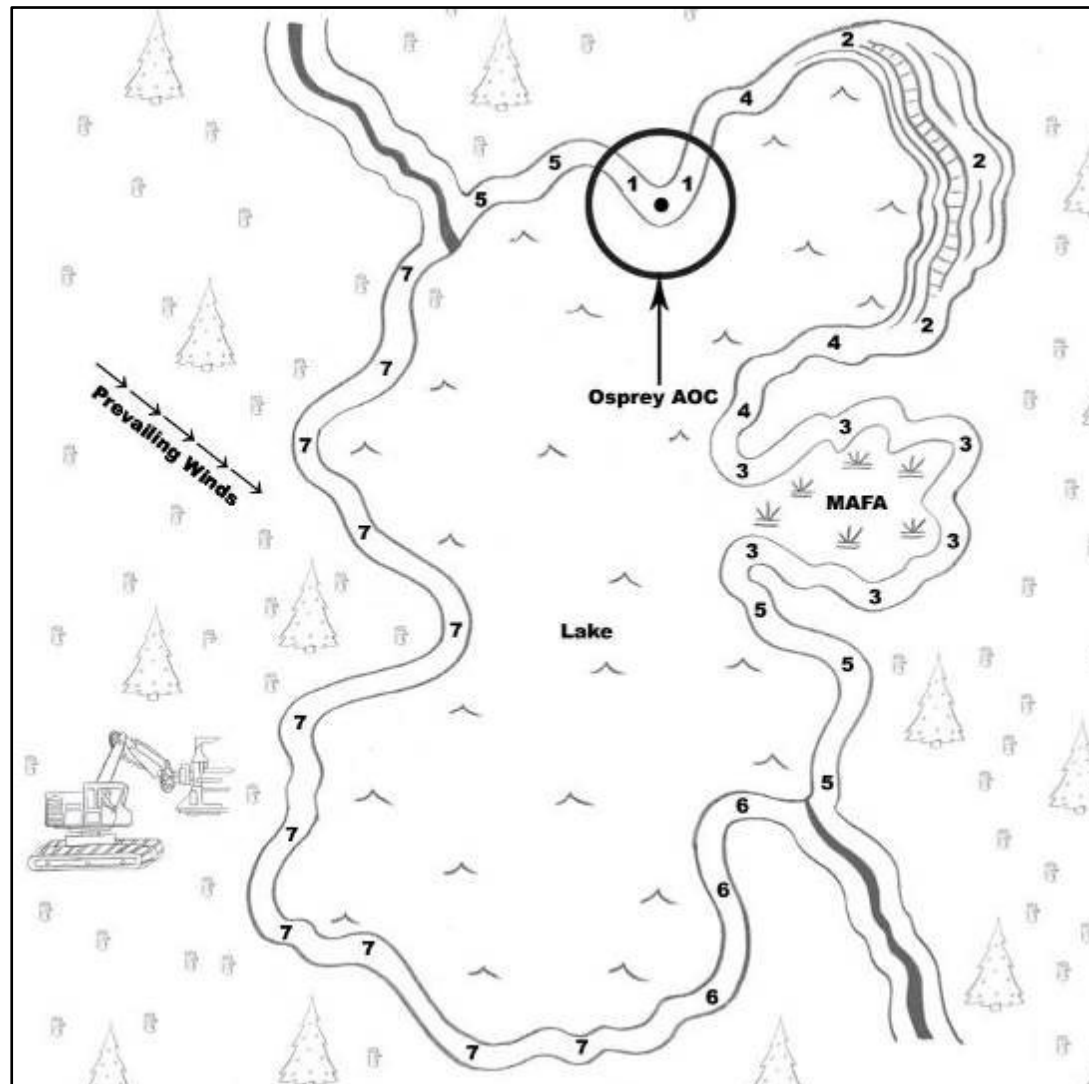


Figure 4.1c. Selecting shoreline forest for retention as residual. In this example, portions of the shoreline AOC labeled 1-6 would be preferentially retained in the following order of priority: include shoreline forest in overlapping AOCs (1); retain forest on steep slopes (2); retain forest adjacent to special habitats such as moose aquatic feeding areas (MAFAs) (3); retain forest to link (1), (2) and (3) (internal connectivity)(4); retain forest to link with other water features (external connectivity)(5); and retain forest along shorelines with the lowest likelihood of being disturbed by natural agents such as wildfire (6). On this lake, shoreline labeled '7' would be the preferable choice for harvest that does not retain residual forest. (Illustration by Mandy Saille).

Best Management Practices

- Harvest, renewal, and tending operations will, to the extent practical and feasible, encourage perpetuation of the distinctive character of the shoreline forest while emulating natural disturbances and/or succession (unless conversion is required to meet other ecological objectives). ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- Construction of new landings and use of existing landings are not permitted within the AOC. ([rationale](#))

Guidelines

- New roads that are not associated with an approved water crossing are not permitted within the AOC except:
 - In extraordinary circumstances and the road, including specific location, is identified and justified through the FMP AOC planning process
 - Where the road is constructed beyond the height of land and its construction does not compromise other standards and guidelines for the water feature ([rationale](#))
- New roads within the AOC that are not associated with an approved crossing will:
 - Use fill material that is erosion-resistant and/or protected from erosion for portions of the road built below the normal high-water mark
 - Limit grubbing to only that required to address engineering and safety concerns (e.g., remove hazards)
 - Have ditches designed to minimize the possibility of sediment entering the water feature ([rationale](#))
- When new roads traverse residual forest within the AOC, the width of the cleared corridor will be as narrow as practical and feasible, and will not exceed 20 m. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- Construction of new forestry aggregate pits and wood storage yards and use of existing forestry aggregate pits and wood storage yards are not permitted within the AOC. ([rationale](#))

4.1.2 Flowing waters: rivers and streams

Flowing waters include rivers and streams. Rivers and streams are relatively shallow linear bodies of unidirectional flowing water typically characterized by constantly changing shorelines, highly variable deposition of sediments, high and variable turbidity,

large fluctuations in water level, and rapid flushing rates. Streams may flow throughout the year (permanent streams) or primarily during wet seasons (intermittent streams).

Rivers and permanent or intermittent streams provide habitat for a wide diversity of aquatic and semi-aquatic plants and animals. This includes more than 60 species of mammals, birds, reptiles, and amphibians, ranging from turtles to waterfowl to aquatic furbearers such as beavers, muskrats, and river otters. Rivers and streams also support about 40 and 50 species of fish, respectively. This list includes sport fish, such as brook trout, and species at risk, such as the northern brook lamprey. ([rationale](#))

Direction

All flowing waters are important components of fish habitat and receive consideration. Habitat suitability and productive capacity of rivers and permanent or intermittent streams are maintained through the AOC planning process. Direction for maintaining habitat suitability and productive capacity of rivers, streams, and associated shoreline forest is described below and focuses on:

- Protecting beds, banks, and shorelines
- Minimizing the risk of sedimentation
- Mitigating the effects of harvesting on water temperature and inputs of fine organic material
- Providing future inputs of coarse woody material
- Maintaining some shoreline forest as residual habitat and dispersal corridors
- Managing some shoreline forest to create some early to mid-successional riparian habitat

See Notes at end of Section 4.1.2 for definitions of **bolded** terms. ([rationale](#))

Description of value

Rivers include:

- Mapped open water polygons (POLYTYPE = WAT).
- Mapped stream segments with catchment area $\geq 50 \text{ km}^2$. Catchment area is defined as the upstream contributing area at any point along a stream.

All rivers are considered to have a high potential sensitivity to forest management operations.

Streams include:

- Streams with high potential sensitivity to forest management operations (HPS streams) which include:
 - Mapped stream segments with catchment area ≥ 3 and $< 50 \text{ km}^2$
 - **Recognizable** unmapped stream segments with an average active channel width $\geq 0.5 \text{ m}$
 - **Stream segments known to support fish that are sensitive to changes in water temperature** or stream segments known to support fish that are species at risk

- Streams with low potential sensitivity to forest management operations (LPS streams) are streams that do not meet any of the criteria for HPS streams.

The width of the AOC is based on potential sensitivity and slope as follows:

Rivers and HPS streams:

- 30 m for 0 - 15% slopes
- 50 m for >15 - 30% slopes
- 70 m for >30 - 45% slopes
- 90 m for >45% slopes

LPS streams:

- 15 m for 0 - 15% slopes
- 25 m for >15 - 30% slopes
- 35 m for >30 - 45% slopes
- 45 m for >45% slopes

The AOC is measured in the field from the edge of vegetation communities capable of providing an effective barrier to the movement of sediment. This will normally be those communities dominated by trees (i.e., $\geq 25\%$ canopy cover of trees), or tall (≥ 1 m high) woody shrubs such as alder or willow, or low woody evergreen shrubs such as Labrador tea or leatherleaf, or with a continuous mat of sphagnum mosses (i.e., not disjunct patches). For mapping purposes, the AOC may be measured from the edge of polygons identified as FOR, TMS, or BSH in the forest resources inventory. If the inner edge of the AOC will be ≥ 300 m from the edge of a river or stream when these criteria are used, an AOC is not required adjacent to those sections of the watercourse, unless the intervening wetland is known to provide components of fish habitat for which there is a high species' dependence (e.g., spawning habitat).

In some cases, the height of land (as defined in the glossary) may occur within the 30-90 m AOC for HPS rivers and streams or the 15 - 45 m AOC for LPS streams. In these instances, certain activities such as harvesting and road construction may occur within the AOC beyond the height of land provided all other standards and guidelines for these features are followed. ([rationale](#))

Operational prescription for the area of concern

Standards (see Figures 4.1a and 4.1c)

- Harvest, renewal, and tending operations are permitted within the AOC subject to the following conditions:
 - Harvest, renewal, and tending operations will follow the conditions on regular operations for working around water in Section 4.1

- Forest that meets the definition of residual (see Section 3.2.2) must be retained within the AOC (based on delineation of the AOC along the entire water feature, both within and outside the harvest area) on at least one side of rivers and HPS streams to provide a travel corridor.
- To provide shade, mature forest with relatively uniform canopy closure $\geq 60\%$ (canopy openings not to exceed individual tree crowns) must be retained within the inner 15 m of the AOC on both sides of HPS and LPS **stream segments known to support fish that are sensitive to changes in water temperature** and **streams that are sensitive to changes in water temperature**, unless the inner boundary of the AOC is >15 m from the active channel. If forest is not mature or does not have an initial canopy closure $\geq 60\%$, no harvest is permitted
- Harvest that retains forest that does not meet the definition of residual (e.g., conventional clearcutting) is permitted within the AOC:
 - Where slope to the water feature is $\leq 30\%$
 - Beyond the height of land (i.e., portion of the AOC that slopes away from the river/stream) within the 30-90 m AOC for HPS rivers and streams or the 15-45 m AOC for LPS streams, provided all other standards and guidelines for these features are followed, including the maintenance of at least a 30 m width of residual forest along HPS rivers and streams to provide a travel corridor. ([rationale](#))

Guidelines

- Some or all of the requirements for the retention of residual forest within the AOC may be met by residual shoreline forest outside the harvest area, residual shoreline forest retained in overlapping AOCs, or residual shoreline forest retained in areas with steep slopes ($>30\%$). Additional requirements for residual shoreline forest may be met by retaining residual shoreline forest:
 - To maintain the suitability of special habitats associated with rivers and streams as described in Section 4.2. For example, preferentially retaining residual shoreline forest:
 - Associated with recharge areas associated with brook trout spawning sites (see Section 4.2.1)
 - Adjacent to moose aquatic feeding areas (MAFAs) (see Section 4.2.4), especially in specific areas (e.g., LLPs) identified for enhanced moose management
 - Where there is a high potential for hydrological connections between terrestrial and aquatic ecosystems that channel ephemeral surface and/or shallow groundwater flows to lakes, ponds, rivers, or streams (see Section 4.1.4). The Ministry's hydrological flow accumulation modelling spatial product, which identifies the potential locations of hydrological connections (flowpaths), is available on the Natural Resources Information Portal (NRIP) for the managed forest.
 - To maintain internal and external connectivity. Within the AOC, a relatively continuous corridor (average width of gaps <50 m; maximum width of

- gaps <200 m) of residual forest at least 30 m wide retained along at least 1 side of each river or HPS stream to connect special habitat features (e.g., osprey nests, MAFAs) associated with the river or stream and link with residual forest on connected lakes, ponds, rivers, and streams.
- To emulate natural disturbance patterns. For example, preferentially retaining residual shoreline forest:
 - On the leeward side of a river or stream
 - Comprised of forest types with lower fire susceptibility (e.g., lowland conifer)
 - Where there is an opportunity to incorporate it into a larger patch of residual forest (see Section 3.2.2)
 - That has the highest likelihood of being windfirm ([rationale](#))

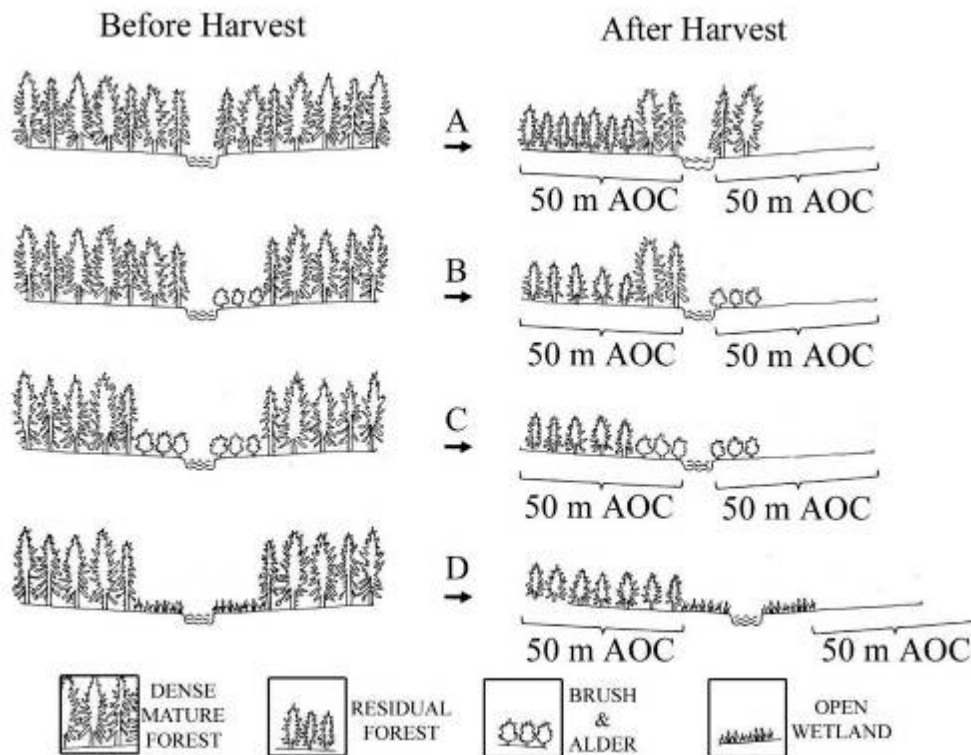


Figure 4.1c. Examples of shoreline forest retention around streams. All scenarios assume a 50 m wide AOC on both sides of the stream (slope not to scale). All scenarios retained residual forest as a travel corridor along the left side of the stream. In scenario A, mature forest occurred to the edge of the stream on both sides. During harvest, dense mature forest was retained within the inner 15 m of the AOC on both sides of the stream to provide shade. In scenario B, mature forest occurred to the edge of the stream on one side only, with 15 m of brush and alder on the other side. During harvest, dense mature forest was retained within the inner 15 m of the AOC on the left side of the stream to provide shade. No dense mature forest was retained on the right side of the stream because there was none within the inner 15 m of the AOC. In scenario C,

brush and alder occurred within 15 m of the stream on both sides. During harvest, no dense mature forest was retained because none occurred within the inner 15 m of the AOC on either side of the stream. In scenario D, there was 15 m of open wetland separating the stream and mature forest on both sides. Although there was mature forest within the inner 15 m of the AOC on both sides of the stream, no dense mature forest was retained during harvest because the closest mature forest was >15 m from the edge of the stream (and thus provided little shade). (Illustration by Mandy Saille).

Best management practices

- Harvest, renewal, and tending operations will, to the extent practical and feasible, encourage perpetuation of the distinctive character of the shoreline forest while emulating natural disturbances and/or succession (unless conversion is required to meet other ecological objectives). ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- Construction of new landings and use of existing landings are not permitted within the AOC. ([rationale](#))

Guidelines

- New roads that are not associated with an approved water crossing are not permitted within the AOC except:
 - In extraordinary circumstances and the road, including specific location, is identified and justified through the FMP AOC planning process, or
 - Where the road is constructed beyond the height of land and its construction does not compromise other standards and guidelines for the water feature. ([rationale](#))
- New roads within the AOC that are not associated with an approved crossing will:
 - Use fill material that is erosion-resistant and/or protected from erosion for portions of the road built below the normal high-water mark
 - Limit grubbing to only that required to address engineering and safety concerns (e.g., remove hazards)
 - Have ditches designed to minimize the possibility of sediment entering the water feature ([rationale](#))
- When new roads traverse residual forest within the AOC, the width of the cleared corridor will be as narrow as practical and feasible, and will not exceed 20 m. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- Construction of new forestry aggregate pits and wood storage yards and use of existing forestry aggregate pits and wood storage yards are not permitted within the AOC. ([rationale](#))

Notes

Recognizable unmapped stream segments are those that can reasonably be identified at the time of operations. During some seasons it may be difficult to accurately identify unmapped streams and/or determine their width. However, forest workers are expected to exercise due diligence in identifying and protecting these features. For example, distinct channels that are bordered by alders and that lead from lakes, ponds, or mapped wetlands likely contain streams. Forest workers should use their professional judgement to determine the likely location and characteristics of the stream and apply the appropriate course of action. Where there is significant uncertainty, a conservative approach should be used. For guidance on determining stream presence, refer to *The Stream Permanency Handbook for South-Central Ontario*. For guidance on methodology used to measure stream width, refer to the in the *Ontario Stream Assessment Protocol* (Section 4, Module 10). ([rationale](#))

Streams segments known to support fish that are sensitive to changes in water temperature are those with inventory data showing the presence of coldwater fish species such as brook trout, American brook lamprey, or slimy sculpin.

Streams that are sensitive to changes in water temperature are those identified to be cold and clear through values maps, local knowledge, or through review of available classification tools, as well as those within 500 m of self-sustaining brook trout lakes. When using available classification tools, cold streams are defined as those having a July average temperature <18.5 Celsius. ([rationale](#))

4.1.3 Wetlands

Wetlands are lands that are seasonally or permanently flooded by shallow water as well as lands where the water table is close to the surface; in both cases the presence of abundant water results in the formation of hydric soils that favor the dominance of either hydrophytic or water tolerant plants.

Wetlands provide many ecological services including regulating water flow, cycling of nutrients, and absorption of toxic compounds. Within a forest management context, wetlands may represent hydrological linkages between aquatic and terrestrial habitats,

'hotspots' for methylation of mercury, and may play a significant role in mitigating catchment-scale effects of harvesting on water quality. There are four main types of wetlands: marshes, swamps, bogs, and fens.

Non-forested wetlands are important habitats for a wide diversity of plants and animals. They provide spawning, nursery, or feeding habitat for at least 40 species of fish, and nest sites, breeding sites, or feeding habitat for over 30 species of reptiles and amphibians, more than 100 species of birds, and more than 40 species of mammals. They are especially important habitat for many species at risk, from the Blanding's turtle and spotted turtle to the least bittern and yellow rail.

Forested wetlands (i.e., treed swamps) are also important habitats for a diversity of plants and animals. For example, black ash-dominated swamps support a diverse array of herbaceous plants, sedges, and bryophytes. These sites are also important components of the habitat of moose and black bears.

Some wetlands evaluated based on the Ontario Wetland Evaluation System, are identified as provincially significant wetlands (PSWs) because of the presence of outstanding biological, social, or hydrological values or other special features.

Woodland pools are small, isolated, temporary open-water wetlands and include ephemeral pools, vernal pools, and autumnal pools. They typically have hydrological regimes characterized by alternating periods of flooding and drying. At the extremes, woodland pools may contain water for only a few weeks during spring each year or may be continuously flooded through most years but then dry completely once every 5 to 10 years. They typically occur in, or next to, forests or other treed areas. When dry, they can be recognized as depressions with compacted leaves (often darkened by water stains) and watermarks on trees, downed woody material, rocks, or plants in the depression or along the edge.

Because woodland pools are seasonal and isolated (i.e., not connected to another aquatic or wetland feature) and typically have an intermittent hydrological regime, they generally do not support fish. However, because fish are absent, woodland pools provide unique habitats for a wide range of both vertebrates and invertebrates. The diversity of species using woodland pools is generally related to the length of the hydroperiod. Woodland pools with intermediate hydroperiods are especially important for pool-breeding amphibians. Alternating periods of flooding and drying in woodland pools also create unique growing conditions for a variety of organisms.

Forest management operations within, or adjacent to, wetlands can affect the composition, structure and/or function of wetlands, including their physical and chemical properties. ([rationale](#))

Direction

PSWs are addressed through operational prescriptions and conditions for AOCs. Each PSW is considered significant for a unique set of features and/or functions and therefore is to be addressed through an individual AOC developed locally by planning teams, unless the features/functions that make the wetland provincially significant are already addressed by other AOCs (e.g., AOC direction for aquatic features, SAR turtles). These operational prescriptions and conditions will ensure no loss of natural features or ecological functions that make a specific wetland provincially significant and address the function of adjacent lands.

All wetlands (rich lowland hardwood-dominated forest, mapped forested and non-forested wetlands, and woodland pools) not addressed by operational prescriptions and conditions for AOCs are protected through conditions on roads, landings, forestry aggregate pits, and wood storage yards. These conditions associated with the planning and constructing of roads, landings, forestry aggregate pits, and wood storage yards are focused on minimizing the risk of disrupting the hydrological function (e.g., hydrological flow) of wetlands.

Herb-rich, lowland, hardwood-dominated (black ash, green ash, red ash, silver maple, white elm) forest occurs as small inclusions within stands dominated by other forest types and is typically uncommon throughout the managed forest. These stands support a diverse array of plants and animals and are usually hydrologically sensitive. Potential effects of forest management operations within these communities are mitigated by conditions on operations. Similar direction for other locally rare, forested wetland types may be developed through application of direction in Section 3.2.1.

Non-forested wetlands capable of providing habitat for fish because they have substantial open water, will typically be defined as ponds and thus addressed by direction in Section 4.1.1. Those potentially providing fish habitat because they are directly connected to lakes, ponds, rivers, or streams will generally be encompassed by the AOCs for those aquatic features (see Sections 4.1.1 and 4.1.2). In the minority of cases, when not addressed by direction in Section 4.1, non-forested wetlands are addressed through conditions on operations.

Woodland pools are also addressed through conditions on operations. Because of their small size and temporary nature, woodland pools may be difficult to identify under certain operating conditions and during certain seasons. However, operators are expected to exercise due diligence in identifying these features and protecting those features that can be reasonably recognized.

Conditions on operations for rich lowland hardwood-dominated forest, mapped non-forested wetlands, and woodland pools focuses on minimizing:

- The risk of sedimentation in all wetlands
- The risk of disrupting the hydrological function of all wetlands
- The interruption of surface and groundwater inputs of all wetlands
- Changes to the composition and structure of wetland and riparian communities

- Disturbance of amphibian breeding activity in woodland pools
- Changes to canopy cover and light penetration in woodland pools. ([rationale](#))

i) Provincially significant wetlands

Description of value

Wetlands identified as provincially significant based on the *Ontario Wetland Evaluation System*.

Operational prescription and conditions for the area of concern

Guidelines

- Provincially significant wetlands (PSWs) will be addressed by individual AOC operational prescriptions and conditions developed by planning teams that will:
 - Result in no loss of natural features or ecological functions that make the wetland provincially significant.
 - May result in some loss of the natural features or ecological functions that make the wetland provincially significant, but the loss is deemed by the Ministry to be minimal and necessary to avoid undesirable ecological or socio-economic impacts of other feasible alternatives.

Appendix 4.1a includes considerations for planning teams developing individual AOC operational prescriptions and conditions for PSWs and adjacent lands.

([rationale](#))

ii) All wetlands (rich lowland hardwood-dominated forest, mapped forested and non-forested wetlands, and woodland pools) not addressed by operational prescriptions and conditions for AOCs

Description of value

All wetlands (rich lowland hardwood-dominated forest, mapped forested and non-forested wetlands, and woodland pools) not addressed by operational prescriptions and conditions for AOCs (e.g., aquatic features addressed in other sections of Section 4.1).

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- Construction of new landings is not permitted within wetlands or within 15 m of mapped marshes and fens or the high-water mark of woodland pools. ([rationale](#))

Guidelines

- When a road must cross a wetland, identify the associated type of surface and ground water flow to help determine the design and construction methods required to minimize the disruption of hydrological and wetland function. Hydrological function will be considered to have been disrupted if:
 - Surface water is not equalized on both sides of the road
 - Mortality of trees and vegetation has occurred on one side of the road due to prolonged inundation

A good reference source is FPInnovations/Ducks Unlimited Canada's *Resource roads and wetlands: A guide for planning, construction and maintenance*. ([rationale](#))

- Construction of new roads is not permitted within 15 m of mapped marshes and fens or the high-water mark of woodland pools unless approved by the Ministry (see Appendix 1b). ([rationale](#))

Best management practices

- To the extent practical and feasible, when planning the location of roads, identify any wetland areas and minimize the amount of roads built across wetlands. ([rationale](#))
- If wetlands must be crossed to conduct forest operations, to the extent practical and feasible, consider using temporary winter crossings. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- Construction of new forestry aggregate pits and wood storage yards and use of existing forestry aggregate pits and wood storage yards are not permitted within 15 m of mapped non-forested wetlands or the high-water mark of woodland pools. ([rationale](#))

iii) Herb-rich, lowland, hardwood-dominated (black ash, green ash, red ash, silver maple, white elm) forest

Description of value

Mapped stands of rich lowland hardwood-dominated forest (ecosites 130 - 133).

Pockets of rich lowland hardwood-dominated forest ≥ 0.5 ha in size encountered during operations.

Conditions on regular operations

Standards

- No harvest, renewal, or tending operations are permitted that exceed the rutting and compaction standards and guidelines for selection, shelterwood, and commercial thinning operations (see Section 5.2.1) or disrupt hydrological function. Hydrological function will be considered to have been disrupted if operations have:
 - Impeded water movement by restricting flow, creating pools of standing water (e.g., caused by deep ruts perpendicular to the flow path).
 - Accelerated water movement by channelizing flow (e.g., caused by long ruts parallel to the direction of flow).
 - Diverted water movement by changing the location of the path of flow (e.g., caused by ruts that create a new flow path). ([rationale](#))
- Harvest will follow direction for the lowland hardwood group found in the Ministry's Silviculture Guide. ([rationale](#))

Best management practices

- To the extent practical and feasible, extraction trails will be minimized and will follow the appropriate operating practices described in Section 4.1.4 to minimize potential disruption of hydrological function. ([rationale](#))

iv) Mapped non-forested wetlands

Description of value

Mapped polygons with the following polygon types (POLYTYPE) in the forest resources inventory and/or ecosites which generally correspond to one of four wetland types:

Polygon type	Ecosite	Wetland type
OMS (open wetland)	136, 139-152, 217, 218	Marshes, fens
TMS (treed wetland), BSH (brush and alder)	126, 134, 135, 137, 138	Bogs, swamps with <25% tree cover

Wetland type will be confirmed in the field. The boundary between non-forested wetlands and forest is defined where the canopy cover of trees ≥ 10 cm dbh is $\geq 25\%$ or the canopy cover of trees ≥ 1.5 m tall is $\geq 30\%$. ([rationale](#))

Conditions on regular operations

Standards

Mapped marshes and fens

- No harvest, renewal, or tending operations are permitted that will result in significant damage to mapped fen or marsh vegetation or disruption of hydrological function. Operations specifically prohibited within 15 m of mapped fens or marshes include:
 - Machine travel/site disturbance during the frost-free period within 3 m of the mapped fen or marsh.
 - Felling of trees during the frost-free period into mapped fens or marshes or within 3 m of mapped fens or marshes. Trees accidentally felled into mapped fens and marshes will be left where they fall.
 - Disturbance that leaves ruts (especially those that channel water into a wetland) or a significant area of exposed mineral soil within 15 m of mapped fens or marshes (see Section 5.2.1). Ruts and significant patches of exposed mineral soil will be promptly rehabilitated to prevent sediment from entering mapped fens and marshes. Patches of mineral soil exposed by natural events are excluded.
 - Spills of deleterious substances (e.g., fuel, oil) that will contaminate mapped fens and marshes. ([rationale](#))

Mapped bogs and swamps

- No harvest, renewal, or tending operations are permitted that will result in:
 - Disturbance that leaves ruts or a significant area of exposed mineral soil within the mapped bog or swamp (see Section 5.2.1). Patches of mineral soil exposed by natural events are excluded.
 - Spills of deleterious substances (e.g., fuel, oil) that will contaminate mapped bogs or swamps. ([rationale](#))

Best management practices

- To the extent practical and feasible, extraction trails will be minimized within 15 m of mapped marshes and fens and within the boundary of mapped bogs and swamps and will follow the appropriate operating practices described in Section 4.1.4 to minimize potential disruption of hydrological function. ([rationale](#))

v) Woodland pools

Description of value

Recognizable temporary bodies of open water encountered during operations that have a surface area $\geq 500 \text{ m}^2$ (i.e., about 25 m in diameter if circular), are not ponds (i.e., $< 0.5 \text{ ha}$ in size), and are not connected to another aquatic or wetland feature. [\(rationale\)](#)

Conditions on regular operations

Standards

- No harvest, renewal, or tending operations are permitted that will result in deposition of sediment within, or reduction of the water-holding capacity of, woodland pools. Operations specifically prohibited include:
 - Machine travel within 3 m of the high-water mark of pools during the frost-free period.
 - Felling of trees into pools or within 3 m of the high-water mark of pools during the frost-free period. Trees accidentally felled into pools will be left where they fall.
 - Disturbance that leaves ruts (especially those that channel water into a woodland pool) or a significant area of exposed mineral soil (see Section 5.2.1) within 15 m of the high-water mark of pools. Ruts or significant patches of exposed mineral soil will be promptly rehabilitated. [\(rationale\)](#)
- Prevent spills of deleterious substances (e.g., fuel, oil) from contaminating woodland pools. [\(rationale\)](#)

Guidelines

- Retention of residual forest within and adjacent to pools will be based on silviculture system applied to the adjacent forest as follows:
 - Selection and shelterwood silviculture systems – Trees will be retained in, and within, 3 m of the high-water mark of pools to provide $\geq 70\%$ canopy cover; residual forest will be retained within 15 m of the high-water mark of pools to provide amphibian cover.
 - Clearcut forest silviculture system – Unmapped residual patches required to meet the direction in Section 3.2.2 will preferentially be connected to pools. When connecting residual patches to pools, trees will be retained in and within 3 m of the high-water mark to provide overhead shade and residual forest will be retained within at least 15 m of the high-water mark to provide amphibian cover. [\(rationale\)](#)

4.1.4 Hydrological connections

In hydrological connections between terrestrial and aquatic ecosystems, shallow subsurface groundwater from upland soils is discharged and transferred to surface flow in the last interface between the land and water. Groundwater and surface run-off in hydrological connections are key sources of water, biogeochemical elements, and biological communities that support and sustain downstream streams, rivers, wetlands, ponds, and lakes. While these linear features rarely contain fish, they do support fish and fish habitat (e.g., they contribute cold water inputs to adjacent aquatic features).

Direction

Direction focuses on mitigating potential disruption of hydrological function from forestry operations, which may include changing the rates and/or patterns of surface and shallow groundwater flow (i.e., impeding, accelerating, or diverting water movement), within areas of hydrological connectivity. Mitigating potential disruption of hydrological function in these linear features is a key component of the Ministry's approach to mitigating potential effects of forest management operations on methylation of mercury and subsequent export to adjacent aquatic features.

Hydrological connections are addressed through conditions on regular operations. [\(rationale\)](#)

Description of value

Hydrological connections between terrestrial and aquatic ecosystems are recognizable linear features that channel ephemeral surface and/or shallow groundwater flows to lakes, ponds, rivers, or streams are those that can reasonably be identified at the time of operations.

During some seasons it may be difficult to accurately identify these features. However, forest workers are expected to exercise due diligence in identifying and protecting these features in all seasons. The Ministry's hydrological flow accumulation modelling spatial product, which identifies the potential locations of hydrological connections (flowpaths), is available on the Natural Resources Information Portal (NRIP) for the managed forest, can be used by forestry workers to identify the potential locations of hydrological connections. Alternatively, with use of a LiDAR-derived digital elevation model (DEM), sustainable forest licensees may choose to undertake flow accumulation modelling for their management unit. To be considered a hydrological connection, a flow initiation threshold of 3.2 ha (i.e., the upstream contributing area at which point flow initiation can reasonably be identified on the ground) would apply. Note: Predicted location of hydrological connections will vary in accuracy depending on the resolution of the DEM (e.g., 5 m versus 30 m) used in the flow accumulation modelling. [\(rationale\)](#)

Conditions on regular operations

Guidelines

- Harvest, renewal, and tending operations will minimize disruption of hydrological function within recognizable linear features that channel ephemeral surface and/or shallow groundwater flow (i.e. springs, seeps) to lakes, ponds, rivers, or streams (i.e., hydrological connections between terrestrial and aquatic ecosystems). Hydrological function will be considered to have been disrupted if operations:
 - Impede water movement by restricting flow, creating long-term pools of standing water that exist for >1 year (e.g., caused by deep ruts perpendicular to the flow path that act to dam flow)
 - Accelerate water movement by channelizing flow (e.g., caused by long ruts parallel to the direction of flow)
 - Divert water movement by changing the location of the path of flow (e.g., caused by ruts that create a new flow path)

The natural “watering up” process associated with the removal of forest cover is not considered a hydrological disruption. ([rationale](#))

- Forestry workers will be vigilant for evidence suggesting the presence of hydrological connections throughout harvest areas (but especially near mapped predicted flow paths) such as changes in:
 - Topography – e.g., presence of a gully or other linear depression
 - Soil texture or moisture – e.g., presence of saturated mineral or organic soils
 - Vegetation structure – e.g., change in canopy height/presence of a linear canopy gap
 - Vegetation composition – e.g., presence of indicators of ephemeral surface and/or shallow groundwater flows such as alder, cedar, tamarack, black ash, and/or grasses/sedges ([rationale](#))
- Forestry workers will use their professional judgement to determine the likely location and characteristics of hydrological connections and apply the appropriate course of action. Where there is significant uncertainty, a conservative approach will be used. ([rationale](#))

Best management practices

- Movement of heavy equipment within hydrological connections (especially along extraction trails) should be avoided to the extent practical and feasible, especially during the frost-free period. ([rationale](#))
- When avoidance is not practical or feasible, heavy equipment should cross hydrological connections:
 - At as few locations as possible
 - At the narrowest point possible
 - As far from connected aquatic features as possible

- At locations with the highest soil bearing capacity possible (look for indicators of drier soil conditions)
- Using techniques to increase bearing capacity and avoid creating soil disturbance including use of corduroy mats, brush mats, or chipper debris ([rationale](#))
- Where restoring surface water flow will not further impact water movement and/or cause additional damage to the site:
 - Remove material (e.g., displaced soil/organic matter, brush mats, corduroy) that may be impeding surface water flow so that natural drainage patterns are re-established.
 - Any rehabilitation work should occur within one year of completion of operations using the appropriate equipment and during optimal conditions (e.g., summer).
- Train field staff, especially equipment operators, in the recognition and significance of disruption of hydrological function. ([rationale](#))
- Operations staff should use maps from hydrological modeling tools (e.g., flow accumulation, topographic index) prior to start-up of operations to help identify possible unmapped drainage, localized wet areas, mapped drainage that is misplaced or may not exist, or hydrological connections. Note: Accuracy of predicted locations of hydrological connections will vary depending on the DEM used in the hydrological modelling and the outputs of these tools should not replace normal field reconnaissance. ([rationale](#))
- Refer to Appendix 5.2b for a partial list of strategies and techniques that will minimize site disturbance (e.g., rutting) during operations and thereby indirectly minimize some of the risk of disrupting surface and subsurface water flow in areas of hydrological connection between terrestrial and aquatic ecosystems. ([rationale](#))

4.1.5 Self-sustaining brook and/or lake trout lakes and ponds with a high risk of threat to sustainability from new or improved access

Direction in Section 4.1, including restrictions on roads, focuses on maintaining various ecological functions of aquatic ecosystems, including the productive capacity that supports fish (i.e., protection of fish habitat). In addition to their potential effects on the productive capacity of aquatic ecosystems, forest access roads constructed during forestry operations may increase access to specific fisheries. In some cases, the risk associated with **new** or **improved** access may be acceptable given the specific management objectives of a fishery (see Notes at end of section for definitions of **bolded** terms). In other cases, the risk associated with new or improved access may

not be acceptable given the management objectives of a fishery if there is a potential for over-harvest or introduction of **alien aquatic species**. New or improved access may increase angling which may facilitate intentional and unintentional dispersal of aquatic alien species across natural barriers into new lakes. Alien aquatic species introduction may be especially harmful to brook and lake trout that rely on littoral prey fish. In some circumstances, other planning exercises or policy documents (such as the *Crown Land Use Policy Atlas*, fisheries management plans, Ministry regional direction) may contain additional management objectives for the construction, use, or decommissioning of roads (as defined in the FMPM) around specific aquatic features that will be considered by planning teams.

Direction

When not specifically identified by other planning exercises or policy documents, direction in this section will be applied.

Self-sustaining trout lakes and ponds are addressed through operational prescriptions and conditions for AOCs. The AOC will apply if new or improved access from forest access roads is created to a lake or pond with a **self-sustaining** population of brook trout and/or lake trout and this access has a high risk of undermining the sustainability of that population due to increased **angler use** and/or introduction of alien aquatic species. Direction focuses on:

- Restricting construction of primary, branch, and operational roads that increases and/or improves access to lakes and ponds with self-sustaining populations of brook trout and/or lake trout that is likely to result in either unsustainable impacts from angler harvest and/or introduction of alien aquatic species, and
- Applying locally appropriate/effective access control measures.

Direction to mitigate other potential impacts to sustainability of these populations (e.g., change to fish habitat) from forestry operations can be found in Section 4.1. ([rationale](#))

Description of value

Self-sustaining brook trout and/or lake trout lakes and ponds are considered at high risk where new or improved access may facilitate unsustainable angler harvest and/or impacts from the introduction of alien aquatic species.

All lakes and ponds with self-sustaining brook trout populations will be identified by the Ministry prior to or during operations.

Self-sustaining lake trout lakes are those listed in the Ministry's *Inland Ontario Lakes Designated for Lake Trout Management* for lake trout management and designated as 'natural' lakes or identified by the Ministry prior to or during operations.

Determining whether a self-sustaining brook and/or lake trout lake is high risk will be assessed using the criteria provided in Appendix 4.1b.

The lake or pond and area within 1,000 m of the shoreline will comprise the AOC. [\(rationale\)](#)

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to restrictions for lakes and ponds (Section 4.1 and 4.1.1). [\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Guidelines

- **New** or **improved** primary and branch roads and landings are not permitted:
 - Within 400 m of the lake or pond except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process
 - Within 401-1,000 m of the lake or pond unless approved by the Ministry (see Appendix 1b) [\(rationale\)](#)
- All **new** or **improved** primary/branch roads will be subject to locally appropriate/effective access control measures (i.e., the least restrictive approach that is likely to achieve the desired results). [\(rationale\)](#)

Best management practices

- Existing primary and branch roads within the AOC should be subject to locally appropriate/effective access control measures when practical and feasible. [\(rationale\)](#)

Conditions on operational roads and landings (planned or existing)

Standards

- **New** or **improved** operational roads must be decommissioned following completion of operations. [\(rationale\)](#)

Guidelines

- **New** or **improved** operational roads and landings are not permitted within 400 m of the lake or pond unless approved by the Ministry (see Appendix 1b). [\(rationale\)](#)

- When operations will be temporarily stopped for a period of greater than three months, **new** or **improved** operational roads within 1,000 m of the lake or pond will be subject to temporary and locally appropriate/effective access control measures (i.e., the least restrictive approach that is likely to achieve the desired results).

Best management practices

- Existing operational roads within the AOC should be subject to locally appropriate/effective access control measures where practical and feasible. [\(rationale\)](#)
- To the extent practical and feasible, plan and construct operational roads to the minimal standard required to reduce future efforts and costs associated with decommissioning (e.g., construct winter roads and crossings, use temporary bridges). [\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- Operations associated with new and existing forestry aggregate pits and wood storage yards are permitted within the AOC while operations are in progress.
- Forestry aggregate pits must be rehabilitated prior to or at the same as road decommissioning activities within the AOC.

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within 400 m of the lake or pond unless approved by the Ministry (see Appendix 1b).

Notes

Self-sustaining populations are lake or brook trout populations that persist from natural reproduction.

New forest access roads are not currently on the land base and are required to facilitate harvest. They are expected to increase angler use of a lake or pond if they reduce travel costs incurred by anglers by lessening travel time and/or effort compared to any existing access to a lake or pond.

Improved forest access roads are existing roads that are planned to be re-opened (e.g., brushing) and are expected to increase angler use of a lake or pond because of improved road quality.

Alien aquatic species of animals, plants, and micro-organisms are those introduced by human actions outside their natural past or present distribution.

Angler use is the angling effort intensity at a lake or pond that is measured by angler hours per ha of lake or pond over the course of a year.

4.2 Special habitat features

Section 4.2 provides direction for maintaining or enhancing the suitability of special habitat features. These include: groundwater recharge areas associated with brook trout spawning habitat; nest sites used by birds; beaver habitat; aquatic feeding areas and mineral licks used by moose; and dens used by bears, wolves, and other furbearing mammals.

4.2.1 Groundwater recharge areas associated with brook trout spawning sites

Groundwater is an important component of the hydrological cycle in forest ecosystems and has a significant effect on aquatic habitats and their biota. Groundwater provides a coldwater source critical to the life history and habitat of a number of fish species, especially thermally sensitive brook trout. For example, within lakes and streams on the Canadian Shield, female brook trout typically lay eggs in nests (redds) that are constructed in cobble-gravel-sand substrates associated with areas of groundwater discharge (upwelling). Suitable areas of groundwater discharge are frequently associated with lenses of coarse till that direct and accelerate groundwater flow. In bedrock-controlled landscapes, distinct sub-catchments (recharge areas) up to 10 ha in size may supply groundwater that maintains flow rates through brook trout spawning sites.

The main risks to recharge areas are hill-slope excavations and ditching associated with road construction or aggregate extraction that may intercept or redirect subsurface flow. Compaction associated with the creation of landings may also affect water infiltration.

Direction

Direction for the protection of groundwater recharge areas associated with known brook trout spawning sites focuses on minimizing risk of interrupting and redirecting groundwater flow and altering infiltration capacity.

Groundwater recharge areas associated with known brook trout spawning sites are addressed through operational prescriptions and conditions for AOCs, and may be

mapped using field surveys or hydrological modeling tools. When operationally feasible, it is recommended to conduct field verifications of groundwater recharge areas that have been modeled in advance of forest operations to confirm presence. ([rationale](#))

Description of value

Groundwater recharge areas associated with known brook trout spawning sites identified by the Ministry prior to operations. Mapped recharge area is the AOC.

Operational prescription for the area of concern

Standards ([rationale](#))

- Regular harvest, renewal, and tending operations are permitted within the AOC.
- Extraction trail location and design will follow the operating practices described in Section 5.2 to minimize rutting that could disrupt shallow groundwater flow.

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines ([rationale](#))

- New all-weather roads and landings are not permitted within the AOC except in extraordinary circumstances, appropriate mitigative measures are taken to minimize the risk of interrupting or redirecting shallow groundwater flow (e.g., no ditching or grubbing, appropriate cross drainage is provided; see Section 5.1), and the road, including specific location, is identified and justified through the FMP AOC planning process.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards ([rationale](#))

- Forestry aggregate pits and wood storage yards are not permitted within the AOC.

4.2.2 Bird nest sites

Forest operations may inadvertently kill, harm, disturb, and/or destroy nesting birds, their eggs or young (effects are collectively known as incidental take). Nesting birds,

eggs, and young of all wild species (except American crow, brown-headed cowbird, common grackle, house sparrow, red-winged blackbird, and European starling) are protected from incidental take by either the federal *Migratory Birds Convention Act, 1994* (MBCA) or the provincial *Fish and Wildlife Conservation Act, 1997* (FWCA).

Forestry operations may also inadvertently remove or destroy nesting structures used by breeding birds. When these structures are enduring features that are likely to be reused by breeding birds (e.g., bald eagle stick nests), their loss may also be considered incidental take.

Forestry operations may further alter the suitability of habitat used by individual pairs of breeding birds. However, the goal of the Ministry's coarse filter approach (see Section 1.3.1) is to maintain an adequate supply of habitat to support widely dispersed healthy populations of most native bird species addressed by this guide (for species at risk see section 4.3). In some cases, coarse-filter direction may need to be supplemented with species-specific direction to support widely dispersed healthy populations. Species-specific direction is generally included for species that are uncommon (and for which loss of individual nests or nesting areas may have population consequences), show strong fidelity to specific nesting structures or nesting areas, and are sensitive to habitat alteration.

The only way to completely eliminate the risk of inadvertently killing, harming, disturbing, and/or destroying nesting birds, their eggs, or young is to avoid all operations that may have adverse effects within habitats likely to be used by nesting birds during the breeding period. However, since some species may be nesting from mid-April until late August¹ in all types and ages of forest and in all types of non-forested habitats (e.g., wetlands, rock outcrops), complete avoidance is generally not practical or feasible. ([rationale](#))

Direction

Direction in Section 4.2.2 (and subsequent subsections) applies to all birds addressed by the MBCA or the FWCA and focuses on:

- Minimizing and mitigating the likelihood that forestry operations will inadvertently kill, harm, disturb, and/or destroy nesting birds, their eggs, or young.
- Minimizing and mitigating the likelihood that forest operations will inadvertently destroy enduring nest structures that are likely to be reused by breeding birds.
- Maintaining suitability of habitat for selected species.

Note: The direction in Section 4.2.2 is intended to minimize and mitigate the likelihood that forestry operations will inadvertently kill, harm, disturb, and/or destroy nesting birds, their eggs, or young. However, complete avoidance can only be assured if all

¹ See https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.html#_fig01

operations with potential adverse effects are conducted outside the breeding period. It is the responsibility of forest workers to determine the level of risk regarding potential contravention of the MBCA or FWCA they are willing to accept.

The direction in Sections 4.2.2.1 to 4.2.2.8 is intended for application at nest sites located in relatively undeveloped situations where birds are likely to be intolerant of forestry operations. Birds that build nests in highly developed or disturbed situations (e.g., adjacent to a well-traveled road or human habitation) may be unusually tolerant of human activities. For these habituated birds, the direction in Sections 4.2.2.1 to 4.2.2.8 may be overly conservative and a planning team may choose to develop a unique, nest site-specific, AOC operational prescriptions and conditions that better reflect the tolerance of the birds. Since the direction in Sections 4.2.2.1 to 4.2.2.8 is not specifically intended for habituated birds, the new AOC operational prescriptions and conditions developed will not be considered an exception to the direction in this guide.

If at the time of operations, the status of a nest has changed or a new nest is located, the values map will be revised, and the appropriate direction applied. If the nest has fallen out of the tree, the nest tree has fallen down, or the tree or habitat has become otherwise unsuitable for nesting, treat as a value that no longer exists.

Refer to the glossary for definitions of terms (e.g., active nest, inactive nest, occupied nest) used in Sections 4.2.2.1 to 4.2.2.8.

The following direction will be included as conditions on regular operations within FMPs. ([rationale](#))

Conditions on regular operations

Standards ([rationale](#))

- All forest workers will be aware of their legal obligation under the MBCA and the FWCA to avoid incidental take of nesting birds, their nests (including trees with pileated woodpecker nesting cavities), eggs, and young.

Guidelines

- When conducting any operations from mid-April to late August, all forest workers will be vigilant for nests of all protected bird species containing nesting birds, eggs, or young. This includes being alert for evidence of nesting activity such as birds flushing from nests, birds carrying food or nesting material, and birds behaving defensively. When encountered, these new values/important ecological features will be reported as per requirements in FIM, and the appropriate AOC direction or conditions on operations will be followed.
- When conducting any operations throughout the year, all forest workers will be vigilant for enduring nest structures that are likely to be reused. This includes

stick nests and trees with large cavities that could be used by nesting or roosting birds such as chimney swifts, falcons, owls, or ducks (see also Section 3.2.3.1). When encountered, the appropriate AOC direction or conditions on operations will be followed.

Best management practices [\(rationale\)](#)

- Whenever practical and feasible, operations that have a high potential to unintentionally kill, harm, disturb, and/or destroy nesting birds, their eggs or young (e.g., operations involving heavy equipment such as harvest, site preparation, and road building) will be scheduled outside the time period when birds may be nesting (generally mid-April to late August) and especially during the peak period of nesting (generally mid-May to late July).
- Minimize the ground covered by machine and extraction trails. Many species of birds (e.g., grouse, waterfowl, some songbirds) nest on or near the ground.
- Preferentially retain wildlife trees (3.2.3.1) with existing cavities (they may contain nests with eggs or young birds)
- Minimize operations within AOCs associated with ponds and wetlands. There is a high likelihood of encountering nesting waterfowl near these features.

4.2.2.1 Cliff-nesting birds

Peregrine falcons are listed on the Species at Risk in Ontario (SARO) list. Direction is provided for natural nest sites that have been occupied by a pair of peregrines falcons. Direction is provided separately for cliffs versus other natural sites (e.g., rock outcrops); cliff sites are considered more suitable for nesting and thus receive more restrictive direction.

Direction is also provided for natural nest sites that have been occupied by a pair of turkey vultures.

If operations that are not consistent with the direction occur within the normal radius of the AOC for an active peregrine falcon or turkey vulture nest site prior to its discovery, the AOC will be laid out to meet the intent of the direction as nearly as possible.

[\(rationale\)](#)

i) Active peregrine falcon nest site on cliffs

Description of value

A natural cliff face occupied by a pair of nesting peregrines falcons within the past 30 years (assuming the cliff face is still suitable for nesting).

The nest site extends vertically from the base to the top of the cliff face and horizontally across the cliff face to include ledges used for nesting and any part of the cliff face within 500 m of used ledges. The cliff face includes the talus slope at the base of the cliff and the rock barren at the top of the cliff (the outer edge of the top and bottom of the cliff will typically correspond to the point where the canopy cover of trees is $\geq 25\%$). If nest sites used by the same pair in different years are on distinct cliffs, each cliff face is a separate nest site.

The nest site and the area within 400 m of the front and back of the nest site comprise the AOC. ([rationale](#))

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest is not permitted within 100 m of the top or bottom of nest sites.
 - Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 101-200 m of the top or bottom of nest sites. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure $< 60\%$. ([rationale](#))

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distances of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary and branch roads and landings that provide increased access to nest sites are not permitted within 200 m of the top or bottom of nest sites. ([rationale](#))

Guidelines

- New primary and branch roads, and landings that provide increased access to nest sites are not permitted within 201-400 m of the top or bottom of nest sites unless approved by the Ministry (see Appendix 1b). ([rationale](#))
- Operations associated with primary and branch roads, and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations.However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Conditions on operational roads and landings (planned or existing)

Guidelines

- New operational roads and landings that provide increased access to nest sites are not permitted within 200 m of the top or bottom of nest sites except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. ([rationale](#))
- Operations associated with operational roads and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations.However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Best management practices

- To the extent practical and feasible, new operational roads and landings will not be constructed within 201-400 m of the top or bottom of nest sites. ([rationale](#))
- When new operational roads are constructed within the AOC, temporary water crossings will be used whenever practical and feasible to limit future access and disturbance. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 200 m of the top or bottom of nest sites. ([rationale](#))

Guidelines

- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations ([rationale](#))

Notes

The **critical breeding period** is defined by Bird Conservation Region (BCR):

Species	BCR 8*	BCR 12*	BCR 13*
Peregrine falcon	Mar 15 – Aug 31	Mar 15 – Aug 31	Mar 1 – Aug 15

*Local knowledge of breeding chronology may be used to adjust these dates ([rationale](#))

ii) Active peregrine falcon nest site on other natural features

Description of value

Nests on natural features (other than cliffs) occupied at least once within the past 15 years.

The nest and the area within 400 m comprise the AOC. ([rationale](#))

Operational prescription for the area of concern

Standards ([rationale](#))

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest is not permitted within 100 m of active nests.

- Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 101-200 m of active nests. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure $< 60\%$.

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations

Conditions on primary and branch roads and landings (planned or existing)

Standards [\(rationale\)](#)

- New primary and branch roads and landings that provide increased access to nests sites are not permitted within 200 m of active nests.

Guidelines [\(rationale\)](#)

- New primary and branch roads and landings that provide increased access to nest sites are not permitted within 201-400 m of active nests unless approved by the Ministry (see Appendix 1b).
- Operations associated with primary and branch roads, and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Conditions on operational roads and landings (planned or existing)

Guidelines [\(rationale\)](#)

- New operational roads and landings that provide increased access to nest sites are not permitted within 200 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
- Operations associated with operational roads and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations.However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Best management practices [\(rationale\)](#)

- To the extent practical and feasible, new operational roads and landings will not be constructed within 201-400 m of active nests.
- When new operational roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access and disturbance.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards [\(rationale\)](#)

- New forestry aggregate pits and wood storage yards are not permitted within 200 m of active nests.

Guidelines

- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations.

iii) Active turkey vulture nests on natural features

Description of value

Turkey vulture nests on natural features (typically cliffs or rock outcrops) occupied at least once within the past 15 years.

The nest and the area within 150 m comprise the AOC. [\(rationale\)](#)

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest is not permitted within 75 m of active nests.
 - Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 76-150 m of active nests. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure $< 60\%$. [\(rationale\)](#)

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 150 m for high potential impact operations
 - 75 m for moderate potential impact operations
 - 40 m of low potential impact operations. [\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary and branch roads and landings are not permitted within 75 m of active nests. [\(rationale\)](#)

Guidelines

- New all-weather primary and branch roads and landings are not permitted within 76-150 m of active nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly < 8 m

tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 20 m. [\(rationale\)](#)

- Operations associated with primary and branch roads and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 150 m for high potential impact operations
 - 75 m for moderate potential impact operations
 - 40 m of low potential impact operations.However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. [\(rationale\)](#)

Conditions on operational roads and landings (planned or existing)

Guidelines

- New operational roads and landings are not permitted within 75 m of active nests unless approved by the Ministry (see Appendix 1b), or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 15 m. [\(rationale\)](#)
- New landings associated with operational roads are not permitted within 76-150 m of active nests unless approved by the Ministry (see Appendix 1b). [\(rationale\)](#)
- Operations associated with operational roads and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 150 m for high potential impact operations
 - 75 m for moderate potential impact operations
 - 40 m of low potential impact operations.However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. [\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 75 m of active nests. ([rationale](#))

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within 76-150 m of active nests except in extraordinary circumstances. ([rationale](#))
- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 150 m for high potential impact operations
 - 75 m for moderate potential impact operations
 - 40 m of low potential impact operations. ([rationale](#))

Notes

The **critical breeding period** is defined by Bird Conservation Region (BCR):

Species	BCR 8	BCR 12	BCR 13
Turkey Vulture	Apr 15 – Sep 15*	Apr 1 – Sep 15*	Mar 15 – Sep 15*

*Local knowledge of breeding chronology may be used to adjust these dates. ([rationale](#))

4.2.2.2 Bald eagle and osprey nests`

Direction is provided for active and inactive nests to be/have been occupied or built by the bald eagle or osprey.

If operations that are not consistent with the direction occurs within 400 m of an active bald eagle nest (or 300 m of an active osprey nest), or 30 m of an inactive bald eagle or osprey nest prior to its discovery, the AOC or patch of residual forest will be laid out so that equivalent sized reserves and modified areas are retained in patches that are as nearly circular as possible (to minimize edge). ([rationale](#))

i) Active bald eagle nests

Description of value

Active nests have been occupied at least once within the past 5 years, unless the nest has been documented as unoccupied for ≥ 3 consecutive years, in which case the nest is considered inactive.

When ≥ 2 active nests occur within AOC and are considered part of the nesting area of an individual pair, the nest with the most recent evidence of occupancy within this nesting area is the active nest; the other nest(s) is(are) considered inactive nests.

When inventory data are insufficient to determine which nest in a nesting area has been most recently occupied, the nest in good repair is considered the active nest. The tree containing the nest and the area within 400 m comprise the AOC. [\(rationale\)](#)

Operational prescription for the area of concern

Standards (see Figure 4.2a)

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest is not permitted within 100 m of primary nests.
 - Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 101-200 m of active nests. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure $< 60\%$. [\(rationale\)](#)

Guidelines

- Within harvested portions of the AOC, wildlife trees that may function as potential nest, perch, and roost sites will be preferentially retained, based on the following order of priority: 1) supercanopy trees, 2) veteran trees, 3) cavity trees, and 4) other live dominant or codominant trees that are windfirm. White pine, red pine, and/or trembling aspen will be favoured when available. [\(rationale\)](#)
- Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m for low potential impact operations. [\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary and branch roads and landings are not permitted within 200 m of active nests.

Guidelines

- New primary and branch roads and landings are not permitted within 201-400 m of active nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))
- Operations associated with primary and branch roads and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations.However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Conditions on operational roads and landings (planned or existing)

Guidelines

- New operational roads and landings are not permitted within 200 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 15 m. ([rationale](#))
- New operational roads and landings permitted within 201-400 m of active nests with Ministry notification (see Appendix 1b).
- Operations associated with operational roads and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. [\(rationale\)](#)

Best management practices [\(rationale\)](#)

- New operational roads constructed within 201-400 m of active nests will have a cleared right-of-way width as narrow as practical/feasible which does not exceed 15 m.
- If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 200 m of active nests. [\(rationale\)](#)

Guidelines

- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied active nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations. [\(rationale\)](#)

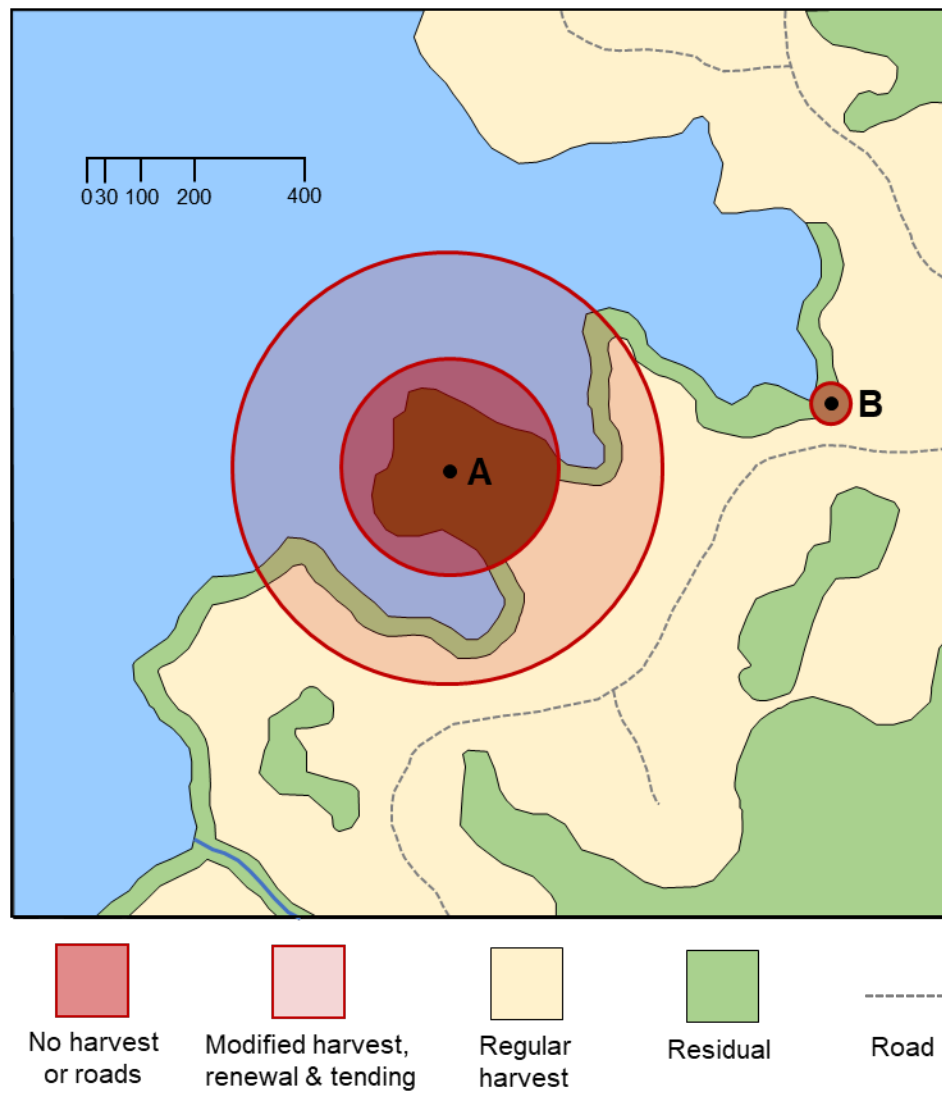


Figure 4.2a. Typical AOC layout for an active (A) and inactive (B) bald eagle nest in a boreal forest management unit (i.e., clearcut harvest). No clearcut harvest, roads, landings, forestry aggregate pits, or wood storage yards are permitted within 200 m of the primary and 30 m of the inactive nest at any time. No high impact operations are permitted within 400 m of the primary nest (if occupied) during the critical breeding period. Note: Some types of partial harvest, such as single tree selection, are permitted within 100-200 m of primary nests, but have not been included in this example – see text.

ii) Inactive bald eagle nests

Description of value

Nests not occupied at least once within the past 5 years.

Active nests documented as unoccupied for ≥ 3 consecutive years.

The tree containing the inactive nest and the area within 30 m comprise the AOC.
([rationale](#))

Operational prescription for the area of concern

Standards (see Figure 4.2a)

- Harvest, renewal, and tending operations are not permitted within 30 m of nest trees. ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- New roads and landings are not permitted within 30 m of inactive nests unless with Ministry approval (see Appendix 1b). ([rationale](#))
- No timing restrictions on operations associated with roads and landings around inactive nests. ([rationale](#))

Conditions forestry aggregate pits and wood storage yards

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within 30 m of inactive nests unless with Ministry approval (see Appendix 1b). ([rationale](#))
- No timing restrictions on operations associated with forestry aggregate pits and wood storage yards around inactive nests. ([rationale](#))

iii) Active osprey nests

Description of value

Active nests have been occupied at least once within the past 5 years, unless the nest has been documented as unoccupied for ≥ 3 consecutive years, in which case the nest is considered inactive.

When ≥ 2 active nests occur within the AOC and are considered part of the nesting area of an individual pair, the nest with the most recent evidence of occupancy within this nesting area is the active nest; the other nest(s) is(are) considered inactive nests.

When inventory data are insufficient to determine which nest in a nesting area has been most recently occupied, the nest in **good repair** is considered the active nest. The tree containing the nest and the area within 300 m comprise the AOC. ([rationale](#))

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest is not permitted within 75 m of primary nests.
 - Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 76-150 m of active nests. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure $< 60\%$. ([rationale](#))

Guidelines

- Within harvested portions of the AOC, wildlife trees that may function as potential nest, perch, and roost sites will be preferentially retained, based on the following order of priority: 1) supercanopy trees, 2) veteran trees, 3) cavity trees, and 4) other live dominant or codominant trees that are windfirm. White pine, red pine, and/or trembling aspen will be favoured when available. ([rationale](#))
- Harvest, renewal, and tending operations are not permitted within the following distance of occupied active nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 300 m for high potential impact operations
 - 150 m for moderate potential impact operations
 - 75 m of low potential impact operations. ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary and branch roads and landings are not permitted within 150 m of active nests. ([rationale](#))

Guidelines

- New primary and branch roads and landings are not permitted within 151-300 m of active nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))
- Operations associated with primary and branch roads and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 300 m for high potential impact operations
 - 150 m for moderate potential impact operations
 - 75 m of low potential impact operations.However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Conditions on operational roads and landings (planned or existing)

Guidelines

- New operational roads and landings are not permitted within 150 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and ≤15 m. ([rationale](#))
- New operational roads and landings permitted within 151-300 m of active nests with Ministry notification (see Appendix 1b).
- Operations associated with operational roads and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 300 m for high potential impact operations
 - 150 m for moderate potential impact operations
 - 75 m of low potential impact operations.However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Best management practices [\(rationale\)](#)

- New operational roads constructed within 151-300 m of active nests will have a cleared right-of-way width is as narrow as practical/feasible which does not exceed 15 m.
- If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 150 m of active nests. [\(rationale\)](#)

Guidelines

- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied active nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 300 m for high potential impact operations
 - 150 m for moderate potential impact operations
 - 75 m of low potential impact operations. [\(rationale\)](#)

iv) Inactive osprey nests

Description of value

Nests not occupied at least once within the past 5 years.

Active nests documented as unoccupied for ≥ 3 consecutive years.

The tree containing the inactive nest and the area within 30 m comprise the AOC. [\(rationale\)](#)

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within 30 m of nest trees. [\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- New roads and landings are not permitted within 30 m of inactive nests unless with Ministry approval (see Appendix 1b). [\(rationale\)](#)
- No timing restrictions on operations associated with roads and landings around inactive nests. [\(rationale\)](#)

Conditions forestry aggregate pits and wood storage yards

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within 30 m of inactive nests unless with Ministry approval (see Appendix 1b). [\(rationale\)](#)
- No timing restrictions on operations associated with forestry aggregate pits and wood storage yards around inactive nests. [\(rationale\)](#)

Notes

The **critical breeding period** is defined by Bird Conservation Region (BCR):

Species	BCR 8*	BCR 12*	BCR 13*
Bald eagle	Mar 1 – Aug 31	Feb 15 – Aug 31	Feb 1 – Aug 31
Osprey	Apr 15 – Aug 31	Apr 1 – Aug 31	Mar 15 – Aug 31

*Local knowledge of breeding chronology may be used to adjust these dates. [\(rationale\)](#)

4.2.2.3 Colonial nesting birds

Direction is provided for colonies that have been used by the great blue heron or black tern. [\(rationale\)](#)

i) Active great blue heron colonies

Description of value

Heron colonies with <20 nests occupied at least once within the past 10 years unless documented as unoccupied for ≥5 years, or with ≥20 nests occupied at least once within the past 20 years unless documented as unoccupied for ≥10 years.

The polygon connecting peripheral trees containing nests and the area within 300 m comprise the AOC. ([rationale](#))

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest is not permitted within 75 m of the polygon connecting peripheral nests.
 - Harvest that retains mature forest with ≥60% relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 76-150 m of polygon connecting peripheral nests. Harvest that retains relatively uniform canopy closure ≥60% is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure <60%.
 - Harvest that retains forest with ≥50% stocking comprised of trees ≥3 m tall is permitted within 151-300 m of the polygon connecting peripheral nests. ([rationale](#))

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests within colonies during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 300 m for high potential impact operations
 - 150 m for moderate potential impact operations
 - 75 m of low potential impact operations. ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary and branch roads and landings are not permitted within 150 m of the polygon connecting peripheral nests. ([rationale](#))

Guidelines

- New primary and branch roads and landings are not permitted within 151-300 m of the polygon connecting peripheral nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))
- Operations associated with primary and branch roads and landings are not permitted within the following distance of occupied active nests within colonies during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 300 m for high potential impact operations
 - 150 m for moderate potential impact operations
 - 75 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. ([rationale](#))

Conditions on operational roads and landings (planned or existing)

Guidelines

- New operational roads and landings are not permitted within 150 m of the polygon connecting peripheral nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. ([rationale](#))
- New operational roads are permitted within 151-300 m of active nests with Ministry notification (see Appendix 1b).
- New landings associated with operational roads are not permitted within 151-300 m of active nests unless approved by the Ministry (see Appendix 1b). ([rationale](#))
- Operations associated with operational roads and landings are not permitted within the following distance of occupied active nests within colonies during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 300 m for high potential impact operations
 - 150 m for moderate potential impact operations
 - 75 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. ([rationale](#))

Best management practices [\(rationale\)](#)

- New operational roads constructed within 151-300 m of the polygon connecting peripheral nests will have a cleared right-of-way width is as narrow as practical/feasible which does not exceed 15 m.
- If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 150 m of the polygon connecting peripheral nests. [\(rationale\)](#)

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within 151-300 m of the polygon connecting peripheral nests unless approved by the Ministry (see Appendix 1b). [\(rationale\)](#)
- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied nests within colonies during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 300 m for high potential impact operations
 - 150 m for moderate potential impact operations
 - 75 m of low potential impact operations. [\(rationale\)](#)

ii) Inactive great blue heron colonies

Description of value

Colonies with ≥ 20 nests in suitable habitat not occupied at least once within the past 20 years or documented as unoccupied for 10 or more consecutive years.

Colonies with < 20 nests in suitable habitat not occupied at least once within the past 10 years or documented as unoccupied for 5 or more consecutive years.

The polygon connecting peripheral trees containing nests and the area within 30 m comprise the AOC. [\(rationale\)](#)

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within 30 m of the polygon connecting peripheral nests. ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- Construction of new roads and landings is not permitted within 30 m of the polygon connecting peripheral nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. ([rationale](#))
- No timing restriction on operations associated with roads and landings within 30 m of the polygon connecting peripheral nests. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Guidelines

- Construction of new forestry aggregate pits and wood storage yards are not permitted within 30 m of the polygon connecting peripheral nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. ([rationale](#))
- No timing restriction on operations associated with forestry aggregate pits and wood storage yards within 30 m of the polygon connecting peripheral nests. ([rationale](#))

iii) Active black tern colonies

Description of value

Colonies occupied by breeding black terns at least once within the past 5 years.

The polygon connecting peripheral nests and the area within 100 m comprise the AOC. ([rationale](#))

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below). [\(rationale\)](#)
- Operations that significantly alter hydrological regime within occupied wetlands to the extent that habitat is no longer suitable for nesting, are not permitted. [\(rationale\)](#)

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 100 m for high potential impact operations
 - 50 m for moderate potential impact operations
 - 25 m of low potential impact operations. [\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary and branch roads, and landings are not permitted within 50 m of the polygon connecting peripheral nests. [\(rationale\)](#)

Guidelines

- New primary and branch roads, and landings are not permitted within 51-100 m of the polygon connecting peripheral nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. [\(rationale\)](#)
- Operations associated with primary and branch roads, and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 100 m for high potential impact operations

- 50 m for moderate potential impact operations
- 25 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. ([rationale](#))

Conditions on operational roads and landings (planned or existing)

Guidelines

- New operational roads and landings are not permitted within 50 m of the polygon connecting peripheral nests except in extraordinary circumstances or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 15 m. ([rationale](#))
- Operations associated with operational roads and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 100 m for high potential impact operations
 - 50 m for moderate potential impact operations
 - 25 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. ([rationale](#))

Best management practices

- New operational roads and landings should not be constructed within 51-100 m of the polygon connecting peripheral nests unless there is no practical and feasible alternative or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 15 m. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Guidelines

- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 100 m for high potential impact operations

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- 50 m for moderate potential impact operations
- 25 m of low potential impact operations. ([rationale](#))

Notes

The **critical breeding period** is defined by Bird Conservation Region (BCR):

Species	BCR 8*	BCR 12*	BCR 13*
Great blue heron	Apr 1 – Aug 31	Mar 15 – Aug 31	Mar 15 – Aug 15
Black tern	May 15 – Jul 31	May 15 – Jul 31	May 1 – Jul 31

*Local knowledge of breeding chronology may be used to adjust these dates. ([rationale](#))

4.2.2.4 Uncommon stick-nesting birds

Direction for uncommon stick-nesting birds is provided for active and inactive nests that have been occupied or built by the Bonaparte's gull, great gray owl, American goshawk, or red-shouldered hawk.

The following direction applies to all nest sites unless an alternate prescription has been identified and rationalized by the planning team as necessary to address beech bark disease. This new prescription will not be considered an exception to the guide.

If operations that are not consistent with this direction occurs within the normal radius of the AOC prior to discovery of an active nest, the AOC will be laid out so that equivalent sized reserves and modified areas are retained in patches that are as nearly circular as possible (to minimize edge). ([rationale](#))

i) Active Bonaparte's gull nest sites

Description of value

Nests occupied at least once within the past 5 years (unless documented as unoccupied for ≥ 3 consecutive years).

Trees containing nests and the area within 100 m comprise the AOC. ([rationale](#))

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest is not permitted within 50 m of active nests.
 - Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 51-100 m of active nests. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure $< 60\%$. ([rationale](#))

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 100 m for high potential impact operations
 - 50 m for moderate potential impact operations
 - 25 m of low potential impact operations. ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary and branch roads, and landings are not permitted within 50 m of active nests. ([rationale](#))

Guidelines

- New primary and branch roads, and landings are not permitted within 51-100 m of active nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly < 8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))
- Operations associated with primary and branch roads, and landings are not permitted within the following distance of occupied active nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 100 m for high potential impact operations
 - 50 m for moderate potential impact operations
 - 25 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Conditions on operational roads and landings (planned or existing)

Guidelines

- New operational roads and landings are not permitted within 50 m of active nests unless approved by the Ministry (see Appendix 1b). ([rationale](#))
- Operations associated with operational roads and landings are not permitted within the following distance of occupied active nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 100 m for high potential impact operations
 - 50 m for moderate potential impact operations
 - 25 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Best management practices

- If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 50 m of active nests. ([rationale](#))

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within 51-100 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. ([rationale](#))
- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 100 m for high potential impact operations

- 50 m for moderate potential impact operations
- 25 m of low potential impact operations. ([rationale](#))

ii) Active great gray owl or American goshawk nest sites

Description of value

Active nests have been occupied at least once within the past 5 years, unless the nest has been documented as unoccupied for ≥ 3 consecutive years, in which case the nest is considered inactive.

When ≥ 2 active nests occur within AOC and are considered part of the nesting area of an individual pair, the nest with the most recent evidence of occupancy within this nesting area is the active nest; the other nest(s) is(are) considered inactive nests.

When inventory data are insufficient to determine which nest in a nesting area has been most recently occupied, the nest in good repair is considered the active nest.

The tree containing the nest and the area within a 400 m radius comprise the AOC. ([rationale](#))

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest is not permitted within 50 m of active nests.
 - A total of 28 ha of suitable nesting habitat will be retained within the AOC. The 50 m radius (0.8 ha) patch of unharvested forest surrounding the active nest (and any inactive nests) contributes to the 28 ha patch of suitable nesting habitat.
 - 7 of the 28 ha of suitable nesting habitat will be retained within 200 m of the active nest and will be mature forest with a relatively uniform canopy closure $\geq 70\%$ and canopy openings not to exceed individual tree crowns.
 - The remaining 21 ha of suitable nesting habitat may be located anywhere within the 400 m AOC and will be mature forest with a relatively uniform canopy closure $\geq 50\%$ and a maximum size of canopy gaps ≤ 0.1 ha.
 - Harvest that changes development stage, reduces canopy closure below 50%, or creates canopy gaps > 0.1 ha is not permitted within 200 m of the active nest. ([rationale](#))

Guidelines

- Suitable nesting habitat will be retained as a contiguous patch that encompasses the active nest and any inactive nests within the AOC. ([rationale](#))
- Suitable nesting habitat will be retained as a circular patch centred on the active nest (300 m radius circle) if the active nest occurs in a large patch of uniform block of habitat. Suitable nesting habitat will be retained as an irregularly-shaped patch (contained within the 400 m AOC) if this configuration better encompasses active and inactive nests. ([rationale](#))
- Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 200 m for high potential impact operations
 - 100 m for moderate potential impact operations
 - 50 m of low potential impact operations. ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary roads and landings are not permitted within 200 m of active nests. ([rationale](#))

Guidelines

- New primary roads and landings are not permitted within 201-400 m of active nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))
- New branch roads and landings are not permitted within 400 m of active nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))
- New landings >0.1 ha in size associated with primary and branch roads are not permitted within 201-400 m unless approved by the Ministry (see Appendix 1b). ([rationale](#))

- Operations associated with primary and branch roads, and landings are not permitted within the following distance of occupied active nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 200 m for high potential impact operations
 - 100 m for moderate potential impact operations
 - 50 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Conditions on operational roads and landings (planned or existing)

Guidelines

- New operational roads are not permitted within 200 m of active nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 15 m. ([rationale](#))
- Operations associated with operational roads and landings are not permitted within the following distance of occupied active nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 200 m for high potential impact operations
 - 100 m for moderate potential impact operations
 - 50 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Best management practices

- If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access and the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 200 m of active nests. ([rationale](#))

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within 201-400 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. ([rationale](#))
- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 200 m for high potential impact operations
 - 100 m for moderate potential impact operations
 - 50 m of low potential impact operations. ([rationale](#))

iii) Active red-shouldered hawk nest sites

Description of value

Active nests have been occupied at least once within the past 5 years, unless the nest has been documented as unoccupied for ≥ 3 consecutive years, in which case the nest is considered inactive.

When ≥ 2 active nests occur within AOC and are considered part of the nesting area of an individual pair, the nest with the most recent evidence of occupancy within this nesting area is the active nest; the other nest(s) is(are) considered inactive nests.

When inventory data are insufficient to determine which nest in a nesting area has been most recently occupied, the nest in good repair is considered the active nest.

The tree containing the nest and the area within 300 m radius comprise the AOC. ([rationale](#))

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest is not permitted within 75 m of active nests.

- Within the remainder of the AOC, mature forest with a relatively uniform canopy closure $\geq 70\%$, average size of canopy openings not to exceed individual tree crowns, and maximum size of canopy gaps ≤ 0.1 ha will be retained. ([rationale](#))

Guidelines

- Within 76-150 m of active nests, at least half the basal area retained will be comprised of trees ≥ 38 cm dbh (if available). ([rationale](#))
- Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 150 m for high potential impact operations
 - 75 m for moderate potential impact operations
 - 40 m of low potential impact operations. ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary roads and landings are not permitted within 150 m of active nests. ([rationale](#))

Guidelines

- New primary roads and landings are not permitted within 151-300 m of active nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly < 8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))
- New branch roads and landings are not permitted within 300 m of active nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly < 8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))
- New landings > 0.1 ha in size associated with primary and branch roads are not permitted within 151-300 m unless approved by the Ministry (see Appendix 1b). ([rationale](#))

- Operations associated with primary and branch roads and landings are not permitted within the following distance of occupied active nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 150 m for high potential impact operations
 - 75 m for moderate potential impact operations
 - 40 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Conditions on operational roads and landings (planned or existing)

Guidelines

- New operational roads are not permitted within 150 m of active nests unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 15 m. ([rationale](#))
- Operations associated with operational roads and landings are not permitted within the following distance of occupied active nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 150 m for high potential impact operations
 - 75 m for moderate potential impact operations
 - 40 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Best management practices

- If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access and the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 150 m of active nests. ([rationale](#))

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within 151-300 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. ([rationale](#))
- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 150 m for high potential impact operations
 - 75 m for moderate potential impact operations
 - 40 m of low potential impact operations. ([rationale](#))

iv) Inactive nests of Bonaparte's gull, great gray owl, American goshawk, or red-shouldered hawk

Description of value

Nests of Bonaparte's gull, great gray owl, American goshawk, or red-shouldered hawk not occupied at least once within the past 5 years or documented as unoccupied for ≥3 consecutive years. ([rationale](#))

Conditions on regular operations, roads, landings, forestry aggregate pits, and wood storage yards

Standards

- Harvest, renewal, and tending operations are not permitted within 20 m of inactive nests. ([rationale](#))

Guidelines

- New roads, landings, forestry aggregate pits, and wood storage yards are not permitted within 20 m of inactive nests unless approved by the Ministry (see Appendix 1b). ([rationale](#))
- No timing restrictions on harvest, renewal, or tending operations or operations associated with roads, landings, forestry aggregate pits, and wood storage yards around inactive nests. ([rationale](#))

Notes

The **critical breeding period** is defined by Bird Conservation Region (BCR):

Species	BCR 8*	BCR 12*	BCR 13*
Bonaparte's gull	Apr 15 – Jul 31	Apr 15 – Jul 31	
Great gray owl	Mar 15 – Jul 15	Mar 15 – Jul 31	
American goshawk	Mar 15 – Jul 31	Mar 15 – Jul 31	Mar 1 – Jul 31
Red-shouldered hawk		Mar 15 – Jul 15	Mar 1 – Jul 15

*Local knowledge of breeding chronology may be used to adjust these dates. ([rationale](#))

4.2.2.5 Common stick-nesting birds

Direction for common stick-nesting birds is provided for nests occupied by the barred owl, broad-winged hawk, common raven, Cooper's hawk, great horned owl, long-eared owl, merlin, red-tailed hawk, or sharp-shinned hawk (active nests). Direction is also provided for stick nests that have been recently occupied but were built or last used by one of these species (inactive nests).

If a nest is no longer usable because it has fallen out of the tree, the tree has fallen down, or the tree has become otherwise unsuitable for nesting, treat as a value that no longer exists. ([rationale](#))

i) Active barred owl, broad-winged hawk, common raven, Cooper's hawk, great horned owl, long-eared owl, merlin, red-tailed hawk, or sharp-shinned hawk stick nests

Description of value

Active nests are occupied by the barred owl, broad-winged hawk, common raven, Cooper's hawk, great horned owl, long-eared owl, merlin, red-tailed hawk, or sharp-shinned hawk at least once within the past 5 years (not documented as unoccupied for ≥ 3 consecutive years).

The tree containing the nest and the area within the following radius comprise the AOC:

- Barred owl: 150 m
- Broad-winged hawk, Cooper's hawk, great horned owl, or red-tailed hawk: 100 m
- Common raven, long-eared owl, merlin, or sharp-shinned hawk: 50 m. ([rationale](#))

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and:
 - Active nest trees will be retained
 - Harvest not permitted within 20 m of active nests of barred owl, Cooper's hawk, common raven, great horned owl, long-eared owl, or red-tailed hawk. ([rationale](#))

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distances of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 100 m for high potential impact operations
 - 50 m for moderate and low potential impact operations. ([rationale](#))

Best management practices

- Nest trees used by broad-winged hawk, merlin, or sharp-shinned hawk that are a potential safety risk should be retained in an unharvested residual patch (≥20 m radius).

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- New roads and landings are not permitted within 20 m of active nests of the barred owl, Cooper's hawk, common raven, great horned owl, long-eared owl, or red-tailed hawk except in extraordinary circumstances or when constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))
- Operations associated with roads and landings are not permitted within the following distances of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - For barred owl:
 - 150 m for high potential impact operations

- 75 m for moderate potential impact operations
- 40 m of low potential impact operations.
- For Cooper's hawk, broad-winged hawk, great horned owl, and red-tailed hawk:
 - 100 m for high potential impact operations
 - 50 m for moderate potential impact operations
 - 25 m of low potential impact operations.
- For common raven, long-eared owl, merlin, and sharp-shinned hawk:
 - 50 m for high potential impact operations
 - 25 m for moderate and low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Best management practices

- To the extent practical and feasible, avoid constructing new roads and landings within 20 m of active nests of the broad-winged hawk, merlin, and sharp-shinned hawk. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Guidelines

- New forestry aggregate pits and wood storage yards will not be constructed within 20 m of active nests of the barred owl, Cooper's hawk, common raven, great horned owl, long-eared owl, or red-tailed hawk except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. ([rationale](#))
- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied active nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - For barred owl:
 - 150 m for high potential impact operations
 - 75 m for moderate potential impact operations
 - 40 m of low potential impact operations.
 - For Cooper's hawk, broad-winged hawk, great horned owl, and red-tailed hawk:
 - 100 m for high potential impact operations
 - 50 m for moderate potential impact operations
 - 25 m of low potential impact operations.
 - For common raven, long-eared owl, merlin, and sharp-shinned hawk:
 - 50 m for high potential impact operations

- 25 m for moderate and low potential impact operations. [\(rationale\)](#)

Best management practices

- To the extent practical and feasible, avoid constructing new forestry aggregate pits and wood storage yards within 20 m of active nests of the broad-winged hawk, merlin, and sharp-shinned hawk. [\(rationale\)](#)

ii) Inactive barred owl, broad-winged hawk, common raven, Cooper's hawk, great horned owl, long-eared owl, merlin, red-tailed hawk, or sharp-shinned hawk stick nests

Description of value

Stick nests occupied by the barred owl, broad-winged hawk, common raven, Cooper's hawk, great horned owl, long-eared owl, merlin, red-tailed hawk, or sharp-shinned hawk, but not within the past 5 years.

Stick nests occupied by the barred owl, broad-winged hawk, common raven, Cooper's hawk, great horned owl, long-eared owl, merlin, red-tailed hawk, or sharp-shinned hawk within the past 5 years but unoccupied for ≥ 3 consecutive years.

Stick nests with no known history of occupancy but suspected to have been built by the broad-winged hawk, common raven, Cooper's hawk, red-tailed hawk, or sharp-shinned hawk. [\(rationale\)](#)

Conditions on regular operations, roads, landings, forestry aggregate pits, and wood storage yards

Standards

- Harvest, renewal, and tending operations are permitted subject to the following restrictions:
 - Nest trees will be retained
 - Harvest, renewal, and tending operations are not permitted within 20 m of inactive nests of barred owl, Cooper's hawk, common raven, great horned owl, long-eared owl, or red-tailed hawk or other **large** inactive nests if species is uncertain. [\(rationale\)](#)

Guidelines

- New roads, landings, forestry aggregate pits, and wood storage yards are not permitted within 20 m of inactive nests of the barred owl, Cooper's hawk, common raven, great horned owl, long-eared owl, or red-tailed hawk or other

large inactive nests if species is uncertain unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))

- No timing restriction on harvest, renewal, or tending operations or on operations associated with roads, landings, forestry aggregate pits, and wood storage yards around inactive nests. ([rationale](#))

Best management practices

- Nest trees used by broad-winged hawk, merlin, or sharp-shinned hawk that are a potential safety risk should be retained in an unharvested residual patch (≥20 m radius).
- To the extent practical and feasible, avoid constructing new roads, landings, forestry aggregate pits, and wood storage yards within 20 m of inactive nests of the broad-winged hawk, merlin, and sharp-shinned hawk or other **small** inactive nests if species unknown. ([rationale](#))

Notes

The **critical breeding period** is defined by Bird Conservation Region (BCR):

Species	BCR 8*	BCR 12*	BCR 13*
Barred owl	Mar 15 – Jul 15	Mar 1 – Jul 15	Feb 15 – Jul 15
Broad-winged hawk	Apr 15 – Aug 15	Apr 15 – Aug 15	Apr 1 – Aug 15
Common raven	Mar 1 – Jun 30	Feb 15 – Jun 30	Feb 1 – Jun 30
Cooper's hawk	Apr 15 – Jul 31	Apr 1 – Jul 31	Mar 15 – Jul 31
Great horned owl	Mar 1 – Jun 30	Feb 15 – Jun 30	Feb 1 – Jun 30
Long-eared owl	Apr 15 – Jul 31	Apr 1 – Jul 31	Mar 15 – Jul 15
Merlin	Apr 15 – Aug 15	Apr 15 – Aug 15	Apr 1 – Aug 15
Red-tailed hawk	Apr 1 – Jul 31	Mar 15 – Jul 31	Mar 1 – Jul 31
Sharp-shinned hawk	Apr 15 – Aug 15	Apr 1 – Aug 15	Mar 15 – Aug 15

*Local knowledge of breeding chronology may be used to adjust these dates. ([rationale](#))

Large nest is about the size of a large pick-up truck tire.

Small nest is about the size of a compact car tire.

4.2.2.6 Common cavity-nesting raptors

Direction is provided for cavity nests that have been recently occupied by the American kestrel, barred owl, boreal owl, eastern screech-owl, great horned owl, northern hawk owl, northern saw-whet owl (active nests). Direction is also provided for cavity nests that have been recently occupied but were last used by one of these species (inactive nests).

If a cavity nest is no longer usable because the tree has fallen down or has become otherwise unsuitable for nesting, treat as a value that no longer exists. ([rationale](#))

i) Active American kestrel, barred owl, boreal owl, eastern screech-owl, great horned owl, northern hawk owl, or northern saw-whet owl cavity nests

Description of value

Active cavity nests occupied by the American kestrel, barred owl, boreal owl, eastern screech-owl, great horned owl, northern hawk owl, or northern saw-whet owl at least once within the past 5 years (not documented as unoccupied for ≥ 3 consecutive years).

The tree containing the cavity nest and the area within the following radius comprise the AOC:

- Barred owl: 100 m
- Great horned owl: 50 m
- American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl: 25 m. ([rationale](#))

Operational prescription for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and:
 - Cavity nest trees will be retained
 - Harvest not permitted within 20 m of active cavity nests of barred owl or great horned owl. ([rationale](#))

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distance of occupied cavity nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - For barred owl and great horned owl:
 - 100 m for high potential impact operations
 - 50 m for moderate or low potential impact operations.
 - For American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl:
 - 25 m for high, moderate, and low potential impact operations.
- [\(rationale\)](#)

Best management practices

- Cavity nest trees used by American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl that are a potential safety risk should be retained in an unharvested patch (≥20 m radius).

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- New roads and landings are not permitted within 20 m of active cavity nests of the barred owl or great horned owl except in extraordinary circumstances or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. [\(rationale\)](#)
- Operations associated with roads and landings are not permitted within the following distance of occupied active cavity nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - For barred owl:
 - 100 m for high potential impact operations
 - 50 m for moderate potential impact operations
 - 25 m of low potential impact operations.
 - For great horned owl:
 - 50 m for high potential impact operations
 - 25 m for moderate and low potential impact operations.
 - For American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl:
 - 25 m for high, moderate, and low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. [\(rationale\)](#)

Best management practices

- To the extent practical and feasible, avoid constructing new roads and landings within 20 m of active cavity nests of the American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl. [\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within 20 m of active cavity nests of the barred owl or great horned owl except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. [\(rationale\)](#)
- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied cavity nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - For barred owl:
 - 100 m for high potential impact operations
 - 50 m for moderate potential impact operations
 - 25 m of low potential impact operations.
 - For great horned owl:
 - 50 m for high potential impact operations
 - 25 m for moderate and low potential impact operations.
 - For American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl:
 - 25 m for high, moderate, and low potential impact operations.[\(rationale\)](#)

Best management practices

- To the extent practical and feasible, avoid constructing new forestry aggregate pits and wood storage yards within 20 m of active cavity nests of the American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl. [\(rationale\)](#)

ii) Inactive American kestrel, barred owl, boreal owl, eastern screech-owl, great horned owl, northern hawk owl, or northern saw-whet owl cavity nests

Description of value

Cavity nests occupied by the American kestrel, barred owl, boreal owl, eastern screech-owl, great horned owl, northern hawk owl, or northern saw-whet owl, but not within the past 5 years.

Cavity nests occupied by the American kestrel, barred owl, boreal owl, eastern screech-owl, great horned owl, northern hawk owl, or northern saw-whet owl within the past 5 years but unoccupied for ≥ 3 consecutive years. ([rationale](#))

Conditions on regular operations, roads, landings, forestry aggregate pits, and wood storage yards

Standards

- Harvest, renewal, and tending operations are permitted subject to the following restrictions:
 - Cavity nest trees will be retained
 - Harvest not permitted within 20 m of inactive cavity nests of barred owl or great horned owl. ([rationale](#))

Guidelines

- New roads, landings, forestry aggregate pits, and wood storage yards are not permitted within 20 m of inactive cavity nests of the barred owl or great horned owl unless approved by the Ministry (see Appendix 1b) or constructed on an existing roadbed (where the vegetation is predominantly < 8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m. ([rationale](#))
- No timing restriction on operations associated with roads, landings, forestry aggregate pits, and wood storage yards around unoccupied cavity nests/communal roosts. ([rationale](#))

Best management practices

- Cavity nest trees used by American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl that are a potential safety risk should be retained in an unharvested residual patch (≥ 20 m radius).
- To the extent practical and feasible, avoid constructing new roads, landings, forestry aggregate pits, and wood storage yards within 20 m of inactive cavity

nests of the American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl. [\(rationale\)](#)

Notes

The **critical breeding period** is defined by Bird Conservation Region (BCR):

Species	BCR 8*	BCR 12*	BCR 13*
American kestrel	Apr 15 – Mar 15	Apr 1 – Aug 15	Mar 15 – Aug 15
Barred owl	Mar 15 – Jul 15	Mar 1 – Jul 15	Feb 15 – Jul 15
Boreal owl	Apr 15 – Jul 15	Apr 15 – Jul 15	unlikely to be nesting in BCR 13
Eastern screech owl	unlikely to be nesting in BCR 8	Mar 15 – Jul 31	Mar 15 – Jul 31
Great horned owl	Mar 1 – Jun 30	Feb 15 – Jun 30	Feb 1 – Jun 30
Northern hawk owl	Apr 1 – Jul 31	Mar 15 – Jul 31	Mar 15 – Jul 31
Norther saw-whet owl	Apr 1 – Jul 31	Mar 15 – Jul 31	Mar 1 – Jul 31

*Local knowledge of breeding chronology may be used to adjust these dates. [\(rationale\)](#)

4.2.2.7 Ground-nesting raptors

Direction is provided for ground nests that are occupied by the northern harrier or short-eared owl. Direction focuses on mitigating potential disturbance of nesting birds. [\(rationale\)](#)

i) Active northern harrier or short-eared owl ground nests

Description of value

Ground nests occupied by the northern harrier or short-eared owl and the area within 50 m comprise the AOC. [\(rationale\)](#)

Operational prescription for the area of concern

Standards

- Regular harvest, renewal, and tending operations are permitted with timing restrictions (see below). [\(rationale\)](#)

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distance of occupied ground nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 50 m for high potential impact operations
 - 25 m for moderate or low potential impact operations. [\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- Operations associated with roads and landings are not permitted within the following distance of occupied ground nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 50 m for high potential impact operations
 - 25 m for moderate or low potential impact operations.However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. [\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Guidelines

- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied ground nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 50 m for high potential impact operations
 - 25 m for moderate or low potential impact operations. [\(rationale\)](#)

Notes

The **critical breeding period** is defined by Bird Conservation Region (BCR):

Species	BCR 8*	BCR 12*	BCR 13*
Northern harrier	May 1 – Jul 31	Apr 15 – Jul 31	Apr 1 – Jul 31
Short-eared owl	Apr 15 – Jul 15	Apr 1 – Jul 15	Mar 15 – Jul 15

*Local knowledge of breeding chronology may be used to adjust these dates. ([rationale](#))

4.2.2.8 Forest-nesting birds not covered by direction in previous sections

Direction is provided for occupied nests of protected species (i.e., those addressed by the MBCA or FWCA) that are not covered in Sections 4.2.2.1 to 4.2.2.7.

Direction largely focuses on protecting occupied nests from destruction and mitigating disturbance of nesting birds. ([rationale](#))

i) Active trumpeter swan nests

Description of value

Active nests occupied at least once within the past 10 years.

The nest and the area within 400 m comprise the AOC. ([rationale](#))

Operational prescription for the area of concern

Standards ([rationale](#))

- Harvest, renewal, and tending operations are permitted subject to timing restrictions (see below) and the following condition: residual forest will be retained within portions of the shoreline AOC associated with the HPS or LPS water feature containing the nest site that fall within the nest site AOC.

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations.

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- New roads and landings are not permitted within 200 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. ([rationale](#))
- Operations associated with roads and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Best management practices

- When practical and feasible, avoid constructing new roads and landings within 201-400 m of active nests. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 200 m of active nests. ([rationale](#))

Guidelines

- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 400 m for high potential impact operations
 - 200 m for moderate potential impact operations
 - 100 m of low potential impact operations. ([rationale](#))

Best management practices

- When practical and feasible, avoid constructing new forestry aggregate pits and wood storage yards within 201-400 m of active nests. ([rationale](#))

ii) Active Canada goose or sandhill crane nests

Description of value

Nests occupied by Canada goose or sandhill crane and the area within 50 m radius comprise the AOC. ([rationale](#))

Operational prescription for the area of concern

Standards ([rationale](#))

- Regular harvest, renewal, and tending operations are permitted with timing restrictions (see below).

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 50 m for high potential impact operations
 - 25 m for moderate or low potential impact operations.

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- Operations associated with roads and landings are not permitted within the following distance of occupied nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 50 m for high potential impact operations
 - 25 m for moderate or low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. ([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Guidelines

- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the following distance of occupied active nests during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:
 - 50 m for high potential impact operations
 - 25 m for moderate or low potential impact operations. ([rationale](#))

iii) Active nests occupied by other protected birds

Description of value

Nests occupied (i.e., to contain adults, eggs, or young) by birds (except American crow, brown-headed cowbird, common grackle, house sparrow, red-winged blackbird, and European starling) not already addressed by AOC direction. ([rationale](#))

Conditions on regular operations, roads, landings, forestry aggregate pits, and wood storage yards

Standards ([rationale](#))

- Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests:
 - Nest not in cavity:
 - 10 m for species robin-sized and larger
 - 5 m for species smaller than a robin.
 - Nest in cavity:
 - 5 m for species robin-sized and larger
 - 0 m (but retain tree with cavity) for species smaller than a robin.

Guidelines

- Operations associated with roads, landings, forestry aggregate pits, and wood storage yards are not permitted within similar distances of occupied nests unless the operation will not physically disturb the nest and its contents and there is compelling evidence to suggest habituation to the activity (e.g., nest built next to an existing road with existing traffic flow).

Notes

The **critical breeding period** is defined by Bird Conservation Region (BCR):

Species	BCR 8*	BCR 12*	BCR 13*
Canada goose	Apr 15 – June 30	Apr 1 – June 30	Mar 15 – June 30
Sandhill crane	Apr 15 – Jul 15	Apr 1 – Jul 15	Mar 15 – Jul 15
Trumpeter swan	Apr 1 – Jul 15	Mar 15 – Jul 15	Mar 1 – Jul 15

*Local knowledge of breeding chronology may be used to adjust these dates. ([rationale](#))

4.2.3. Beaver habitat

The Beaver is widely considered to be a keystone species; the mosaic of habitat conditions (newly flooded ponds, stagnant ponds, de-watered ponds, and beaver meadows) it creates across watersheds leads to increased species richness of both plants and animals. Beaver ponds are especially important habitat for a variety of dabbling ducks of conservation concern, such as American black ducks. While beaver activity is often viewed as detrimental to cold water sport fish, beaver ponds may actually provide important fish habitat; research suggests that the productivity and diversity of fish communities in headwater streams is associated with the mosaic of beaver ponds found in various stages of succession.

Beavers feed on a wide range of herbaceous and woody vegetation, but the supply of preferred woody vegetation that can be cached for winter feeding may be limiting. As beavers feed selectively on woody vegetation in the riparian zone, they remove preferred forage species such as trembling aspen, gradually causing an increase in the amount of less palatable and more shade tolerant woody plants such as balsam fir. As food supply is exhausted, beavers may abandon a pond, beginning the phase of pond de-watering and beaver meadow creation. Abandoned ponds may eventually be reoccupied but since preferred forage species are shade intolerant, some significant disturbance such as fire or timber harvest may be required to rejuvenate food supply. However, fire suppression activities and past practices that routinely retained unharvested forest around beaver ponds have led to a growing concern that beavers and beaver pond habitats may be declining, at least in some parts of the province.

([rationale](#))

Direction

Direction in Section 4.1.1 promotes some management of shoreline forest adjacent to all lakes and ponds and is thus generally beneficial for beavers. Additional direction for beaver ponds or beaver meadows requiring special management (as identified by the Ministry or local trappers) focuses on managing shoreline forest to maximize regeneration of beaver food supply (primarily trembling aspen).

Beaver ponds and beaver meadows requiring special management to regenerate food supply are addressed through operational prescriptions and conditions for AOCs.

Direction (i.e., operational prescription and conditions on roads, landings, forestry aggregate pits, and wood storage yards) for the aquatic features associated with these values apply (see Section 4.1). ([rationale](#))

Description of value

Beaver ponds and beaver meadows identified by the Ministry or local trappers that require special management to regenerate food supply. ([rationale](#))

Operational prescription for the area of concern

Guidelines

- Harvest, renewal, and tending operations within the AOC will promote establishment or perpetuation of intolerant hardwood or mixedwood forest units, to the extent practical and feasible, unless inconsistent with other ecological objectives. ([rationale](#))

Best management practices ([rationale](#))

- For clearcut silviculture system:
 - In the AOC, as much of the shoreline forest should be clearcut to the edge of water as is practical and feasible, considering residual forest requirements in Section 4.1. Clearcut portions of the AOC should ideally be ≥ 200 m long and within 50 m of water.
 - When clearcutting, shoreline forest with $>10\%$ trembling aspen (or other intolerant hardwoods) in the overstory, limited conifer advanced regeneration in the understory, and on low slopes should be targeted.
 - Conifer advanced regeneration (especially balsam fir) should be removed to the extent practical and feasible. Use of prescribed fire should be considered.
 - Aerial or machine-based ground application of herbicides should not be conducted within 50 m of the beaver pond or beaver meadow (applies to shorelines where regenerating hardwoods will be accessible to beavers).
- For selection and shelterwood silviculture systems:
 - In the AOC, small clearcuts or large group openings in patches of intolerant hardwood, mixedwood, other conifer, or poor quality pine or hardwood shoreline forest should be created whenever practical and feasible, considering residual forest requirements in Section 4.1. Openings should be >0.1 ha in size (ideally >0.2 ha) and within 50 m of the pond.

4.2.4. Moose aquatic feeding areas and mineral licks

In early summer, moose frequent aquatic habitats where they forage on submerged and floating aquatic plants that are rich in sodium. These moose aquatic feeding areas (MAFAs) are typically associated with shallow lakes, slow-moving rivers, shallow bays of deep lakes, and beaver ponds. Moose may also meet some of their annual sodium requirements by consuming muddy water found in mineral-rich springs, called mineral licks.

Mineral licks and MAFAs are important components of habitat for moose. Forest management practices have the potential to alter shoreline forest that provides access routes, thermal cover, and visual screening. ([rationale](#))

Direction

MAFAs are typically associated with lakes, ponds, rivers, or streams; standards and guidelines for these aquatic feature associated with the MAFA apply (Section 4.1.1 or 4.1.2). There is no additional AOC associated with MAFAs. However, direction in Sections 4.1.1 and 4.1.2 specifies that residual shoreline forest will be retained preferentially adjacent to MAFAs, especially in specific areas (e.g., LLPs) identified for enhanced moose management (see Section 3.3.2) (preferential retention of residual shoreline forest adjacent to MAFAs is not required in areas managed for woodland caribou; see the Boreal Landscape Guide for direction related to woodland caribou). MAFAs are also discussed in Section 3.3.2; their presence may be used to select for retention of habitat providing summer thermal cover within areas of enhanced management for moose. Direction for selecting residual forest with the greatest effect on the suitability of MAFAs is provided below and focuses on maintaining residual shoreline forest adjacent to MAFAs to provide access routes and visual screening.

Mineral licks are addressed through operational prescriptions and conditions for AOCs. Direction to maintain suitability of mineral licks is described below and focuses on restricting operations around mineral licks to protect the hydrological integrity of the lick, provide thermal cover, and screen moose from disturbance. ([rationale](#))

i) Moose aquatic feeding areas

Description of value

Known class 2, 3, and 4 MAFAs (based on the methodology described by Ranta 1998) identified prior to operations. (rationale)

Operational prescription for the area of concern

Best management practices

- Residual shoreline forest should be retained preferentially when it:
 - Is adjacent to higher quality MAFAs (i.e., class 4 MAFAs are better than class 3 MAFAs which are better than class 2 MAFAs),
 - Is adjacent to larger MAFAs (i.e., MAFAs >8 ha are better than MAFAs 4-8 ha which are better than MAFAs <4 ha),
 - Is adjacent to MAFAs without features that restrict access such as steep terrain,
 - Will provide screening from roads,
 - Connects MAFAs to other residual forest (especially identified patches of summer thermal shelter; see Section 3.3.2) and/or travel corridors, or
 - Minimizes the distance between the aquatic vegetation and cover.
[\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Best management practices

- Roads should be planned and constructed to avoid high quality MAFAs (e.g. roads should be ≥100 m away from MAFAs ranked 3 or 4 that are ≥4 ha in size).

ii) Mineral licks

Description of value

Natural mineral licks known or encountered during operations. Excludes mineral licks created by salt accumulation along roadways.

The mineral lick and the area within 120 m (measured from the edge of woody vegetation averaging at least 2 m tall and with ≥25% canopy cover) comprise the AOC.
[\(rationale\)](#)

Operational prescription for the area of concern

Standards

- No harvest, renewal, or tending operations are permitted within the AOC.

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- Operations associated with existing roads are permitted within the AOC.

Guidelines

- New roads and landings are not permitted within the AOC except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- Operations associated with existing forestry aggregate pits and wood storage yards are permitted within the AOC.

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within the AOC except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

4.2.5 Dens

Within the managed forest, a variety of species utilize dens as sites for reproduction and/or hibernation. For example, black bears use dens as hibernation sites. Cubs are also born within dens during the hibernation period. Black bears may use a wide variety of structures as dens, from hollow trees and logs to caves. However, throughout most of the managed forest, dens are excavated into a mound or brush pile or under the root-mass of a fallen tree. Dens are rarely reused.

Other furbearing mammals that use dens for reproduction include the beaver, American marten, bobcat, coyote, fisher, least weasel, long-tailed weasel, lynx, mink, muskrat, raccoon, red fox, red squirrel, river otter, short-tailed weasel, and striped skunk. There is very little information on the effects of forest management operations on dens or their use. However, human activities within the vicinity of dens have been shown to affect use by some species. Moreover, the FWCA prohibits intentional damage or destruction of dens of black bears and other furbearing mammals, other than foxes (the gray fox is a species at risk in Ontario, Regulation 230/08 (the SARO list)) and skunks.

Direction for dens used by species at risk, including gray foxes, cougars, eastern wolves and wolverines can be found in Section 4.3. The direction for grey wolves which is not a species at risk is the same as the direction for eastern wolves and can be found in a single prescription for wolves in Section 4.3.

Direction

Dens known or suspected (with a high degree of certainty) to be or have been occupied by black bears, are addressed through operational prescriptions and conditions for AOCs because dens belonging black bears are explicitly protected by the FWCA. Dens of other furbearing mammals (excluding red foxes and skunks) are addressed by conditions on operations. Direction for dens of black bears and other furbearing mammals (excluding red foxes and skunks) is described below and focuses on:

- Minimizing disturbance of animals using dens
- Maintaining den structures
- Maintaining suitability of habitat immediately surrounding dens for those sites likely to be traditionally used.

Direction applies to occupied dens known before, or found during, operations.

[\(rationale\)](#)

i) Black bear dens

Description of value

- Dens known or suspected to contain one or more hibernating black bears.
- The den and the area within 100 m (centred on the den entrance) comprise the AOC. [\(rationale\)](#)

Operational Prescription for the Area of Concern

Standards

- Regular harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below).

Guidelines

- Harvest, renewal, and tending operations involving heavy equipment are not permitted within the AOC during the **denning period**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
- Other harvest, renewal, and tending operations that might potentially disturb denning bears are not permitted within the AOC during the first 4 weeks of the **denning period**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- Road construction is not permitted within the AOC during the **denning period**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
- Hauling and road maintenance operations are not permitted within the AOC during the **denning period**, unless the road predates the den, is required for safety reasons or environmental protection, or except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Guidelines

- Aggregate extraction and operations associated with wood storage yards are not permitted within the AOC during the **denning period**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

ii) Dens of furbearing mammals in enduring features

Description of value

Dens in caves, excavated burrows, under large piles of coarse woody material, or other enduring features that are known to have been occupied by furbearing mammals (other than red foxes, skunks, wolves, and wolverines) at least once within the past 5 years.

[\(rationale\)](#)

Conditions on regular operations

Standards

- Harvest, renewal, and tending operations are not permitted within 20 m of the den entrance.

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New roads and landings are not permitted within 20 m of the den entrance.

Guidelines

- Road construction is not permitted within 20 m of occupied dens, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
- Hauling and road maintenance operations are not permitted within 20 m of occupied dens unless the road predates the den, is required for safety reasons or environmental protection, or except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 20 m of the den entrance.

Guidelines

- Aggregate extraction and operations associated with wood storage yards are not permitted within 20 m of occupied dens, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. ([rationale](#))

iii) Dens of furbearing mammals in transitory features

Description of value

Dens in tree cavities, hollow logs, brush piles, or other transitory features that are known to be occupied by furbearing mammals (other than red foxes, skunks, wolves, and wolverines) and that are encountered during operations. ([rationale](#))

Conditions on regular operations

Standards

- Known occupied dens encountered during operations will not be **destroyed**.

Guidelines

- Minimize **disturbance** of furbearers occupying known dens encountered during operations.

Best management practices

- Harvest, renewal, and tending operations should be avoided within 3 m of dens known to be occupied. Specifically,
 - Trees should be retained within 3 m of dens known to be occupied (patch may be counted as a clump of wildlife trees)
 - Trees should not be felled into the area within 3 m of dens known to be occupied
 - Heavy equipment should not travel within 3 m of dens known to be occupied.

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Best management practices

- New roads and landings should not be constructed within 3 m of dens known to be occupied.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Best management practices

- New forestry aggregate pits and wood storage yards should not be constructed within 3 m of dens known to be occupied. ([rationale](#))

Notes

Denning period for black bears generally lasts from October 15 to April 30, but exact dates vary depending on a variety of factors including latitude and weather. Local knowledge of denning chronology may be used to adjust these dates.

Destroyed in this context, means the complete or partial damage of the den structure or its contents (i.e., adults or young).

Disturbance in this context, means the incidental interference with significant life history activities associated with the den (e.g., whelping or raising of young).

4.3 Protection of species at risk

There are over 80 species (or species' populations) inhabiting the managed forest that are currently listed as species at risk in Ontario Regulation 230/08 (the Species at Risk in Ontario (SARO) list).

In Ontario, species at risk are protected under the provisions of several pieces of legislation and policies. The *Crown Forest Sustainability Act* was amended in 2020 to include S. 47.1 which excludes persons conducting forest operations, in a Crown forest in accordance with an approved forest management plan, from clause 9 (1) (a) and subsection 10 (1) of the *Endangered Species Act, 2007* (ESA). As well, many species are either listed as Specially Protected Wildlife in schedules under the *Fish and Wildlife Conservation Act, 1997*, or are directly or indirectly addressed by the federal *Species at Risk Act, 2002*, *Fisheries Act, 1985*, or *Migratory Birds Convention Act, 1994*.

In the following sections, direction is provided for species at risk that occur within the managed forest, that may be negatively affected by forest management operations, and may not be fully addressed by direction within the Landscape Guides, or other sections of this guide. There are some species at risk that occur in the managed forest for which there is no species-specific direction in this guide, see Background and Rationale for Direction.

The direction applies to reliable observations and in some cases known or suspected (with a high degree of certainty). Historical sightings and those with low positional accuracy should be a high priority for resurvey and confirmation.

With respect to forest management operations, this guide provides science-based information and direction for species within the managed forest that have been designated as endangered, threatened, or special concern. The direction in this guide is intended to minimize the risk that forest management operations might incidentally impact species that are currently on the SARO list.

The Committee on the Status of Species at Risk in Ontario (COSSARO) assesses and classifies species based on the best available scientific information (including community knowledge and Aboriginal Traditional Knowledge). The priority list of species to be assessed and classified by COSSARO is available through their website (<https://cossaroagency.ca/stay-informed>). The SARO list is amended annually, one year after the Minister of Environment Conservation and Parks receives COSSARO's annual report to reflect new classifications.

Planning teams may choose to identify some rare species (e.g., those classified as S1 to S3 by the Natural Heritage Information Centre) that are not listed as species at risk, or otherwise addressed in this guide, as locally featured if forest management operations have the potential to adversely affect population viability. Direction for these

species (see Section 3.2.1) should be developed in consultation with regional or provincial species experts as per the FMPM. ([rationale](#))

4.3.1 Non-woody plants

There are a number of species of non-woody plants listed at risk which occur within the managed forest. Direction is provided below for American ginseng, found within the Great Lakes-St. Lawrence forest region, and wetland plants including branched bartonia, small white lady's-slipper, and eastern prairie fringed-orchid.

American ginseng is an at risk plant that inhabits rich, moist areas in relatively undisturbed mature tolerant hardwood forest in the southern portions of the Great Lakes-St. Lawrence forest region. Illegal harvesting of the plants themselves is a principal threat. New roads may increase access and thus vulnerability to plant harvest. Tree harvest operations that change canopy cover or disturb the forest floor may negatively alter habitat.

A number of the species are generally not found in forested habitats but could be affected by some forest management operations (primarily road construction). Three species are found in wetland habitats such as fens and bogs (branched bartonia, eastern prairie fringed-orchid), or marshes (small white lady's-slipper) within the managed forest. Direction below focuses on minimizing disturbance to the ecosystems containing these species. Forest management practices that encourage a natural cycle of beaver pond establishment, abandonment, and renewal are likely beneficial to these species. Branched bartonia, small white lady's-slipper, and/or eastern prairie fringed-orchid and their habitat are frequently components of provincially significant wetlands. Section 4.1.3 provides direction for provincially significant wetlands to minimize adverse effects on these species, in addition to direction that addresses road construction.

Natural grasslands may also provide habitat for eastern prairie fringed-orchid and small white lady's-slipper orchid. The supply of natural grassland habitats is much reduced from the period prior to European settlement, and accounts for a very small percentage of the managed forest. Small remnant patches remain scattered across the southern portion of northwestern Ontario and in a few isolated locations along the edge of the managed forest in southern Ontario. The natural grassland areas are not generally impacted by forest management activities.

Direction

Direction for American ginseng focuses on identifying and protecting patches known before, or encountered during, operations in tolerant hardwood forest in the southern portion of the managed forest. Plants separated by no more than 10 m constitute a 'patch'. Patches are addressed through operational prescriptions and conditions for AOCs. Direction is described below and focuses on:

- Minimizing access for collectors (for American ginseng)
- Maintaining high canopy cover

- Minimizing disturbance of the forest floor.

Since harvest of plants is a principal threat to American ginseng populations, information on the location and population status will remain confidential. See the FIM and the associated technical specifications for a discussion of the treatment of classified values information.

Direction is provided for large and small patches of American ginseng and its habitat.

i) American ginseng large patches

Description of value

American ginseng patches are considered polygonal features.

AOC is comprised of a patch of ≥ 30 American ginseng plants and the area within a distance of 100 m from the patch boundary.

American ginseng patches and modified management zones to be delineated by the Ministry, include individual American ginseng plants separated by ≤ 10 m.

The delineated patch is a reserve.

The area within:

- 0-10 m of a large ginseng patch comprises Modified Management Zone 1 (MMZ1)
- 11-60 m of a large ginseng patch comprises Modified Management Zone 2 (MMZ2)
- 61-100 m of a large ginseng patch comprises Modified Management Zone 3 (MMZ3). ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within the delineated ginseng patch.
- Trees will not be felled into the patch. Trees accidentally felled into the patch will be left where they fall.
- Can reach into MMZ1 from outside and remove trees, felling them away from the patch with the following conditions:

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- No machine travel or cable skidding within MMZ1
- Single tree selection harvesting only
- Maintain $\geq 70\%$ (dominant and co-dominant trees) uniform canopy cover within MMZ1. ([rationale](#))
- Harvest, renewal, and tending operations within MMZ2 are subject to the following conditions:
 - Harvest, renewal, and tending operations will be conducted in a manner that minimizes site disturbance. Operations within MMZ2 will not:
 - Exceed 2% coverage of ruts
 - Exceed 10% coverage of extraction trails
 - Leave ruts or a significant area of exposed mineral soil. Ruts and significant areas of exposed mineral soil will be promptly rehabilitated without adversely affecting ginseng plant habitat suitability
 - Mechanical site preparation is not permitted within MMZ2.
 - Only hand-based application of herbicides is permitted in MMZ2 following ginseng senescence. ([rationale](#))
- Markings associated with the delineation of both large and small patches of American ginseng plants that might attract collectors will be removed or hidden upon completion of operations. ([rationale](#))

Guidelines

- Harvest, renewal, and tending operations within MMZ2 are subject to the following conditions:
 - Harvest that retains a relatively uniform canopy cover of $\geq 70\%$ (dominant and co-dominant trees) is permitted within MMZ2. Harvest will normally be restricted to single tree selection
 - Harvest operations will be conducted during the winter, unless with Ministry approval ([rationale](#))

Best management practices

- Follow the *Clean Equipment Protocol for Industry* (Halloran et al 2013) when moving equipment from areas where an invasive plant species is known to occur to minimize the risk of transporting and introducing the species to harvest areas adjacent to known American ginseng patches.

Conditions on primary roads and landings (planned or existing)

Standards

- New primary roads and associated landings are not permitted within MMZ1.
- No new landings permitted within MMZ2.

- Forestry-related traffic and maintenance of existing roads are permitted within the AOC subject to the following condition:
 - The footprint of the road will not be increased.

[\(rationale\)](#)

Guidelines

- New primary roads are not permitted within MMZ2 or MMZ3, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process subject to the following condition:
 - New primary roads are only permitted within MMZ2 or MMZ3 when constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 20 m to result in less impact on American ginseng or its habitat.
- Forestry-related traffic and maintenance of existing roads are permitted within the AOC subject to the following condition:
 - Road maintenance is restricted to surface grading or other **low risk** road maintenance operations necessary to maintain safe travel conditions.
- When there are no practical or feasible alternatives within MMZ2, **old landings** may be reused subject to the following conditions:
 - The footprint of the landing will not be increased
 - Gaps associated with landings will be included in the estimation of canopy closure (see above).
- Reuse of **old landings** is permitted within MMZ3.
- In the absence of reusable landings in the AOC, wood may be piled and processed on the road right-of-way (if consistent with Ministry conditions on corridor width and worker and public safety considerations).

[\(rationale\)](#)

Conditions on branch and operational roads and landings (planned or existing)

Standards

- New branch and operational roads and associated landings are not permitted in MMZ1.
- Forestry-related traffic and maintenance of existing roads are permitted within the AOC subject to the following condition:
 - The footprint of the road will not be increased
- No new landings within MMZ1.

Guidelines

- New branch and operational roads are permitted in MMZ2 or MMZ3 with Ministry approval (see Appendix 1b) subject to the following conditions:
 - Canopy gaps associated with new roads will be included in the estimation of canopy closure in MMZ2 (see above)
 - Construct new roads on an existing roadbed (where the vegetation is predominantly <8 m tall) to result in less impact on ginseng or its habitat
 - Construct winter roads unless there is no practical or feasible alternative
 - Roads will be built to minimum standards to mitigate potential impact on ginseng habitat and potential for illegal collection (e.g., right-of-way <10 m, no grubbing, no disruption of hydrological flow, no ditching, locate road as far from ginseng patch as possible)
 - New roads will be promptly decommissioned upon completion of operations unless with Ministry approval (see Appendix 1b).
- Forestry-related traffic and maintenance of existing roads are permitted within the AOC subject to the following condition:
 - Road maintenance is restricted to surface grading or other **low risk** road maintenance operations necessary to maintain safe travel conditions.
- When there are no practical or feasible alternatives, **old landings** in MMZ2 may be reused subject to the following conditions:
 - The footprint of the landing will not be increased
 - Gaps associated with landings will be included in the estimation of canopy closure (see above).
- Construction of new landings and reuse of **old landings** are permitted within MMZ3.
- In the absence of reusable landings in the AOC, wood may be piled and processed on the road right-of-way (if consistent with Ministry conditions on corridor width and worker and public safety considerations).

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within MMZ1 or MMZ2.

Guidelines

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- New forestry aggregate pits and wood storage yards are permitted within MMZ3, with Ministry approval (see Appendix 1b) and under the following condition:
 - Cannot be located within suitable habitat (normally includes mature or older deciduous or mixed forest with <50% of the overstory basal area comprised of tolerant or mid-tolerant hardwoods).
- Existing forestry aggregate pits and wood storage yards within MMZ2 or MMZ3 may be reused as long as the footprint of the forestry aggregate pit or wood storage yard will not be increased.

[\(rationale\)](#)

Notes

An **old landing** is any clearly recognizable landing with dominant vegetation generally comprised of shrubs and/or saplings that is predominantly <8 m tall (i.e., not contributing to the overall canopy closure).

Low risk road maintenance operations do not involve machine travel off the roadbed and include grading the travelled portion of the road, topdressing, removal of woody material, and dust suppression.

ii) American ginseng small patches

Description of value

American ginseng patches are considered polygonal features.

AOC is comprised of a patch of <30 American ginseng plants and the area within a distance of 30 m from the patch boundary comprise the AOC.

American ginseng patches and modified management zones to be delineated by the Ministry, include individual American ginseng plants separated by ≤ 10 m.

The delineated patch is a reserve.

The area within:

- 0-10 m of a small ginseng patch comprises Modified Management Zone 1 (MMZ1).
- 11-30 m of a small ginseng patch comprises Modified Management Zone 2 (MMZ2).

[\(rationale\)](#)

Operational prescription and conditions for the area of concern

Standards

- Trees will not be felled into the patch. Trees accidentally felled into the patch will be left where they fall.
- Can reach into MMZ1 from outside and remove trees, felling them away from the patch with the following conditions:
 - No machine travel or cable skidding within MMZ1
 - Single tree selection only
 - Maintain 70% (dominant and co-dominant trees) uniform canopy cover within the delineated patch. [\(rationale\)](#)
- Harvest, renewal, and tending operations within MMZ2 are subject to the following conditions:
 - Harvest, renewal and tending operations will be conducted in a manner that minimizes site disturbance. Operations within MMZ2 will not:
 - Exceed 2% coverage of ruts.
 - Exceed 10% coverage of extraction trails.
 - Leave ruts or a significant area of exposed mineral soil. Ruts and significant areas of exposed mineral soil will be promptly rehabilitated without adversely affecting ginseng plant habitat suitability.
 - Mechanical site preparation is not permitted.
 - Only hand-based application of herbicides is permitted in MMZ2 following ginseng senescence. [\(rationale\)](#)
- Markings associated with the delineation of both large and small patches of American ginseng plants that might attract collectors will be removed or hidden upon completion of operations. [\(rationale\)](#)

Guidelines

- Harvest, renewal, and tending operations within MMZ2 are subject to the following conditions:
 - Harvest that retains a relatively uniform canopy cover of $\geq 70\%$ (dominant and co-dominant trees) is permitted within MMZ2. Harvest will normally be restricted to single tree selection
 - Harvest operations will be conducted during the winter, unless with Ministry approval. [\(rationale\)](#)

Best management practices

- Follow the *Clean Equipment Protocol for Industry* (Halloran et al 2013) when moving equipment from areas where an invasive plant species is known to occur to minimize the risk of transporting and introducing the species to harvest areas adjacent to known American ginseng patches.

Conditions on primary roads and landings (planned or existing)

Standards

- New primary roads and associated landings are not permitted within the AOC.
- Forestry-related traffic and maintenance of existing roads are permitted within the AOC subject to the following condition:
 - The footprint of the road will not be increased.

Guidelines

- Forestry-related traffic and maintenance of existing roads are permitted within the AOC subject to the following condition:
 - Road maintenance is restricted to surface grading or other **low risk** road maintenance operations necessary to maintain safe travel conditions.

[\(rationale\)](#)

Conditions on branch and operational roads and landings (planned or existing)

Standards

- New branch and operational roads are not permitted within MMZ1.
- Forestry-related traffic and maintenance of **existing roads** are permitted within the AOC subject to the following condition:
 - The footprint of the road will not be increased.
- No new landings within AOC.

Guidelines

- New branch and operational roads are permitted in MMZ2 with Ministry approval (see Appendix 1b) subject to the following conditions:
 - Canopy gaps associated with new roads will be included in the estimation of canopy closure (see above)
 - Construct new roads on existing roadbeds (where the vegetation is predominantly <8 m tall) to result in less impact on ginseng or its habitat
 - Construct winter roads unless there is no practical or feasible alternative
 - Roads will be built to minimum standards to mitigate potential impact on ginseng habitat and potential for illegal collection (e.g., right-of-way <10 m, no grubbing, no disruption of hydrological flow, no ditching, locate road as far from ginseng patch as possible)
 - New roads will be promptly decommissioned upon completion of operations unless with Ministry approval (see Appendix 1b).

- Forestry-related traffic and maintenance of **existing roads** are permitted within the AOC subject to the following condition:
 - Road maintenance is restricted to surface grading or other **low risk** road maintenance operations necessary to maintain safe travel conditions.

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within the AOC.
- No operations allowed in existing forestry aggregate pits and wood storage yards within the AOC.

[\(rationale\)](#)

Notes

Low risk road maintenance operations do not involve machine travel off the roadbed and include grading the travelled portion of the road, topdressing, removal of woody material, and dust suppression.

iii) Wetland plants (branched bartonia, small white lady's-slipper, and eastern prairie fringed-orchid)

Direction for wetland plants focuses on:

- Maintaining the integrity of the wetland
- Minimizing the disturbance of the wetland vegetation community containing the listed wetland plants.

Description of value

Wetland vegetation communities (WVCs) known to have been occupied by branched bartonia, small white lady's-slipper, or eastern prairie fringed-orchid (i.e., occupied WVCs) within the past 20 years and an adjacent 120 m wide modified management zone (MMZ) comprise the AOC.

Occupied WVCs to be delineated by the Ministry based on methodology for mapping vegetation communities described within the Ontario Wetland Evaluation System.

WVCs are considered polygonal features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within occupied WVCs.
- Harvest, renewal, and tending operations are permitted within the MMZ if they retain **residual forest** and will not result in direct damage to vegetation or deposition of sediment within occupied WVCs. Operations are subject to the following conditions:
 - Machine travel is not permitted through upland habitats within 3 m of occupied WVCs or through wetland habitats within 15 m of occupied WVCs
 - Excessive removal or damage of sapling-sized trees (<10 cm dbh) and shrubs is not permitted in **upland habitats** within 3 m of occupied WVCs or in wetland habitats within 15 m of occupied WVCs
 - Felling of trees into occupied WVCs or into **upland habitats** within 3 m of occupied WVCs or into wetland habitats within 15 m of occupied WVCs is not permitted. Trees accidentally felled into WVCs will be left where they fall
 - Operations that leave ruts, significant areas of exposed mineral soil or disrupt hydrological function (see Sections 4.1.4 and 5.2.1) within 15 m of occupied WVCs is not permitted. Ruts or significant patches of exposed mineral soil will be promptly rehabilitated.
- Contamination of occupied WVCs by foreign materials is not permitted. Specifically,
 - No equipment maintenance (e.g., washing or changing oil) is permitted within 30 m of occupied WVCs
 - Aerial application of herbicides is not permitted within the AOC. Machine-based ground application of herbicides (e.g., air-blast sprayers mounted on skidders) is not permitted within 60 m of occupied WVCs. Hand-based ground application of herbicides (e.g., back-pack sprayers) is not permitted within 3 m of occupied WVCs.

Guidelines

- If there is a risk of introducing invasive species to AOCs occupied by plants listed as SAR (e.g., equipment is coming from an area known or suspected to contain invasive species), all equipment will be thoroughly inspected by operators and, as required, cleaned following the methods described in the *Clean Equipment Protocol for Industry* (Halloran et al 2013) before operating within these AOCs.

[\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New all-weather roads and landings are not permitted within the AOC.

Guidelines

- Winter roads are not permitted within the AOC except in extraordinary circumstances, as specifically identified and justified, including road location, through the FMP AOC planning process, the road is not permitted within occupied WVCs and must be >20 m from WVC. Appropriate mitigative measures will be taken to minimize the risk of disruption of hydrological flow (see Section 4.1.4).

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits are not permitted within the AOC.
- Operations associated with existing forestry aggregate pits are permitted within the MMZ. However aggregate extraction is not permitted below the water table.

[\(rationale\)](#)

Notes

See definition of **residual forest** in the glossary and section 3.2.2.1.

Upland habitats include any habitats not considered to be aquatic features or wetlands.

4.3.2 Woody plants

Direction is provided for one woody plant listed as a species at risk (butternut) which occurs within the managed forest.

Butternut typically inhabits rich, moist sites in tolerant hardwood forest in the southern portions of the Great Lakes-St. Lawrence forest region. It is threatened by an introduced pathogen, the butternut canker. Because butternut is intolerant of shade, forest harvesting can be used to regenerate the species, but indiscriminate harvesting may remove potentially resistant genetic material.

Black ash is also listed as an at risk woody plant. ESA O. Reg. 6/24 applies to the area south of the managed forest and forestry on Crown land is exempt as long as they are operating under an approved forest management plan prepared under the CFSA.

Direction

Direction focuses on maintaining healthy individual trees.

Pockets of healthy trees, and even individual healthy trees, should be reported to the Forest Gene Conservation Association (www.fgca.net).

While not listed as species at risk, some tree species may be locally rare or uncommon in specific portions of the managed forest (e.g., red spruce in the Great Lakes-St. Lawrence forest region, white pine in the boreal forest). Direction for maintaining populations of these species may be found in other Ministry guides such as *The Forest Management Guide to Silviculture in the Great Lakes – St. Lawrence and Boreal Forests of Ontario*. ([rationale](#))

i) Butternut

Direction applies to all recognizable living butternut trees of any size encountered during forest operations and their habitat. This direction does not apply to butternut trees that have been assessed as Category 1.

Living butternut trees may not be harvested (or otherwise killed) unless assessed by a Butternut Health Expert (BHE) as per the Butternut Assessment Guidelines. Living butternut trees are classified by a BHE as follows:

- Category 1 - The butternut tree is affected by butternut canker to such an advanced degree that retaining the tree would not support the protection or recovery of butternut trees in the area in which the tree is located.
- Category 2 - The butternut tree is not affected by butternut canker, or the butternut tree is affected by butternut canker but the degree to which it is affected is not too advanced and retaining the tree could support the protection or recovery of butternut trees in the area in which the tree is located.
- Category 3 - The butternut tree may be useful in determining sources of resistance to butternut canker.

Harvest (or killing) of living butternut trees assessed as Category 1 by a BHE is permitted. ([rationale](#))

Description of value

Butternut trees are considered point features.

Living butternut trees (stems of any size), that have been assessed by a Butternut Health Expert (BHE) as Category 2 or 3 trees (or unassessed trees), and the area within 50 m comprise the AOC.

Direction applies to butternut trees and their habitat known before, or found during, operations. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Standards

- Herbicide application (other than hand-based ground application) is not permitted within the AOC. Herbicide application will avoid Category 2 or 3 (or unassessed) butternut trees.

Guidelines

- Harvest, renewal, and tending operations are permitted within the AOC are subject to the following conditions:
 - Harvest must retain shade on at least 2 sides of dominant, co-dominant, or intermediate Category 2 or 3 (or unassessed) butternut trees
 - Harvest, renewal, and tending operations will follow careful logging practices to ensure that the crown, stem, and roots of Category 2 or 3 (or unassessed) butternut trees are not damaged. Specifically,
 - Felling of trees that could damage Category 2 or 3 (or unassessed) butternut trees (e.g., trees leaning into butternut trees or into which butternut trees are leaning, trees whose crowns are interconnected with the crowns of butternut trees) is not permitted
 - No extraction trails within the dripline of the tree during the frost-free period unless approved by the Ministry (see Appendix 1b)
 - No ruts within the dripline of the tree

[\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- New roads or associated landings are not permitted within the critical rooting zone (CRZ) of Category 2 or 3 butternut trees (or unassessed) butternut trees, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process. The CRZ is considered to extend the following distance from the stem of butternut trees:
 - 5 m for butternut trees <10 cm dbh
 - 10 m for butternut trees 10-24 cm dbh
 - 15 m for butternut trees 25-35 cm dbh
 - 20 m for butternut trees ≥36 cm dbh. [\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within the CRZ of Category 2 or 3 (or unassessed) butternut trees. The CRZ is considered to extend the following distance from the stem of butternut trees:
 - 5 m for butternut trees <10 cm dbh
 - 10 m for butternut trees 10-24 cm dbh
 - 15 m for butternut trees 25-35 cm dbh
 - 20 m for butternut trees ≥36 cm dbh. ([rationale](#))

4.3.3 Lichens

Direction is provided below for the pale-bellied frost lichen, found within the Great Lakes-St. Lawrence forest region, and the white-rimmed shingle lichen which is found within the boreal forest region.

The pale-bellied frost lichen mainly grows on the trunks of ironwood in southeastern Ontario. The white-rimmed shingle lichen has only been found on eastern white cedar in northwestern Ontario. Forest management operations that remove trees surrounding the host tree or along the edge of pools, or alter hydrological processes within pools, could potentially affect habitat. Lichens are sensitive to changes in microclimate such as alterations to humidity levels, wind hydrology, and light conditions.

Direction

Direction for lichens focuses on:

- Maintaining the host tree
- Minimizing impacts to the microclimate/habitat of the lichen
- Minimizing impacts to potential host trees within the AOC.

i) Pale-bellied frost lichen

Description of value

Host trees (live, dead, or downed) that support the pale-bellied frost lichen and the area within a radius of 100 m comprise the AOC.

The area within:

- 0-50 m of a host tree is a reserve
- 51-100 m of a host tree is an MMZ.

Host trees known to support the pale-bellied frost lichen are considered point features.

[\(rationale\)](#)

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within 50 m of known host trees.
- Trees will not be felled into the reserve. Trees accidentally felled into the reserve will be left where they fell.
- Herbicide application (other than hand-based ground application) is not permitted within the AOC.

[\(rationale\)](#)

Best management practices

- Follow normal silviculture practices OR follow the principles of the *Ontario Tree Marking Guide*.

Conditions on primary roads and landings (planned or existing)

Standards

- New primary roads or associated landings are not permitted within 50 m of known host trees.
- Operations associated with existing roads and landings that increase their footprint are not permitted within the AOC.

Guidelines

- New primary roads and associated landings are not permitted within the MMZ, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Conditions on branch and operational roads and landings (planned or existing)

Standards

- New branch and operational roads and associated landings are not permitted within 50 m of host trees.
- Operations associated with existing roads and landings that increase their footprint are not permitted within the AOC.

Guidelines

- New branch and operational roads and associated landings are permitted in the MMZ subject to the following conditions:
 - New roads will be promptly decommissioned upon completion of operations unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Best management practices

- Construct new roads on existing roadbeds (where the vegetation is predominantly <8 m tall) whenever practical and likely to result in less impact on pale-bellied frost lichen or its habitat.
- Construct new roads to the minimum standards practical.
- Make the right-of-way associated with new roads as narrow as practical (e.g., 15 m wide).

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 50 m of known host trees.
- Operations associated with existing forestry aggregate pits and wood storage yards that increase their footprint are not permitted within the AOC.
- Aggregate extraction within the AOC is not permitted below the water table.

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within the MMZ, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Best management practices

- Rehabilitate forestry aggregate pits in a manner that encourages future habitat for the species (i.e., woody vegetation that supports host tree species and provides a barrier to wind/direct sunlight).

ii) White-rimmed shingle lichen

Description of value

Host trees (live, dead, or downed) that support the white-rimmed shingle lichen and the area within a radius of 100 m comprise the AOC.

Host trees known to support the white-rimmed shingle lichen are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within 0-50 m of known host trees.
- Herbicide application (other than hand-based ground application) is not permitted within the AOC.

Guidelines

- Harvest, renewal and tending operations are not permitted within 51-100 m of known host trees, unless with Ministry approval and subject to the following condition:
 - Harvest, renewal, and tending operations will be conducted in a manner that minimizes site disturbance and extraction trails will not exceed 10% coverage within the AOC.

([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary and branch roads and associated landings are not permitted within 50 m of known host trees.
- New primary roads and associated landings are not permitted within 51-100 m of known host trees.
- Operations associated with existing roads and landings that increase their footprint are not permitted within the AOC.

Guidelines

- New branch roads and/or associated landings are not permitted within 51-100 m of a known host tree except in extraordinary circumstances as justified through the AOC planning process and subject to the following conditions:
 - Construct new roads on an existing roadbed (where the vegetation is predominantly <8 m tall).
 - Ensure appropriate mitigative measures are taken to minimize the risk of disruption of hydrological flow (see Section 4.1.4 and 5.1.1)
 - New roads will be promptly decommissioned upon completion of operations unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Conditions on operational roads and landings (planned or existing)

Standards

- New operational roads and/or associated landings are not permitted within 50 m of known host trees.
- New operational roads and/or associated landings are permitted within 51-100 m of known host tree subject to the following conditions:
 - Ensure appropriate mitigative measures are taken to minimize the risk of disruption of hydrological flow (see section 4.1.4 and 5.1.1)
- Operations associated with existing roads and landings that increase their footprint are not permitted within the AOC.

[\(rationale\)](#)

Guidelines

- New operational roads will be promptly decommissioned upon completion of operations unless with Ministry approval (see Appendix 1b). [\(rationale\)](#)

Best management practices

- Construct new roads on existing roadbeds (where the vegetation is predominantly <8 m tall) whenever practical and likely to result in less impact on white-rimmed shingle lichen or its habitat.
- Construct new roads to the minimum standards practical.
- Make the right-of-way associated with new roads as narrow as practical (e.g., 15 m wide).

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within AOC.
- Operations associated with existing forestry aggregate pits and wood storage yards that increase their footprint are not permitted within the AOC.
- Aggregate extraction within the AOC is not permitted below the water table.

[\(rationale\)](#)

Best management practices

- Rehabilitate forestry aggregate pits in a manner that encourages future habitat for the species (i.e., woody vegetation that supports host tree species and provides a barrier to wind/direct sunlight).

4.3.4 Invertebrates

There are a number of insects found within the managed forest which are listed as species at risk. The monarch is a butterfly of non-forested, riparian, and forest-edge habitats and is not likely negatively affected by forest management operations so no species-specific direction is prescribed. The American bumble bee and yellow-banded bumble bee are at risk due to a number of factors. The threats include pesticide use, mainly neonicotinoids, and habitat loss, mainly to agricultural intensification. The Suckley's cuckoo bumble bee is an obligate social parasite (cannot survive independent of the host species), and is threatened by the loss of its host, the yellow-banded bumble bee. The habitat for these species is along the edges of forests, such as roadside or along the edges of forestry aggregate pit openings.

Species-specific direction is prescribed in this section for the bogbean buckmoth and its habitat. The bogbean buckmoth is restricted to open, chalky, low shrub fens containing large amounts of bogbean, an emergent wetland flowering plant. Forest management practices that encourage a natural cycle of beaver pond establishment, abandonment, and renewal are likely beneficial to these species. Bogbean buckmoth and its habitat are frequently components of provincially significant wetlands (see Section 4.1.3).

Species-specific direction is also prescribed in this section for the West Virginia white and its habitat. The West Virginia white is a butterfly of mature, moist, rich hardwood forest with broad-leaved toothwort in the understory (critical for larval development). Primary threats appear to be loss or fragmentation of suitable habitat and loss of toothwort to competition from invasive garlic mustard. Selection harvesting may be acceptable as long as toothwort is not negatively affected by soil disturbance and roads do not create movement barriers. Species-specific direction is prescribed below.

Direction

Direction is provided below and focuses on:

- Maintaining suitable stand structure/vegetation communities in occupied habitat

- Minimizing soil disturbance by operating outside the frost-free period
- Minimizing creation of barriers to movement.

Best Management Practices

- The monarch, American bumble bee, Suckley's cuckoo bumble bee, and yellow-banded bumble bee may benefit from:
 - Seeding of specific native plant species (e.g., milkweed, nectar producing plants) when rehabilitating forestry aggregate pits and landings
 - Avoiding the use of *Bacillus thuringiensis* (Bt) and glyphosate near forest edges, clearings, and roads. ([rationale](#))

i) Bogbean buckmoth

Description of value

Wetland vegetation communities (WVCs) known to have been occupied by bogbean buckmoth (i.e., occupied WVCs) within the past 3 years and an adjacent 120 m wide modified management zone (MMZ) comprise the AOC.

Occupied WVCs to be delineated by the Ministry based on methodology described in the Ontario Wetland Evaluation System.

WVCs are considered polygonal features.

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within occupied WVCs.
- Harvest, renewal, and tending operations are permitted within the MMZ if they retain **residual forest** and will not result in direct damage to vegetation or deposition of sediment within occupied WVCs. Operations are subject to the following conditions:
 - Machine travel is not permitted through **upland habitats** within 3 m of occupied WVCs or through wetland habitats within 15 m of occupied WVCs
 - Excessive removal or damage of sapling-sized trees (<10 cm dbh) and shrubs is not permitted in **upland habitats** within 3 m of occupied WVCs or in wetland habitats within 15 m of occupied WVCs
 - Felling of trees into occupied WVCs or into **upland habitats** within 3 m of occupied WVCs or into wetland habitats within 15 m of occupied WVCs is not permitted. Trees accidentally felled into WVCs will be left where they fall

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- Operations that leave ruts, significant areas of exposed mineral soil or disrupt hydrological function (see Sections 5.2.1 and 4.1.4) within 15 m of occupied WVCs is not permitted. Ruts or significant patches of exposed mineral soil will be promptly rehabilitated.
- Contamination of occupied WVCs by foreign materials is not permitted. Specifically,
 - No equipment maintenance (e.g., washing or changing oil) is permitted within 30 m of occupied WVCs.
 - Aerial application of herbicides is not permitted within the AOC. Machine-based ground application of herbicides (e.g., air-blast sprayers mounted on skidders) is not permitted within 60 m of occupied WVCs. Hand-based ground application of herbicides (e.g., back-pack sprayers) is not permitted within 3 m of occupied WVCs.

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New all-weather roads and landings are not permitted within the AOC.

Guidelines

- Winter roads are not permitted within the AOC except in extraordinary circumstances, as specifically identified and justified, including road location, through the FMP AOC planning process, the road is not permitted within occupied WVCs and must be >20 m from WVC. Appropriate mitigative measures will be taken to minimize the risk of disruption of hydrological flow (see Section 4.1.3).

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within the AOC.
- Operations associated with existing forestry aggregate pits and wood storage yards are permitted within the MMZ. However, aggregate extraction is not permitted below the water table.

Notes

See definition of **residual forest** in the glossary and section 3.2.2.1.

Upland habitats include any habitats not considered to be aquatic features or wetlands.

ii) West Virginia white

Description of value

Suitable habitat occupied by the West Virginia white at least once within the past 10 years and either:

- The area within a distance of 30 m above the high-water mark of permanent streams or 10 m above the high-water mark of intermittent streams, as delineated through field survey, or
- As delineated through field survey.

Delineated habitat comprises the AOC.

Occupied habitats are considered polygonal features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Selection harvest is permitted within the AOC subject to timing restrictions (see notes below); other types of harvest are not permitted within the AOC (see also direction in Section 4.1.2).
- Renewal and tending operations are permitted within the AOC subject to timing restrictions (see notes below).
- All equipment will be thoroughly washed before use in the AOC when there is a risk of introducing garlic mustard.

Guidelines

- Harvest, renewal, and tending operations are not permitted within the AOC during the **frost-free period** except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

([rationale](#))

Conditions on primary roads and landings (planned or existing)

Standards

- New roads and landings are not permitted within the AOC.

Guidelines

- No timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading).

[\(rationale\)](#)

Best management practices

- Use water as a dust suppressant on roads and landings.

Conditions on branch and operational roads and landings (planned or existing)

Guidelines

- New roads and landings are not permitted within the AOC, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process provided the cleared right-of-way will not exceed 15 m for operational roads and 20 m for branch roads.
- No timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading).

[\(rationale\)](#)

Best management practices

- Use water as a dust suppressant on roads and landings.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within the AOC.

[\(rationale\)](#)

Notes

Frost-free period is defined as April 1-December 31. Local knowledge may be used to adjust these dates to ensure operations will not be conducted when there is a significant risk of soil disturbance.

4.3.5 Fish

There are a number of species or subspecies of fish listed as species at risk that inhabit standing or flowing waters within the managed forest. Some of the main threats to these species are, or have been:

- Lake acidification (aurora trout)
- Changes in water quality associated with agriculture and urban development (channel darter, river herring, grass pickerel, rainbow mussel)
- Commercial over-fishing (American eel, kiyi, lake sturgeon, shortjaw cisco)
- Movement barriers created by dams (American eel, lake sturgeon)
- Loss of spawning habitat (lake sturgeon, silver lamprey)
- Sea lamprey control (northern brook lamprey, silver lamprey)
- Competition from introduced species (lake sturgeon, shortjaw cisco, Lake Opeongo whitefish (large and small-bodied populations), rainbow mussel).

Forest management operations are generally not viewed as contributing to the decline of these species or as a principal threat to their persistence. Thus, general direction for maintaining suitability of aquatic and wetland habitats (Section 4.1) is considered sufficient and no species-specific direction is prescribed. However, in Section 4.1, aquatic features containing fish that are species at risk are considered to have high potential sensitivity to forest management operations and receive the highest level of protection.

In addition to the direction in Section 4.1, all operations around water must adhere to the *Fisheries Act*. Moreover, the *Ministry of Natural Resources and Forestry/Fisheries and Oceans Canada Protocol for the Review and Approval of Forestry Water Crossings* requires review by DFO for all water crossings associated with habitat occupied by species at risk.

Forest access roads may potentially increase the risk of introducing fish species that may prey upon or compete with fish that are species at risk. Thus, planning teams may choose to place additional restrictions on the construction, use, or decommissioning of roads around aquatic features that support fish that are species at risk, such as lake sturgeon, that may be adversely affected by introduced species (see discussion on strategic road planning in Section 5.1.1). ([rationale](#))

4.3.6 Amphibians and reptiles

No amphibians that occur within the managed forest are listed as species at risk at the time of publication of this guide. Amphibians generally benefit from the direction for the

protection of aquatic and wetland habitats (Section 4.1), especially woodland pools (Section 4.1.3), and the retention of downed woody material (Section 3.2.3.2).

There are a number of species of reptiles, including snakes, turtles, and lizards, known to inhabit the managed forest which are listed as species at risk. Many of these species benefit from or are protected by general direction for aquatic and wetland habitats (Section 4.1).

Direction

Section 4.3.6.1 provides direction for listed snakes. Known snake hibernation and nesting/gestation/basking/shedding sites are addressed by operational prescriptions and conditions for AOCs.

Direction is described below and focuses on:

- Prohibiting physical disturbance of known snake hibernation and nesting/gestation/basking/shedding sites.
- Minimizing operations involving heavy equipment around known hibernation sites during the fall entrance and spring emergence periods for species that show fidelity to communal hibernation sites and/or exhibit staging behavior.

Direction for eastern foxsnake, eastern hog-nosed snake, gray ratsnake, massasauga, and eastern ribbonsnake is provided for special habitat features including nesting sites, gestation sites, communal shedding or basking sites, and hibernation sites (eastern hog-nosed snake, gray ratsnake, massasauga, and eastern ribbonsnake).

Section 4.3.6.2 includes direction for listed turtles. The Blanding's turtle, spotted turtle, and wood turtle are terrestrial, or semi-terrestrial (and thus most likely to be directly affected by road traffic and forest management operations), or potentially threatened by illegal collection. Species-specific direction is provided for the Blanding's turtle spotted turtle, and wood turtle and focuses on:

- Reducing access to populations by collectors
- Minimizing risk of direct mortality from forestry-related traffic and forest management operations
- Mitigating potential effects of forest management operations on special habitat features, especially known or suspected nesting sites and hibernation.

The other turtle species are addressed by direction that focuses on protecting known nesting sites, both natural and anthropogenic, and hibernation sites from unacceptable habitat alteration and harm to turtles.

Since illegal collection is one of the principal threats to wood turtle populations, information on the location and population status will remain confidential. See the *Forest Information Manual* and the associated technical specifications for a discussion of the treatment of classified values information.

Section 4.3.6.3 includes direction for Ontario's only lizard. Direction focuses on minimizing impacts on the five-lined skinks and known nesting sites.

4.3.6.1 Snakes

There are a number of snakes listed as species at risk which occur within the Great Lakes-St. Lawrence forest region in the managed forest: eastern foxsnake eastern hog-nosed snake, eastern ratsnake, eastern ribbonsnake, and massasauga rattlesnake. All species may be found in the forest but generally prefer non-forested habitats (e.g., wetlands), forest openings, or forest edges. Main threats to these species are habitat loss resulting from human development, persecution, and traffic-related mortality. However, forest management operations have the potential to affect two significant components of habitat for these species: hibernation sites and nesting/gestation/basking/shedding sites.

These snakes overwinter singly or communally in traditionally used hibernation sites. Hibernation sites are typically animal burrows, rock crevices, caverns, fissures, or subterranean spaces in wetlands. Hibernation sites permit snakes to move below the frost line to avoid freezing and have sufficient moisture to prevent desiccation. The gray ratsnake and massasauga show the greatest fidelity to communal hibernation sites and may also be found concentrated (staging) in the vicinity of hibernation sites for several days to weeks when snakes are entering or emerging from hibernation sites. The other species are typically less likely to use communal hibernation sites, show less fidelity, or exhibit less staging behavior.

The massasauga rattlesnake and eastern ribbonsnake give birth to live young. Gravid massasaugas restrict their activities to specific locations, known as gestation sites, during summer. Gestation sites are small (<1 ha), are generally found in forest openings (often rock outcrops), and are typically associated with enduring features such as large flat rocks ('table rocks') that provide basking sites and cover. Individual gestation sites may be used over many years, frequently by multiple females. Gravid eastern ribbonsnakes do not appear to have special habitat requirements.

The other species lay eggs at locations termed oviposition sites. Oviposition sites include large logs and stumps, decaying leaf piles, sandy areas, rocks, and rock crevices. Because warm temperatures are critical for successful incubation of eggs, oviposition sites almost always occur in areas with open canopies. Sites may be used by more than one female in multiple years. ([rationale](#))

Standards

- Awareness and driver training are required for any individuals working in habitat potentially occupied by threatened or endangered snakes. This training must provide information about the species (i.e., identification, timing restrictions, habitat), including the distribution of educational materials (e.g., species

identification cards) and the actions that operators are expected to take to minimize threats (e.g., reducing speed, speed control devices).

- A local protocol will be developed that describes how threatened or endangered snakes will be protected from injury if encountered during operations (i.e., how they should be handled, temporarily held, and/or relocated). See the Ministry's *Ontario Species at Risk Handling Manual* for suggestions.

[\(rationale\)](#)

i) Eastern hog-nosed snake or eastern ribbonsnake hibernation sites

Description of value

Hibernation sites known to have been used within the past 5 years and the area within a radius of 30 m comprise the AOC.

Hibernation sites are considered point features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Guidelines

- Harvest, renewal, and tending operations are not permitted during the **entrance and emergence periods** unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New roads and landings are not permitted within the AOC.

Guidelines

- Operations associated with existing roads and associated landings during the **entrance and emergence periods** will include the following conditions:
 - During road maintenance operations, roads and landings within the AOC will be clearly identified using flagging tape, signs, or other visual markers
 - Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within the AOC.
- Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the AOC during the **entrance and emergence period**.

[\(rationale\)](#)

Notes

Entrance and emergence periods are September 1-October 31 and April 1-May 31, respectively. Local knowledge may be used to adjust these dates.

ii) Gray ratsnake hibernation sites

Description of value

Hibernation sites known to have been used within the past 20 years and the area within a radius of 150 m comprise the AOC.

The area within 0-50 m of a hibernation site is a reserve.

The area within 51-150 m of a hibernation site comprises the Modified Management Zone (MMZ).

Hibernation sites are considered point features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Guidelines

- Harvest, renewal, and tending operations are permitted within the MMZ subject to timing restrictions and the following conditions:
 - Harvest, renewal and tending operations involving heavy equipment (e.g., skidders, mechanical harvesters) are not permitted in the MMZ during the **entrance and emergence periods** unless with Ministry approval (see Appendix 1b)

- Harvest will retain forest that meets the definition of residual and retains wildlife trees and downed woody material as per Section 3.2.3.2, and $\geq 50\%$ canopy closure
- Renewal and tending operations will leave a residual stand structure that meets the minimum described above; all other renewal and tending operations are permitted within the MMZ.

[\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary roads, branch roads and associated landings are not permitted within the AOC.

Guidelines

- Operations associated with existing roads and landings during the **entrance and emergence periods** will include the following conditions:
 - During road maintenance operations, roads and landings within the AOC will be clearly identified using flagging tape, signs, or other visual markers
 - Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).

[\(rationale\)](#)

Conditions on operational roads and landings (planned or existing)

Standards

- New operational roads and landings are not permitted within 0-50 m of the hibernation site.
- New operational winter roads and new all-weather operational roads, including those built on existing roadbeds (where the vegetation is predominantly < 8 m tall), will be built to minimum standards (e.g., maximum right-of-way width 15 m).
- No new landings permitted within the MMZ.

Guidelines

- New all-weather operational roads are not permitted within the MMZ, unless with Ministry approval. If there is no practical or feasible alternative, construct winter roads, as approved by the Ministry (see Appendix 1b).
- Operations associated with existing roads and landings during the **entrance and emergence periods** will include the following conditions:

- During road maintenance operations, roads within the AOC will be clearly identified using flagging tape, signs, or other visual markers.
- Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).

[\(rationale\)](#)

Best management practices

- Where possible new operational winter roads and new all-weather operational roads will be built on **existing roadbeds**.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the MMZ during the **entrance and emergence periods**.

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within the MMZ unless approved by the Ministry (see Appendix 1b).

[\(rationale\)](#)

Notes

Entrance and emergence periods are September 1-October 31 and April 1-May 31, respectively. Local knowledge may be used to adjust these dates.

iii) Massasauga hibernation sites

Description of value

Hibernation sites known to have been used by massasauga within the past 20 years and the area within a radius of 100 m comprise the AOC.

The area within 0-30 m of a hibernation site is a reserve.

The area within 31-100 m of a hibernation site comprises the Modified Management Zone (MMZ).

Hibernation sites are considered point features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Guidelines

- Harvest, renewal, and tending operations are not permitted within the MMZ during the **entrance and emergence periods** unless with Ministry approval (see Appendix 1 b). [\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Standards

- New primary roads, branch roads and landings are not permitted within the AOC.

Guidelines

- Operations associated with existing primary and branch roads and landings during the **entrance and emergence periods** will include the following conditions:
 - During road maintenance operations, roads and landings within the AOC will be clearly identified using flagging tape, signs, or other visual markers
 - Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).

[\(rationale\)](#)

Conditions on operational roads and landings (planned or existing)

Standards

- New operational roads and landings are not permitted within 0-50 m of the hibernation site.
- New operational winter roads and new all-weather operational roads, including those built on existing roadbeds (where the vegetation is predominantly <8 m tall), will be built to minimum standards (i.e., maximum right-of-way width 15 m).
- No new landings permitted within the MMZ.

Guidelines

- New all-weather operational roads are not permitted within the MMZ unless with Ministry approval. If there is no practical or feasible alternative, construct winter roads as approved by the Ministry (see Appendix 1b).
- Operations associated with existing operational roads and landings during the **entrance and emergence periods** will include the following conditions:
 - During road maintenance operations, roads and landings within the AOC will be clearly identified using flagging tape, signs, or other visual markers
 - Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).

Best management practices

- Where possible, new operational winter roads and all-weather operational roads will be built on **existing roadbeds**.

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the MMZ during the **entrance and emergence periods**.

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within the MMZ unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Notes

Entrance and emergence periods are September 1-October 31 and April 1-May 31, respectively. Local knowledge may be used to adjust these dates.

iv) Eastern foxsnake, eastern hog-nosed snake, gray ratsnake, or massasauga nesting sites, gestation/oviposition sites, and communal shedding or basking sites

Description of value

Nesting sites, and communal (i.e., used by two or more snakes) shedding or basking sites known to have been used by eastern foxsnake, eastern hog-nosed snake, or gray ratsnake within the past 5 years and the area within a radius of 30 m comprise the AOC.

Gestation/oviposition sites, and communal shedding or basking sites known to have been used by massasauga within the past 20 years and the area within a radius of 30 m comprise the AOC.

Nesting sites, gestation/oviposition sites, and communal shedding or basking sites are considered point features.

Eastern foxsnake and gray ratsnake nesting sites and communal basking and shedding sites may be more transient than other habitat features, and their suitability should be verified over time. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within the AOC. ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New roads and landings are not permitted within the AOC.

Guidelines

- Operations associated with existing roads and landings are not permitted within the AOC during the **gestation/oviposition, nesting, incubation and juvenile dispersal period** (nesting and gestation sites) or the **active season** (communal shedding and basking sites), unless with Ministry approval (see Appendix 1b), including the following conditions:
 - During road maintenance operations, roads and landings within the AOC will be clearly identified using flagging tape, signs, or other visual markers
 - Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).

([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits are not permitted within the AOC.

Guidelines

- Operations associated with existing forestry aggregate pits are not permitted within the AOC during the **gestation/oviposition, nesting, incubation and juvenile dispersal period** (nesting and gestation sites) and/or during the **active season** (communal shedding and basking sites), unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Notes

Active season is April 15-October 15. Local knowledge may be used to adjust these dates.

Gestation, nesting, incubation and juvenile dispersal period is June 15-October 15. Local knowledge may be used to adjust these dates.

4.3.6.2 Turtles

Many listed turtle species are found in the managed forest: Blanding's turtle, eastern musk turtle, formerly known as stinkpot, northern map turtle, spotted turtle, wood turtle and snapping turtle. All but the snapping turtle are found primarily within the Great Lakes-St. Lawrence forest region. Seven of eight turtle species found in Ontario are now listed as at risk but only one species is found within the managed forest.

All species are aquatic during some portion of the year, inhabiting lakes, ponds, rivers, streams, and permanent or seasonal wetlands. Main threats are traffic-related mortality, shoreline development, recreational use of shorelines, wetland drainage, water level control, environmental contaminants, or illegal collection. Harvest, renewal and tending operations rarely affect the habitat of most species, except potentially at nest sites or hibernation sites.

Nests are typically excavated in coarse soils, but eggs may also be laid in moss, decaying vegetation, or rotting wood, depending on the species. Nest sites are generally located in open habitats typically close to water, such as beaches and sand bars. However, some nest sites may be up to a few hundred meters from water. Nest sites may be used by several females; fidelity to nest sites varies among species. It is

not well studied for all species but has been documented for Blanding's turtle, snapping turtle, northern map turtle and wood turtle.

Turtles typically hibernate in wetlands, ponds, or deep pools in rivers or streams. Hibernation sites are usually occupied by numerous individuals. Fidelity to individual hibernation sites is commonly reported.

The wood turtle is the most terrestrial of the turtle species. During spring and fall, it is largely aquatic and is primarily associated with rivers and large streams. During summer, it becomes increasingly terrestrial, wandering hundreds of meters from watercourses used in spring and fall. Thus, it is the species most likely to be directly affected by forest management operations. The Blanding's turtle and spotted turtle are semi-terrestrial. They may be found in upland habitats when nesting, basking, aestivating, moving between wetlands, or moving to or from hibernation sites, and thus may also be directly affected by forest management operations. The main effect of forest management operations on these species is likely increased potential for traffic-related mortality and illegal collection associated with increased access.

Direction

The Blanding's turtle, spotted turtle, and wood turtle are terrestrial, or semi-terrestrial (and thus most likely to be directly affected by road traffic and forest management operations), or potentially threatened by illegal collection. Species-specific direction is provided for the Blanding's turtle, spotted turtle and wood turtle and focuses on:

- Reducing access to populations by collectors.
- Minimizing risk of direct mortality from forestry-related traffic and forest management operations.
- Mitigating potential effects of forest management operations on special habitat features, especially known or suspected nesting sites and hibernation sites.

[\(rationale\)](#)

Standards

- Awareness and driver training are required for any individuals working in habitat potentially occupied by at risk turtles. This training must provide information about the species (i.e., identification, timing restrictions, habitat), including the distribution of educational materials (e.g., species identification cards) and the actions that operators are expected to take to minimize threats (e.g., reducing speed, speed control devices).
- A local protocol will be developed that describes how at risk turtles will be protected from injury if encountered during operations (i.e., how they should be handled, temporarily held, and/or relocated). See the Ministry's *Ontario Species at Risk Handling Manual* for suggestions.

[\(rationale\)](#)

i) Turtle natural nesting sites

Description of value

Natural nesting sites known to have been used by spotted turtle, wood turtle, or snapping turtle within the past 40 years and eastern musk turtle or northern map turtle within the past 10 years and the area within a radius of 30 m and nesting sites known to have been used by Blanding's turtle during the current year and the area within a radius of 10 m comprises the AOC.

Nesting sites are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Guidelines

- Harvest, renewal, and tending operations are not permitted within the AOC unless with Ministry approval (see Appendix 1b). ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing) Conditions on operational roads and landings (planned or existing)

Standards

- New roads or landings are not permitted within the AOC.

Guidelines

- Maintenance operations associated with existing roads or operations associated with existing landings are not permitted within the AOC during the **nesting, incubation, and juvenile dispersal period** unless with Ministry approval (see Appendix 1b), including the following conditions:
 - During road maintenance operations, roads and landings within the AOC will be clearly identified using flagging tape, signs, or other visual markers
 - Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).

([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within the AOC.

Guidelines

- Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the AOC during the **nesting, incubation, and juvenile dispersal period** unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Notes

Natural nesting sites include roads or landings not actively used or maintained.

Nesting, incubation, and juvenile dispersal period is June 1-October 31. Local knowledge may be used to adjust these dates.

ii) Turtle anthropogenic nesting sites

Description of value

Nesting sites or areas known to have been used by Blanding's turtle, spotted turtle, wood turtle, eastern musk turtle, northern map turtle or snapping turtle within the past 40 years and the following:

- Nesting sites on roads and the road surface within 50 m either side comprise the AOC.
- Areas delineated by the Ministry along roads and the road surface known to be used for nesting by turtles
- Nesting sites in forestry aggregate pits or wood storage yards and the area delineated by the Ministry
- Nesting sites on landings the AOC comprises the entire landing
- Nesting sites in forestry aggregate pits or wood storage yards delineated by the Ministry.

Nesting sites are considered point features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within the AOC. [\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- Maintenance operations that disturb the roadbed (except those required for safety or environmental protection and accompanied mitigation) associated with existing roads or operations associated with existing landings are not permitted within the AOC during the **nesting, incubation, and juvenile dispersal period** unless with Ministry approval (see Appendix 1b), including the following conditions:
 - During road maintenance operations, roads and landings within the AOC will be clearly identified using flagging tape, signs, or other visual markers
 - Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits) and measures to increase awareness (e.g., training, signage).

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Guidelines

- Operations associated with existing forestry aggregate pits are not permitted within the AOC during the **nesting, incubation, and juvenile dispersal period** unless with Ministry approval (see Appendix 1b), including the following condition:
 - During aggregate extraction, the AOC will be clearly identified using flagging tape, signs, or other visual markers.

[\(rationale\)](#)

Notes

Nesting, incubation, and juvenile dispersal period is June 1-October 31. Local knowledge may be used to adjust these dates.

iii) Turtle hibernation sites

Description of value

Suitable hibernation sites and associated aquatic features known to have been used by the eastern musk turtle, northern map turtle or snapping turtle at least once within the past 10 years.

The associated aquatic features are defined as either:

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- the river segment 200 m above and below a hibernation site, or
- the wetland polygon containing a hibernation site.

Direction applies to suitable hibernation sites and associated aquatic features identified by the Ministry prior to, or during, operations.

Hibernation sites are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within the AOC. ([rationale](#))

Conditions on primary roads and landings (planned or existing)

Standards (See also appropriate aquatic and wetland ecosystem direction in Section 4.1)

- New roads or landings are not permitted within the AOC.
- Water drawdowns or other activities that significantly alter hydrological regime are not permitted.

Guidelines

- Reconstruction of water crossings within the AOC will be conducted with Ministry approval (see Appendix 1b).

([rationale](#))

Conditions on branch and operational roads and landings (planned or existing)

Standards

- Water drawdowns or other activities that significantly alter hydrological regime are not permitted.

Guidelines

- New roads or landings are not permitted within the AOC except in extraordinary circumstances as identified and justified through the FMP AOC planning process.
- Reconstruction of water crossings within the AOC will be conducted with Ministry approval (see Appendix 1b).

([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- Water drawdowns or other activities that significantly alter hydrological regime are not permitted.

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within the AOC except in extraordinary circumstances as identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

iv) Blanding's turtle foraging, thermoregulation, hibernation, and movement habitat

Direction for Blanding's turtle and its foraging, thermoregulation, hibernation, and movement habitat is combined with direction for turtle nesting sites.

Description of value

Identified large aquatic habitats and the area within a distance of 200 m that are within 2 km of reliable observations and identified small aquatic habitats and the area within 30 m that are within 2 km of reliable observations within the past 40 years comprise the AOC (see Figure 4.3a).

Aquatic habitats include:

- Aquatic features that have a high potential to be used by Blanding's turtle during the **active season** and **hibernation period**
- Large aquatic habitats, ≥ 0.5 ha known to be used during the **active season**
- Isolated small aquatic habitats, < 0.5 ha, known to be used during the **active season** and the **staging period**.

Direction applies to habitat identified by the Ministry prior to, or during operations, based on field surveys or other reliable methods.

For large aquatic habitats, the area within:

- 0-30 m of large aquatic habitats comprises Modified Management Zone 1 (MMZ1)
- 31-100 m of large aquatic habitats comprises MMZ2
- 101-200 m of large aquatic habitats comprises MMZ3.

Small aquatic habitats, the area within:

- 0-15 m of small aquatic habitats is a reserve
- 16-50 m of small aquatic habitats comprises MMZ4.

Observations are considered point features. ([rationale](#))

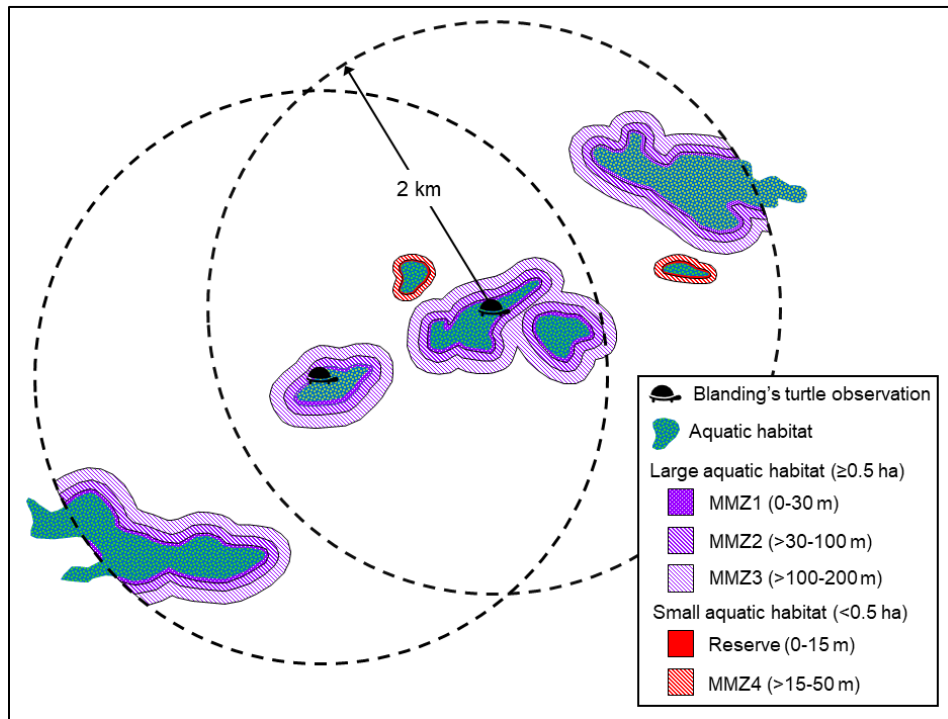


Figure 4.3a. Blanding's turtle AOC showing reserves and modified management zones for large and small aquatic habitats.

Operational prescription and conditions for the area of concern

Standards

- In aquatic habitats, operations involving heavy equipment (e.g., mechanical harvesters, skidders, bulldozers) or otherwise representing a potential injury risk to turtles are not permitted:
 - In MMZ1 during the **active season**
 - In MMZ2 during the **terrestrial period**
 - In MMZ3 during the **nesting period**
 - In MMZ4 during the **terrestrial period** and **staging period**. ([rationale](#))

Conditions on primary roads and landings (planned or existing)

Standards

- Only operations associated with **low risk** road maintenance necessary to maintain safe travel conditions on existing primary roads within MMZ1 are allowed during the **active season** (see also turtle nesting site direction).
- Materials accumulated through road maintenance (e.g., brush, gravel) will not be deposited into small aquatic habitats (e.g., borrow pits, roadside ditches, vernal pools).

Guidelines

- New primary (including winter roads) and associated landings are not permitted within MMZ1 or MMZ4 except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.
- New all-weather primary roads or associated landings within MMZ2 and MMZ3 will be constructed with Ministry approval (see Appendix 1b) to ensure roads are built in areas with the least potential impact on turtles and their habitat.
- Operations associated with existing landings are not permitted within MMZ1 during the **active season** unless with Ministry approval (see Appendix 1b).
- Forestry-related traffic and operations on existing primary roads within MMZ1 during the **active season** or within MMZ2 and MMZ3 during the **nesting period** will be accompanied by measures to reduce traffic speed (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).
- Temporary water drawdowns that negatively impact hibernation habitat are not permitted but may be allowed subject to timing restriction and with Ministry approval (see Appendix 1b).
- Road maintenance activities that will result in permanent changes to water levels within large aquatic habitats are not permitted except where beaver activity has affected a water crossing and the resulting water levels are likely to create a safety or environmental concern and the activity will not lower water levels below what was present before the beaver activity.

Best management practices

- Construct new roads on existing roadbeds (where the vegetation is predominantly <8 m tall) whenever practical.
- Reuse **old landings** whenever practical.

[\(rationale\)](#)

Conditions on branch and operational roads and landings (planned or existing)

Standards

- Construction of new branch roads, operational roads and associated landings is not permitted:
 - In MMZ1 during the **active period**
 - In MMZ4 during the **terrestrial period** or the **staging period**.
- Construction of new roads or associated landings are not permitted:
 - In MMZ2 during the **terrestrial period**
 - In MMZ3 during the **nesting period**.
- Only operations associated with **low risk** road maintenance necessary to maintain safe travel conditions on existing branch roads and operational roads within MMZ1 are allowed during the **active season** (see also turtle nesting site direction).
- Materials accumulated through road maintenance (e.g., brush, gravel) will not be deposited into small aquatic habitats (e.g., borrow pits, roadside ditches, vernal pools).

Guidelines

- New branch roads, operational roads and associated landings are not permitted within MMZ1 or within MMZ4, unless with Ministry approval (see Appendix 1b).
- New branch roads, operational roads and associated landings within MMZ2 and MMZ3 will be constructed with Ministry approval (see Appendix 1b) to ensure roads are built in areas with the least potential impact on turtles and their habitat.
- Operations associated with existing landings are not permitted within MMZ1 during the **active season**, unless with Ministry approval (see Appendix 1b).
- Forestry-related traffic and operations on branch roads and operational roads within MMZ1 and MMZ4 during the **active season** or within MMZ2 and MMZ3 during the **nesting period** will be accompanied by measures to reduce traffic speed (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).
- Temporary water drawdowns that negatively impact hibernation habitat are not permitted but may be allowed with Ministry approval (see Appendix 1b) and subject to timing restrictions.
- Road maintenance activities that will result in permanent changes to water levels within large aquatic habitats are not permitted except where beaver activity has affected a water crossing and the resulting water levels are likely to create a safety

or environmental concern and the activity will not lower water levels below what was present before the beaver activity.

Best management practices

- Construct new roads on existing roadbeds (where the vegetation is predominantly <8 m tall) whenever practical.
- Reuse **old landings** whenever practical.

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within MMZ1.

Guidelines

- New forestry aggregate pits and wood storage yards within MMZ2, MMZ3 and MMZ4 will be constructed with Ministry approval (see Appendix 1b).

Best management practices

- During operations associated with existing aggregate pits and wood storage yards operators should walk the aggregate pit or yard immediately (i.e., less than one hour) before operations within MMZ1 during the **active season** or within MMZ2 and MMZ3 during the **nesting period**.

[\(rationale\)](#)

Notes

Active season is April 15-October 15.

Terrestrial period is April 15-July 7.

Nesting period is June 1-July 7.

Staging period is August 21-October 15.

Local knowledge may be used to adjust these dates.

An **old landing** is any clearly recognizable landing with dominant vegetation generally comprised of shrubs and/or saplings that is predominantly <8 m tall (i.e., not contributing to the overall canopy closure).

Low risk road maintenance operations include grading localized areas of the travelled portion of the road such that the shoulders and edges of the road (first 30 cm of the roadbed) remain unaltered, topdressing in the traveled portion of the road (again

ensuring that shoulders and edges of the road remain unaltered), removal of woody material, and dust suppression.

v) Spotted turtle hibernation, foraging, thermoregulation, and movement habitat

Direction for spotted turtle and its hibernation, foraging, thermoregulation, and movement habitat is combined with direction for nesting sites.

Description of value

Permanent mapped aquatic features of suitable aquatic habitat (SAH) and the area within a distance of 130 m from the boundary of SAH that are within 1 km of reliable observations of spotted turtles reported within the past 40 years comprise the AOC.

SAH includes a variety of permanent mapped aquatic features such as marshes, bogs, fens, swamps, deep ponds and small lakes within bog areas. SAH should have soft substrate with abundant aquatic and floating vegetation, with shallow areas (<2 m in depth). These features provide habitat for foraging, cover and thermoregulation.

Observations are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to the following conditions:
 - Harvest, renewal, and tending operations (including extraction trails) are not permitted within **known** or **suspected** hibernation sites or in SAH
 - Harvest, renewal and tending operations are not permitted within 30 m of SAH during the **active season**.

Best management practices

- Minimize operations involving heavy equipment (e.g., mechanical harvesters, skidders, bulldozers) or otherwise representing a potential injury risk to turtles within the AOC during the **active season**.

([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Standards

- Only operations associated with **low risk** road maintenance necessary to maintain safe travel conditions on existing primary and branch roads within 30 m of SAH are allowed during the **active season**.

Guidelines

- New primary and branch roads are permitted within the AOC subject to the following conditions:
 - New primary and branch roads are not permitted within 30 m of SAH, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process
 - New primary and branch roads are not permitted within 130 m of significant communal hibernation sites, as defined by the Ministry
 - New all-weather primary and branch roads or associated landings within 31-130 m of SAH will be constructed with Ministry approval (see Appendix 1b) to ensure roads are built in areas with the least potential impact on turtles and their habitat.
- Forestry-related traffic and operations on primary and branch roads within 30 m of SAH during the **active season**, within 130 m of SAH during the **nesting period** will be accompanied by measures to reduce speeds (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training and signage).

[\(rationale\)](#)

Best management practices

- Minimize operations associated with primary and branch roads and landings within 130 m of SAH during the **active season**.
- Where feasible, activities that will potentially alter water levels in SAH will occur within the **active season**. However, road maintenance activities that will result in permanent changes to water levels within SAH are not permitted except where beaver activity has affected a water crossing and the resulting water levels are likely to create a safety or environmental concern and the activity will not lower water levels below what was present before the beaver activity.

Conditions on operational roads and landings (planned or existing)

Standards

- Only operations associated with **low risk** road maintenance necessary to maintain safe travel conditions on existing operational roads within 30 m of SAH are allowed during the **active season**.

Guidelines

- New operational roads are permitted within the AOC subject to the following conditions:
 - New operational roads are not permitted within 30 m of SAH, unless approved by the Ministry (see Appendix 1b)
 - New operational roads are not permitted within 130 m of communal hibernation sites, as defined by the Ministry
 - New all-weather operational roads or associated landings within 31-130 m of SAH will be constructed with Ministry approval (see Appendix 1b) to ensure roads are built in areas with the least potential impact on turtles and their habitat.
- New operational roads will be promptly decommissioned when operations are done unless with Ministry approval (see Appendix 1b).
- Forestry-related traffic and operations on operational roads within 30 m of SAH during the **active season**, within 130 m of SAH during the **nesting period** will be accompanied by measures to reduce speeds (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training and signage).

[\(rationale\)](#)

Best management practices

- Minimize operations associated with operational roads and landings within 130 m of SAH during the **active season**.
- Where feasible, activities that will potentially alter water levels in SAH will occur within the **active season**. However, road maintenance activities that will result in permanent changes to water levels within SAH are not permitted except where beaver activity has affected a water crossing and the resulting water levels are likely to create a safety or environmental concern and the activity will not lower water levels below what was present before the beaver activity.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 30 m of SAH.

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within 130 m of significant communal hibernation sites, as defined by the Ministry.

- New forestry aggregate pits and wood storage yards within 31-130 m of SAH will be constructed with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Best management practices

- During operations associated with existing aggregate pits and wood storage yards, operators should walk the aggregate pit or yard immediately (i.e., less than one hour) before operations within 30 m of SAH during the **active season** or within 130 m of SAH during the **nesting period**.

Notes

Active season is April 15-October 31.

Nesting period is June 1-30.

Local knowledge may be used to adjust these dates.

Low risk road maintenance operations include grading localized areas of the travelled portion of the road such that the shoulders and edges of the road (first 30 cm of the roadbed) remain unaltered, topdressing in the traveled portion of the road (again ensuring that shoulders and edges of the road remain unaltered), removal of woody material, and dust suppression.

vi) Wood turtle foraging, thermoregulation, hibernation, and movement habitat

Direction for wood turtle and its hibernation, foraging, thermoregulation, and movement habitat is combined with direction for nesting sites.

Description of value

Suitable aquatic habitat (SAH) within 2 km of reliable observations of wood turtles reported within the past 40 years and the area within a distance of 200 m from the boundary of SAH comprise the AOC.

SAH to be identified by the Ministry will normally include rivers and/or streams with moderate current, sand or gravel substrates, deep pools (generally >1 m deep in the winter), and nearby nesting sites (e.g., sand and gravel bars). SAH may also have undercut banks, log jams, and beaver dams. SAH includes the aquatic feature up to the high-water mark. Local knowledge may be used to refine the definition of SAH.

The AOC is divided into two zones:

- **Zone A** consists of SAH within 2 km of reliable observations of wood turtles within the past 40 years and the area within 0-30 m
- **Zone B** consists of the area within 31-200 m of SAH described in **Zone A**.

Observations are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within **Zone A**.
- Harvest, renewal, and tending operations are permitted within **Zone B** subject to timing restrictions (see notes below) and the following condition:
 - Within **Zone B**, ensure ≥30% **mature forest** is retained.

Guidelines

- Operations involving heavy equipment or otherwise representing a significant risk to turtles are not permitted in **Zone B** during the **terrestrial period**.

([rationale](#))

Conditions on primary roads and landings (planned or existing)

Standards

- Construction of new primary roads or associated landings are not permitted in **Zone A** during the **active season** and in **Zone B** during the **terrestrial period**.
- Only operations associated with **low risk** road maintenance necessary to maintain safe travel conditions on existing primary roads within **Zone A** and **Zone B** are allowed during the **active season**.

Guidelines

- New primary roads are not permitted in **Zone A** or **Zone B**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
- Temporary water drawdowns that negatively impact hibernation habitat are not permitted but may be allowed subject to timing restriction and with Ministry approval (see Appendix 1b).
- Road maintenance activities that will result in permanent changes to water levels within large aquatic habitats are not permitted except where beaver activity has affected a water crossing and the resulting water levels are likely to create a safety

or environmental concern and the activity will not lower water levels below what was present before the beaver activity.

- Operations within existing landings are not permitted in **Zone A** and **Zone B** during the **terrestrial period**, unless with Ministry approval (see Appendix 1b).
- Forestry-related traffic on primary roads in **Zone A** and **Zone B** during the **active season** will be accompanied by measures to reduce traffic speed (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).

[\(rationale\)](#)

Best management practices

- Construct new roads on existing roadbeds (where the vegetation is predominantly <8 m tall) whenever practical.
- Reuse **old landings** whenever practical.

Conditions on branch and operational roads and landings (planned or existing)

Standards

- Only operations associated with **low risk** road maintenance necessary to maintain safe travel conditions on existing branch roads and operational roads within **Zone A** and **Zone B** are allowed during the **active season**.
- New branch roads, operational roads and associated landings are permitted within the AOC subject to the following condition:
 - Construction of new branch roads, operational roads or associated landings is not permitted in **Zone A** during the **active season** and in **Zone B** during the **terrestrial period**.

Guidelines

- New branch roads, operational roads and associated landings are permitted within the AOC subject to the following conditions:
 - New branch roads, operational roads and associated landings will be constructed with Ministry approval (see Appendix 1b) to ensure roads are built with the least potential impact on turtles and their habitat
 - New branch roads and operational roads will be constructed to conditions that restrict traffic flow and road longevity (e.g., maximum 10 m wide cleared corridor, roads built to minimum standards) unless with Ministry approval (see Appendix 1b).

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- New branch and operational roads will be promptly decommissioned when operations are done unless with Ministry approval (see Appendix 1b).
- Temporary water drawdowns that negatively impact hibernation habitat are not permitted but may be allowed subject to timing restriction and with Ministry approval (see Appendix 1b).
- Road maintenance activities that will result in permanent changes to water levels within large aquatic habitats are not permitted except where beaver activity has affected a water crossing and the resulting water levels are likely to create a safety or environmental concern and the activity will not lower water levels below what was present before the beaver activity.
- Operations within existing landings are not permitted in **Zone A** and **Zone B** during the **terrestrial period**, unless with Ministry approval (see Appendix 1b).
- Forestry-related traffic on branch and operational roads in **Zone A** and in **Zone B** during the **active season** will be accompanied by measures to reduce traffic speed (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).

[\(rationale\)](#)

Best management practices

- Construct new roads on existing roadbeds (where the vegetation is predominantly <8 m tall) whenever practical.
- Reuse **old landings** whenever practical.

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are permitted within the AOC subject to the following condition:
 - New forestry aggregate pits and wood storage yards are not permitted within **Zone A**. [\(rationale\)](#)

Guidelines

- New forestry aggregate pits and wood storage yards are permitted within the AOC subject to the following condition:
 - New forestry aggregate pits and wood storage yards within **Zone B** will be constructed with Ministry approval (see Appendix 1b). [\(rationale\)](#)

Best management practices

- During operations associated within existing forestry aggregate pits and wood storage yards in **Zone A** during the **active season** and in **Zone B** during the **terrestrial period**, operators should walk the aggregate pit or yard immediately (i.e., less than one hour) before operations during the nesting period.

Notes

Active season is April 1-October 31.

Terrestrial period is May 1-September 30.

Local knowledge may be used to adjust these dates.

Low risk road maintenance operations include grading localized areas of the travelled portion of the road such that the shoulders and edges of the road (first 30 cm of the roadbed) remain unaltered, topdressing in the traveled portion of the road (again ensuring that shoulders and edges of the road remain unaltered), removal of woody material, and dust suppression.

Mature forest meets the forest unit-specific age definition in the *Forest Management Guide for Great Lakes-St. Lawrence Landscapes* and has not received a selection harvest within the past 20 years or a shelterwood harvest within the past 40 years.

Old landing is a clearly recognizable landing with dominant vegetation generally comprised of raspberries (*Rubus* spp), other shrubs, and saplings <8 m tall.

4.3.6.3 Lizards

Ontario's only lizard, the five-lined skink, is listed as a species at risk and is found along the southern edge of the managed forest. However, it typically inhabits non-forested habitats; main threats are thought to be cottage and shoreline development. ([rationale](#))

i) Five-lined skink nesting sites

Description of value

Nesting sites known to have been used by five-lined skink within the past 5 years and the area within a radius of 30 m comprise the AOC.

Nesting sites are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within the AOC. [\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New roads and landings are not permitted within the AOC.

Guidelines

- Operations associated with existing roads and landings are not permitted within the AOC during the **active season** unless with Ministry approval (see Appendix 1b), including the following conditions:
 - During road maintenance operations, roads within the AOC will be clearly identified using flagging tape, signs, or other visual markers
 - Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within the AOC.

Guidelines

- Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the AOC during the **active season** unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Notes

Active season is April 15-October 15. Local knowledge may be used to adjust these dates.

4.3.7 Birds

There are a number of species of birds listed as species at risk that breed within the managed forest. Species-specific direction is not provided for every species. These species benefit from or are protected by general direction for conserving biodiversity (Section 3.2) and aquatic and wetland habitats (Section 4.1).

Section 4.2.2 provides direction for peregrine falcon, short-eared owl and black tern, that may be affected by forest management operations and have identifiable nest sites. In the following section, direction is provided for a number of listed bird species that could be affected by forest management operations for which individual nest sites are unlikely to be known, but for which occupied breeding habitat can be delineated.

See Section 4.2.2 for application of the MBCA.

Direction

Suitable habitat occupied by breeding birds listed as species at risk is addressed by operational prescriptions and conditions for AOCs. Direction provided below focuses on:

- Maintaining suitability of occupied breeding habitat
- Avoiding disturbance of nesting birds during the critical breeding period.

[\(rationale\)](#)

i) Bank swallow

The following direction is provided for bank swallow and its nest sites. Other components of bank swallow habitat are addressed by the coarse filter direction in the Boreal and Great Lakes – St. Lawrence Landscape Guides (see discussion in Background and Rationale for Direction). The bank swallow nests in burrows excavated in riverbanks, lakeshore bluffs, road cuts and aggregate pits. Harvesting operations may create foraging habitat for this species.

Description of value

Natural or artificial bank/pit faces containing burrows, that are **known** or **suspected** to have been occupied by breeding bank swallows within the past 10 years for natural sites or 3 years for artificial sites and the area within a radius of 50 m comprise the AOC.

Bank/pit faces containing burrows, or structurally supporting burrows are considered linear features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Guidelines

- Harvest, renewal, and tending operations are not permitted within the following distance of occupied burrows during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), unless with Ministry approval (see Appendix 1b):
 - 50 m for high potential impact operations
 - 25 m for moderate impact operations
 - 10 m for low potential impact operations. ([rationale](#))

Conditions on primary roads and landings (planned or existing)

Standards

- New primary roads and associated landings are not permitted within the AOC associated with riverine nest sites.

Guidelines

- Operations associated with existing roads and landings are not permitted within 10 m (low impact operations), 25 m (moderate impact operations), or 50 m (high impact operations) (see Appendix 4.2) of occupied burrows during the **critical breeding period** unless with Ministry approval (see Appendix 1b). However, there is no timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading).

([rationale](#))

Conditions on branch and operational roads and landings (planned or existing)

Standards

- New branch roads and operational roads and associated landings are not permitted within the AOC associated with riverine nest sites.

Guidelines

- New branch roads and operational roads are permitted within the AOC associated with riverine nest sites if constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 15 m, outside the **critical breeding period**.
- Operations associated with existing roads and landings are not permitted within 10 m (low impact operations), 25 m (moderate impact operations), or 50 m (high impact operations) (see Appendix 4.2) of occupied burrows during the **critical breeding period** unless with Ministry approval (see Appendix 1b). However,

there is no timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading).

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- Follow forestry aggregate pit and wood storage yard direction, as per FMPM (Appendix III and IV), outside the **critical breeding period**.

Guidelines

- Operations associated with forestry aggregate pits and wood storage yards are not permitted within 10 m (low impact operations), 25 m (moderate impact operations), or 50 m (high impact operations) (see Appendix 4.2) of occupied burrows during the **critical breeding period**, unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Notes

Nest sites **known** to be or have been occupied are those at which breeding activity has been confirmed. Nest sites **suspected** to be or have been occupied are those at which breeding activity has not been confirmed, but for which there is compelling evidence of current or previous use (e.g., presence of recognizable bank swallow burrows).

The **critical breeding period** is May 1-July 31. Local knowledge of breeding chronology may be used to adjust these dates.

ii) Barn swallow

The following direction is provided for barn swallow and its nest sites. Other components of barn swallow habitat are addressed by the coarse filter direction in the Boreal and Great Lakes – St. Lawrence Landscape Guides (see discussion in Background and Rationale for Direction). Barn swallows are found in open areas throughout the managed forest. Nesting sites may include bridges and culverts.

See *Best Management Practices for Excluding Barn Swallows and Chimney Swifts from Buildings and Structures* (OMNRF 2017).

Description of value

Nests **known** or **suspected** to be or have been occupied by barn swallows and the area within a radius of 20 m comprise the AOC.

Nests are considered point features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within the AOC. [\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- If operations that will remove, damage, or destroy nests or adversely alter the supporting structure are planned to take place during the **critical breeding period**, the following condition applies:
 - Measures must be in place before the **critical breeding period** to prevent barn swallows from accessing existing nests and/or any part of the supporting structure that is being altered by the planned operations.
- Any moderate or high impact operations (see Appendix 4.2) associated with existing roads are not permitted during the **critical breeding period** if nests are occupied, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process. However, there is no timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading).

[\(rationale\)](#)

Notes

Nests **known** to be or have been occupied are those at which breeding activity has been confirmed. Nests **suspected** to be or have been occupied are those at which breeding activity has not been confirmed, but for which there is compelling evidence of current or previous use (e.g., presence of recognizable barn swallow nests).

The **critical breeding period** is May 1-August 31. Local knowledge of breeding chronology may be used to adjust these dates. [\(rationale\)](#)

iii) Cerulean warbler

The following direction is provided for Cerulean warbler and its breeding habitat. The cerulean warbler is a songbird that inhabits mature tolerant hardwood forest in the southern portions of the Great Lakes - St. Lawrence forest region. Principal threats are the loss and fragmentation of large patches of mature tolerant hardwood forest.

Description of value

Suitable habitat within a radius of 250 m of reliable observations of cerulean warbler breeding evidence reported within the past 30 years comprises the AOC.

The area within:

- 0-125 m is a reserve
- 126-250 m comprises a modified management zone (MMZ).

Suitable habitat to be delineated by the Ministry typically includes dense (i.e., ≥ 20 m²/ha basal area and/or $\geq 70\%$ canopy closure) mature or older tolerant hardwood forest with occasional large canopy gaps.

Observations are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within the inner 125 m of the AOC.
- Harvest, renewal, and tending operations are permitted within the MMZ subject to timing restrictions (see below) and the following condition:
 - Harvest operations are limited to selection harvest that follows residual stand structure targets for old growth hardwood forest (see *Ontario Tree Marking Guide*)

Guidelines

- Harvest, renewal and tending operations are not permitted within the AOC during the **critical breeding period** unless with Ministry approval (see Appendix 1b).

([rationale](#))

Conditions on primary roads and landings (planned or existing)

Standards

- New primary roads and associated landings are not permitted within the AOC.
- Operations associated with existing primary and associated landings are not permitted within the AOC during the **critical breeding period**.

Guidelines

- There is no timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading).

[\(rationale\)](#)

Conditions on branch and operational roads and landings (planned or existing)

Standards

- New branch roads and operational roads are not permitted within the inner 125 m of the AOC.
- New landings are not permitted within the AOC.
- Operations associated with new or existing branch roads, operational roads and associated landings are not permitted within the AOC during the **critical breeding period**.

Guidelines

- New branch roads and operational roads are permitted within the MMZ if constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 15 m, outside the **critical breeding period**.
- There is no timing restriction on forestry related traffic or low potential impact road maintenance operations (e.g., grading).

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits are not permitted within the AOC.

Guidelines

- Operations associated with existing forestry aggregate pits are not permitted within the AOC during the **critical breeding period** unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Notes

The **critical breeding period** is May 1-July 31. Local knowledge of breeding chronology may be used to adjust these dates.

iv) Chimney swift

The following direction is provided for chimney swift and its natural nest or roost sites. Other components of chimney swift habitat are addressed by the coarse filter direction in the Boreal and Great Lakes – St. Lawrence Landscape Guides (see discussion in Background and Rationale for Direction). Chimney swift nest and roost, singly or communally, in hollow structures (e.g., tree cavities).

Description of value

Trees with suitable nest/roost cavities **known** or **suspected** to be or have been occupied by nesting or roosting swifts and the area within a radius of 30 m comprise the AOC.

Nests/roosts are considered point features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to the following condition:
 - The nest/roost tree(s) will be retained [\(rationale\)](#)

Guidelines

- Harvest, renewal, and tending operations are permitted within the AOC subject to the following conditions:
 - Harvest, renewal, and tending operations are not permitted within the AOC when there are occupied nests/roosts during the **critical breeding/roosting period**, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process

- Operations involving heavy equipment or that might otherwise adversely affect nest/roost trees or the amount of vertical or lateral cover are not permitted within 20 m of natural nest or roost sites. ([rationale](#))

Conditions on primary roads and landings (planned or existing)

Standards

- New primary roads and associated landings are not permitted within the AOC.

Guidelines

- Operations associated with existing primary roads or landings are not permitted during the **critical breeding/roosting period** when nest/roost trees are occupied, unless with Ministry approval (see Appendix 1b). However, there is no timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading) if the road predates the nest/roost site. ([rationale](#))

Conditions on branch and operational roads and landings (planned or existing)

Standards

- New landings are not permitted within the AOC.

Guidelines

- New branch and operational roads are permitted in the AOC if constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 15 m outside the **critical breeding period**.
- Operations associated with existing branch and operational roads and landings are not permitted during the **critical breeding/roosting period** when nest/roost trees are occupied, unless with Ministry approval (see Appendix 1b). However, there is no timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading) if the road predates the nest/roost site.

([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within the AOC.

Guidelines

- Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the AOC, during the **critical breeding/roosting period** when nest/roost trees are occupied, unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Notes

Trees **known** to be or have been occupied are those at which breeding or roosting activity has been confirmed. Trees **suspected** to be or have been occupied are those at which breeding or roosting activity has not been confirmed, but for which there is compelling evidence of current or previous use (e.g., swifts observed in the vicinity of a tree suitable for nesting or roosting).

The **critical breeding/roosting period** is May 1-September 30. Local knowledge of breeding/roosting chronology may be used to adjust these dates.

v) Eastern whip-poor-will

The following direction is provided for eastern whip-poor-will and its breeding habitat.

Description of value

A 12.5 ha polygon of suitable habitat OR suitable habitat within a 200 m radius of reliable observations of eastern whip-poor-will breeding evidence reported within the past 10 years comprises the AOC, unless documented as unoccupied for 4 consecutive years.

The Ministry will situate the AOC to encompass a mosaic of habitats suitable for nesting, roosting, and foraging. The AOC shall encompass all known or suspected whip-poor-will nesting, roosting sites and foraging area within a single breeding territory. Suitable habitat typically includes forest with sparse (<25%) to moderate tree cover (25-75%) and open habitat. Whip-poor-will have an affinity for rocky barren areas and open wetlands for foraging habitat. For roosting and nesting habitat, they prefer patches of forest cover such as closed canopy with open understory.

Observations are considered point features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Retain a minimum of 20% residual forest to provide nesting and roosting habitat. Harvest that retains residual forest is generally restricted to commercial thinning, shelterwood preparatory and regeneration cuts, and single tree selection harvest. No harvest is permitted if initial canopy closure is <50%.
 - In clearcuts and final shelterwood cuts, retain a minimum of 20% residual forest in patches ≥ 30 m in radius that will provide nesting and roosting habitat
 - Wildlife trees and downed woody material will be retained as per direction in Sections 3.2.3.1 and 3.2.3.2, respectively
 - Nests encountered during operations will be retained in an unharvested residual patch ≥ 50 m in radius
 - Non-mechanical renewal operations are permitted during the **critical breeding period** (e.g., hand planting).

Guidelines

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following condition:
 - Mechanical renewal and tending operations are only permitted outside of the critical breeding period, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process
- Harvest operations are not permitted during the **critical breeding period**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC approval process.

[\(rationale\)](#)

Best management practices

- When local populations (e.g., more than one singing male) are detected, blocks should be deferred and additional surveys should be conducted.

Conditions on primary and branch roads and landings (planned or existing) Conditions on operational roads and landings (planned or existing)

Standards

- Operations associated with existing roads or landings that result in the removal of vegetation are not permitted during the **critical breeding period**.

Guidelines

- New roads and associated landings are not permitted within the AOC, unless with Ministry approval (see Appendix 1b), subject to the following condition:
 - New roads and landings will be constructed outside the **critical breeding period**.

Best management practices

- To the extent practical and feasible, operations associated with existing roads or landings will be conducted during daylight during the **critical breeding period**. Check local sunrise and sunset times.

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- Operations associated with existing forestry aggregate pits and wood storage yards that result in the removal of vegetation or increasing the footprint are not permitted during the **critical breeding period**.

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within the AOC, unless with Ministry approval (see Appendix 1b), subject to the following condition:
 - New forestry aggregate pits will be constructed outside the **critical breeding period**.

Best management practices

- To the extent practical and feasible, operations associated with existing forestry aggregate pits and wood storage yards will be conducted during daylight during the **critical breeding period**. Check local sunrise and sunset times.

[\(rationale\)](#)

Notes

The **critical breeding period** is May 15-July 31. Local knowledge of breeding chronology may be used to adjust these dates. [\(rationale\)](#)

vi) Golden-winged warbler and yellow rail

The following direction is provided for the golden-winged warbler and the yellow rail and their breeding habitat.

Description of value

Suitable habitat occupied by breeding golden-winged warblers or yellow rails within the past 20 years defined by either:

- suitable habitat occupied by breeding birds as delineated by field survey, or
- a 10 ha (golden-winged warbler)/15 ha (yellow rail) patch of suitable non-forested wetland habitat (or the entire wetland polygon if <10/15 ha) associated with reliable observations or other reliable sightings associated with breeding activity.

Direction applies to suitable breeding habitat delineated by the Ministry prior to, or during, operations. Delineated habitat comprises the AOC.

Observations are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Wildlife trees and residual forest will be retained within harvested portions of the AOC as per direction in Section 3.2.3. ([rationale](#))

Conditions on primary roads and landings (planned or existing)

Standards¹

- New primary roads and associated landings are not permitted within the AOC.
- Water drawdowns or other activities that alter hydrological regime are not permitted.

([rationale](#))

Conditions on branch and operational roads and landings (planned or existing)

Standards¹

- Water drawdowns or other activities that alter hydrological regime are not permitted.

Guidelines

- New branch and operational roads and associated landings are not permitted within the AOC, except in extraordinary circumstance as specifically identified and justified through the FMP AOC planning process.

([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards¹

- New forestry aggregate pits and wood storage yards are not permitted within the AOC.

[\(rationale\)](#)

Notes

¹See also direction for mapped non-forested wetlands in Section 4.1.3.

vii) Kirtland's warbler

The following direction is provided for the Kirtland's warbler and its breeding habitat.

Description of value

Suitable habitat within a radius of 500 m of reliable observations of Kirtland's warbler breeding evidence reported within the past 20 years comprises the AOC.

Suitable habitat to be delineated by the Ministry typically includes young stands of jack pine or red pine, 1.5-5 m tall, with $\geq 3,000$ pine stems/ha, and an understory containing low sweet blueberry, bearberry, sweet fern, bracken fern, Canada mayflower, and various grasses.

Observations are considered point features.

See the *Action Plan for the Kirtland's Warbler (Setophaga kirtlandii) in Canada* (ECCC 2016) for more information on habitat suitability. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Guidelines

- Harvest, renewal and tending operations are not permitted within the AOC unless compatible with enhancing or maintaining habitat as specifically identified and justified within the FMP AOC planning process, conducted outside the **critical breeding period**. [\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New landings are not permitted within the AOC.

Guidelines

- New roads are not permitted within the AOC except in extraordinary circumstances as specifically identified and justified through FMP AOC planning process and the following condition:
 - The patch of suitable habitat associated with the AOC is >80 ha in size, the road, including specific location.
- Road construction is not permitted within the AOC during the **critical breeding period** except in extraordinary circumstances, as specifically identified and justified through FMP AOC planning process. There are no restrictions on operations associated with existing roads and landings within the AOC.

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within the AOC; there are no restrictions on operations associated with existing forestry aggregate pits.

[\(rationale\)](#)

Notes

The **critical breeding period** is May 1-August 15. Local knowledge of breeding chronology may be used to adjust these dates.

viii) Least bittern

The following direction is provided for the least bittern and its breeding habitat.

Description of value

Suitable habitat within a radius of 400 m of reliable observations of least bittern breeding evidence reported within the past 20 years comprises the AOC.

Suitable habitat to be delineated by the Ministry typically includes marshes and shrub swamps with tall and robust emergent herbaceous and/or woody vegetation interspersed with open water (hemi-marsh conditions).

Observations are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within the AOC.

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New landings are not permitted within the AOC.
- Operations associated with existing roads and landings are permitted within the AOC subject to the following condition:
 - Road maintenance is restricted to surface grading or other maintenance operations identified in the approved FMP.
- Water drawdowns or other operations that significantly alter hydrological regime are not permitted within the AOC.

Guidelines

- New all-weather roads are not permitted within the AOC. However, water crossings and associated approaches (branch and operational roads only) may be permitted in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. In all cases, water crossings and associated approaches will be decommissioned or otherwise subject to access control measures following operations.
- New winter roads are permitted within the AOC with Ministry approval (see Appendix 1b).

([rationale](#))

ix) Louisiana waterthrush

The following direction is provided for the Louisiana waterthrush and its breeding habitat.

Description of value

Suitable habitat within 50 m on both sides of a stream for a distance of 400 m above and below of reliable observations of Louisiana waterthrushes within the past 10 years comprises the AOC.

Suitable habitat to be delineated by the Ministry typically includes forested ravines and wooded swamps or wetlands within mature, closed canopy forest.

Observations are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Single-tree selection harvest is permitted within the AOC outside the **critical breeding period**. No other types of harvest are permitted within the AOC.
- Renewal and tending operations are permitted within the AOC outside the **critical breeding period**.
- Wildlife trees and downed woody material will be retained within harvested portions of the AOC (see Sections 3.2.3.1 and 3.2.3.2).

Guidelines

- Harvest, renewal, and tending operations are not permitted within the AOC during the **critical breeding period**, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.

([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New all-weather roads or landings are not permitted within the AOC.

Guidelines

- New winter roads are not permitted except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.

- Only operations associated with low-risk road maintenance (e.g., surface grading) to maintain safe travel conditions on existing roads are allowed during the **critical breeding period**.

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New aggregate pits and wood storage yards are not permitted within the AOC.

Guidelines

- Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the AOC during the **critical breeding period**, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Notes

The **critical breeding period** is May 1-July 31. Local knowledge of breeding chronology may be used to adjust these dates.

x) Red-headed woodpecker

The following direction is provided for the red-headed woodpecker and its breeding habitat.

Description of value

Suitable habitat occupied by breeding red-headed woodpeckers within the past 10 years defined by either:

- suitable habitat occupied by breeding birds as delineated through field survey, or,
- a 3 ha patch of suitable habitat associated with reliable observations of red-headed woodpecker breeding evidence or other reliable sightings associated with breeding activity.

Direction applies to suitable breeding habitat delineated by the Ministry prior to, or during, operations. Delineated habitat comprises the AOC.

Observations are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest is permitted within the AOC that retains ≥ 70 dominant or codominant trees/ha subject to timing restrictions (see below); known nest trees will be retained in uncut patches ≥ 20 m in radius.

Guidelines

- Harvest, renewal, and tending operations are not permitted within the AOC during the **critical breeding period**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
- Wildlife trees and downed woody material will be retained within harvested portions of the AOC as per general direction in Sections 3.2.3.1 and 3.2.3.2; living wildlife trees with cavities or the potential to develop cavities will be emphasized.

Best management practices

- Creation of group openings will be encouraged in single tree selection cuts.

([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Guidelines

- Road construction is not permitted within the AOC during the **critical breeding period**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. However, there is no timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading).

([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits are not permitted within the AOC.

Guidelines

- Operations associated with existing forestry aggregate pits are not permitted within the AOC during the **critical breeding period** unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Notes

The **critical breeding period** is May 14-July 21. Local knowledge of breeding chronology may be used to adjust these dates.

4.3.8 Mammals

There are several species or ecotypes of mammals listed as at risk which occur (or potentially occur) within the managed forest. The woodland caribou responds to habitat composition and structure at large scales. Thus, direction for caribou is included in the Forest Management Guide for Boreal Landscapes.

Eight species of bats occur within the managed forest: big brown bat, eastern small-footed myotis (formerly small-footed bat), hoary bat, little brown myotis (formerly little brown bat), northern myotis (formerly northern long-eared bat), eastern red bat (formerly red bat), silver-haired bat, and the tri-colored bat (formerly eastern pipistrelle). All species of bats are listed as specially protected mammals in the *Fish and Wildlife Conservation Act, 1997*. All of Ontario's bats are insectivores. Seven of the bat species are listed. The principal threat to eastern-small-footed myotis, little brown myotis, northern myotis and the tri-colored bat is white-nose syndrome. The principal threat to the hoary bat, eastern red bat and silver-haired bat is impact with wind turbines and decline in prey availability.

General direction for bat habitat that maintains a diversity of forest types and ages (including old growth), a range of potential roost and nursery sites within stands (cavity trees), and the integrity of aquatic and shoreline habitats largely addresses the basic habitat requirements of bats is found in Sections 3.2 and 4.1. Direction is provided in this section for bat hibernation sites.

The eastern wolf (formerly known as Algonquin wolf), grey wolf and cougar are habitat generalists that likely benefit from the diversity of conditions created by the general direction in the Landscape Guides, Section 3 of this guide, and the fine filter direction for key prey species (moose, deer) in Section 3.3. Direction is provided in this section for eastern wolf and grey wolf den sites and eastern wolf rendezvous sites and cougar den sites.

The gray fox is also a habitat generalist that likely benefits from the diversity of conditions created by the general direction in the Landscape Guides and Section 3 of this guide. Direction is provided in this section for gray fox den sites.

Direction

Direction for bat hibernation sites and maternity roosts focuses on:

- Minimizing alteration of habitat in the immediate vicinity of the hibernation site opening(s) or maternity roost and the surrounding microclimate
- Minimizing access to hibernation sites
- Minimizing potential sources of disturbance around hibernation sites during hibernation and during periods of entry and emergence
- Minimizing potential sources of disturbance around maternity roosts during the period females are lactating until the pups can fly.

Direction for eastern wolf, gray fox, and cougar den sites and eastern wolf rendezvous sites focuses on:

- Minimizing disturbance of animals using den sites and traditional rendezvous sites (eastern wolf)
- Maintaining den structures
- Maintaining suitability of habitat immediately surrounding den sites and rendezvous sites (eastern wolf) for those sites likely to be traditionally used.

[\(rationale\)](#)

i) Bat hibernation sites

Bats mostly forage over lakes, ponds, streams, wetlands, associated riparian habitats, other open habitats, or along roads, trails, and other forest edges; some foraging also occurs below, within, or above forest canopies, especially in older forest with irregular canopy structure. All bat species use forested habitats for roosting and/or reproduction. Some species simply roost in tree foliage but most species roost under the loose bark of dead or declining trees or in tree hollows or cavities. Most nursery colonies are reported from human dwellings, but trees with large hollows or cavities are likely used in natural situations.

Five bat species hibernate in Ontario, including four listed species, eastern small-footed myotis, little brown myotis, northern myotis, and tri-colored bat, plus big brown bat, typically using caves or abandoned mines that provide above-freezing air temperature and high relative humidity. Suitable hibernation sites may be a limited resource; individual sites may be used by large numbers of bats drawn from an area of several thousand km² around the hibernation sites. Disturbance of hibernating bats is a major mortality factor.

Description of value

Hibernation sites **known** or **suspected** to have been used at least once within the past 20 years and the area 200 m wide surrounding hibernation sites comprise the AOC.

Hibernation sites to be delineated by the Ministry as the minimum convex polygon encompassing the full extent of entry/exit points and underground network of chambers associated with occupied caves or mines.

Hibernation sites are considered polygonal features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest, renewal, and tending operations are not permitted within 100 m of hibernation sites
 - Harvest, renewal, and tending operations associated with the clearcut silviculture system are not permitted within the AOC.
- Harvest, renewal, and tending operations are not permitted within the AOC during **fall swarming** or **spring emergence periods**.

([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New roads and landings are not permitted within 100 m of hibernation sites.
- Operations associated with existing roads and landings are permitted within the AOC.
- Construction of roads and landings is not permitted within the AOC during the **hibernation, fall swarming, or spring emergence periods**.

Guidelines

- Avoid constructing new roads and landings within the outer 100 m of the AOC unless with Ministry approval (see Appendix 1b).

([rationale](#))

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within 100 m of hibernation sites.
- Construction of new forestry aggregate pits and wood storage yards is not permitted during the **hibernation, fall swarming, or spring emergence periods**.
- Operations associated with forestry aggregate pits and wood storage yards are not permitted within the AOC during the **hibernation period**.

Guidelines

- Avoid constructing new forestry aggregate pits and wood storage yards within the outer 100 m of the AOC unless with Ministry approval (see Appendix 1b).

[\(rationale\)](#)

Notes

Hibernation sites **known** to have been used are those where presence of hibernating bats has been confirmed. Hibernation sites **suspected** to have been used are those where presence of bats during fall swarming or spring emergence has been confirmed. Given the potential difficulty of identifying all species using a hibernation site, this direction will be applied to all known or suspected hibernation sites unless the Ministry confirms sites are not occupied or likely to be occupied by bats.

The **fall swarming period** is defined as August 1-October 31.

The **spring emergence period** is defined as March 1-May 15.

The **hibernation period** is defined as October 1- April 30.

Local knowledge may be used to adjust these dates (considering all species of bats present).

ii) Eastern wolf and grey wolf

Direction is provided for eastern wolf (formerly known as Algonquin wolf) and grey wolf and their den sites and for eastern wolf rendezvous sites. Planning teams will use the most recent information available to determine whether wolves in their forest management unit are likely the eastern or northern grey subspecies (e.g., see the *Backgrounder on Wolf Conservation in Ontario*, (OMNR 2005)).

Dens can include excavated, underground tunnels, crevasses, rock caves, upturned tree roots, hollow logs or stumps, or abandoned beaver lodges. Den sites are typically found in conifer dominated forests close to a permanent water source. The pack uses one or more dens for the first one to two months of the wolf pups' life. There is fidelity to den sites and although not re-used each year, the re-use of den sites is common.

When Eastern wolf pups are about two months of age, they are moved from maternal dens to a series of rendezvous sites where they remain while the pack hunts. Individual sites may be occupied for a period of days to weeks. By early fall, pups begin to hunt with the pack and use of rendezvous sites decreases.

Eastern wolf rendezvous sites may be found in a variety of habitats such as open bogs, burns, clearcuts, beaver meadows, and open forest. Rendezvous sites are often used by wolf packs during multiple years. Areas used as rendezvous sites one year may be used as den sites in a subsequent year. Wolves in remote areas, or where prone to harvest by humans, appear to have a low tolerance for human activity near rendezvous sites.

Eastern wolf and grey wolf den sites

Description of value

Suitable den sites known or **suspected** (with a high degree of certainty) to have been occupied by Eastern wolves or grey wolves at least once within the past five years and the area with a radius of 200 m comprise the AOC.

Dens are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following condition:
 - Harvest is not permitted within 50 m of dens

Guidelines

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 51-100 m of dens. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure $< 60\%$
 - Renewal and tending operations that will leave a residual stand structure below the minimum described above are not permitted; all other renewal and tending operations are permitted.

- Harvest, renewal, and tending operations are not permitted within the 200 m of occupied dens during the **denning period** except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New roads and landings are not permitted within the inner 100 m of the AOC.

Guidelines

- New roads and landings will not be constructed within the outer 100 m of the AOC unless with Ministry approval (see Appendix 1b).
- When roads are constructed within the AOC, temporary roads and/or water crossings will be used to limit future access and disturbance unless with Ministry approval (see Appendix 1b).
- Road construction operations are not permitted within 200 m of occupied dens during the **denning period**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
- Forestry-related traffic and road maintenance operations are not permitted within 100 m of occupied dens during the **denning period** unless the road predates the den or except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within the inner 100 m of the AOC.

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within the outer 100 m of the AOC unless with Ministry approval (see Appendix 1b).
- Operations associated with forestry aggregate pits and wood storage yards are not permitted within 200 m of occupied dens during the **denning period**, except in

extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Notes

The **denning period** is April 1-June 30. Local knowledge of denning chronology may be used to adjust these dates.

Den sites **suspected** to be or have been occupied, are those at which animal presence has not been confirmed, but for which there is compelling evidence of current or previous use (e.g., presence of scat, gnawed bones or litter, hair).

Eastern wolf traditional rendezvous sites

Description of value

Traditional rendezvous sites are those that have been used ≥ 2 weeks/year for ≥ 2 years within the past 10 years. When detailed information on the periodicity of use is lacking, presence of matted vegetation, well-worn trails, and abundant wolf scat can be used as evidence of traditional use.

Rendezvous sites known to have received traditional use by the eastern wolf and the area within a radius of 200 m comprise the AOC.

Rendezvous sites are considered point features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following condition:
 - Harvest is not permitted within 50 m of rendezvous sites

Guidelines

- Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:
 - Harvest that retains **residual forest** is permitted within 51-100 m of rendezvous sites; no harvest is permitted if initial canopy closure $< 50\%$

- Renewal and tending operations that will leave a residual stand structure below the minimum described above are not permitted; all other renewal and tending operations are permitted.
- Harvest, renewal, and tending operations are not permitted within the 200 m of occupied rendezvous sites during the **normal period of use** except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New roads and landings are not permitted within the inner 100 m of the AOC.

Guidelines

- New roads and landings will not be constructed within the outer 100 m of the AOC unless with Ministry approval (see Appendix 1b).
- When roads are constructed within the AOC, temporary roads and/or water crossings will be used to limit future access and disturbance unless with Ministry approval (see Appendix 1b).
- Road construction operations are not permitted within 200 m of occupied rendezvous sites during the **normal period of use**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
- Forestry-related traffic and road maintenance operations are not permitted within 100 m of occupied rendezvous sites during the **normal period of use** unless the road predates the rendezvous site or except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are not permitted within the inner 100 m of the AOC.

Guidelines

- New forestry aggregate pits and wood storage yards are not permitted within the outer 100 m of the AOC unless with Ministry approval (see Appendix 1b).
- Operations associated with forestry aggregate pits and wood storage yards are not permitted within 200 m of occupied dens during the **normal period of use**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Notes

See definition of **residual forest** in Section 3.2.2.1.

The **normal period of use** is May 15-September 15. Local knowledge of the chronology of use may be used to adjust these dates.

iii) Gray fox den sites

Site-specific direction is provided below to minimize disturbance around gray fox and its den sites.

Description of value

Den sites known or **suspected** (with a high degree of certainty) to have been occupied by gray foxes and the area within a radius of 100 m comprise the AOC.

Dens are considered point features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within 20 m of the den entrance.

Guidelines

- Harvest, renewal, and tending operations are not permitted within the AOC during the **denning period** if dens are occupied, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New roads and landings are permitted within the AOC subject to the following condition:
 - New roads and landings are not permitted within 20 m of the den entrance.

Guidelines

- New roads and landings are permitted within the AOC subject to the following condition:
 - Construction of new roads and landings is not permitted within the AOC during the **denning period** if dens are occupied, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
- Forestry-related traffic and road maintenance operations are not permitted within 50 m of occupied dens during the **denning period** unless the road predates the den or except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits are permitted within the AOC subject to the following condition:
 - New forestry aggregate pits are not permitted within 20 m of the den entrance

Guidelines

- New forestry aggregate pits are permitted within the AOC subject to the following condition:
 - Construction of new forestry aggregate pits is not permitted within the AOC during the **denning period** if dens are occupied, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

- Operations associated with existing forestry aggregate pits are not permitted within the AOC during the **denning period** if dens are occupied, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Notes

The **denning period** is April 15-September 15. Local knowledge of denning chronology may be used to adjust these dates.

Den sites **suspected** to be or have been occupied, are those at which animal presence has not been confirmed, but for which there is compelling evidence of current or previous use (e.g., presence of scat, remains of prey, hair).

iv) Cougar den sites

Site-specific direction is provided to minimize disturbance around cougar and its den sites.

Description of value

Den sites known or **suspected** (with a high degree of certainty) to have been occupied by cougars and the area within a radius of 200 m comprise the AOC.

Dens are considered point features. [\(rationale\)](#)

Operational prescription and conditions for the area of concern

Standards

- Harvest, renewal, and tending operations are not permitted within 20 m of the den entrance.

Guidelines

- Harvest, renewal, and tending operations are not permitted within the AOC during the **denning period** if dens are **occupied**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Standards

- New roads and landings are permitted within the AOC subject to the following condition:
 - New roads and landings are not permitted within 20 m of the den entrance

Guidelines

- New roads and landings are permitted within the AOC subject to the following condition:
 - Construction of new roads and landings is not permitted within the AOC during the **denning period** if dens are **occupied**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
- Forestry-related traffic and road maintenance operations are not permitted within 100 m of **occupied** dens during the **denning period** unless the road predates the den or except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- New forestry aggregate pits and wood storage yards are permitted within the AOC subject to the following condition:
 - New forestry aggregate pits and wood storage yards are not permitted within 20 m of the den entrance

Guidelines

- New forestry aggregate pits and wood storage yards are permitted within the AOC subject to the following condition:
 - Construction of new forestry aggregate pits and wood storage yards is not permitted within the AOC during the **denning period** if dens are **occupied**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
- Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the AOC during the **denning period** if dens are **occupied**, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

[\(rationale\)](#)

Notes

Kittens are typically born between April and September, but **occupied** dens may be located at any time of year. Thus, the **denning period** is potentially different for each **occupied** den encountered and is considered to extend for 8 weeks from the date an **occupied** den is located, or until a den is known to be no longer **occupied**.

Den sites **suspected** to be or have been occupied, are those at which animal presence has not been confirmed, but for which there is compelling evidence of current or previous use (e.g., presence of scat, gnawed bones, hair).

v) Wolverine den site(s) and foraging area

Wolverines require large areas (100s km²) with little human infrastructure for their home range. The landscape-scale approach to the management of woodland caribou habitat and creation of large landscape patches in the Boreal Landscape Guide is expected to maintain large blocks of unharvested and roadless habitat suitable for wolverines when combined with the landscape-scale structure, composition, and pattern direction in the Boreal Landscape Guide. Direction is provided in this section to create small landscapes with minimal human disturbance associated with the protection of known denning and associated foraging areas from the effects of disturbance.

Direction is provided for wolverine and its den site(s) and foraging area. Wolverine dens may be comprised of snow tunnels up to 60 m long and are typically associated with large boulders, large woody material, or fallen trees. They also use the permanent features into the spring. Human contact may cause females to abandon den sites; dens are typically located a considerable distance from roads and human infrastructure.

Direction for den sites and foraging area of wolverines focuses on:

- Minimizing disturbance of wolverines using den sites
- Maintaining suitability of habitat surrounding den sites and foraging areas.

Direction for development of a den site(s) and foraging area management plan for wolverines is nested within the landscape-scale direction in the Boreal Landscape Guide. ([rationale](#))

Description of value

Natal and/or maternal den areas known to have been occupied by wolverines within the past 8 years (unless documented as unoccupied for ≥4 consecutive years) and:

- The area centred on a single den site within a radius of 4 km comprise the AOC, or

- The area centred on a minimum convex polygon (minimum distance between multiple den sites) within a radius of 4 km comprise the AOC.

Dens are considered point features. ([rationale](#))

Operational prescription and conditions for the area of concern

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

Conditions on forestry aggregate pits and wood storage yards (planned or existing)

Standards

- In consultation with Ministry staff with expertise in species at risk, a den site(s) and foraging area management plan will be developed that outlines the extent and timing of harvest, renewal, and tending operations acceptable within the AOC, as well as conditions on roads, landings, forestry aggregate pits, and wood storage yards. NOTE: a den site(s) and foraging area management plans are required if the denning area overlaps planned operations.

Guidelines

- Reasonable efforts will be made to incorporate the AOC into a large block of unharvested and unroaded forest (e.g., incorporate the AOC into a dynamic caribou habitat schedule block that is not scheduled to be harvested in the near future).
- The den site(s) and foraging area management plan will:
 - Normally prohibit forest management operations during the **denning period**.
 - Any harvest, renewal, and tending operations, road and wood storage yard construction, and aggregate extraction permitted within the AOC will maintain the suitability of denning and foraging habitat. It is recognized that some operations may be permitted to meet ecological, social, or economic objectives.
 - Considerations in the development of the den site(s) and foraging area management plan should include: the strategic landscape map, planned operations, existing operations, existing disturbances, landscape features and balancing objectives (including socio-economic). If operations are considered, a modified management zone will be defined in the den site(s) and foraging area management plan.
 - Include Use Management Strategies for existing roads that will provide locally appropriate measures to minimize road-associated impacts on

wolverines. This may include access controls while roads are in use and a decommissioning plan for roads following use.

[\(rationale\)](#)

Notes

The **denning period** is January 15-June 1. Local knowledge of denning chronology may be used to adjust these dates.

5.0 OPERATIONAL CONSIDERATIONS

The majority of the direction in the Stand and Site Guide can be directly related to at least one aspect (e.g., emulating natural disturbance) of the CFSA principle to conserve *large, healthy, diverse and productive Crown forests and their associated ecological processes and biological diversity*. This section aims to prevent, minimize, or mitigate any potential negative impacts on wildlife and the physical environment that could result from forest operations and that are not addressed in Sections 3 or 4.

The potential impacts of operations need to be considered during both the planning and implementation phases. Well-informed, advanced planning will help to prevent the selection of inappropriate operations and identify methods to prevent, minimize, and mitigate potential negative impacts that may occur during implementation.

A variety of strategies and techniques can be used during the implementation of forest operations to prevent, minimize, and mitigate negative impacts. However, the direction in this section of the guide is generally limited to what is required during planning or preparing for operations. In many cases, the direction in the guide will provide only the goal (e.g., minimize mineral soil exposure) or the conceptual approach (e.g., use erosion-resistant materials below the high-water mark).

There is a large amount of technical information available that can be used to implement the direction in this guide. Some commonly used technical documents that are particularly relevant to Ontario are cited, but in recognition of the fast pace of improvements in methods and materials (e.g., techniques and materials to mitigate concerns regarding erosion) direction on technical implementation of operations is generally not provided. Further, there are many technical details that cannot be well articulated in any document and only exist in the experience and ingenuity of the operators.

Section 5.1 provides direction for the planning, construction, maintenance and decommissioning of roads and water crossings. Section 5.2 provides direction for the conservation of soil resources and productive forest area. Section 5.3 provides a short discussion on the spread of invasive species.

The majority of the direction in Sections 5.1 will be implemented as conditions on roads, landings, forestry aggregate pits, and wood storage yards and the majority of the direction in Section 5.2 will be implemented as conditions on regular operations.
([rationale](#))

5.1 Roads and water crossings

The standards, guidelines, and best management practices assist planning teams with addressing environmental, social, and safety concerns associated with the planning,

construction, maintenance, and decommissioning of roads and water crossings in FMPs. Much of the direction in this section has been used in Ontario for a number of years. The *Environmental Guidelines for Access Roads and Water Crossings* remains available as a technical reference for this guide at <https://www.ontario.ca/page/forest-management-guides>. ([rationale](#))

5.1.1 Roads

Most requirements for road construction, maintenance, and decommissioning on Crown land in the managed forest are described in the FMPM. This section provides additional direction intended to mitigate potential adverse effects of all roads planned, constructed, maintained, and potentially decommissioned in accordance with the FMPM on wildlife, the physical environment, and public safety. Refer to Sections 3.3, 4.1, 4.2 and 4.3 and the Landscape Guides for additional restrictions based on the specific values (e.g., moose emphasis areas, water features, wetlands, nests, dens, species at risk) associated with LLPs, conditions for AOCs, or conditions on roads, landings, forestry aggregate pits, and wood storage yards for important ecological features. Refer to Section 5.1.2 for direction that addresses the potential effects of road crossings on water features.

Forest access roads no longer required for forestry purposes may be decommissioned. As per the FMPM, decommissioning is undertaken to render the road impassable to vehicular traffic, enhance public safety and reduce potential environmental damage. The objective of decommissioning a road or road network may be to limit vehicle access to a remote tourism lake (this may or may not include treatments to renew the roadbed as part of the physical work) or to return the right-of-way and roadbed to productive forest cover.

The decommissioning of roads and road networks generally includes the removal of associated water crossings at the same time. See Section 5.1.2. for further information on the removal of water crossings.

Direction

The direction in this section will be implemented using regular FMP products (e.g., road corridor or boundary planning) and conditions on roads, landings, forestry aggregate pits, and wood storage yards. ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)

Conditions on operational roads and landings (planned or existing)

i) Design and location

Guidelines

- To minimize the potential adverse effects of roads on terrestrial and aquatic ecosystems, road planning (location, layout and design) will:
 - Make use of existing roads where practical for long-term access
 - Ensure temporary roads are designed to the minimal standard necessary, reflecting their future management intent (e.g., anticipated traffic volume and service life, potential decommissioning)
 - Minimize the number of water crossings
 - Avoid unsuitable terrain including long, steep (>10%) grades, deep swamps, bedrock, and shallow soils
 - Avoid locating landings and turn-arounds in low, wet areas where they may disrupt hydrological function or cause rutting. [\(rationale\)](#)
- When the location of the road and landings within the approved corridor or operational road boundary are being finalized, avoid hydrological connections that channel ephemeral surface flow and/or shallow groundwater flow to lakes, ponds, rivers, or streams. [\(rationale\)](#)

Best management practices

- To minimize the risk of disrupting hydrological function within hydrological connections when avoidance is not practical or feasible, roads should cross:
 - At the narrowest point possible
 - At right angles to the direction of hydrological flow
 - As far from the connected aquatic features as possible
 - At locations with the highest soil bearing capacity possible (look for indicators of drier soil conditions). [\(rationale\)](#)
- Where possible, locate roads and landings so skidding and forwarding does not have to cross natural drainage patterns. [\(rationale\)](#)
- Avoid creating permanent, all-season loop roads where they may result in increased hunting and/or angling pressure and/or impede enforcement to pursue unauthorized hunting and angling activities. [\(rationale\)](#)

ii) Construction and maintenance

Standards

- Materials moved during construction, such as grubbed soil and organic material, will not be piled where they block drainage courses. [\(rationale\)](#)
- The Ministry will ensure that signs used to identify the use management strategies for roads (e.g., travel restrictions) are maintained. [\(rationale\)](#)

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- When grading roads, do not create false ditches (accumulated berms of gravel along road edges) that channel sediment-bearing water down the road directly into a water feature. ([rationale](#))
- Ensure road grading operations do not result in the blockage of off-take ditches. ([rationale](#))
- When grading a road adjacent to a bridge, do not pull road surface material onto bridge deck. ([rationale](#))

Guidelines

- Minimize the clearing width of the road right-of-way to that required for construction and safety (i.e., line of sight) purposes and specify maximum clearing widths (for roads outside AOCs that specify maximum right-of-way widths) in the FMP. ([rationale](#))
- When recognizable hydrological connections (linear features that channel ephemeral surface flow and/or shallow groundwater flows to lakes, ponds, rivers, or streams) must be crossed, road construction will not disrupt hydrological function. Maintain hydrological function through adequate cross drainage. Hydrological function will be considered to be disrupted if a road impedes water movement by restricting flow and creating pools of standing water that exist for >1 year that may or may not cause the flooding and subsequent mortality of adjacent trees. These locations may best be identified in the spring when ponding may be more frequent along a new road. ([rationale](#))
- When ongoing monitoring reveals the need for road maintenance, remedial action will be undertaken as soon as possible based on the potential for environmental damage and/or risk to public safety. ([rationale](#))

Best management practices

- Grubbed material should be piled and stored so that it can be used to assist in road decommissioning. ([rationale](#))
- Construct offtake ditches on long sustained grades to reduce the flow velocity and volume of water being carried down roadside ditches. ([rationale](#))
- Ensure winter roads are constructed with water crossings able to accommodate flows from early and mid-winter thaws or from rain-on-snow precipitation events. ([rationale](#))
- Establish a minimum size for cross drainage culverts based on local conditions. ([rationale](#))

- Consider the following practices to mitigate the potential impacts of short duration, high intensity rainfall events:
 - Increase the number (spacing frequency) and size of cross drainage culverts to accommodate higher flows and more debris which will reduce the likelihood of washouts
 - Construct and maintain (through grading) road crowns to 3-5% to facilitate rapid removal of water off the road surface
 - Construct a shallow, armoured depression beside culverts (see Figure 5.1a) on low-volume roads to provide peak flow water passage over top of the road surface and divert flow back toward the natural channel with minimum damage. [\(rationale\)](#)
- Consider following the signage requirements (regulatory, warning, temporary conditions, information and Ministry-specific signs) identified in the Ministry's *Roads and Crossings Sign Manual* (2018) for roads on Crown land that are administered under the CFSA. Users of the guide may refer to the manual for further direction on sign design, placement and maintenance. [\(rationale\)](#)
- Have a maintenance schedule to keep cross drainage culverts clear of obstructions to help avoid potential problems such as roadside water ponding and washouts. [\(rationale\)](#)
- Provide breaks in high snowbanks along the sides of a road to allow meltwater trapped on the road surface to flow away from the road. [\(rationale\)](#)

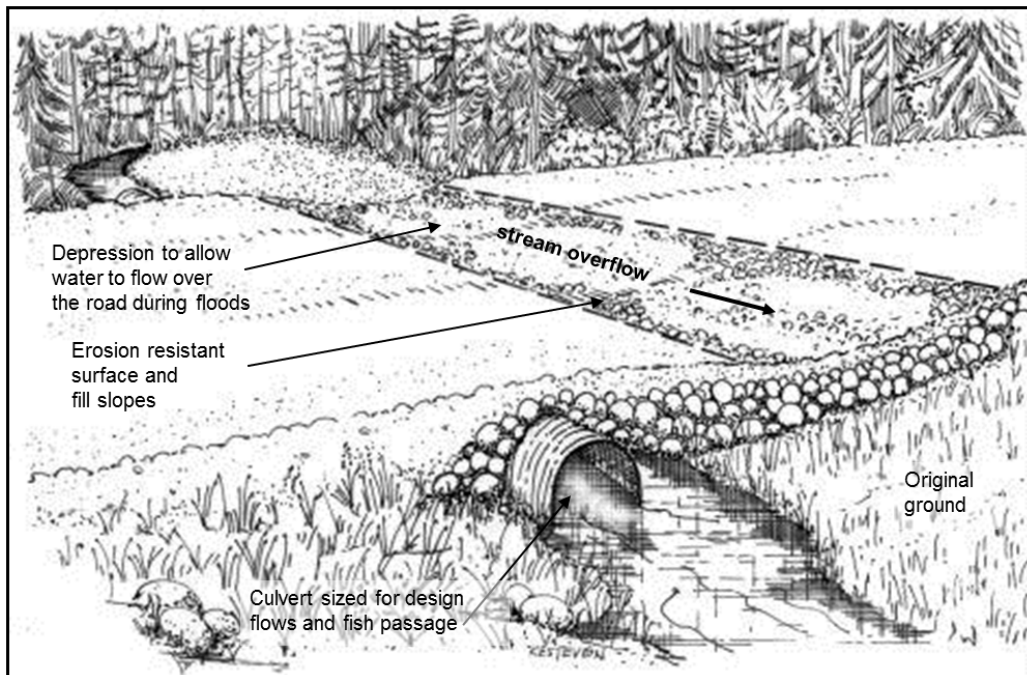


Figure 5.1a. A depression beside the culvert allows water to spill over the road in the event of a flood or culvert blockage (Illustration by Kestevan Design).

iii) Decommissioning

Guidelines

- For each road or road network scheduled to be decommissioned, stabilize slopes susceptible to washouts (e.g., slope grading, surface roughening, applying logging debris, seeding) to prevent erosion and protect public safety. ([rationale](#))
- When a road or road network is to be decommissioned, all associated water crossings that have been assessed to pose a potential threat to public safety, water quality or fish habitat, as per the criteria for water crossing structure removal in Section 5.1.2, will be removed in conjunction with the scheduling of any associated road treatments. Decommissioning of a road or road network may not require removal of all water crossings where agreed upon by the Ministry. ([rationale](#))

Best management practices

- Materials which had been moved and piled during construction, such as grubbed soil and organic materials and post-harvest slash should be pulled back onto the roadbed. This material will help to deter vehicles and improve microsite conditions for regeneration. ([rationale](#))
- Plan and construct roads to the minimum standard required to reduce efforts and costs associated with decommissioning (e.g., construct winter roads and crossings where operationally feasible, use temporary bridges). ([rationale](#))
- If the use management strategy includes access control, consider options such as:
 - Signage (under the *Public Lands Act*)
 - Physical barriers such as large rocks, slash, or berms
 - A gate
 - Seasonal closure
 - Any other option the planning team deems appropriate/effective for the area. ([rationale](#))
- Remove cross drainage culverts and slope the roadbed where culverts have been removed to prevent erosion and for public safety concerns, while allowing water to flow freely over it. ([rationale](#))
- If the objective of the road decommissioning includes returning the roadbed to a forested condition, establish access control(s) to prevent vehicular access to recently re-forested roadbeds to improve regeneration survival and growth. ([rationale](#))

- Consider establishing multiple access controls (e.g., multiple berms) on a road to improve the effectiveness of the treatment for reducing traffic. The number and type of access controls to be installed should reflect the sensitivity of the value being protected and the anticipated non-compliance efforts. ([rationale](#))
- Where it is operationally and environmentally feasible to do so, take advantage of natural barriers to traffic when decommissioning roads. Strategically located water crossing removals or roadbed removal where it crosses a wetland may reduce unwanted fording or circumvention of the decommissioning treatment. ([rationale](#))

5.1.2 Water crossings

Water crossings are locations where a road crosses a water feature. Water crossings can potentially have significant detrimental impacts on water quality, fish habitat and fish populations. Improperly designed, constructed, maintained, and/or removed water crossings can affect fish and fish habitat either directly or indirectly by blocking migration, causing sedimentation, removing shade and food sources through loss of vegetation, and/or adding deleterious substances to the water. Additionally, failed water crossings can potentially pose a serious risk to public safety and continued road use. Through appropriate selection of water crossing structure and location, and adherence to proper construction, maintenance, and removal practices and mitigation measures, potential disturbance or damage to the environment and aquatic resources will be minimized.

Direction

The direction in this section is applicable to all water crossings (i.e., temporary and permanent) unless more specific information is provided (e.g., direction for a temporary, winter-only crossing, non-road crossing). It also applies to previously constructed water crossings that require replacement, repair, or upgrading due to sub-standard safety, environmental, or operational issues.

The direction in this section will be implemented using regular FMP products (e.g., water crossing location planning) and conditions on roads, landings, forestry aggregate pits, and wood storage yards. ([rationale](#))

Conditions on primary and branch roads and landings (planned or existing)
Conditions on operational roads and landings (planned or existing)

i) General

Standards

- The submission, review and approval of water crossings built under authority of the CFSA will comply with the requirements of the FMPM, *Ministry of Natural Resources and Forestry/Fisheries and Oceans Canada Protocol for the Review and Approval of Forestry Water Crossings, Crown Land Bridge Management Guidelines*, and all other applicable legislation. Further information about the approval process for water crossings (e.g., Ministry engineering approvals) can be obtained from the local Ministry office and/or Conservation Authority. [\(rationale\)](#)
- For the approval of construction or removal of single, closed-bottom round culverts >1,200 mm in diameter and/or multiple culverts, the Ministry will ensure that at a minimum, the general water crossing standards and water crossing standards for the construction and removal of single, small ($\leq 1,200$ mm) closed-bottom round culverts are applied. [\(rationale\)](#)

ii) Design and location

Guidelines

- Selection of the type of water crossing structure, its location, and its capacity to pass water and allow for the movement of fish, will consider:
 - i. possible negative effects on the form and function of the undisturbed natural channel and its floodplain;
 - ii. the fish species present and the impact of the crossing structure on them, as required by the *Fisheries Act*; and
 - iii. whether the water crossing is over navigable waters. [\(rationale\)](#)

Best management practices

- If past or present beaver activity is identified at a crossing location, change the crossing location (preferably upstream of the area with beaver activity) or include mitigative techniques to address the probability beavers will return to the site. [\(rationale\)](#)
- On large streams (i.e., streams >2 m wide), consider crossing with a bridge or arch (open-bottom) culvert. Bridges and arches have a higher initial cost but are less prone to washouts and beaver problems than closed-bottom round culverts. [\(rationale\)](#)

iii) Construction and maintenance

Standards

- To facilitate fish passage, install culverts with at least 10% of the diameter of the culvert below the natural stream bed (excludes culverts installed for temporary winter access). ([rationale](#))
- Construct and use fords during the driest time of the year but not during the restricted time of high risk to fish (see Table 5.1a); ensure the ford does not restrict fish passage. ([rationale](#))

Guidelines

- Construction operations that enter a water feature (i.e., in-water work) or potentially cause sediment to enter a water feature, are not to occur during periods of fish spawning, incubation, or fry emergence, unless approved by the Ministry (see Appendix 1b). Timing restrictions vary across the province; generic timing restrictions, by species for each Ministry region, are provided in Table 5.1a. ([rationale](#))

Table 5.1a. Timing restrictions for in-water work to protect fish and fish habitat¹

Spring spawners	Northwest region	Northeast region	Southern region
Walleye	Apr. 1 – June 20	Apr. 1 – June 20	Mar. 15 – May 31
Northern pike	Apr. 1 – June 15	Apr. 1 – June 15	Mar. 15 – May 31
Lake sturgeon	May 1 – June 30	May 1 – July 15	May 1 – June 30
Muskellunge	May 1 – July 15	May 15 – July 15	Mar. 15 – May 31
Largemouth bass	May 15 – July 15	May 15 – July 15	May 1 – July 15
Smallmouth bass	May 15 – July 15	May 15 – July 15	May 1 – July 15
Rainbow trout	Apr. 1 – June 15	Apr. 1 – June 15	Mar. 15 – June 15
Unknown species	Apr. 1 – June 15	Apr. 1 – June 15	Mar. 15 – July 15
Fall spawners	Northwest region	Northeast region	Southern region
Lake trout	Sept. 1 – May 31	Sept. 1 – May 31	Oct. 1 – May 31
Brook trout	Sept. 1 – June 15	Sept. 1 – June 15	Oct. 1 – May 31
Pacific salmon	Sept. 1 – June 15	Sept. 1 – June 15	Sept. 15 – May 31
Lake whitefish	Sept. 15 – May 31	Sept. 15 – May 15	Oct. 15 – May 31

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Lake herring	Oct. 1 – May 15	Oct. 1 – May 31	Oct. 15 – May 31
Unknown species	Sept. 1 – June 15	Sept. 1 – June 15	Oct. 1 – May 31

¹All dates inclusive. Local knowledge of periods of reproductive activity may be used to adjust these dates. In-water work may proceed with appropriate mitigation as approved by the Ministry or the appropriate authority.

- When existing water crossings are identified for replacement, maintenance, or unplugging (e.g., from beaver activity) in the monitoring program for road and water crossings approved in the FMP, prioritize required remedial work based on risk assessment (e.g., higher priority will be given to crossings that pose the greatest risk to public safety and fish passage and migration). ([rationale](#))
- When clearing water crossings that have been affected by beaver activity or other debris remove material gradually beginning with a small breach, working in stages to control flows and prevent sediment from being released, downstream erosion, and fish stranding.

Best management practices

- Nuisance beaver activity should be managed to keep culverts clear and provide for the passage of water and fish. Suggested methods are provided in the Ministry's *The Beaver Handbook* (1995) or in [Fisheries and Ocean's Canada \(DFO\)'s Code of practice: Beaver dam breaching and removal](#). ([rationale](#))

iv) Removal

Standards

- When decommissioning of a road or road network is planned, all water crossings on that road or road system will be assessed for potential removal. ([rationale](#))

Guidelines

- Water crossing removal operations that may enter a water feature (i.e., in-water work) or that may potentially cause sediment to enter a water feature, are not to occur during periods of fish spawning, incubation, or fry emergence, unless approved by the Ministry (see Appendix 1b). Timing restrictions vary across the province; generic timing restrictions, by species for each Ministry region, are provided in Table 5.1a. ([rationale](#))
- Whether and how a water crossing structure is to be removed will be agreed upon by the Ministry and will be based on an analysis of the following criteria as a minimum:
 - Biological

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- i. history of beaver activity;
- ii. sensitivity of fish species;
- iii. whether the structure is currently an impediment to fish migration or may be an impediment to fish migration in the future;
- iv. the presence of critical fish habitat and the likelihood of the habitat being impacted should a washout occur; and
- v. whether removal activities would cause damage to fish or fish habitat.

Water quality

- i. in the event of a washout or erosion problems, will additions to natural background levels of suspended sediments affect downstream fish habitat or other values.

Engineering

- i. the type of the water crossing structure (e.g., culvert);
- ii. the length of time the structure was designed to be functional (e.g., whether the crossing has been designed for a 10-year or 100-year storm event);
- iii. the expected life of the materials used in the construction of the crossing structure;
- iv. whether the fill material is similar to the streambed/streambank material;
- v. whether the road will allow for floodwaters to pass without washing out;
- vi. the amount and type of fill used in construction of the water crossing.

Safety

- i. if the water crossing structure failed or if a washout occurred, would a hazardous situation result.

Anticipated future use

- i. whether the removal of water crossings is consistent with the vehicular traffic expected by the use management strategy for the road or road network.
- ii. whether the crossing site will remain safe and erosion resistant after crossing structure removal if continued vehicle passage is anticipated (Figure 5.1b). [\(rationale\)](#)

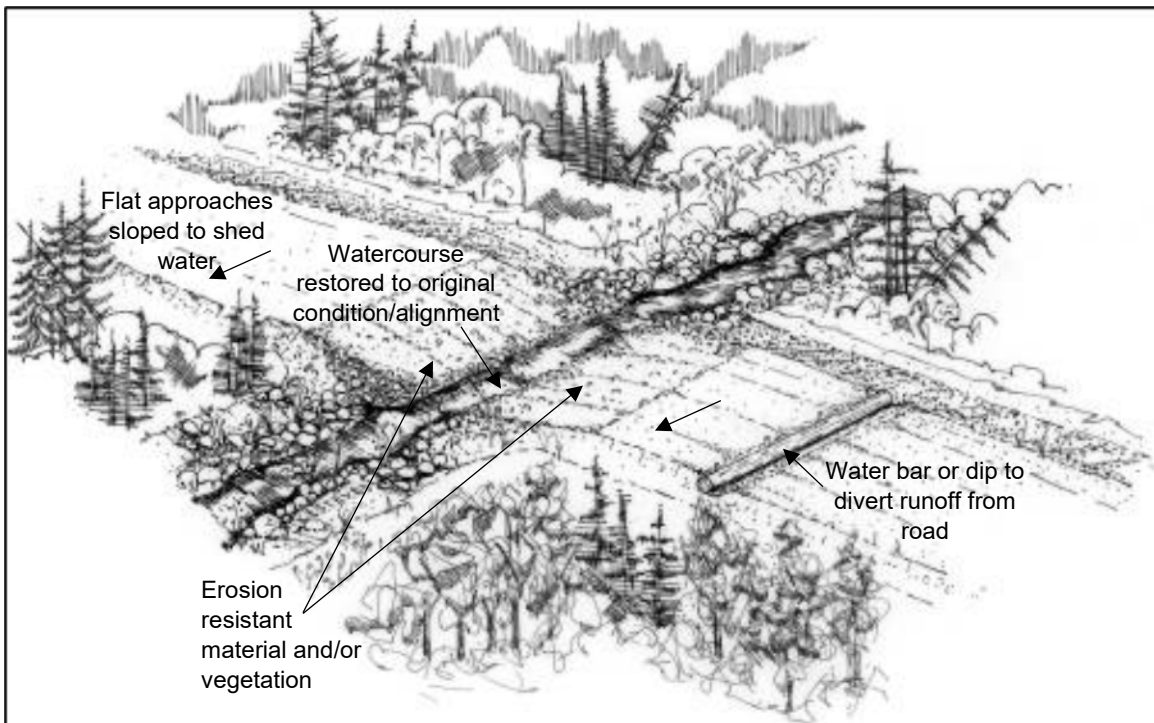


Figure 5.1b. Typical features and conditions of road approaches and watercourse after water crossing removal (Illustration by Kestevan Design).

Best management practices

- Where a road or road network is being decommissioned and culverts are not being removed, incorporating a shallow depression in the approach will allow floodwater to flow over the road in the event of a culvert blockage or capacity exceedance (Figure 5.1a). This may require placing erosion-resistant materials in the depression and on the downstream side of the road fill. ([rationale](#))
- When water crossing removal results in conditions unsuitable for vehicular passage, consider installing physical barriers (e.g., a large rock berm) for public safety. ([rationale](#))

5.2 Soil and productive forest area conservation

Maintaining healthy forest soils and productive forest area is critical to maintaining healthy forest ecosystems. The combination of all the direction (standards, guidelines, and best management practices) in this guide (e.g., aquatic values and hydrological connections between terrestrial and aquatic ecosystems in Section 4.1) and other forest management guides (e.g., Silviculture Guide) constitutes a comprehensive approach to soil and productive forest area conservation. If any single piece of direction in this section is applied in isolation, it would not be adequate to conserve soil resources and productive forest area. However, if applied in an integrated fashion, the probability of adverse impacts will be minimized.

Section 5.2 addresses the conservation of soil resources and productive forest area during forest management activities, with a focus on site disturbance resulting from forestry operations. Site disturbance does not necessarily imply site damage. The effects of site disturbance can be long-lasting or short-lived. Site disturbance can occur through both natural and human-caused forces, which may be important to long-term ecosystem function. The direction in this section is intended to lower the probability of site damage occurring but does not necessarily represent the threshold where site disturbance would begin to be considered site damage.

There are many ways to categorize the types of site disturbance that may be associated with forest management activities. The following sections present site disturbance direction under the categories of rutting and compaction (and associated hydrological disruption), erosion, nutrient loss, and loss of productive forest area (see Figure 5.2a). All of the above categories are linked and it is difficult to discuss one without thinking about the other. When considering direction for one type of site disturbance, managers are encouraged to consider opportunities for synergy with the direction in other disturbance categories and other sections of this guide. For example, soil rutting often results in compaction and both rutting and compaction can influence water infiltration and movement which can lead to erosion.

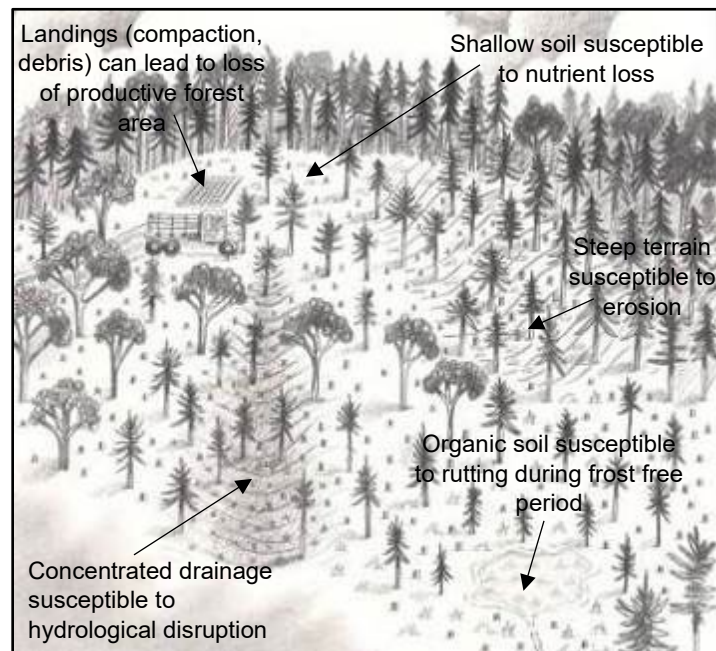


Figure 5.2a. Stylized overview depicting hypothetical areas susceptible to various forms of site disturbance resulting from forestry operations (Illustration by Mandy Saille).

Well-informed advanced planning is the most critical step in conserving soil resources and productive forest area. This includes all aspects of planning such as block design, road location, landing location, skid trail layout, machinery selection, timing of entry, duration of entry, operator training, contingency planning, and renewal and tending

planning. Sections 5.2.1-5.2.4 detail the standards, guidelines, and best management practices that are designed to prevent, minimize, or mitigate negative site disturbance or site damage occurrences and loss of productive forest area. The importance of prevention, through advanced planning, information on site susceptibility, communication, and operator training cannot be overstated.

Throughout this guide (e.g., Section 4.1) terms such as rut and significant mineral soil exposure are used. To understand the various pieces of direction that refer to these terms, it is important to first understand the definitions. The terms associated with site disturbance as used in this guide are defined below. These definitions by themselves are not to be construed as direction. Refer to the individual section where a definition is used to understand the application.

Rut: Continuous trench or furrow created by machine traffic that is ≥ 4 m long and ≥ 30 cm deep (Figure 5.2b). When operating on shallow soils the lesser of depth to bedrock/large boulders or 30 cm will be used. Ruts may be empty, filled with water, or filled with varying amounts of intermixed organic and mineral soil/debris. In cases of concentrated rutting, it may be difficult to distinguish individual ruts. Furrows, scalps, trenches, etc., created specifically for site preparation purposes are not considered ruts. This definition alone does not imply that ruts in excess of these dimensions are not allowed or that damage has occurred when these dimensions are exceeded.

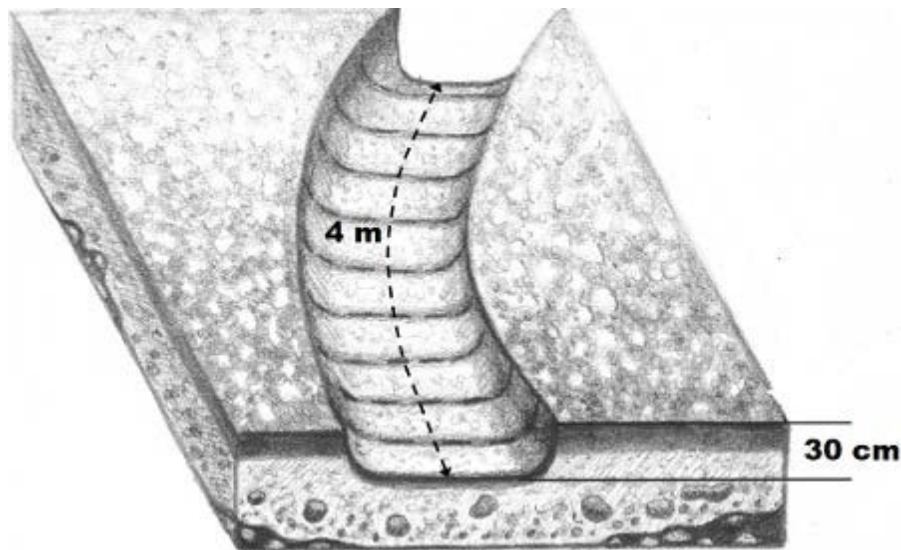


Figure 5.2b. Illustration of a rut (Illustration by Mandy Saille).

Extraction trails: Anywhere a machine being used for extraction of wood (skidder, forwarder, etc) has traveled within the block (excluding travel on roads, landings, and roadside work areas).

Significant mineral soil exposure: Patches of mineral soil exposed by machine traffic that are individually larger than 4 m^2 in size or have an aggregate area that exceeds 5%

coverage. The percent coverage of exposed mineral soil will be measured over a 15 m by 15 m area when operating adjacent to water or over the harvested area of the AOC for all other values (e.g., American ginseng).

[\(rationale\)](#)

Direction

The direction in Sections 5.2.1-5.2.4 apply equally to:

- Operations within regular harvest areas and areas of concern
- All harvest, renewal and tending operations.

Unless specifically referenced in the individual piece of direction, the direction in Sections 5.2.1-5.2.4 does not apply to roads, forestry aggregate pits, landings, roadside work areas, or wood storage yards. When assessing site disturbance of a current operation, any site disturbance associated with previous entries will be taken into consideration.

Direction will be implemented as conditions on regular operations. [\(rationale\)](#)

5.2.1 Rutting and compaction

The objective of the direction in this section is to prevent, minimize, and/or mitigate rutting and compaction associated with forestry operations.

In general terms, a rut is a trench or furrow created by machine wheels or tracks caused by soil displacement and/or compaction. Compaction is the compression of soil caused by the machine load that exceeds the strength of the soil to resist it. Compaction can occur independent of rutting through machine vibration and slipping of tires. Rutting may occur independent of compaction (e.g., on saturated soil), but in general, a rut can be thought of as a visual proxy for compaction. [\(rationale\)](#)

Conditions on regular operations

i) All silviculture systems

Standards

- No more than 40% of any 0.1 ha circle is permitted in ruts. [\(rationale\)](#)
- Ministry and industry compliance staff will follow the approach to measuring rutting, the definition of a roadside work area, and percent coverage of extraction trails in Appendix 5.2a. This approach will be documented in the FMP. [\(rationale\)](#)

Guidelines

- The area of rutting and compaction will be minimized. [\(rationale\)](#)

Best management practices

- Refer to Appendix 5.2b for suggested strategies and techniques to minimize rutting and compaction during field implementation. ([rationale](#))
- Equipment operators should be trained in the identification of sites susceptible to rutting and compaction. ([rationale](#))
- Identify susceptible sites in advance of operations (e.g., via ground reconnaissance, drone-captured aerial imagery, remote sensing). An approach to dealing with these areas should be developed and communicated to operators and supervisors.
 - The site disturbance susceptibility table in Appendix 5.2c can be used as a starting point.
 - Hydrological modeling tools (e.g., flow accumulation models, LiDAR derived digital elevation models (Figure 5.2c)) can be used as an additional source of information for the possible location of susceptible sites. The outputs of these tools are not to be thought of as requiring verification, but equally they should not replace normal field reconnaissance. ([rationale](#))

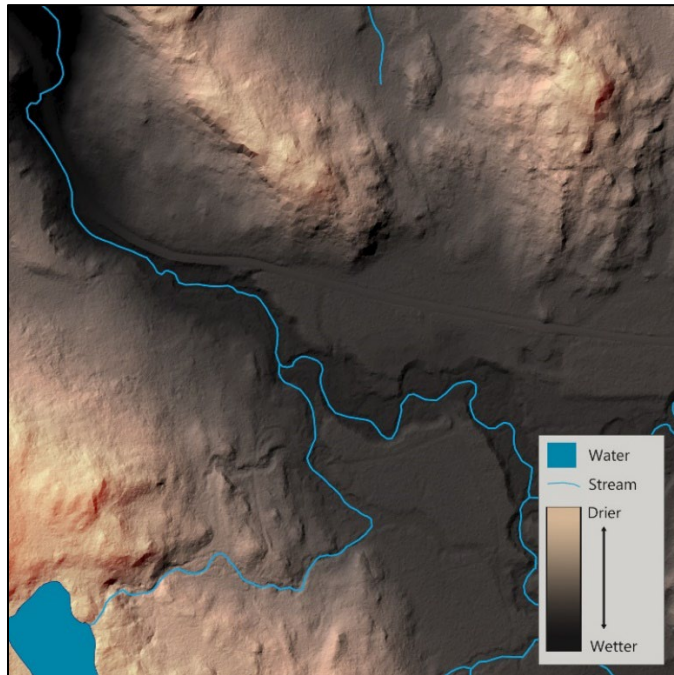


Figure 5.2c. Example of a LiDAR-derived digital terrain model that can be used to predict relative wetness. Knowing locations of predicted wet areas and concentrated drainage in advance better informs operational planning (season of harvest, equipment selection, road and skid trail layout, etc.).

- Develop local standard operating procedures to prevent, minimize, and/or mitigate disturbance for various site type and machine combinations that may potentially result in compaction and rutting. [\(rationale\)](#)
- Selection of areas for harvest, both at individual and multi-year temporal scales, should consider susceptible sites and equipment limitations and seek a balance between stands in which operations can occur at any time of the year and those where operations are best carried out in the winter or the driest part of the summer. [\(rationale\)](#)
- Where practical and feasible, maintain a choice of operating blocks within an economical floating distance to be able to move from susceptible areas during periods of abnormal environmental conditions (e.g., high rainfall, early thaw, late freeze) with minimal interruption in production. [\(rationale\)](#)

ii) Clearcut silviculture system (excluding commercial thinning)

Standards

- No more than:
 - 5% of any 20 ha area (or the operating block if less than 20 ha) is permitted in ruts in shallow soils (<30 cm)
 - 10% of any 20 ha area (or the operating block if less than 20 ha) is permitted in ruts in all other soils. [\(rationale\)](#)

Best management practices

- In clearcut operations, where advanced regeneration is a significant contributor to future forest development (e.g., CLAAG, HARP, white pine advanced regeneration, tolerant hardwood understory), the area in extraction trails will be minimized. On sites susceptible to rutting, achievement of this guideline will have to be balanced against the increased rutting that may occur when extraction is concentrated on fewer trails. [\(rationale\)](#)

iii) Selection and shelterwood (including irregular shelterwood) silviculture systems, commercial thinning

Standards

- No more than 900 m of rutted extraction trails for any continuous 20 ha area is permitted. [\(rationale\)](#)

Guidelines

- If the threshold standard above is exceeded, ruts are to be rehabilitated within one year of completion of operations using the appropriate equipment and during

conditions (e.g., summer) that will not cause additional damage to the site. Follow the assessment method outlined in Appendix 5.2a. [\(rationale\)](#)

- Area in extraction trails will be minimized and will not exceed the following values unless a higher value is required to meet objectives and specified in the FMP (e.g., silvicultural ground rule, conditions on regular operations).
 - 20% for selection
 - 30% for shelterwood and thinning [\(rationale\)](#)
- Local criteria will be developed to identify when stabilization, repair, and/or work stoppage must occur to mitigate effects of ruts on long or short, steep slopes that may cause significant erosion that can degrade sites and prevent future use of extraction trails. [\(rationale\)](#)

Best management practices

- When developing local criteria to address erosion potential, ruts longer than 20 m on slopes greater than 20% should be stabilized (during operations) and/or rehabilitated (upon completion of operations). Stabilization and rehabilitation can include practices such as levelling, diverting runoff water to surrounding vegetation (e.g., water bars), controlling sediment (e.g., brush matting, straw bales) and/or other techniques appropriate to the circumstances. [\(rationale\)](#)

5.2.2 Erosion

Erosion can be defined as the overland movement of soil particles by water, wind, or gravity. Erosion can be the result of either natural causes or human site alterations. Operations that are not implemented with erosion controls in mind can destabilize previously stable ground and result in localized erosion. Erosion can result in loss of productive land (e.g., blow sand – Figure 5.2d) and provide a source point for further erosion. The associated deposition of sediment can smother the roots of residual trees and may result in the harmful alteration, disruption, or destruction of fish habitat. Due to the relatively flat topography in most of Ontario, large-scale erosion is not normally a significant concern. Localized occurrences of erosion are most often visible following localized site disturbances. It is recognized that not all indicators of site instability are visible; however, if reasonable precautions are taken, the chance of localized occurrences of erosion can be minimized.



Figure 5.2d. Large areas of ‘blow sand’ can be difficult to stabilize and regenerate once exposed. Where it is not possible to maintain ground cover, prompt regeneration with suitable species can reduce the likelihood of erosion (photo by Scott McPherson).

Direction

The objective of the direction in this section is to prevent, minimize, and/or mitigate erosion associated with forest management operations. In addition to the guidelines and best management practices listed below, refer to direction for roads and water crossings (Section 5.1), rutting and compaction (Section 5.2.1), and aquatic and wetland ecosystems (Section 4.1).

The direction in this section will be implemented using conditions on regular operations. [\(rationale\)](#)

Conditions on regular operations

Guidelines

- Stabilize (during operations) and/or rehabilitate (upon completion of operations) extraction trails constructed on steep slopes by levelling, diverting runoff water to surrounding vegetation (e.g., water bars – Figure 5.2e), and controlling sediment (e.g., brush matting, straw bales or other techniques appropriate to the circumstances). [\(rationale\)](#)



Figure 5.2e. Rehabilitating main extraction trails by installing water bars on slopes and other means can reduce the risk of future erosion (photo by Bancroft Minden Forest Company Inc.).

Best management practices

- Refer to Appendix 5.2b for a partial list of strategies and techniques that may be used to minimize erosion during operations. ([rationale](#))
- Identify susceptible sites (see Appendix 5.2c for a starting point) and develop local standard operating procedures to minimize the risk of erosion on those sites. ([rationale](#))
- Minimize mineral soil exposure to that required for efficient operations and effective silviculture (i.e., consistent with silvicultural ground rule for the site). ([rationale](#))
- Field supervisors and equipment operators should be trained in:
 - Recognizing/locating sites susceptible to erosion
 - The significance of soil exposure and erosion. ([rationale](#))
- Areas susceptible to mass wasting (e.g., steep sloped alluvial river banks, soil over steep bedrock) should be treated carefully. Silvicultural ground rules or individual plans should be developed for the areas and include specific measures to minimize erosion potential. ([rationale](#))

5.2.3 Nutrient loss

Nutrient loss can be described as the release and off-site transport of nutrients following forest management operations. With present commercial rotations, on most sites, nutrient removals due to logging are not significant and total nutrient levels may actually increase over time. Natural nutrient cycling should replenish nutrient capital lost due to forest harvest with minimal impacts on ecosystem productivity if rotation lengths are sufficiently long. Sites where the trees hold a relatively high proportion of the nutrient capital are regarded as most susceptible (e.g., Fig 5.2f)



Figure 5.2f. Shallow soil site with potentially limited nutrient capital (photo by Dan Duckert).

Post-harvest nutrient loss due to leaching is also a consideration in determining site sensitivity. Leaching is greatest when no plant material is available to absorb and store nutrients on the site. Therefore, site susceptibility is related to how fast the site can be occupied by vegetation after harvest.

Direction

The objective of the direction in this section is to provide prevent, minimize and/or mitigate unintentional nutrient loss associated with forest management operations.

The direction in this section will be implemented using conditions on regular operations. [\(rationale\)](#)

Conditions on regular operations

Standards

- Refer to the *Forest Management Guide to Silviculture in the Great Lakes-St. Lawrence and Boreal Forest of Ontario* for direction for specific site and treatment combinations that may be susceptible to nutrient loss. ([rationale](#))

Best management practices

- Refer to Appendix 5.2b for a partial list of strategies and techniques that may be used to minimize the risk of nutrient loss during operations on susceptible sites. ([rationale](#))
- Identify susceptible sites (see Appendix 5.2c for a starting point) and develop local standard operating procedures to minimize the risk of nutrient loss on those sites. ([rationale](#))

5.2.4 Loss of productive forest area

Loss of productive forest area can be described as the conversion of previously productive forest to a long-term or permanently non-forested condition as a result of forest management operations. Some loss of productive forest area through the conversion to other land types (e.g., permanent roads) is inevitable in even the most efficient forest operations.

During the forest management planning process, the loss of productive forest area is forecast and any effect incorporated into the development of the long-term strategic direction. The actual area of non-forest or non-productive forest (roads, landings, slash/debris piles, grass, brush, etc.) created through forest management operations is either spatially incorporated into the inventory, or otherwise reflected in the inventory attributes. Larger and more permanent features (e.g., primary roads) are normally represented as polygons in the inventory while the effects (if any) of smaller and less permanent features (e.g., slash/debris piles) are reflected in the stand description (e.g., stocking).

Direction

The objective of the direction in this section is to minimize and account for the loss of productive forest area associated with forest management operations.

The direction in this section will be implemented using conditions on regular operations. ([rationale](#))

Conditions on regular operations

Standards

- Coverage of operational roads and landings and unutilized slash and chipper debris will not impact the ability of a harvested area to meet the renewal

standard (i.e., site occupancy, species composition) of the predominant silvicultural ground rule in a block (Figure 5.2g). [\(rationale\)](#)



Figure 5.2g. Unutilized woody material that accumulates at roadside can be piled and burned to maximize the area available for regeneration (photo by Herb Neubrand).

Best management practices

- As a rule-of-thumb, strive to keep the area of roads and landings to less than 4% on a per block basis (it is recognized that operational constraints may require more road in some circumstances and that less road may be possible, and therefore desirable, in others). [\(rationale\)](#)
- Refer to Appendix 5.2b for a partial list of strategies and techniques that may be used to achieve the standard addressing loss of productive forest area during operations. [\(rationale\)](#)
- Avoid piling unutilized fiber on productive non-forested wetlands (e.g., brush and alder). [\(rationale\)](#)

5.3 Spread of invasive species

The health and biological diversity of Ontario's forests are at potential risk from the introduction and spread of a variety of invasive species. Invasive fungi, forest pathogens, and insects (e.g., butternut canker, white pine blister rust, emerald ash borer) can severely impact native tree species by damaging or killing populations of their native hosts, thus impacting forest ecosystem function and composition. Invasive plants are capable of spreading rapidly and outcompeting native plant species for water, nutrients and space if they become established. The potential disruptive impacts of invasive plants on sensitive wetland ecosystems include habitat loss for wetland-dependent wildlife species which include about 20% of Ontario's species at risk.

The *Ontario Invasive Species Strategic Plan* (2012) was developed to prevent the introduction of new invasive species and reduce the spread and harmful impact of existing species in the province. The subsequent *Invasive Species Act, 2015* established a legislative framework to regulate invasive species through prevention, detection, control, and eradication. Specifically, the Act provides for the regulation of carriers (things capable of facilitating movement of invasive species from one place to another including machinery used in forest operations). Moving machinery and other mechanical equipment not properly cleaned can unintentionally introduce invasive species (e.g., common buckthorn, garlic mustard) to new areas by transporting their seed or other propagules that may be contained in mud on machinery.

When the spread of invasive species is known to threaten the viability of specific species, explicit direction has been provided in previous sections of this guide. For example, Appendix 4.1a associated with Section 4.1.3 recommends minimizing ground disturbance and all-season road construction (i.e., roadsides, ditches) in wetlands to deter the establishment of invasive wetland plant species in provincially significant wetlands. Section 4.3 encourages removal of trees that are infected with butternut canker to help reduce spread of the disease and requires thorough inspection and washing of equipment before working in habitat occupied by wetland plant and insects listed on the SARO list. Other Ministry guides, such as the *Forest Management Guide to Silviculture in the Great-Lakes St. Lawrence and Boreal Forests of Ontario* and the *Ontario Tree Marking Guide*, provide direction including recommending silviculture treatments that minimize the establishment, spread and persistence of invasive species and the removal of trees infected by introduced diseases such as white pine blister rust.

Direction

In addition to the cases noted above where specific pests may threaten certain values, forest operations should strive to minimize the risk of spreading any invasive species. The best management practices included in this section may be implemented as conditions on regular operations. ([rationale](#))

Conditions on regular operations

Best management practices

- Forest workers should be trained to identify invasive species in their local area and know what actions can be employed to minimize their spread. Various sources may be consulted for the latest information on invasive species such as:
 - Ontario Invasive Plant Council website (ontarioinvasiveplants.ca)
 - Canadian Forest Service's Forest Invasive Alien Species of Canada website (www.exoticpests.gc.ca)
 - Ontario Federation of Anglers and Hunters' Invading Species Awareness Program website (www.invadingspecies.com). ([rationale](#))

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- Follow the [*Clean Equipment Protocol for Industry*](#) (Halloran et al 2013) when moving equipment from areas where an invasive plant species is known to occur to minimize the risk of transporting and introducing the species to new locations. [*\(rationale\)*](#)

6.0 SALVAGE AND BIOFIBRE HARVEST

6.1 Salvage harvest

Salvage harvesting is undertaken in forests recently killed or damaged by natural disturbances (e.g., wildfires, insect outbreaks, windstorms) to recover timber volumes before decay reduces or eliminates its economic value. Given that the frequency of wildfire, wind disturbances, and insect outbreaks is expected to increase with climate change, the frequency and extent of salvage harvest operations in Crown forests in the province may increase in the future.

The potential impacts of salvage harvesting on ecosystem processes and diversity (particularly following wildfire) may be more considerable than those of harvesting or natural disturbance alone due to the cumulative effects of multiple disturbance events over a relatively short period of time. The objective of the direction in this section is to mitigate potential salvage harvest-related impacts that may compromise post-disturbance ecosystem diversity, function, productivity and recovery.

Although forest practices, within silvicultural limits, that emulate natural disturbances and landscape patterns are used to conserve biodiversity in Crown forests, they are unable to fully mimic the ecological processes and conditions created by natural disturbances. Thus, the direction below ensures that some naturally disturbed forest, in the form of patches and individual standing dead trees, be left unharvested on the landscape to fulfill its ecological role.

Direction

The direction in this section will apply to all salvage operations, regardless of the origin or type of natural disturbance. It does not apply to accelerated harvest operations that may be undertaken in an insect pest management program as a pre-emptive attempt to prevent an insect pest infestation from affecting particular stands.

The direction in this section will be implemented using FMP products (e.g., delineation of salvage boundary) and conditions on regular operations. ([rationale](#))

Conditions on regular operations

Guidelines

- Consistent with direction in Section 3.2.3.1, salvage harvest will normally retain a minimum average of ≥ 25 stems/ha at least ≥ 3 m in height and ≥ 10 cm dbh. This is the minimum average for the harvest block (or minimum average per 10 ha if the harvest block ≥ 10 ha) contingent upon the availability of sufficient numbers and types of standing stems in a condition suitable for retention. ([rationale](#))
- Salvage operations will consider strategic landscape objectives. ([rationale](#))

- When finalizing boundaries of a salvage operation that results from wildfire, the area of undisturbed forest included in the salvage operation will be minimized. [\(rationale\)](#)
- When finalizing boundaries of a salvage operation that results from blowdown, insect infestation, or other factors (e.g., ice storms), the area of the salvage operation can include undisturbed forest. When salvage operations include undisturbed area, Section 3.2.2 will apply. [\(rationale\)](#)
- The trees retained following salvage operations will have a range of distribution patterns (relatively even spaced to some clumping), recognizing operational limitations, and subject to the availability of standing trees. [\(rationale\)](#)
- Adjust the timing of entry and/or other operational factors to minimize unnecessary site disturbance that could potentially result in ecological damage (e.g., avoid salvaging a swamp in the frost-free period). [\(rationale\)](#)

Best management practices

- Whenever possible, the trees retained following harvest will be the same species and size classes as those that would have been retained following normal harvest (as per direction in Section 3.2.3.1). [\(rationale\)](#)
- When leaving unsalvaged patches of disturbed forest, give preference to areas adjacent to, or in close proximity to, the undisturbed forest. [\(rationale\)](#)
- Limit skid trail coverage when salvage operations are extended for ≥ 3 years, particularly in fire salvage areas. [\(rationale\)](#)
- In fire salvage areas, preferably retain conifers such as jack pine and black spruce as wildlife trees. [\(rationale\)](#)

6.2 Biofibre harvest

Forest biofibre refers to forest resources from Crown forests that are not normally being utilized for conventional forest products (e.g., sawlogs, pulpwood) and made available under an approved FMP (MNRF Forest Directive 03 02 01). Forest biofibre includes:

1. Unmerchantable timber such as undersized wood, cull trees or portions of trees
2. Individual trees and stands of trees that are unmerchantable and unmarketable
3. Trees that may be salvaged as a result of a natural disturbance.

Forest biofibre is differentiated from forest biomass in that the latter includes all organic material from trees (e.g, stumps, roots). Additionally, by limiting the scope of biofibre to material made available under an approved FMP, biofibre can be thought of as simply

an additional forest resource, similar to sawlogs or pulpwood, which can be used to produce forest products (e.g., bioenergy, wood pellets, biochemicals). Biofibre is typically removed for bioenergy feedstock through harvest intensification as a secondary product of undersized material from optimizing recovery of veneer, sawlogs, or pulpwood. Biofibre may also be the primary product of otherwise unmarketable stands of low-grade hardwoods.

Direction

The direction in this section aims to mitigate the potential negative impacts of biofibre harvesting on forest biodiversity, wildlife habitat, and long-term site productivity. In consideration of Ontario's emerging forest bioeconomy potential and the products derived, the direction in this section makes explicit the restrictions on what can be removed through forest harvesting, and unless otherwise specified, applies equally to all planned harvest areas.

The direction in this section will be implemented using conditions on regular operations. [\(rationale\)](#)

Conditions on regular operations

Guidelines

- Stumps and all below ground portions of a tree are not available for utilization as a forest product. Movement or removal associated with normal operations (e.g., construction of roads, landings, and skid trails; renewal and tending; slash piling), including incidental movement or removal during harvest operations, is permitted but will be minimized to that required for efficient operations. Removal for forest health purposes is permitted. [\(rationale\)](#)
- Organic matter that is not part of a harvested tree (including boles, branches, roots, bark, leaves, needles, debris, soil carbon) will remain on site. Movement of such material for access or silvicultural purposes is permitted. [\(rationale\)](#)

7.0 EFFECTIVENESS MONITORING

Direction in this guide is based on the best scientific information and expert advice available at the time of writing (see Background and Rationale for Direction). Some of the direction is based on a large body of scientific literature that thoroughly describes the effects of forest management operations, and in some cases, even evaluates the effectiveness of previous direction (e.g., red-shouldered hawk). However, some of the direction is based on a more limited body of scientific knowledge. For this direction, there is uncertainty associated with the outcome of its application. Uncertainty arises for numerous reasons. For example, there may have been few studies upon which to base direction, studies may have been conducted in a different ecological context (e.g., in western temperate forests), or results of studies may have been inconclusive or contradictory. Direction that is uncertain can be viewed as a hypothesis that requires testing within the context of the suite of forest management operations practised across Ontario's ecologically diverse landscape.

The Forest Operations and Silviculture Manual (FOSM) acknowledges uncertainty and stipulates that for all its associated policies, key uncertainties will be identified to inform, support, and undertake scientific investigations and monitor policy effectiveness. Additionally, the FOSM requires that all new or revised forest management guides will include a description of the approach to effectiveness monitoring.

Testing the effectiveness of direction forms one phase of the guide development cycle (Figure 7.0a). In the first phase, overarching objectives of the guide (i.e., CFSA principles) are defined. These principles, together with experience-based advice from practitioners and scientists, scientific and Indigenous traditional knowledge, and available technologies and information, were considered during the development of the coarse and fine filter direction in this guide. When implemented through the forest management planning process, the direction described in Section 1.3 and contained in Sections 3 to 6 will influence strategic and operational planning including silviculture prescriptions, AOC prescriptions, and conditions on operations. Actual operations will be monitored to ensure compliance with approved FMPs and the results of operations will be monitored to ensure that direction is effective in producing anticipated outcomes. Effectiveness monitoring will then be used to evaluate (test) the effectiveness and effects of direction in the guide and revise as appropriate. A strong enough signal from the compliance monitoring (e.g., compliance inspections, independent forest audits) or evaluation phase may result in a feedback loop that informs aspects of guide development (e.g., revise testable hypotheses) and/or implementation. This "learning while doing" cycle exemplifies the principles of adaptive management.

The following sections outline the Ministry's approach to monitoring the effectiveness of direction in this guide. A brief conceptual framework for conducting effectiveness monitoring research is first presented. Direction for which there is a relatively high degree of uncertainty, and thus is high priority for effectiveness monitoring, is then identified. Finally, the Ministry's approach to delivery of an effectiveness monitoring

program that will acquire new knowledge to facilitate future review and revision of direction in the guide is described. ([rationale](#))

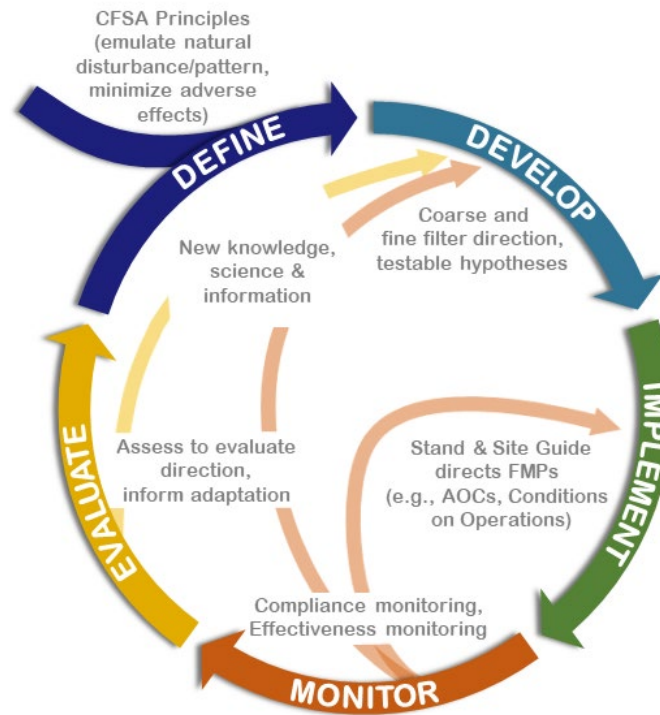


Figure 7.0a. The five-phase adaptive management cycle for the Stand and Site Guide.

7.1 Effectiveness monitoring principles

Direction in this guide is intended to conserve biological diversity at site, stand, multi-stand, and meso-landscape scales, using a nested coarse and fine filter approach (see Section 1.3).

Testing coarse filter direction

Coarse filter direction is designed to create habitat at various scales that supports a community of plants and animals that has a complement of species, has an abundance of each species, and functions in a manner similar to that of communities in habitats derived from natural processes. Examples of coarse filter direction include guidance on pattern within harvest areas, wildlife tree retention, and downed woody material.

Testing the effectiveness of coarse filter direction requires a comparison of plant and animal communities in stands or small landscapes that have been created through forest management operations that followed direction in the guide (or created conditions similar to those prescribed by the guide) and those that have arisen from natural events. Studies may be mensurative or manipulative experiments. No study can hope to monitor all plants and animals so species or groups of species that serve as indicators of the composition, abundance, and functional integrity of the community need to be

identified. There is a large body of literature describing how species can be selected as indicators. Species are typically selected to represent different taxonomic groups, functional groups, body sizes, habitat affinities, and special ecological roles (e.g., keystone species).

Comparing the list of species, or groups of species, and their abundance within habitats arising from forest management operations and natural disturbances will provide one assessment of the effectiveness of the direction in this guide. However, abundance by itself is not always a good indicator of habitat suitability. Some habitats may support a high density of a specific species, but certain characteristics of the habitat may predispose residents to high rates of mortality or low rates of fecundity. These habitats may be population sinks rather than sources. Consequently, testing the effectiveness of direction also requires some comparison of population demographics or trend in addition to simple measures of species richness and abundance.

Testing fine filter direction

Fine filter direction is intended to either provide habitat conditions that maintain a specific species at a desired level or to mitigate the potentially disruptive effects of some forest management operations on wildlife or the physical environment. Examples of the former include direction that specifies the amount of mild and severe winter cover to retain in winter deer emphasis areas and the amount of dense mature hardwood forest to retain in the vicinity of red-shouldered hawk nests. Examples of the latter include direction that restricts harvest, renewal, and tending operations near bald eagle nests during the breeding season and direction that limits the amount of extraction trail coverage.

Testing the effectiveness of individual pieces of fine filter direction requires explicit identification of the objective of the direction. For example, restrictions on operations within 400 m of bald eagle nests during the breeding season are intended to ensure use and productivity patterns that are comparable between nests in harvest areas and those in remote undisturbed locations.

Testing the effectiveness of fine filter direction lends itself to either manipulative or mensurative experimental approaches. In both cases, it is essential to have a sample size that is large enough to have a reasonable expectation of being able to detect meaningful differences if they exist.

How close is close enough?

Ideally, coarse filter direction in this guide would create habitat with exactly the same mix of species and with each species found in exactly the same abundance as in habitat arising from natural processes. In reality, outcomes from application of the guide will rarely be exactly the same as conditions observed in natural situations. Management activities guided by coarse filter direction cannot completely duplicate all aspects of natural processes (especially the tremendously wide range of natural variability). The CFSA recognizes this fact by explicitly requiring the emulation not duplication of natural disturbances within the limits of silvicultural requirements. Even when management

activities and natural processes produce habitats with similar composition and structure, differences in the response of plants and animals may, as an example, be observed simply due to sampling error. Thus, when evaluating the coarse filter direction in the guide it is imperative to define in advance ‘how close is close enough’, and which spatial and temporal scales are appropriate for assessment.

In contrast to coarse filter direction, evaluating the effectiveness of fine filter direction is somewhat more straightforward because it is associated with simpler objectives. However, as a consequence of sampling error, observed outcomes may not exactly match expected outcomes, even when direction is effective. Thus, as part of the evaluation process, it is important to identify in advance what will be considered a meaningful (rather than simply a statistically significant) deviation from expectation.

The response of plants and animals to the habitat created by both the coarse and fine filter direction in this guide may be influenced by numerous factors unrelated to habitat, such as level of harvest by hunters, density of local predator populations, and severity of local winter weather conditions. Thus, when evaluating the effectiveness of direction in this guide, it is imperative that these non-habitat factors be considered and incorporated or controlled, to the extent possible, during study design and data analysis.

Rempel et al (2011) provides a detailed discussion of the Ministry’s forest management guide effectiveness monitoring strategic direction and principles associated with study design, study area selection, monitoring program economic sustainability, and context of decision analysis and adaptive management. [\(rationale\)](#)

7.2 What to evaluate – Identifying key uncertainties

Significant resources would be required to rigorously test the effects of forest management operations and/or the effectiveness of all guide direction for which there is some uncertainty. To efficiently direct effectiveness monitoring efforts, eight priority hypotheses have been identified. During development of this revised version of the guide, the 10 key uncertainties in the previous version were reviewed by subject matter experts, advisory teams, and the Provincial Forest Technical Committee. Those that were considered adequately addressed or no longer relevant were removed and those that were considered not adequately addressed have been retained. The following eight priority hypotheses were identified considering the amount of reliable supporting knowledge and the potential impact of applying ineffective (or inefficient) direction. [\(rationale\)](#)

Wildlife communities and wildlife habitat and supply

H₀1: Within the context provided by direction in the Landscape Guides, if the coarse filter direction in Section 3.2.2 and fine filter direction in Section 4 produce a pattern of harvested and residual forest at stand and multi-stand scales similar to that found in habitats disturbed by natural events, then similar wildlife communities will be maintained. [\(rationale\)](#)

H₀2: If the direction for AOCs (around water features and other site-specific values), small residual patches, wildlife trees, and downed woody material in Section 3.2.3 maintains or produces sufficient downed woody material through time similar to that arising from natural events, then DWM-dependent wildlife, plant, and fungal communities and ecological processes (e.g., nutrient cycling) will be maintained.

[\(rationale\)](#)

H₀3: If forest management operations permitted within shoreline AOCs (Sections 4.1.1 and 4.1.2) create a diversity of ages of shoreline forest similar to that found in habitats arising from natural events, then similar riparian wildlife communities (including beavers) will be maintained. [\(rationale\)](#)

H₀4: The fine filter direction for moose in Section 3.3.4 will create habitat that sustains a higher density of moose (or a higher harvest of moose) than that produced by the general coarse filter direction in the Landscape and Stand and Site Guides. [\(rationale\)](#)

Terrestrial and aquatic ecosystems processes

H₀5: Within the context provided by direction in the Landscape Guides, if the coarse filter direction in Section 3.2.2 and fine filter direction in Section 4 retain residual forest that is spatially arranged in catchments similar to that observed in naturally disturbed catchments, then hydrological effects resulting from forest management operations will not exceed observed and acceptable levels for specific parameters (e.g., methylmercury). [\(rationale\)](#)

H₀6: Direction in Sections 4.1, 4.1.1, and 4.1.2 will mitigate undesirable effects (e.g., harmful alteration, disruption, or destruction of fish habitat) of forest management activities permitted within shoreline AOCs on water quality and aquatic biota. [\(rationale\)](#)

H₀7: Direction in Sections 4.1, 5.1, and 5.2 will mitigate undesirable effects of forest management operations on hydrological linkages between upland forest and aquatic habitats. [\(rationale\)](#)

H₀8: Restrictions on rutting and skid trail coverage in Section 5.2.1 will result in acceptable growth of residual trees (partial harvests) and regeneration success (all harvests). [\(rationale\)](#)

Direction contained within this guide for many species at risk is associated with a high degree of uncertainty. Direction with the highest degree of uncertainty tends to be associated with species with few known sites. While further research on these species is desirable, specific questions have not been identified as a high priority for consideration within the Ministry's effectiveness monitoring program because too few sites are typically known to permit a scientifically rigorous evaluation. However, it would be desirable, when opportunities for potential collaboration and partnerships arise, to undertake smaller-scale research projects (with sufficient sample sizes) on the

effectiveness of individual pieces of fine-filter direction in this guide to minimize adverse effects of forest management activities on species at risk and their habitats.

Similarly, an effectiveness monitoring strategy for this guide may also include undertaking smaller-scale research projects on the effects of other fine-filter direction to minimize adverse effects on some aspects of the managed forest that are beyond their intended scope including:

- Forest access roads (distribution, density, and access to resources)
- Available harvest area
- Habitat for plant and animal species valued by Indigenous communities and stakeholders for which specific direction is not provided.

7.3 Delivering effectiveness monitoring: Acquiring new knowledge

The Ministry has an extensive science, research, and monitoring organization with a long history of conducting terrestrial and aquatic ecosystem research, including monitoring the effects of forest operations and the effectiveness of forest management guides in mitigating effects. In 2014-15, the Ministry's Science and Research Branch (SRB) undertook a strategic exercise to review its current science portfolio and to identify its science needs. As a result of this exercise, two strategic science initiatives, the Integrated Science Action Plan (ISAP) and the Integrated Monitoring Framework (IMF), were developed. The ISAP addresses activities across the full science continuum from data and values collection to inventory, monitoring, and assessment, to applied research and development, and the associated information management. The priority hypotheses identified in Section 7.2 fall under the Ministry's science priorities as described in the ISAP objectives to:

- Collect information about the state of wildlife species to inform and evaluate wildlife policies including:
 - Monitoring landscape scale populations of cervid species (Objective 4a)
 - Inventorying the distribution and diversity of wildlife species as an indicator of the state of crown forest biodiversity and terrestrial habitats and ecosystems (Objective 4d).
- Acquire knowledge about forested landscapes, ecosystems, and associated species including conducting research to understand:
 - Effects of natural disturbance emulation, natural and anthropogenic post-disturbance ecology and succession on terrestrial and aquatic ecosystems, landscape processes, and cumulative impacts (Objective 8a)
 - Potential impacts of forest operations on site protection and productivity (e.g., soil disturbance standards) (Objective 8c)
 - Ecological and management implications of removing forest bio-fibre on wildlife habitat and long-term forest productivity (Objective 8d).

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- Acquire knowledge about wildlife species and their habitat by conducting research on game and furbearing species to address critical knowledge gaps (Objective 9a).

The Ministry's monitoring activities will contribute to informing and evaluating guide direction by assessing the effects of ecological and environmental changes on forest resources, impacts of management actions on ecosystems, and whether specified management activities had the desired effect. Specifically, the Ministry's terrestrial monitoring (e.g., broad-scale land cover and disturbance mapping, growth and yield permanent forest plot network, and wildlife and moose monitoring (aerial moose population inventory) programs will help to measure changes in species, habitats, biodiversity, and the factors affecting them, as well as identifying additional monitoring and research needs to better address and inform effectiveness monitoring questions.

The Ministry routinely follows a process of assessing its science and monitoring needs to inform short-term science priorities. Periodic discussions also occur to assess the longer-term foundational science portfolio. As part of the regular and longer-term science dialogue within the Ministry, science priorities, including the eight priority hypotheses noted above will be brought forward for resourcing discussions. The Ministry will then investigate opportunities for addressing and resourcing the highest priority science needs that are believed to provide the greatest benefit related to reducing risks associated with natural resource management decision making. This will enable the Ministry to balance its responsiveness to emerging and longer-term science needs.

The Ministry uses a range of approaches to acquire new reliable knowledge important to informing resource management decision making. When there are insufficient resources or capacity internally within the science organization to address the priority questions, the Ministry will seek out collaborations with and encourage partners to initiate new research studies relevant to the priority questions.

The Ministry will continue to review and evaluate relevant scientific literature for application in Ontario and monitoring information and maintain connections with researchers to identify new knowledge that may help evaluate direction in the guide. As part of the regular review and revision of guides to complete the adaptive guide development cycle, new knowledge acquired through this combination of approaches will be used to revise direction as appropriate. ([rationale](#))

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APPENDICES

Note: The numbering system used in these appendices (and the Background and Rationale for Direction document) does not follow a conventional numbering system. The number for each appendix corresponds to the section and subsection (e.g., 4.2) where it is first referred to in the guide. Where more than one appendix was referred to in the same section, an alphabetic suffix has been added (e.g., 5.2b).

Appendix 1a – Contributors

To be completed

Appendix 1b - Procedure for implementing activities requiring Ministry notification or approval in an operational prescription or condition(s) in an area of concern or conditions on operations in the FMP

Ministry notification

The procedure for implementing activities requiring Ministry notification in an operational prescription or condition(s) for an AOC or CRO in the FMP will be documented in the FMP and is as follows:

1. If implementing an activity requiring Ministry notification in an operational prescription or condition(s) for an AOC or CRO in the FMP because it cannot be reasonably avoided, the forest licensee will identify the activity and prepare a notice. The notification documentation can be provided in a template format and will include:
 - a. The details of the individual identified value, including associated geographical area of the AOC, or important ecological feature including location portrayed on a map, block number, and a description of the activity requiring Ministry notification in an operational prescription or condition(s) for an AOC or CRO in the FMP.
 - b. Rationale for implementing the activity requiring Ministry notification, including any impacts of not implementing the activity.
 - c. A summary of how potential impacts of the activity requiring Ministry notification on the value or feature will be minimized or mitigated.
 - d. An approximate start date the preferred course of action will commence.
2. The forest licensee will submit the notification documentation to the Ministry staff member(s) designated as the recipient in the FMP (e.g., Ministry Management Biologist, Management Forester, Integrated Resource Management Technical Specialist assigned to forest management unit) in the form of an email with a carbon copy sent to the Ministry District Supervisor. Every practical effort should be made by the forest licensee to provide notification in a timely manner so that the Ministry is able to conduct a field visit (if necessary) and to provide any input or concerns to the forest licensee. Once notification has been submitted, the forest licensee can commence work (i.e., no response from the Ministry is required prior to implementing activity). The forest licensee and Ministry are encouraged to conduct joint field visits when contemplating situations where activities requiring Ministry notification in an operational prescription or condition(s) in an AOC or CRO in the FMP will be implemented.

3. Ministry staff will file notification documentation to be accessed and used for compliance purposes once operations are complete.

Ministry approval

The procedure for implementing activities requiring Ministry approval in an operational prescription or condition(s) for an AOC or CRO in the FMP will be documented in the FMP and is as follows:

1. If implementation of an activity requiring Ministry approval in an operational prescription or condition(s) in an AOC or CRO in the FMP cannot be reasonably avoided, the forest licensee will identify the activity and prepare an approval request. The request will include:
 - a. The details of the individual identified value, including associated geographical area of the AOC, or important ecological feature including location portrayed on a map, block number, and a description of the activity requiring Ministry approval in an operational prescription or condition(s) for an AOC or CRO in the FMP.
 - b. Rationale for implementing the activity requiring Ministry approval, including any impacts of not implementing the activity.
 - c. A summary of how potential impacts of the activity requiring Ministry approval on the value or feature will be minimized or mitigated.
2. The forest licensee will submit the request to the Ministry staff member(s) designated as the recipient(s) of approval requests in the FMP (e.g., Ministry Management Biologist, Management Forester, Integrated Resource Management Technical Specialist assigned to forest management unit) in the form of an email, with a carbon copy sent to the Ministry District Supervisor, to seek input and approval.
3. The Ministry recipient of approval request ensures other appropriate Ministry staff (if necessary) are informed of request so that they may review request and provide input. A field visit or request for additional information may be required.
4. The Ministry District Supervisor will approve or deny request and provide forest licensee with an email response (include appropriate individuals as identified in FMP) within an agreed upon timeframe (10 working days (i.e., two weeks) is recommended) identified in the FMP.
5. Ministry staff will file approval documentation to be accessed and used for compliance purposes once operations are complete.

Appendix 1c – Scientific names of species mentioned in the Stand and Site Guide

(based primarily on the Natural Heritage Information Centre website
<https://www.ontario.ca/page/get-natural-heritage-information>)

Common name	Scientific name
Woody Plants	
Alder	<i>Alnus incana</i> & <i>Alnus viridis</i>
Balsam fir	<i>Abies balsamea</i>
Black ash	<i>Fraxinus nigra</i>
Black spruce	<i>Picea mariana</i>
Bur oak	<i>Quercus macrocarpa</i>
Butternut	<i>Juglans cinerea</i>
Cedar	<i>Thuja occidentalis</i>
Dogwood	<i>Cornus</i> spp.
Green ash	<i>Fraxinus pennsylvanica</i> var. <i>subintegerrima</i>
Hemlock	<i>Tsuga canadensis</i>
Jack pine	<i>Pinus banksiana</i>
Labrador tea	<i>Rhododendron groenlandicum</i>
Leatherleaf	<i>Chamaedaphne calyculata</i>
Mountain ash	<i>Sorbus</i> spp.
Oak	<i>Quercus</i> spp.
Red ash	<i>Fraxinus pennsylvanica</i>
Red pine	<i>Pinus resinosa</i>
Red spruce	<i>Picea rubens</i>
Trembling aspen	<i>Populus tremuloides</i>
White birch	<i>Betula papyrifera</i>
White elm	<i>Ulmus americana</i>
White pine	<i>Pinus strobus</i>
White spruce	<i>Picea glauca</i>
Willow	<i>Salix</i> spp.
Non-woody plants	
American ginseng	<i>Panax quinquefolius</i>
Branched bartonia	<i>Bartonia paniculata</i>
Broad beech fern	<i>Phegopteris</i>
<i>hexagonoptera</i>	
Eastern prairie fringed-orchid	<i>Platanthera leucophaea</i>
Flooded jellyskin	<i>Leptogium rivulare</i>
Garlic mustard	<i>Alliaria petiolata</i>
Ogden's pondweed	<i>Potamogeton x ogdenii</i>
Small-flowered lipocarpha	<i>Lipocarpha</i>
<i>micrantha</i>	

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Small white lady's-slipper orchid	<i>Cypripedium</i>
<i>candidum</i>	
Lowland toothcup	<i>Rotala ramosior</i>

Invertebrates

American bumble bee	<i>Bombus pensylvanicus</i>
Monarch	<i>Danaus plexippus</i>
Rainbow mussel	<i>Villosa iris</i>
Suckley's cuckoo bumble bee	<i>Bombus suckleyi</i>
Yellow-banded bumble bee	<i>Bombus terricola</i>
West Virginia white	<i>Pieris virginiensis</i>

Fish

American eel	<i>Anguilla rostrata</i>
Aurora trout	<i>Salvelinus fontinalis timagamiensis</i>
Brook trout	<i>Salvelinus fontinalis</i>
Channel darter	<i>Percina copelandi</i>
Upper Great Lakes Kiyi	<i>Coregonus kiyi</i>
Grass pickerel	<i>Esox americanus vermiculatus</i>
Lake herring	<i>Coregonus artedii</i>
Lake trout	<i>Salvelinus namaycush</i>
Lake sturgeon	<i>Acipenser fulvescens</i>
Lake whitefish	<i>Coregonus clupeaformis</i>
Largemouth bass	<i>Micropterus salmoides</i>
Muskellunge	<i>Esox masquinongy</i>
Northern brook lamprey	<i>Ichthyomyzon fossor</i>
Northern pike	<i>Esox lucius</i>
Rainbow trout	<i>Oncorhynchus mykiss</i>
Redside dace	<i>Clinostomus elongatus</i>
River redhorse	<i>Moxostoma carinatum</i>
Shortjaw cisco	<i>Coregonus zenithicus</i>
Shortnose cisco	<i>Coregonus reighardi</i>
Silver lamprey	<i>Ichthyomyzon unicuspis</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Walleye	<i>Sander vitreus</i>

Reptiles

Blanding's turtle	<i>Emydoidea blandingii</i>
Eastern foxsnake	<i>Elaphe gloydi</i>
Eastern hog-nosed snake	<i>Heterodon platirhinos</i>
Gray ratsnake	<i>Elaphe obsoleta</i>
Eastern ribbonsnake	<i>Thamnophis sauritus</i>
Five-lined skink	<i>Plestiodon fasciatus</i>
Massasauga	<i>Sistrurus catenatus</i>
Milksnake	<i>Lampropeltis triangulum</i>
Northern map turtle	<i>Graptemys geographica</i>

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Snapping turtle	<i>Chelydra serpentina</i>
Spiny softshell	<i>Apalone spinifera</i>
Spotted turtle	<i>Clemmys guttata</i>
Eastern musk turtle	<i>Sternotherus odoratus</i>
Wood turtle	<i>Glyptemys insculpta</i>

Birds

American black duck	<i>Anas rubripes</i>
American crow	<i>Corvus brachyrhynchos</i>
American kestrel	<i>Falco sparverius</i>
American goshawk	<i>Accipiter gentilis</i>
American white pelican	<i>Pelecanus erythrorhynchos</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Bank swallow	<i>Riparia riparia</i>
Barn swallow	<i>Hirundo rustica</i>
Barred owl	<i>Strix varia</i>
Black tern	<i>Chlidonias niger</i>
Bonaparte's gull	<i>Larus philadelphia</i>
Boreal owl	<i>Aegolius funereus</i>
Broad-winged hawk	<i>Buteo platypterus</i>
Brown-headed cowbird	<i>Molothrus ater</i>
Canada warbler	<i>Cardellina canadensis</i>
Cerulean warbler	<i>Dendroica cerulea</i>
Chimney swift	<i>Chaetura pelagica</i>
Common grackle	<i>Quiscalus quiscula</i>
Common nighthawk	<i>Chordeiles minor</i>
Common raven	<i>Corvus corax</i>
Common yellowthroat	<i>Geothlypis trichas</i>
Cooper's hawk	<i>Accipiter cooperii</i>
Eastern kingbird	<i>Tyrannus tyrannus</i>
Eastern screech-owl	<i>Megascops asio</i>
Eastern whip-poor-will	<i>Antrostomus vociferus</i>
European starling	<i>Sturnus vulgaris</i>
Evening grosbeak	<i>Coccothraustes vespertinus</i>
Golden eagle	<i>Aquila chrysaetos</i>
Golden-winged warbler	<i>Vermivora chrysoptera</i>
Great blue heron	<i>Ardea herodias</i>
Great gray owl	<i>Strix nebulosa</i>
Great horned owl	<i>Bubo virginianus</i>
House sparrow	<i>Passer domesticus</i>
Kirtland's warbler	<i>Dendroica kirtlandii</i>
Least bittern	<i>Ixobrychus exilis</i>
Long-eared owl	<i>Asio otus</i>
Louisiana waterthrush	<i>Seiurus motacilla</i>
Merlin	<i>Falco columbarius</i>
Northern harrier	<i>Circus cyaneus</i>

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Northern hawk owl	<i>Surnia ulula</i>
Northern saw-whet owl	<i>Aegolius acadicus</i>
Osprey	<i>Pandion haliaetus</i>
Peregrine falcon	<i>Falco peregrinus</i>
Pileated woodpecker	<i>Dryocopus pileatus</i>
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Red-winged blackbird	<i>Agelaius phoeniceus</i>
Sharp-shinned hawk	<i>Accipiter striatus</i>
Short-eared owl	<i>Asio flammeus</i>
Turkey vulture	<i>Cathartes aura</i>
Wild turkey	<i>Meleagris gallopavo</i>
Wood duck	<i>Aix sponsa</i>
Yellow rail	<i>Coturnicops noveboracensis</i>

Mammals

Beaver	<i>Castor canadensis</i>
Big brown bat	<i>Eptesicus fuscus</i>
Black bear	<i>Ursus americanus</i>
Bobcat	<i>Lynx rufus</i>
Cougar	<i>Puma concolor</i>
Coyote	<i>Canis latrans</i>
Tri-colored bat	<i>Perimyotis subflavus</i>
Eastern wolf	<i>Canis sp. cf. lycaon</i>
Elk	<i>Cervus canadensis</i>
Fisher	<i>Martes pennanti</i>
Gray fox	<i>Urocyon cinereoargenteus</i>
Hoary bat	<i>Lasiurus cinereus</i>
Least weasel	<i>Mustela nivalis</i>
Little brown myotis	<i>Myotis lucifugus</i>
Long-tailed weasel	<i>Mustela frenata</i>
Lynx	<i>Lynx canadensis</i>
Marten	<i>Martes americana</i>
Mink	<i>Mustela vison</i>
Moose	<i>Alces americanus</i>
Muskrat	<i>Ondatra zibethicus</i>
Northern grey wolf	<i>Canis lupus occidentalis</i>
Northern myotis	<i>Myotis septentrionalis</i>
Raccoon	<i>Procyon lotor</i>
Eastern red bat	<i>Lasiurus borealis</i>
Red fox	<i>Vulpes vulpes</i>
Red squirrel	<i>Tamiasciurus hudsonicus</i>
River otter	<i>Lontra canadensis</i>
Short-tailed weasel	<i>Mustela erminea</i>
Silver-haired bat	<i>Lasionycteris noctivagans</i>

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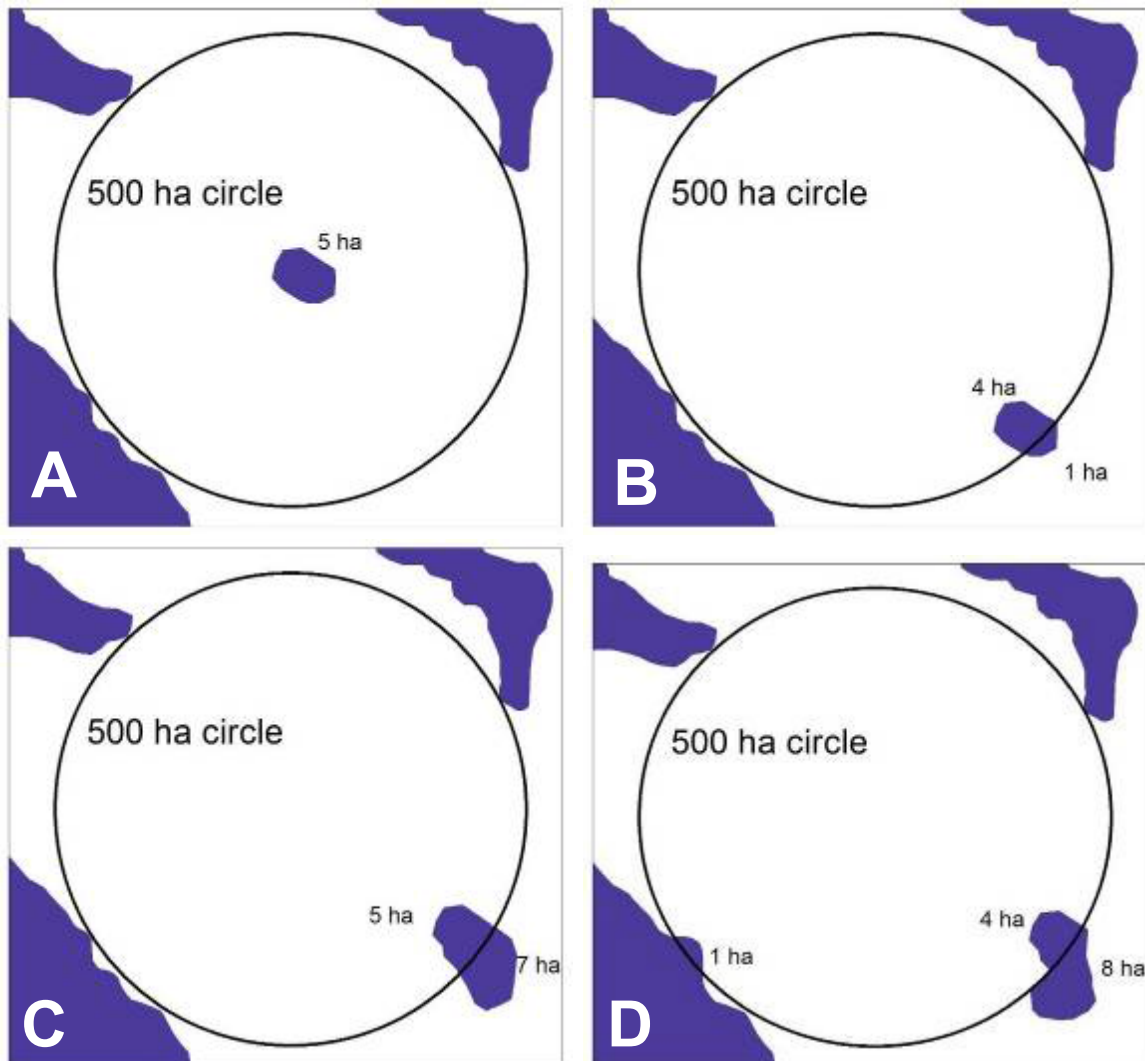
Eastern small-footed myotis	<i>Myotis leibii</i>
Southern flying squirrel	<i>Glaucomys volans</i>
Striped skunk	<i>Mephitis mephitis</i>
White-tailed deer	<i>Odocoileus virginianus</i>
Wolf	<i>Canis lupus</i>
Wolverine	<i>Gulo gulo</i>
Woodland caribou	<i>Rangifer tarandus caribou</i>

Diseases

Beech bark disease	<i>Nectria coccinea</i> var. <i>faginata</i>
Butternut canker	<i>Sirococcus clavigignenti-juglandacearum</i>
White pine blister rust	<i>Cronartium ribicola</i>

Appendix 3.2a – Example of the implementation of the 5 ha patch size requirement in Section 3.2.2.2

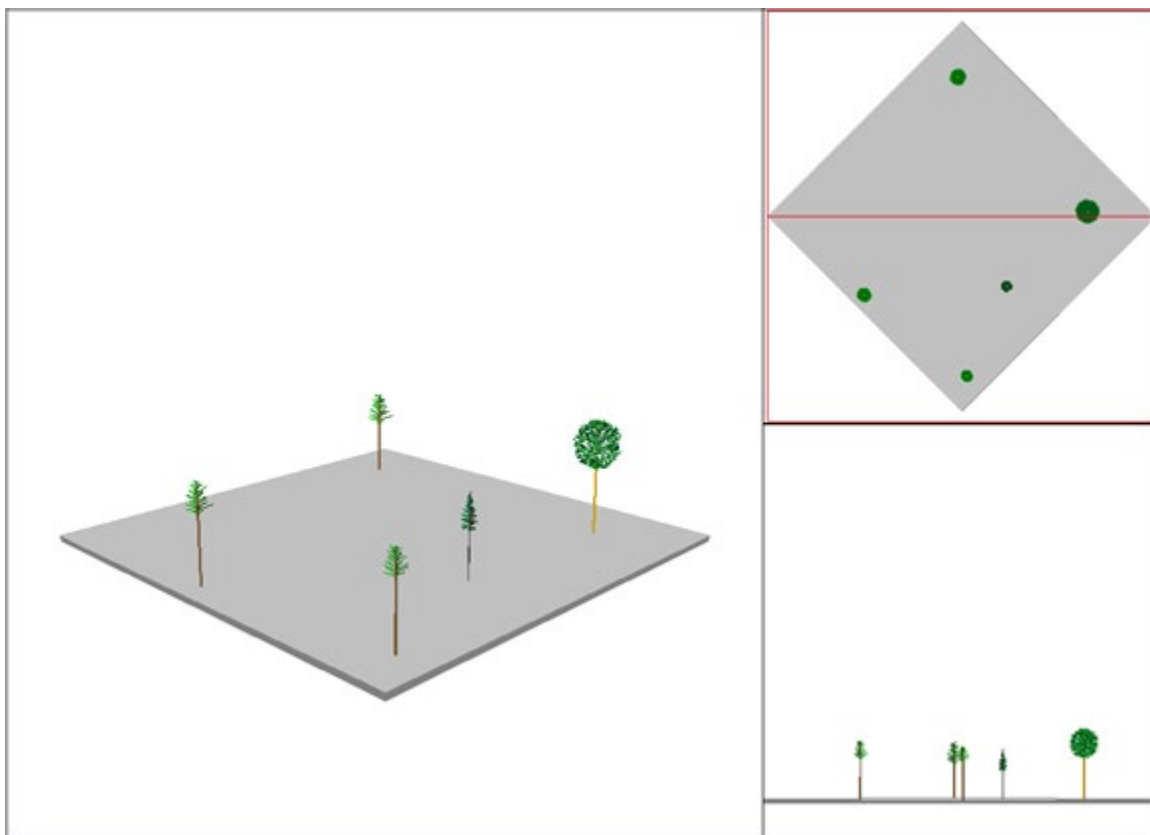
The 5 ha requirement can be satisfied by a single 5+ ha patch completely contained within the 500 ha assessment area (A), a single 5+ ha patch partially within the circle with at least 5 ha within the assessment area (C), or several 5+ ha patches partially within the 500 ha assessment area whose combined area within the assessment area is at least 5 ha (D). A single 5 ha patch that is not entirely within the assessment area (B) or several 5+ ha patches partially within the 500 ha assessment area with a combined area less than 5 ha (not shown) would not be acceptable.



Appendix 3.2b - Graphical examples of post-harvest stand structure created by application of the wildlife tree direction in Section 3.2.3.1

Example A: Clearcut harvest

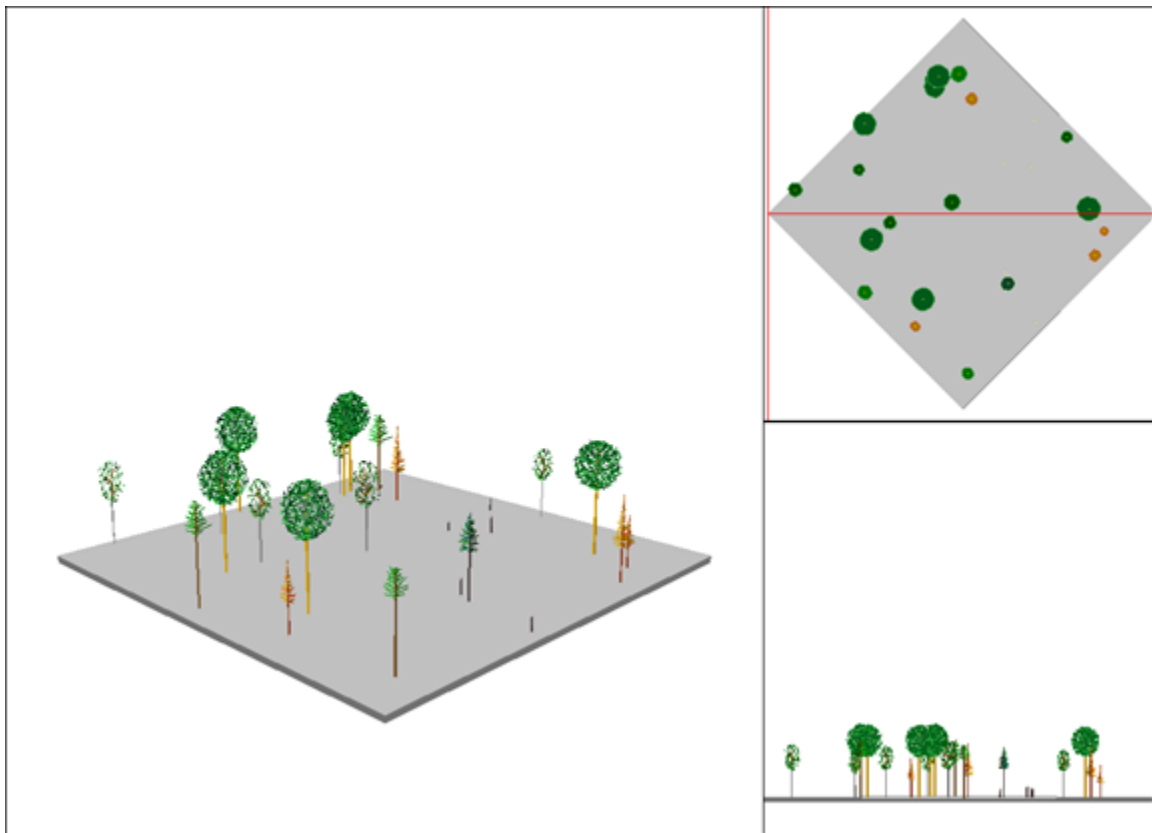
The following figure depicts a hypothetical 1 ha block of forest that meets the minimum wildlife tree direction for clearcut harvests (i.e., ≥ 5 large living and/or dying trees/ha). In this case, the operator has left 1 large living trembling aspen (oval crown) and 4 large living conifers (pyramidal crowns) with existing cavities or the potential to develop cavities. While this condition is acceptable on individual hectares within a cutblock, wildlife tree retention within any 10 ha portion of a cutblock must meet the following additional direction including an average of ≥ 25 wildlife trees/ha and an average of ≥ 10 large stems or large stubs/ha.



Example B: Clearcut harvest

The following figure depicts a hypothetical 1 ha block of forest that meets all wildlife tree standards and guidelines for clearcut harvests. The operator has left:

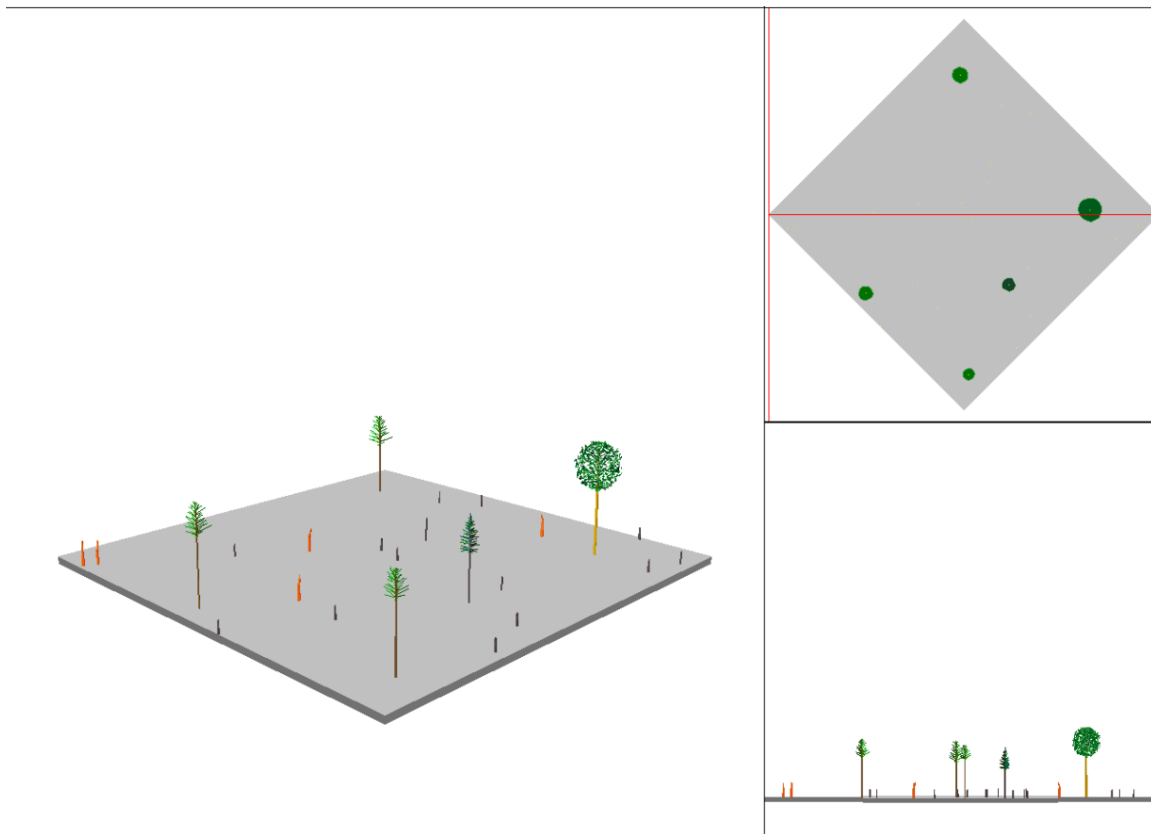
- 25 wildlife trees/ha (direction is an average of $\geq 25/\text{ha}$), comprised of:
 - 10 large living trees – mix of trembling aspen (large, oval crowns) and conifers (green, pyramidal crowns) with existing cavities or the potential to develop cavities (direction is an average of ≥ 10 large stems/ha with a minimum of 5 large living and/or dying trees/ha), and
 - 15 other stems – mix of small trembling aspen (small, oval crowns), small safe dead conifers (brown, pyramidal crowns), and small stubs (black sticks) (direction is additional wildlife trees may be safe standing dead trees, small stubs, or any other living trees; stubbing is encouraged as a best management practice).
- Wildlife trees are well-dispersed; at least 10 individual stems/ha.



Example C: Clearcut harvest

The following figure depicts a hypothetical 1 ha block of forest that meets all wildlife tree standards and guidelines for clearcut harvests. The operator has left:

- 25 wildlife trees/ha (direction is an average of $\geq 25/\text{ha}$), comprised of:
 - 5 large living trees – 1 trembling aspen (oval crown) and 4 conifers (pyramidal crowns) with existing cavities or the potential to develop cavities – and 5 large stubs (orange sticks) (direction is an average of ≥ 10 large stems/ha with a minimum of 5 large living and/or dying trees/ha)
 - 15 small stubs (black sticks) (direction is additional wildlife trees may be safe standing dead trees, small stubs, or any other living trees; stubbing is encouraged as a best management practice).
- Wildlife trees are well-dispersed; at least 10 individual stems/ha.

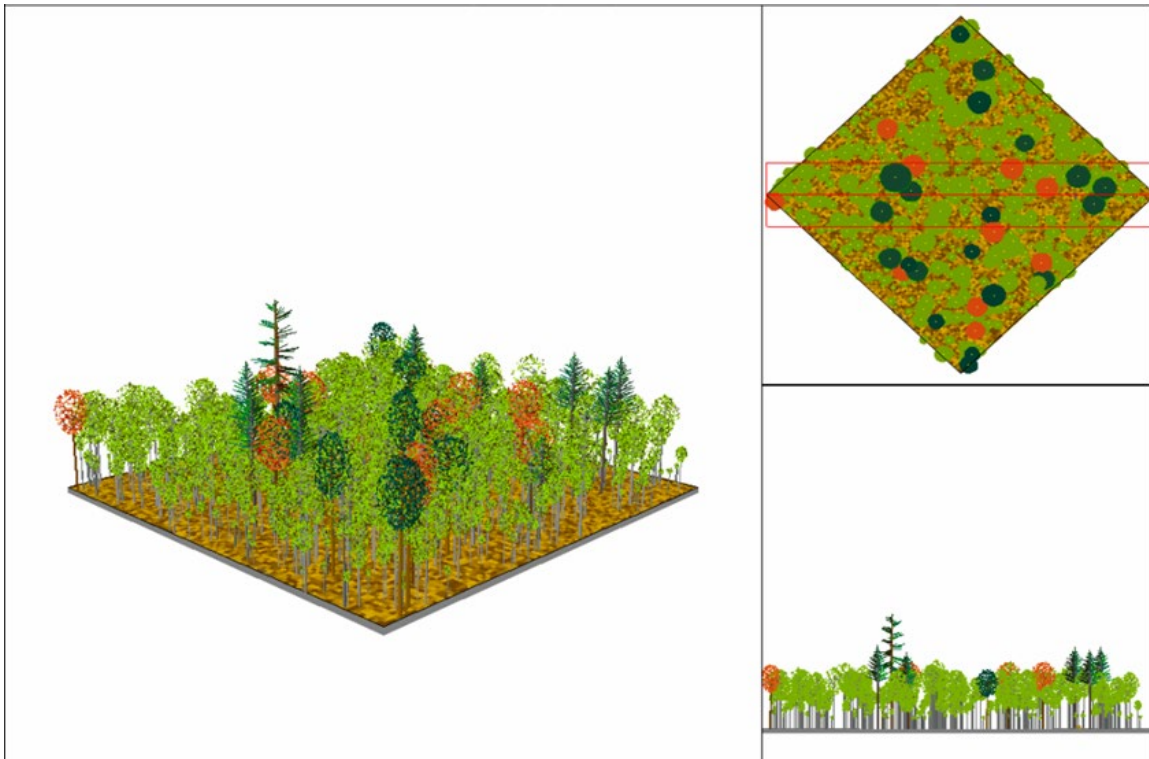


Example D: Selection harvest

The following figure depicts a hypothetical 1 ha block of forest that meets all wildlife tree standards and guidelines for tolerant hardwood selection harvests. Tree markers retained:

- 10 living cavity trees – tolerant hardwoods (dark green oval crowns) with existing cavities or the potential to develop cavities (direction is an average of ≥ 10 living cavity trees or large stubs/ha with a minimum of 5 living and/or dying cavity trees on each hectare)
- 10 scattered conifers (pyramidal crowns) (direction is an average of ≥ 10 /ha), including 1 pine supercanopy tree (tallest of the conifers shown) (mandatory direction is an average of ≥ 1 /ha)
- 10 mast trees – healthy dominant and co-dominant beech trees (orange oval crowns) (direction is an average of ≥ 10 /ha)
- Wildlife trees are well-dispersed.

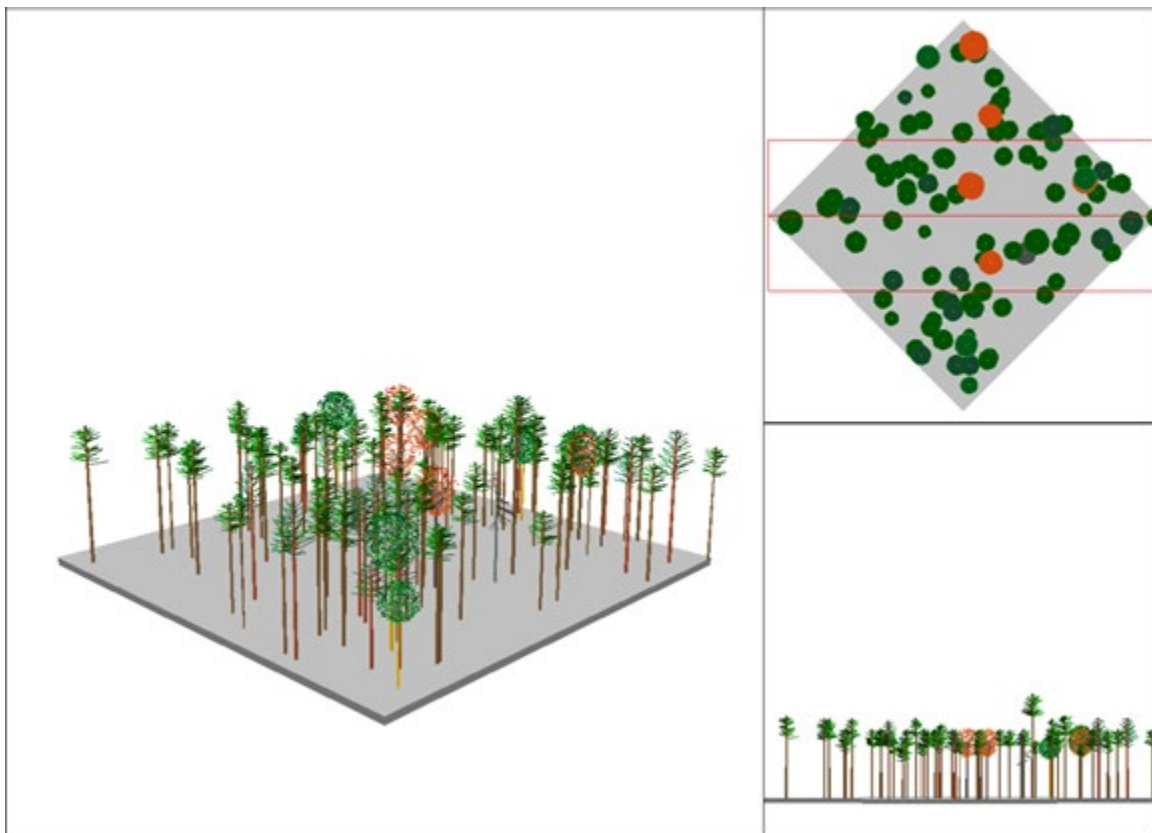
The other pale green trees were left for silvicultural purposes.



Example E: White pine shelterwood regeneration harvest

The following figure depicts a hypothetical 1 ha block of forest that meets all wildlife tree standards and guidelines for white pine shelterwood regeneration harvests. Tree markers retained:

- 10 living cavity trees – mix of trembling aspen (dark green oval crowns) and pines (pyramidal crowns) with existing cavities or the potential to develop cavities (direction is an average of ≥ 10 living cavity trees or large stubs/ha with a minimum of 5 living cavity trees on each hectare)
- 5 mast trees – healthy dominant and co-dominant oaks (orange oval crowns) (direction is an average of ≥ 10 /ha when available - in this case, all oaks present were retained)
- 1 pine supercanopy tree (tallest of the conifers shown) (direction is an average of ≥ 1 /ha)
- 84 pine crop trees - crop trees address direction of ≥ 10 scattered conifers/ha
- Wildlife trees are well-dispersed; at least half as individual stems.

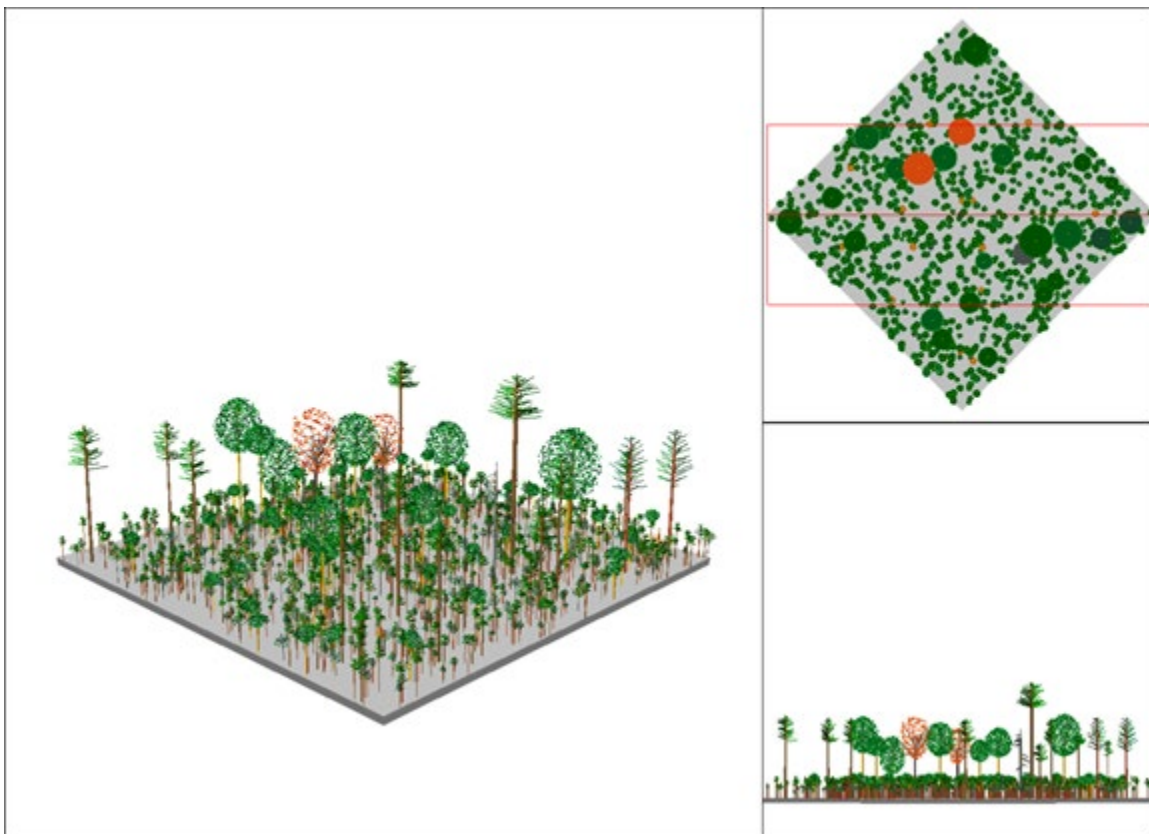


Example F: White pine shelterwood final removal harvest

The following figure depicts a hypothetical 1 ha block of forest that meets all wildlife tree standards and guidelines for white pine shelterwood final removal harvests. Tree markers retained:

- 25 wildlife trees/ha (direction is an average of ≥ 25 stems/ha), comprised of:
 - 10 living cavity trees – mix of trembling aspen (green oval crowns) and pines (pyramidal crowns) with existing cavities or the potential to develop cavities (direction is an average of ≥ 10 living cavity trees or large stubs/ha with a minimum of 5 living cavity trees on each hectare)
 - 10 veteran trees – mix of healthy, dominant and co-dominant pines (pyramidal crowns) and oaks (orange oval crowns) (direction is an average of ≥ 10 veteran trees/ha with a minimum of 5 on each hectare)
 - 1 pine supercanopy tree (tallest of the conifers shown) (direction is average of ≥ 1 supercanopy tree/ha)
 - 4 other pines - not necessarily healthy, dominant or co-dominant trees (direction is additional wildlife trees may be safe standing dead trees, small stubs, or any other living trees).
- Wildlife trees are well-dispersed; at least 10 individual stems/ha.

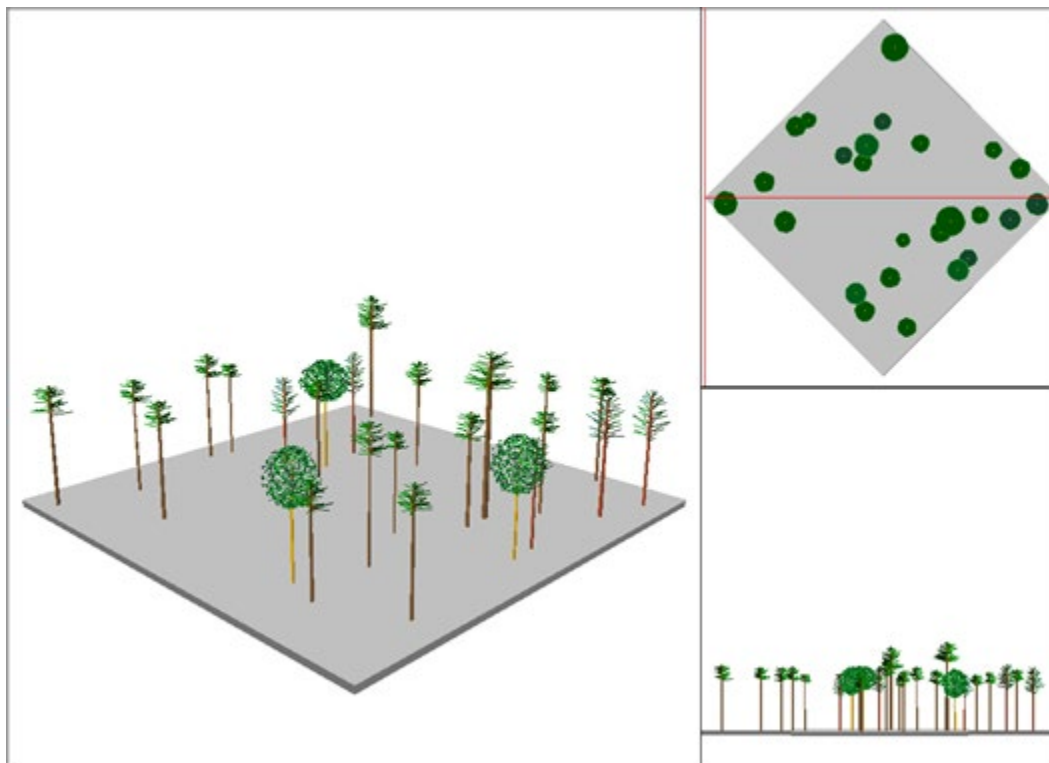
The short green stems represent regeneration (too small for wildlife trees).



Example G: White and red pine seed tree harvest

The following figure depicts a hypothetical 1 ha block of forest that meets all wildlife tree standards and guidelines for white and red pine seed tree harvests. Tree markers retained:

- 25 wildlife trees (direction is an average of $\geq 25/\text{ha}$), comprised of:
 - 10 living cavity trees – mix of trembling aspen (oval crowns) and pines (pyramidal crowns) with existing cavities or the potential to develop cavities (direction is an average of ≥ 10 living cavity trees or large stubs/ha with a minimum of 5 living cavity trees on each ha)
 - 15 healthy dominant and co-dominant pine seed trees – seed trees count as veteran trees (direction is an average of ≥ 10 veteran trees/ha with a minimum of 5 on each hectare)
 - 2 of the pine cavity trees are also supercanopy trees (tallest of the conifers shown) (direction is average of ≥ 1 supercanopy tree/ha).
- Wildlife trees are well-dispersed; at least 10 individual stems/ha.



Appendix 4.1a - Considerations for developing individual AOC operational prescriptions and conditions for provincially significant wetlands that mitigate potential effects on wetland features and functions and adjacent lands

Wetland function	Planned forest management activities	Potential impacts on function	Considerations for developing direction for provincially significant wetlands (PSWs) north of ecoregion 5E and adjacent lands
Hydrological - Water quantity/flow - Water quality	Harvest, renewal, tending	- Rutting/compaction - Erosion/sedimentation - Forest cover removal can result in thermal warming of water - Disruption of hydrological linkages between aquatic and terrestrial ecosystems - Short term post-harvest inundation (watering-up)	- To moderate water temperature, trap sediments, and filter nutrients, for more hydrologically sensitive portions of PSWs (marshes, fens), follow operational prescriptions for HPS lakes/ponds (30-90 m AOC) in section 4.1.1. - For less hydrologically sensitive portions of PSWs (swamps, bogs), follow operational prescriptions for LPS ponds (15-45 m AOC) in section 4.1.1. - For operations in adjacent lands that are linked to the PSW, follow conditions on regular operations for hydrological connections between terrestrial and aquatic ecosystems in section 4.1.4. - If planned harvest will exceed 25% of a catchment, consider scheduling harvest over multiple years to mitigate potential impacts of forest cover removal on water yield.
	Roads, landings, forestry aggregate pits, wood storage yards	- Erosion/sedimentation - Disruption of ground and subsurface hydrological function/flow	- No construction of roads, landings, forestry aggregate pits, or wood storage yards permitted within more hydrologically sensitive marsh/fen portions of PSW. - Apply conditions on roads, landings, forestry aggregate pits, and wood storage yards for standing water in section 4.1.1 in adjacent lands. - For less hydrologically sensitive portions of PSWs (swamps, bogs), follow conditions on roads, landings, forestry aggregate pits, and wood storage yards for all wetlands not addressed by operational prescriptions and conditions for AOCs in section 4.1.3. Permitting a road to cross these portions of a PSW may be acceptable if impact is deemed to be minimal and other feasible alternatives would result in undesirable ecological or socio-economic impact (e.g., crossing a PSW a narrow point to avoid the construction of additional roads/water crossings elsewhere). Consider winter road construction where practical and feasible.

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			• Permitting use (and associated maintenance) of existing roads, landings, forestry aggregate pits, and wood storage yards in a PSW may be acceptable if impact on significant wetland features/functions is deemed to be minimal and other feasible alternatives would result in undesirable ecological or socio-economic impact.
Biological Terrestrial/aquatic habitat	Harvest, renewal, tending	• Change in forest composition and structure in adjacent lands can lead to local habitat loss or alteration for terrestrial wetland species • Sedimentation in PSWs capable of providing fish habitat • Increased potential for introduction of invasive/exotic species	• Apply prescriptions/conditions as an overlapping AOC if they exist (e.g., heronry). • Develop AOC prescriptions/conditions if they do not exist as per FMPM. When developing an AOC, consider potential wetland wildlife and plant species habitat requirements that extend beyond the wetland boundary (e.g. suitable nesting sites, mature forest cover, early successional habitat). For example, the Natural Heritage Reference Manual (2010) suggests an adjacent lands AOC width of 120 m for wetland species that are dependent on adjacent lands for upland habitat.
	Roads, landings, forestry aggregate pits, wood storage yards	• Increased human activity	• Establish proximity limitations for new roads, landings, forestry aggregate pits, and wood storage yards where wetland dependent species (e.g., non-SAR amphibians, reptiles) that use adjacent lands to complete a portion of their life cycle are a significant biological feature. • Permitting use (and associated maintenance) of existing roads, landings, forestry aggregate pits, and wood storage yards in a PSW may be acceptable if impact on significant wetland features/functions is deemed to be minimal and other feasible alternatives would result in undesirable ecological or socio-economic impact.
Attribute • Species at risk, rare species • Critical/vulnerable habitat (concentrations of species, migration areas)	Harvest, renewal, tending Roads, landings, forestry aggregate pits, wood storage yards	• Change in forest composition and structure in adjacent lands can lead to local habitat loss or alteration for terrestrial wetland species • Sedimentation can reduce habitat suitability for aquatic species • Increased potential for invasive/exotic species • Increased human activity	Species at risk: • Apply SAR prescriptions/conditions as an overlapping AOC if they exist. • Develop SAR AOC prescriptions/conditions if they do not exist as per FMPM. Rare species, critical/vulnerable habitat: • If the PSW provides habitat for a rare plant community, an AOC width of 15 m would provide for the maintenance of the natural physical and chemical characteristics of aquatic resources. • Harvest, renewal and tending operations at an appropriate scale may be used to renew critical/vulnerable habitat within the AOC.

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			• Construct winter road or decommission or control access of roads once operations are complete if increased human access will potentially impact species or habitat. • If a PSW is an important waterfowl staging area, schedule forest management activities to avoid staging periods. • If introduction of invasive wetland plants is a concern for a PSW, develop conditions that prohibit new all-season road access (i.e., significant mineral soil disturbance) adjacent to the wetland boundary.

Appendix 4.1b – Determining self-sustaining trout lakes and ponds with a high risk of threat to sustainability from increased angling use and alien aquatic species establishment associated with new or improved access

i) Risk assessment considerations for self-sustaining brook trout lakes and ponds

All lakes and ponds with **self-sustaining** brook trout populations should be considered high risk if **new** or **improved** forest access roads are expected to increase **angler use** of the lake or pond (see Notes in Section 4.1.5 for definitions of bolded terms).

See additional considerations below that apply to all self-sustaining trout lakes.

ii) Risk assessment considerations for self-sustaining lake trout lakes less than 500 ha in size

When assessing whether **alien aquatic species** establishment might negatively impact the status of existing lake trout populations, lake size is an important consideration. Vander Zanden et al (1999) found that lake trout populations are more vulnerable to invasions of alien aquatic species, such as smallmouth bass, in lakes that lack pelagic prey-fish (i.e., cisco). In these lakes, alien aquatic species often outcompete lake trout for littoral prey-fish, which is typically their primary food source. In lakes where pelagic prey-fish exist, including cisco, lake trout may shift their diet to rely more on pelagic prey-fish which are generally not consumed by bass. Larger lakes typically support more complex fish communities, including cisco. Analysis of unpublished Aquatic Habitat Inventory (AHI) data for 9,437 Ontario lakes supplied by Nigel Lester (March 2020) indicates that the probability of presence of cisco increases to greater than 50% when lake surface area exceeds 500 ha. Thus, lake trout populations in larger lakes may be less impacted by alien aquatic species establishment.

All lakes less than a threshold size of 500 ha with self-sustaining lake trout populations should consequently be considered high risk (i.e., apply direction in Section 4.1.5) if new or improved forest access roads are expected to increase angler use of the lake. However, if a comprehensive lake inventory exists that confirms the presence of cisco or other pelagic prey-fish for a lake less than 500 ha in size, the risk assessment described in iii) should be applied as angling exploitation may still be a concern.

See additional considerations below that apply to all self-sustaining trout lakes when deciding to apply direction in Section 4.1.5.

iii) Risk assessment considerations for self-sustaining lake trout lakes 500 ha and greater in size

To determine whether lakes 500 ha and greater in size with self-sustaining lake trout are high risk, the assessment not only includes consideration of the potential increase in angler use from new or improved access, but also a consideration of the potential impact of this increased use on the sustainability of the population (considerations (1) and (2) in Figure 1). This additional consideration acknowledges that increased angler use may not always result in the over-harvest of lake trout populations in self-sustaining lake trout lakes.

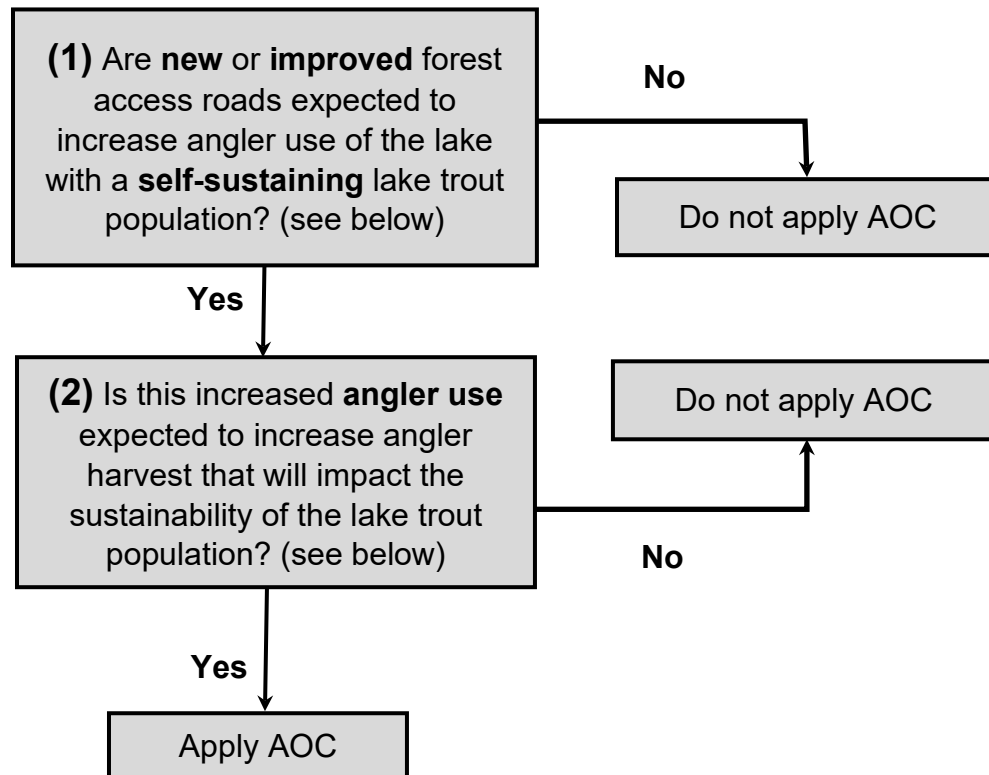


Figure 1. Decision key for assessing risk of new or improved forest access roads on the sustainability of self-sustaining populations of lake trout in lakes 500 ha and greater in size.

Consideration (1) in Figure 1

This consideration in the decision key acknowledges that new or improved access near a self-sustaining lake trout lake may not always result in increased angler use. For example, a new forest access road constructed near a self-sustaining lake trout lake will not result in increased use if the lake has a pre-existing boat launch.

Consideration (2) in Figure 1

For lakes 500 ha and greater in size with self-sustaining lake trout populations, the consequences of increased angler use on population sustainability must be considered (consideration (2) in Figure 1). This consideration is limited in scope to potential impacts from expected angler harvest from new or improved access alone. Often, site-specific

information about the status of existing populations of lake trout will be unavailable. In these cases, it is recommended that the evaluation be conducted using aggregated data and information such as those available for Fisheries Management Zones or Ministry administrative regions.

Information from Lester et al (2021) can be used to assess whether increased angler use might result in unsustainable lake trout harvest in lakes 500 ha and greater in size. They provide a detailed lake trout model to estimate maximum sustainable level of angling effort intensity (E_{MSY} , in h/ha). Using survey data from the Aquatic Habitat Inventory, the model was used to calculate E_{MSY} for surveyed lakes in Ontario. Mean E_{MSY} for lakes 500 ha and greater in size by fisheries management zone and lake size class (500-1,500 ha, 1,501-5,000 ha, >5,000 ha) are presented in Table 1.

With data from Ontario's Broadscale Monitoring program (BsM) (September 2020), estimates of average lake trout targeted angling effort intensity (h/ha) on lake trout lakes for each Ministry administrative region are presented in Table 2. These estimates are subject to change as additional BsM data become available. Practitioners are encouraged to search for revised data before using these estimates.

Table 1. Average estimated angling effort intensity at maximum sustainable yield (E_{MSY} in h/ha/yr) for lakes greater than 500 ha by FMZ and lake size class. E_{MSY} values in brackets represent 68% confidence interval (CI). E_{MSY} values in bold indicate that the upper bounds of 68% CI for current average lake trout targeted angling effort intensity (from Table 2) exceeds lower bounds of 68% CI for mean E_{MSY} . If angling effort intensity exceeds E_{MSY} , lakes that fall into that FMZ/size class should be designated as high risk.

Ministry Region	FMZ	E_{MSY} (h/ha/yr)		
		500-1,500 ha	1,501-5,000 ha	>5,000 ha
Northwestern	2	2.8 (2.6-2.9)	1.8 (1.7-1.9)	1.7 (1.6-1.8)
	4	2.9 (2.7-3.0)	2.3 (2.2-2.4)	1.8 (1.7-1.9)
	5	3.6 (3.5-3.7)	2.9 (2.8-3.0)	2.4 (2.2-2.5)
	6	3.4 (3.3-3.6)	2.6 (2.4-2.7)	1.7 (1.5-1.9)
Northeastern	7	2.9 (2.7-3.1)	2.4 (2.2-2.6)	2.0 (1.8 - 2.2)
	3	1.7 (1.7-1.7)	no data	no data
	8	2.7 (2.5-3.0)	2.0 (1.9-2.2)	1.7 (1.7-1.7)
	10	3.5 (3.4-3.6)	2.5 (2.3-2.7)	1.8 (1.6-2.1)
	11, 12	3.5 (3.3-3.7)	2.6 (2.3-2.9)	2.0 (1.8-2.1)
Southern	15	3.3 (3.2-3.4)	2.8 (2.7-2.9)	2.5 (2.4-2.6)
	18	2.9 (2.7-3.1)	2.1 (1.9-2.3)	no data

Table 2. Average lake trout targeted angling effort intensity (h/ha/yr) from BsM data for lakes greater than 500 ha by Ministry administrative region and lake size class. Angling effort intensity values in brackets represent 68% confidence interval (CI).

Ministry Region	Angling effort intensity (h/ha/yr)		
	500-1,500 ha	1,501-5,000 ha	>5,000 ha
Northwestern	1.4 (1.1-1.8)	1.6 (1.2-1.9)	1.4 (1.1-1.6)
Northeastern	3.5 (2.2-5.5)	1.9 (1.6-2.3)	2.4 (1.8-3.0)
Southern	6.4 (5.5-7.3)	6.1 (4.7-7.5)	6.3 (5.0-7.6)

If the estimated angling effort intensity on a lake or pond with self-sustaining lake trout exceeds the estimated angling effort intensity at maximum sustainable yield, the waterbody should be designated as high risk.

See additional considerations below that apply to all self-sustaining trout lakes.

Kaufman et al (2009) provides an alternate approach to estimate open water season and winter fishing effort on lake trout lakes where angling effort is divided by lake size (ha) to obtain angling effort intensity. These authors estimated models of angling effort on Northeast Region lakes with lake trout from factors including lake size, access type, and travel time to different size communities of people. These model estimates, therefore, can provide estimates of angling effort intensity that account for some contextual factors beyond region and lake size.

iv) Risk assessment considerations that apply to all self-sustaining trout lakes

- Generally, for lakes or ponds without pre-existing access, if a new road is proposed or an existing road that is to be improved is located within 1,000 m of a lake or pond with a self-sustaining trout population, there is a higher potential that it will result in increased angler use of the lake or pond (Hunt and Lester 2009).
- Any existing use management strategies identified in the FMP (e.g., efforts in place to control access) for roads or road networks within the vicinity of lake or pond also need to be considered when determining if any planned access may result in increased angler use of the lake or pond.
- A high-risk designation for potential unsustainable harvest and/or alien aquatic species introduction should also be informed by expert judgement and local knowledge that brings regional and local contextual factors into the evaluation including but not limited to:
 - Fishing regulations (e.g., regulations that close winter fishing on brook trout and/or lake trout, regulations that ban live bait);

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- Expected demand for angling use at the lake (e.g., available fishing alternatives, fishing quality, number of anglers who reside nearby, regional patterns of fishing activity, and available technology to the angler such as tools that increase fishing effort or the harvest efficiency of effort).; and
 - Local site conditions (e.g., fish species, lake size, topography, soils).
- The risk assessment (high or not high risk) for self-sustaining trout populations also requires an estimation of confidence. When confidence in the assessment is low, the AOC should be applied to be consistent with a precautionary principle approach. The confidence assessment should focus on available information used to decide whether; 1) new or improved forest access roads will increase angler use of lakes and ponds, and for lake trout in lakes 500 ha and greater, 2) increased angler use will result in potentially unsustainable angling effort intensity. Gaps in knowledge and understanding that prevent greater confidence in the assessment should be identified and addressed through additional science-based activities.

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Appendix 4.2 – Assessing the potential impact of forest management operations on nesting birds

Forest management operations (excluding nest monitoring) that may potentially disturb nesting birds are classified as high, moderate, or low impact operations in Section 4.2.2 based on the following six criteria:

Criterion	Description and score
A	Duration of individual events (e.g., a truck driving past a nest is a discrete event): 1. Seconds 2. Minutes 3. Hours
B	Number of individual events per day: 1. Few (<5) discrete events 2. Many (≥5) discrete events 3. Events are continuous (e.g., harvest operation)
C	Time period over which events occur during the breeding season: 1. Minutes 2. Hours 3. Days
D	Detectability of events at nest: 1. Low likelihood of being heard or seen 2. Likely to be heard 3. Likely to be seen
E	Number of pedestrians involved in activity: 0. None 1. Few (<5) 2. Many (≥5)
F	Number of small (e.g., chainsaws) or large (e.g., skidders) pieces of equipment involved that produce noise: 1. None 2. One large or a few (<5) small pieces of equipment

The overall score = $[(A+B+C)*(D+E+F)]/36$

A score ≥ 0.67 suggests a HIGH potential impact

A score ≥ 0.33 suggests a MODERATE potential impact

A score < 0.33 suggests a LOW potential impact

For example, a mechanical harvesting operation involving 1 or more feller bunchers, 1 or more grapple skidders, and many people that could be heard for numerous weeks from an osprey nest would score a 2 for criterion A, a 2 for criterion B, a 2 for criterion

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C, a 1 for criterion D, a 2 for criterion E, and a 2 for criterion F for a total score of 0.83 (high potential impact).

A small crew of tree planters working around an osprey nest in a cutover for 1 day would score a 2 for criterion A, a 2 for criterion B, a 1 for criterion C, a 2 for criterion D, a 1 for criterion E, and a 1 for criterion F for a total score of 0.56 (moderate potential impact).

One truck hauling within sight of an osprey nest (>5 loads per day) for a week would score a 0 for criterion A, a 1 for criterion B, a 2 for criterion C, a 2 for criterion D, a 0 for criterion E, and a 1 for criterion F for a total score of 0.25 (low potential impact).

The above approach can be used to rate the potential impact of any proposed activity. The following table provides some examples of how common activities typically rank using the above approach.

Potential Impact	Examples
High	Harvest operation Large tree plant (≥5 people) if visible Mechanical site preparation Road construction
Moderate	Ground (airblast) herbicide application Large tree plant if not visible Small tree plant if visible Small crew using brushsaws
Low	Aerial application of herbicides Boundary/tree marking Hauling Routine road maintenance (e.g., grading)

Note: For complex operations, the cumulative potential impact of all concurrent activities should be assessed. For example, when a harvest operation involves concurrent felling, skidding/forwarding, roadside delimbing, slashing, and loading, all activities should be included in the evaluation of potential impact.

Appendix 5.2a – Measuring rutting and extraction trail coverage and defining roadside work areas

The following methodologies are recommended for measuring rutting and extraction trail coverage and defining roadside work areas. Planning teams may choose to adjust or expand upon locally.

Measuring rut depth and length

- Measure rut depth from the top of the soil surface, including organic layers (LFH) if present. Figure 1 provides examples from which local determinations can be expanded.

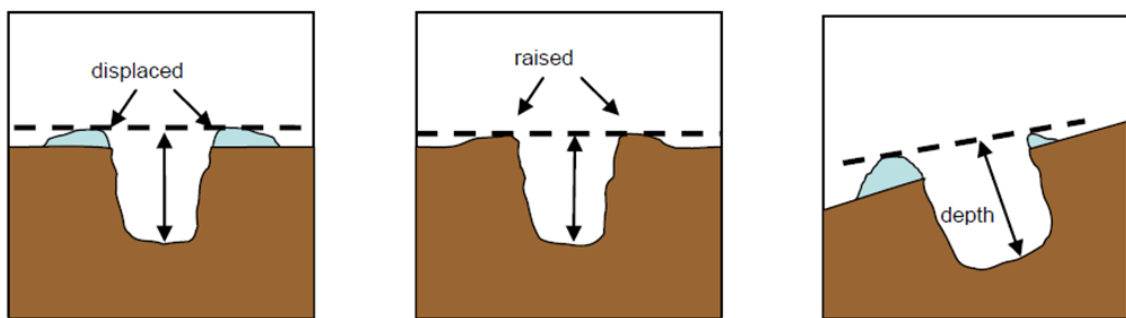


Figure 1. Approach to measuring rut depth.

- When the depth varies across the width of the rut (i.e., perpendicular to the direction of travel), the deepest point is to be measured as the depth.
- When a rut has been filled, or partially filled with soil, litter, water, or debris, the depth will be measured as if the rut had not been filled. This includes areas in organic soil where churning and mixing of surface and sub-surface organic layers has occurred. In some circumstances it will be difficult to determine the unfilled depth.
- When determining if a potential rut is at least 4 m long, the length is measured as the contiguous portion that is deeper than 30 cm (or depth to bedrock / large boulders) and is not to be an average depth measurement where some of the length is less than 30 cm deep.

Measuring rutted extraction trail coverage of any 20 ha area in selection and shelterwood (including irregular shelterwood) silviculture systems and commercial thinning

- Identify a continuous 20 ha area (~450 m x 450 m or as block boundaries permit) where it is suspected the block-level rutting threshold of 900 m of extraction trails has been exceeded based on observations (e.g., during a ground inspection or from drone-captured aerial imagery). Exclude roads, roadside work areas,

landings, and the first 30 m of any extraction trail that originates from a landing from the assessment area.

- Measure the length of extraction trails that are rutted in the 20 ha area by measuring how many meters of extraction trail are either single (i.e., only one wheel track) or double rutted (i.e., both wheel tracks). Where parallel trails exist and where total width exceeds 7 m, measure parallel trails separately as independent trails.

Measuring rut coverage (clearcuts, excluding commercial thinning) or extraction trail coverage (selection, shelterwood, and commercial thinning) of any 20 ha area using the line transect method

- Stratify block to delineate areas where the direction applies;
 - Exclude roads, landings, and roadside work areas
 - Define the area of clearcut, shelterwood, and selection harvest
 - Define the area of shallow soils in clearcut areas.
- To layout transects, select the center of a 250 m radius circular plot (20 ha) covering the most disturbed area in the block (Figure 2). For a quick, preliminary assessment to determine if rut or trail coverage may be approaching the allowable threshold, establish three random, 100-pace transects, offset by 120°, within the 20 ha plot.
- Walk each of the three 100-pace transects. Count every time a pace (1 pace = 2 steps) intersects a rut or trail. The percent cover of ruts or trails would be the total number of paces on the three transects that intersect a rut or trail divided by the total 300 paces surveyed. For example, if 30 of a total 300 paces fell over top of a rut or trail, coverage would be 10%.
- If the percent coverage of ruts or trails for the three transect lines is approaching or exceeds the threshold using the preliminary pace assessment, a more accurate (and intensive) assessment will need to be conducted. Switch from pace-based transects to transects measured in meters. Establish three 100 m transects and measure the total length (m) of ruts or trails that intersect the three transects. The percent coverage of ruts or trails would be the total number of meters of ruts or trails measured along the three transects divided by the total 300 m of transects surveyed. Additional 100 m transects may need to be established within the 20 ha plot for a more accurate assessment if rut or trail coverage is very close to the threshold (e.g., +/- 5%).

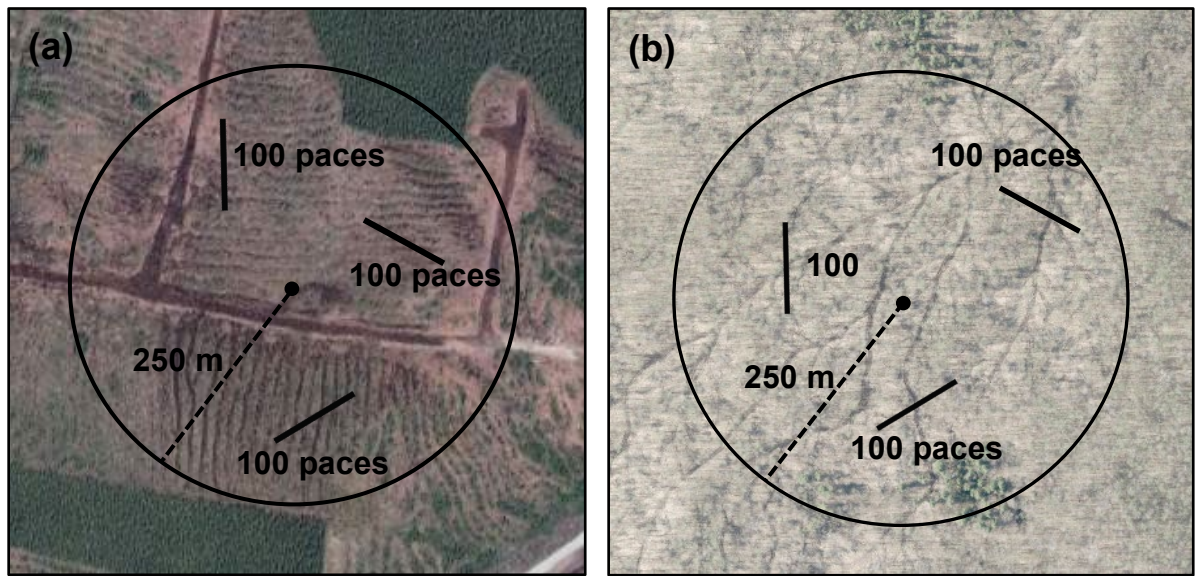


Figure 2. Plot layout to do a preliminary assessment of percent coverage of ruts (a) and extraction trails (b) for a 20 ha area using 100-pace (1 pace = 2 steps) transects.

Defining roadside work areas

Roadside work areas include areas at the edge of the road where concentrated activity other than skidding (e.g., piling, delimbing, slashing, chipping, slash piling) is necessary to receive and process wood from the rest of the harvest area. The roadside work area can extend up to 1.5 tree-lengths (e.g., 30 m) from the edge of the road and may only occur along the length of some portions of the road, depending on the pattern of operations. Operations that process in the block and deliver wood to roadside may have a narrower roadside work area than full-tree and tree length operations.

Appendix 5.2b – Suggested strategies and techniques to minimize site disturbance during harvest, renewal, and tending operations

i) Rutting and compaction

- Encourage advanced planning of access within the block (i.e., skid trails and landings) by the operator and/or supervisor.
- Identify and locate primary trails and convergence zones where the ground has the greatest load-bearing capacity.
- Limit and flag the number of main skid trails and ensure all operators are aware of their location.
- In fully mechanized operations, limit travel of forwarder and skidder to harvester trails.
- Consider strengthening main trails and convergence zones with slash matting where damage is likely to occur. In some cases, gravelling of main skid trails should be considered.
- Keep skid trails as straight or as gently curving as possible.
- In clearcut systems, normally distribute skid trails widely, while avoiding wet or other susceptible areas. In partial cut systems, normally concentrate skid trails to minimize the extent of damage to residual stems.
- Forwarding/skidding should not deviate from designated extraction trails.
- When only a few machine passes can create a significant risk of compaction or rutting, concentrate machine traffic on main trails and mitigate any damage that occurs (i.e., do not disperse traffic).
- Recognize that some damage to main trails should be anticipated as a cost of minimizing damage to residual trees and rest of site and have a plan to mitigate and/or rehabilitate damage on main trails.
- In partial cut systems, winch as much wood as possible to the skidder to minimize the extent of skid trails.
- Use high floatation equipment if summer logging includes large areas of organic soil and monitor closely to ensure damage is minimal.
- If it is not possible to avoid susceptible wet areas such as swales, seeps, and wetlands:
 - Reach into them with a felling head or winch wood out of them using conventional cut and skid systems
 - Use feller-bunchers to cut and move bunches to solid ground
 - Use “hoe-chucking” (e.g., excavator) to move wood to solid ground
 - Use brush and tops to increase load-bearing capacity of the soil, recognizing some disturbance may occur
 - If machine traffic must enter a wet area, avoid crossing the entire width, but rather approach from both sides and reach into middle.
- On sites susceptible to compaction and rutting, place slash in front of machines when using cut-to-length systems that limb and top on site.

- Recognize that use of slash matting or other mitigative techniques may disguise some types of soil disturbance and consider moving blocks if excessive use of mitigation is required.
- Minimize disturbance/removal of soil organic layers and topsoil during harvesting and site preparation operations.
- Operations should be undertaken or discontinued based on actual compaction and rutting which is occurring. As examples:
 - In late winter/early spring, if frost conditions permit, it may be possible to operate overnight until mid-morning and cease operations when the ground warms up in the afternoon
 - A shut down for a few days may be required after a period of high precipitation.
- Whenever possible, non-productive areas (such as rock outcrops) or other relatively high load-bearing soils should be selected for landing sites.
- Daily on-site planning is important. Operators need to be competent, properly trained, and aware of the objectives and plans for specific sites.
- Frequently monitor operations (both during and after) to mitigate any damage that may occur and better forecast where future problems may occur.
- In winter conditions where the soil is not adequately frozen, compacting snow with a feller-buncher prior to wood extraction or blading off some snow from trails and landings, will allow frost to penetrate deeper. Allow sufficient wait time in sub-zero temperatures (at least overnight) for the soil to freeze.
- Skid or forward wood as soon as possible to avoid the “watering up” that can occur within days after felling.
- Where possible, locate roads and landings so that skidding can occur in a downhill direction. Adjust strategy as necessary when working on erosion-prone soils.
- Where possible, turn machinery on roads or on other high strength soil rather than in cutblock.
- Where machine design permits (e.g., some forwarders), travel empty in reverse to avoid soil damage caused by turning.
- On high hazard sites (see Appendix 5.2b), or when conditions are such that rutting can occur, reduce skidder loads to distribute weight evenly on all wheels (rule of thumb – 2/3 of a full load).

ii) Erosion

- Where safety permits, skid across slopes and avoid skidding with slope.
- Avoid road and landing layout that requires skidding or forwarding up or down steep slopes.
- Where skidding or forwarding with the slope is necessary:
 - Consider dispersing traffic so repeat traffic does not cause rutting and/or compaction
 - use chains or other implements to increase traction to avoid tearing root mat and organic layers
 - avoid turning on slope to minimize tearing of root mat and organic layers.

- Consider extremely steep slope areas as inoperable and avoid machine travel. The specific steepness threshold should be determined locally, based on site conditions and available machinery.
- Consider the use of winter-only operations on very high-hazard sites (e.g., very fine sand with thin organic layers).
- Avoid harvesting areas where tree removal (and associated root decay) is likely to increase erosion damage (e.g., discontinuous shallow organic layer over bedrock).
- Where possible, use low or no mineral soil exposure renewal and site preparation options such as natural regeneration, direct planting, manual site preparation, or mechanical mounding in steep and/or erosion-prone areas.
- Where safety permits, ensure site preparation runs across the slope and avoid aligning with slope.
- Site prepare to provide the minimum amount of mineral soil exposure to achieve silviculture objectives. On high-hazard sites, favour mounding over continuous trenching or broadcast site preparation (e.g., blading, ploughing).
- Within the limits of operational efficiency, use the smallest prime-mover possible to achieve site preparation goals.
- Schedule timely renewal and select fast-growing species in steep or erosion prone areas.
- Identify ruts or furrows on slopes that are channeling runoff and causing erosion. Limit further erosion by filling these ruts with slash, debris, or non-erodible soil.
- Divert mid-slope ruts that are, or are likely to, channel water with cross drains, obstacles, or berms (i.e., water bars). This is particularly applicable to extraction trails in partial harvest systems.
- On high-hazard sites, frequently monitor operations (both during and after) to mitigate any damage that may occur and better forecast where future problems may occur.
- Where possible, disperse unutilized slash over areas that are prone to erosion (e.g., fine sands that are easily eroded by wind and on slopes).

iii) Nutrient Loss

- Give preference to logging methods that leave debris and unutilized fibre in the block (e.g., cut-to-length, tree length) over logging methods that process and pile debris and unutilized fibre at roadside (e.g., full-tree).
- Use winter harvest operations to conserve nutrients on site (leaf fall and root stores).
- Where possible, re-distribute unutilized slash and chipper debris back over block in a manner that will not interfere with silviculture or diversity objectives.
- Retain a diversity of tree and shrub species on site, including hardwood species and alders, to improve capture and cycling of nutrients.
- Leave some trees (potentially non-crop trees) un-harvested to serve as nutrient sinks to capture mobile ions made available immediately following harvest and site preparation.

- On very shallow soil sites, or sites with undulating topography, use high flotation (low impact) equipment to maintain surface organic layer integrity and prevent rutting or compaction in deeper soil inclusions. This is especially important during wet weather conditions when the organic layer or soil is saturated.
- Post-harvest prescriptions and renewal efforts should be carried out as quickly as possible on shallow soil sites to encourage full site occupancy. This should also help to prevent problems with erosion and loss of nutrients.
- Lower nutrient demanding species, such as jack pine, should be matched to nutrient-poor sites. Selection of fast-growing species is advisable to ensure timely renewal and reduce erosion risk.

iv) Loss of productive forest area

- All roads should be marked on the ground in advance of construction, preferably the corridor as well as the center line.
- Develop a block plan for operational roads and communicate plan to operators. Alternatively, encourage operators to develop a block plan in advance of harvesting and construction.
- Locate branch and operational roads to ensure operators are skidding the maximum cost-effective distance.
- Avoid excessive use of turn-arounds and loop roads.
- Use winter-only access options where delivery schedules and silviculture requirements permit.
- Pre-determine number and location of landings and communicate with the operator. Identify contingency landings to adapt to localized situations, such as encountering susceptible areas or unmapped streams that may change skidding plan.
- Use shovel equipment (excavator, backhoe, etc.) rather than bladed equipment (dozers, etc.) to build roads to minimize width of disturbed areas.
- Whenever possible, non-productive areas (such as rock outcrops) should be selected for landing sites.
- Where feasible, use equipment combinations that maximize distance between roads (e.g., forwarders).
- Where feasible, select machinery combinations that maximize within-block processing to minimize slash and debris piles.
- Practice environmentally friendly, zero discharge maintenance and re-fueling to ensure no soil contamination occurs.
- Pile roadside wood as high as safety permits to minimize area of landings.
- Keep bush inventories low by “hot logging” to minimize number of landings. This approach should be balanced with the potential for rutting and compaction as a greater area of the block converges on fewer landings.
- Where a use management strategy suggests a road will not be used in the long-term (e.g., operational roads), consider returning the roadbed to productive forest area. Roadbeds, log landings, loading areas, and turn-around areas can be treated and planted with trees or other plants appropriate for the site and consistent with other management objectives of the area.

- Educate supervisors and operators on short- and long-term effects of excessive conversion to non-forest to enable informed planning and decision-making.
- Where safety permits and other values will not be compromised, burn piles of slash, debris, and unutilized fibre.
- If long windrows of slash are created, breaks should be provided to allow animals, other forest users and operations unobstructed access routes across the right-of-way. A 10 m break every 100 m of windrow is a good target.
- Reduce thickness and footprint of debris on productive land through carry back, piling/spreading, or burning to make it more amenable to further silviculture treatment.
- Maximize use of unutilized processing debris for:
 - Road construction. (e.g., brush matting swamp crossings, fill wet holes, stabilize steep road banks, stabilize ditches)
 - Rehabilitation of gravel pits, borrow pits, or other human-caused unproductive sites.
- Use the following decision key (modified from Buda et al (2015)) to assist in making informed decisions about chipper debris management.

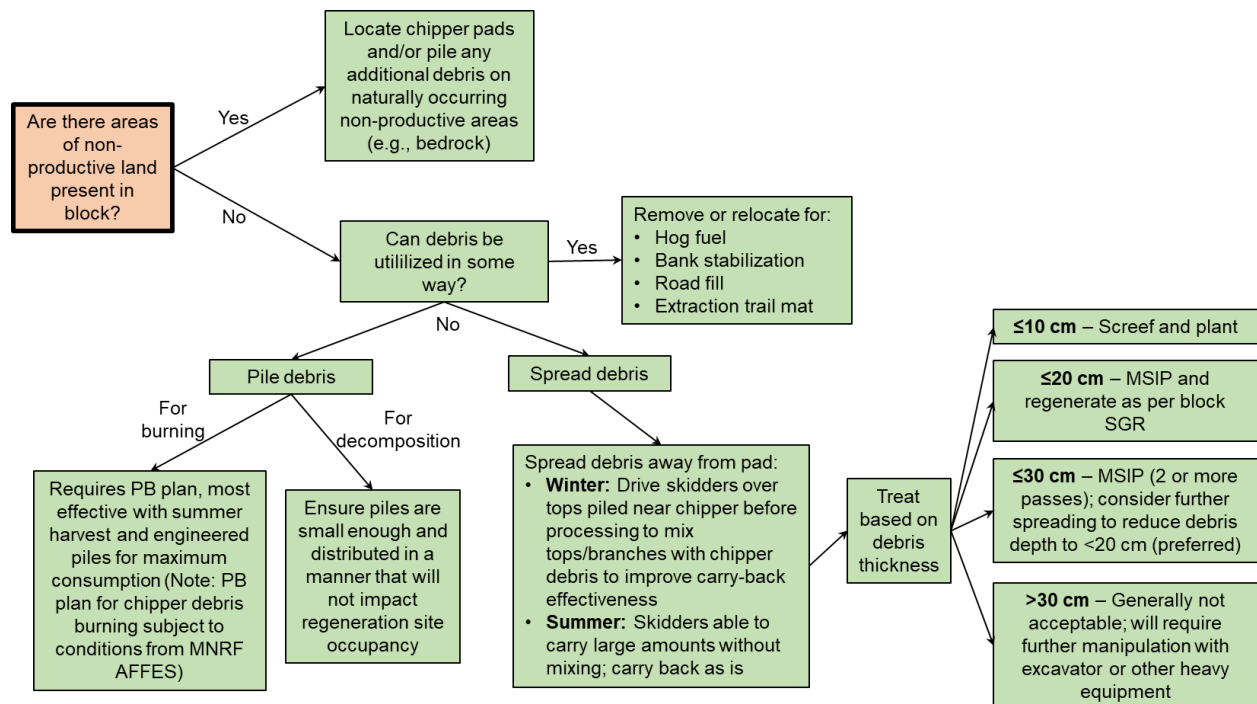


Figure 3. A chipper debris management decision key based on the recommendations of the northwestern Ontario Chipper Debris Working Group (modified from Buda et al (2015)).

Literature cited

Buda, N., J. Lane, D. Morris, G. Nishio, P. Poschmann and D. Reid. 2015. The Northwestern Ontario Chipper Debris Working Group: A summary of activities and

Revised Forest Management Guide for the Conservation of Biodiversity at the Stand and Site
Scales DRAFT

findings, 2011-2014. OMNRF, Science and Research Branch, Peterborough, ON.
Science and Research Information Report IR-04.

Appendix 5.2c – Site disturbance susceptibility tables

The following color codes apply to the site disturbance susceptibility charts. The soil descriptions generally follow the Ontario Institute of Pedology descriptions.

Rutting susceptibility

	Texture	Mineral			Organic			
	Depth	All <30cm	Sand 31+	Other 31+	Fibric all	Mesic all	Humic all	
Soil Moisture Condition	Wet							Low Low-mod Mod Mod-high High NA
	Moist							
	Dry							
	Frozen							

Erosion susceptibility

	Texture	All shallow mineral		Mineral other than silty		Silty		Organic - fibric		Organic – mesic/humic	
	Depth	0-5	6-30	31-60	61+	31-60	61+	21-40	41+	21-40	41+
Slope (%)	31+										
	11-30										
	0-10										

Nutrient loss susceptibility

	Texture	All shallow mineral			Sandy		Other mineral	Organic
	Organic Depth	0-5	6-20	0-5	0-5	6-20	All	All
	Mineral Depth	0-5	0-5	6-30	31-60	31-60	All	All
Logging method	Clearcut - full tree							
	Clearcut – tree length and cut to length							
	Partial harvest							

GLOSSARY

Active nests/colonies: Occupied nests/colonies (occupied colonies are those containing ≥ 1 occupied nest) where breeding activity has been confirmed or those at which breeding activity has not been confirmed, but for which there is compelling evidence of recent use.

AOC: Area of concern

BCR: Bird Conservation Region – Ecologically distinct regions in North America with similar plant and wildlife communities as well as similar soils, drainage, and climatic characteristics. There are 4 bird conservation regions within Ontario.

Bedding areas: Generally in reference to specific areas where cervids lie down or sleep. Bedding areas often have a seasonal and/or temporal aspect to their location and pattern of use (e.g., day and night).

Best management practice: A component of a guide that suggests a practice or strategy to help implement the overall purpose of the associated standard(s) and/or guideline(s).

Biofibre: Forest resources from Crown forests that are not normally being utilized for conventional forest products and that are made available under an approved forest management plan.

Browse: Twigs and foliage of tree and shrub stems that are consumed by one or more species of cervid. Species used and preferred as browse differ among cervid species. Usually, only the current annual growth is suitable and selected as browse, because it is more nutritious and palatable. However, older stems and twigs may be consumed, particularly when populations exceed habitat carrying capacity.

BSH: Brush and alder (a polygon type in the forest resources inventory of a forest management plan as defined in the *Forest Information Manual* and associated *Forest Resource Inventory Technical Specifications*)

Cavity tree: A dead, dying, or live tree with a cavity or cavities, or with the potential to develop cavities, that is ≥ 10 cm dbh and ≥ 3 m tall. In the past, these trees were sometimes referred to as 'snags' or 'snag trees'. The term snag is no longer applied to wildlife trees to avoid confusion or contradiction in terminology (e.g., *Regulations for Industrial Establishments O. Reg. 851 (s.103), made under the Occupational Health and Safety Act, 1979*).

Cervid: Mammalian species that are a member of the deer family. There are four cervid species in Ontario (moose, white-tailed deer, elk, and woodland caribou).

CFSA: *Crown Forest Sustainability Act, 1994*

CLAAG: Careful logging around advanced growth – An operational practice that can be applied with any harvest method under the clearcut silviculture system where the objective is to remove the overstory, protect understory advance growth, and regenerate an even-aged stand. The resulting stand develops under full light conditions, generally with a reduced rotation length.

Conditions on operations: Conditions applied in areas of harvest, renewal and tending operations (conditions on regular operations), conducted in accordance with the silvicultural ground rules, and conditions applied on roads, landings, forestry aggregate pits, and wood storage yards to maintain or protect important ecological features (e.g., grouse nests, wildlife trees) that are not addressed by operational prescriptions and conditions for areas of concern or to implement specific operational direction (e.g., rutting, large landscape patches).

Critical breeding season: The critical breeding season includes courtship, nest building, egg laying, incubation, and rearing of young to fledging and is defined based on the best data available for Ontario (primarily by using the Nesting Calendar Query Tool available on the Birds Canada website (<https://www.birdscanada.org/>)).

Crown/canopy closure: The ground area covered by the crowns of trees or woody vegetation as delineated by the vertical projection of crown perimeters and commonly expressed as a percentage of total ground area.

Culvert: Corrugated steel pipe is the common material used for small diameter (usually less than 1,800 mm) culverts to convey water under an access road. The term refers to the factory-assembled round shapes connected together with couplers. Larger culverts (generally those >1,800 mm diameter), are normally multi-plate or structural plate culverts and are assembled in the field.

Deer winter concentration area: Normally identified as winter deer emphasis area (DEA). A forested area deer traditionally migrate to and where they spend the winter months. The ‘core’ of a deer winter concentration area is where use by deer is highest during winters that are severe, also referred to as stratum I. Boundaries of a deer winter concentration area tend to change over time.

DFO: Department of Fisheries and Oceans

Disruption of hydrological function: Alteration of the physical characteristics of a site such that the natural flow of water, on or below the surface, is significantly impeded (e.g., by damming), accelerated (e.g., by channelization), or diverted (e.g., by ditching). The natural “watering up” process associated with the removal of forest cover is not considered a hydrological disruption.

Diversity tree: Trees retained as wildlife trees that occur infrequently or are uncommon for the forest type.

ESA: *Endangered Species Act, 2007*

Exception: An operational prescription or condition for an area of concern or a condition on operations for an important ecological feature or specific operational direction which differs from a standard or guideline in this guide. Requirements for including an exception in an FMP are specified in the *Forest Management Planning Manual*

Existing roadbed: Any clearly recognizable roadbed with dominant vegetation generally comprised of shrubs and/or saplings that is predominantly <8 m tall (i.e., not contributing to the overall canopy closure).

Extraction trail: Anywhere a machine being used for extraction (e.g., skidder, forwarder) has traveled within the block (excluding travel on roads and landings).

Extraordinary circumstances: In a very limited number of situations during the implementation of an FMP, deviation from direction in this guide may be permitted when:

1. Strict application of the direction would result in unacceptable and imminent socio-economic or environmental consequences
2. The modified activities are unlikely to have an adverse effect on the objectives of the direction
3. The situation could not reasonably be foreseen and planned for, is unavoidable, and is beyond the forest licensee's control.

For example:

- 1) An occupied hawk nest is located after some harvesting has been conducted within its AOC. Skidding wood already felled would normally not be permitted during the critical breeding period. However, if there is a high risk that the merchantability of the wood will be compromised by delaying skidding until after the critical breeding period (e.g., white pine logs will stain) and the risk of disrupting the breeding activity is considered to be low (e.g., skidding activity will not be visible from the nest, will be conducted when the chicks are no longer being brooded, will not be conducted on cold or wet days), the situation may be considered an extraordinary circumstance.
- 2) During operational road layout, it is determined that due to site conditions both within (e.g., steep or otherwise unsuitable terrain) and adjacent (e.g., presence of lakes and/or other land ownership) to the approved operational road boundary, the only reasonable alternative for the road location is within an adjacent AOC associated with a lake. This situation may be considered an extraordinary circumstance if not locating the road within the AOC results in an additional length of required road that results in an unacceptable increase in construction costs and footprint on the land base. Depending on site conditions, road

construction within the AOC would be subject to mitigative measures such as locating the road as far from the lake as possible, minimizing grubbing and ditching during construction, and/or ensuring adequate erosion control and cross drainage.

In both these examples, the prescription for the specific value may be amended to permit the normally prohibited activity as subject to appropriate conditions. An amendment (administrative or minor) will be prepared to amend this individual prescription to the FMP. This amended prescription will not be considered an exception to this guide.

Fish habitat: Resources and conditions essential for the production of fish, including water quality and quantity, spawning grounds, nursery, rearing, food supply, and migration areas on which fish depend, directly or indirectly, for their life processes.

Featured species: These are species that have been identified as species for which habitat will be managed. The habitats of provincially-featured species, which include moose, deer, marten, pileated woodpecker and species that are listed as species at risk in Ontario Regulation 230/08 (the Species at Risk in Ontario (SARO) list), must be managed; habitats of species identified as locally-featured are managed at the discretion of the District Manager in recognition of the value of that species locally. Locally-featured species may be individual species or combinations of species and can be animals or plants.

FMP: Forest Management Plan

FMPM: Forest Management Planning Manual

GIS: Geographic information system

Guideline: Mandatory direction (i.e., must be followed) that may require professional judgement and/or local or Indigenous knowledge, within the constraints set out in the guideline, to be applied appropriately at the local level.

Habitat carrying capacity: Carrying capacity (K) is a concept basic to wildlife management, generally defined as the maximum number of individuals (e.g., moose) an area can support on a sustained basis (i.e., without detrimental effects on the habitat).

Habituated birds: In the context of this guide, habituated birds are those that exhibit a high tolerance for human activity in the vicinity of their nest sites (e.g., they nest in close proximity to well-traveled roads or human habitation). Direction in Section 4.2.2 may be overly conservative for habituated birds. Thus, planning teams may choose to develop unique prescriptions for habituated birds that will not be considered exceptions to the direction in this guide. Habituated birds will be identified by the Ministry based on consideration of the history of occupancy and productivity of the nest site and the

history of both forestry and non-forestry related human activities in the vicinity of the nest site.

HARP: Harvest with advanced regeneration protection – The removal of the dominant canopy layer in uneven-aged lowland black spruce ecosystems. HARP protects and retains stems below a set diameter limit leaving a significant component of the overstory. The resulting stand is uneven-aged and uneven-sized.

Height of land: The local, highest portion of ground above a water feature at which point surface water run-off would drain away from the water feature and not flow directly into the water feature.

High potential impact operations: (as used in Section 4.2.2) Forest management operations that have a high potential to disturb nesting birds and adversely affect occupancy or productivity. Potential impact of operations is based on duration of individual events, number of individual events per day, time period over which events occur during the breeding season, detectability of events at the nest, number of pedestrians involved in activity, and number of small (e.g., chainsaw) or large (e.g., skidder) pieces of equipment involved that produce noise (see Appendix 4.2 for details). Harvest operations, large tree planting operations (≥5 people) if visible, and road construction are typically considered high potential impact operations.

Hydrological connection: Linear feature that connect terrestrial and aquatic ecosystems that channel ephemeral surface and/or shallow groundwater flows to lakes, ponds, rivers, or streams that can be reasonably recognized at the time of operations. They are linear features without well-defined channels that generally flow (visibly) only during and after large precipitation events.

Inactive nests/colonies: Unoccupied nests/colonies for the duration according to the species-specific definition, see sections 4.2.2.1 – 4.2.2.8

Intermittent streams: Streams with a well-defined channel that generally flow only during wet seasons (30-90% of the year). During the driest part of the summer, flow may be reduced to a trickle or may only occur within the streambed.

Lakes: Areas of open water ≥8 ha in size and, at some point, >2 m deep. Small lakes are <100 ha in size. Medium lakes are 100-999 ha in size. Large lakes are ≥1,000 ha in size.

LiDAR: Light detection and ranging

LLP: Large landscape patch

Low potential impact operations: (as used in Section 4.2.2) Forest management operations that have a low potential to disturb nesting birds and adversely affect occupancy or productivity. Potential impact of operations is based on duration of

individual events, number of individual events per day, time period over which events occur during the breeding season, detectability of events at nest, number of pedestrians involved in activity, and number of small (e.g., chainsaw) or large (e.g., skidder) pieces of equipment involved that produce noise (see Appendix 4.2 for details). Tree marking, routine road maintenance such as grading, and hauling are typically considered low potential impact operations.

MAFA: See moose aquatic feeding areas

Mast tree: Mast trees are trees that produce edible fruits. Mast is usually described as hard mast (e.g., acorns) or soft mast (e.g., cherries).

Mature forest: As used in this guide, forest that has reached the mature development stage. Holloway et al. (2004) define the mature development stage as the period in which overstory trees attain full development and sexual maturity, mortality of overstory trees begins to create canopy gaps and encourages understory development, and height growth of overstory trees slows dramatically. The onset age of the mature development stage is typically 60-80 years.

Moderate potential impact operations: (as used in Section 4.2.2) Forest management operations that have a moderate potential to disturb nesting birds and adversely affect occupancy or productivity. Potential impact of operations is based on duration of individual events, number of individual events per day, time period over which events occur during the breeding season, detectability of events at nest, number of pedestrians involved in activity, and number of small (e.g., chainsaw) or large (e.g., skidder) pieces of equipment involved that produce noise (see Appendix 4.2 for details). Large tree planting operations (≥ 5 people) if not visible, small tree planting operations if visible, and small crews using brushsaws are typically considered moderate potential impact operations.

Moose aquatic feeding areas (MAFAs): Relatively small, shallow water areas with an abundance of aquatic vegetation comprised of mostly submergent species moose (and deer) favour as food.

Nests – good repair: A nest is considered to be in good repair when there is sufficient nest material present to permit its use with minimal reconstruction. The nest on the left is in poor repair. The nest on the right is in good repair. (Photo by K. Szuba)



Occupied nests: Nests where breeding activity was confirmed (containing eggs or young or being attended by adults in anticipation of laying eggs) or where breeding activity was not confirmed, but for which there is compelling evidence of recent use. Nests in suitable habitat that are in good repair or contain new material may be suspected to have been recently occupied.

Examples (see below and see criteria in Box 4.3 (page 90) in OMNR 2004):

- Pair of falcons observed at cliff site during the critical breeding period;
- **Nests in good repair**, in suitable habitat, with down feathers, decoration, new material or whitewash;
- Are in close proximity (within 400 m) to nests occupied by species in question.

Old forest: Holloway et al. (2004) define the old development stage as the period when frequent mortality of overstory trees results in a mosaic of canopy gaps and encourages development of a multi-layered canopy and an abundance of dead trees and downed woody material. The onset age of the old development stage is typically 90-130 years.

OMS: Open wetland (a polygon type in the forest resources inventory of a forest management plan as defined in the Forest Information Manual and associated Forest Resource Inventory Technical Specifications)

Permanent stream: A stream with a well-defined channel that generally flows throughout the majority ($\geq 90\%$) of the year. The streambed is typically located below the water table and groundwater (or a permanent water feature) is the primary source of flow.

Ponds: Bodies of shallow (generally <2 m deep), open water ($\leq 25\%$ of surface area covered by emergent vegetation) between ≥ 0.5 ha and <8 ha in size.

PSW: Provincially significant wetlands are wetlands ranked as provincially significant through the science-based Ontario Wetland Evaluation System (OWES) because of the presence of outstanding biological, social, or hydrological values or other special features.

Residual forest: A forested patch that generally functions more as habitat for wildlife that inhabit older forest than as habitat for wildlife that inhabit younger forest. Quantitative criteria are provided in Section 3.2.2.1. As defined in this guide, it is not to be confused with the term “residual” (e.g., residual stocking, residual basal area, residual tree spacing) to describe post-harvest retention objectives in partial harvest systems.

Roadside work area: The area of land adjacent to a road and within the boundaries of the harvest area where concentrated activity other than skidding (e.g., piling, delimbing, slashing, chipping, slash piling) is necessary to receive and process wood from the rest of the harvest area.

Rut: Continuous trench or furrow created by machine traffic that is ≥ 4 m long and ≥ 30 cm deep. When operating on shallow soils the lesser of depth to bedrock/large boulders or 30 cm will be used. Ruts may be empty, filled with water, or filled with varying amounts of intermixed organic and mineral soil/debris. In cases of concentrated heavy rutting it may be difficult to distinguish individual ruts. Furrows, scalps, trenches, etc., created specifically for site preparation purposes are not considered ruts.

SGR: Silvicultural ground rule

Significant mineral soil exposure: Patches of mineral soil exposed by machine traffic that are individually larger than 4m^2 in size or have an aggregate area that exceeds 5% coverage. The percent coverage of exposed mineral soil will be measured over a 15 m by 15 m area when operating adjacent to water, or the harvested area of the AOC for all other values (e.g., ginseng).

Silviculture system: A process that applies silviculture practices, including tending (thinning, pruning, etc.), harvesting, and renewal, to a stand to produce a crop of timber and other forest products. Systems are classified according to the method of harvesting of mature forest stands with a view to regeneration establishment (i.e., clearcut, shelterwood, selection).

Stage of management: One of a series of cuts when using the shelterwood silviculture system to aid in stand improvement and regeneration. Generally, these are referred to as preparatory, regeneration, and removal cuts, although the number of stages can vary

dependent on stand characteristics and silviculture objectives. Cutting may be distributed uniformly across a stand or concentrated in narrow strips or small patches.

Standard: Mandatory direction that must be followed as written; there is no flexibility for interpretation on the part of guide users.

Stubs: A stub is a live tree that has been cut (and killed) well above the normal stump height (i.e., 3-5 m high). In managed forests, the 'stubbing' of live trees is increasingly being used when the objective is to emulate some of the physical properties of a tree that died quickly during a catastrophic natural event (e.g., wildfire).

Succession: Changes in species composition in an ecosystem over time, often in a predictable order.

Supercanopy trees: Large trees that emerge above the main canopy of a stand.

Tending: Forest operations which are carried out to improve the growth or quality of a forest. Tending may involve cleaning (i.e., the removal of undesirable or competing vegetation using herbicides or manual treatments), thinning, stand improvement, or pruning.

TMS: Treed wetland (a polygon type in the forest resources inventory of a forest management plan as defined in the Forest Information Manual and associated Forest Resource Inventory Technical Specifications)

Travel routes: Trails used by animals (e.g., cervids) to move among, or between, habitats. Travel routes are often traditional, may be used over long periods of time, and may have a seasonal aspect to use.

Use management strategy: A statement outlining the purpose and description, and defining the roles and responsibilities related to use, maintenance, use control, abandonment, and monitoring of roads on Crown land.

Veteran trees: Trees with characteristics (e.g., thick bark) that allow them to survive a stand-initiating disturbance, such as a fire, and eventually grow to become supercanopy trees in the future mature stand.

Windrow: A longitudinal pile of material, usually difficult for humans, large mammals, and machinery to traverse. Road building may result in windrows comprised of rocks, boulders, and other aggregate that tend to run parallel to a section of road. Windrows are also commonly created by the piling of tops and branches of trees that have been brought to roadside and de-limbed or by the alignment of slash during site preparation operations.

Woodland pools: Small isolated open water wetlands that have hydrologic regimes characterized by alternating periods of flooding and drying.

CHANGE AND RATIONALE (C&R) DOCUMENT TO SUPPORT REVIEW OF DRAFT REVISED GUIDE

NOTE TO READER:

This change and rationale (C&R) document presents background information on the topics discussed within, and the rationale for proposed direction contained within the preceding draft revised Stand and Site Guide. The content of the following C&R document will largely form the updates to the current Background and Rationale for Direction (B&R) document. The final updated B&R document is anticipated to be released with the approved revised Stand and Site Guide.

The numbering of sections in this document parallels that found in the preceding draft revised Stand and Site Guide.

(C&R)1.0 INTRODUCTION

(C&R) 1.1 Purpose of the Stand and Site Guide

Revised guide status and rationale:

Section 1.1 text remains largely unchanged with exception of updated reference for definition of conservation.

(C&R) 1.2 Content of the Stand and Site Guide

(C&R) 1.2.1 Organization

Revised guide status and rationale:

Minor changes made to Section 1.2.1 to reflect changes in guide section contents.

(C&R) 1.2.2. Direction characterization

Revised guide status and rationale:

Feedback received from the five-year review of the guide was that direction with the reasonable efforts clause is not easily enforceable from a compliance perspective. Thus, the reasonable efforts clause has been replaced with the requirement to either notify the Ministry for lower risk activities or seek Ministry approval for higher risk activities (i.e., activities in an operational prescriptions or conditions for and AOC or CRO for species at risk). Procedures have been developed for both the notification and approval processes. In the five-year review of the guide, practitioners suggested that the process and documentation requirements for extraordinary circumstances provision need to be further clarified. Have added clarification for extraordinary circumstances in Section 1.2.2 and in the definition found in the glossary.

(C&R) 1.2.3. Exceptions

Revised guide status and rationale:

New section that provides brief description added to guide to identify ability of planning teams to deviate from a standard or guideline associated with an area of concern or conditions on operations for an important ecological feature provided it is identified as an exception in the FMP and exceptions monitoring is undertaken as per the FMPM. This ability has always existed in the guide, however, it was not clearly identified in current guide. Content of section taken largely from similar section on exceptions in Silviculture Guide (Section 6.2.3).

(C&R) 1.3 Conserving forest biodiversity

(C&R) 1.3.1 The coarse and fine filters

Revised guide status and rationale:

Change and Rationale Document to Support the Review of the Draft Revised Stand and Site Guide

Discussion in current remains relevant. No new empirical evidence could be found that refutes the Ministry's current nested coarse and fine filter approach to conservation of biodiversity and management of wildlife habitat needs and the provision of healthy forests. Replaced Figure 1a to illustrate nesting of the Landscape and Stand and Site Guides and the application of coarse and filters at a variety of spatial scales.

(C&R) 1.3.2 Learning from the past and preparing for the future

Revised guide status and rationale:

Updated to be current with Ministry existing strategic direction (Our Sustainable Future no longer applies). Added to discussion on use of adaptive management framework in the development of forest management guides.

(C&R)1.4 Legislative and policy context

Revised guide status and rationale:

Legislation and policy context updated to reflect the exemption of forest management from EA Act requirements contained in Declaration Order MNR-75. Other minor updates to make section consistent with current policy.

(C&R) 1.5 Pilot testing

Revised guide status and rationale:

Revised to reflect the pilot testing undertaken to ensure some of the more significant new or revised direction could be implemented effectively and efficiently prior to revised guide approval.

(C&R) 1.6 Socio-economic impact analysis

Revised guide status and rationale:

Revised to reflect the socio-economic impact analysis undertaken to quantify potential changes in wood supply and wood costs associated with some of the more significant new or revised direction compared to the baseline current direction in the guide.

(C&R) 1.7 Climate change considerations

Revised guide status and rationale:

New section. One of the key recommendations from the five-year review of the Stand and Site Guide was related to how the guide addresses climate change. It was recommended that the revised guide provide sufficient flexibility to enable practitioners to adapt their practices to unanticipated outcomes of climate change and this provision should be associated with a rigorous rationalization process. The guide provides the required flexibility by enabling planning teams to deviate from standards and guidelines by including it as an exception in the FMP. Furthermore, it was suggested that the

Change and Rationale Document to Support the Review of the Draft Revised Stand and Site Guide

introduction section include a general discussion on how the revised guide will address climate change adaptation.

(C&R) 1.8 Ministry's Statement of Environmental Values

Reduced section to only include what is required; acknowledgement that the Ministry considered the SEV as a source of direction during the development of the revised guide. A decision was made in September 2020 to update the Ministry's SEV to reflect government and Ministry priorities.

(C&R) 2.0 INTEGRATION AND IMPLEMENTATION

(C&R) 2.1 Integration

Revised guide status and rationale:

Section 2.1 text remains largely unchanged.

(C&R) 2.2 Implementation

Revised guide status and rationale:

Section 2.2 text remains largely unchanged. Revised guide will continue to enable planning teams to amend new or revised direction in the guide into existing approved FMPs should they choose to do so. To acknowledge that the workload/required resources to amend all the new or revised direction may not be practical or feasible, this section enables planning teams to amend only portions of the new or revised direction into a currently approved FMP mid-plan. Otherwise, the revised guide will need to be used in the preparation of FMPs that come into effect on or after April 1, 2029.

(C&R) 2.3 Previous guides replaced by the Stand and Site Guide

Revised guide status and rationale:

This section has been removed in the revised guide.

(C&R) 3.0 CONSERVING BIODIVERSITY - Management at the stand, multi-stand, and meso-landscape scales

(C&R) 3.1 Introduction and linkage to landscape-level direction

Revised guide status and rationale:

Section 3.1 text remains largely unchanged. Removed examples of integrative thinking as they did not seem to add a lot of value to the introduction.

(C&R) 3.2 Applying the Coarse Filter

(C&R) 3.2.1 Composition

Preamble

Revised guide status and rationale:

Minor editorial changes made.

Standards and guidelines: Retained, revised, or new

When developing management direction, develop an objective and desired level for each individual forest unit. The sum of desired levels for all forest units will be consistent with any grouped composition targets (e.g., upland conifer).

Revised guide status and rationale:

No change proposed.

No recommendations from five-year review of guide to revise this direction. The purpose of this direction is to ensure that an objective and desired level be identified for each forest unit so that no individual forest unit part of a grouped composition, landscape objective is reduced (below naturally occurring levels) due to conversion to another forest unit, unless there is an intentionally strategic reason to do so as documented in the FMP. This is assessed in the trend analysis required for the year six and final year annual reports as per the FMPM. Specifically, the information and associated analysis for forest condition and status of silviculture objectives are reported/discussed for the forest units described in the FMP.

It is also required that the analysis include:

- Conclusions/recommended changes for consideration in the determination of future silviculture activities and expenditures, and the continued use of effective SGRs and yield predictions.
- Documentation on how implications to forest level objectives will be considered in future annual work schedules.

Change and Rationale Document to Support the Review of the Draft Revised Stand and Site Guide

Where there is not a strategic decision to do otherwise, select harvest, renewal, and tending treatments that maintain existing tree species diversity at the forest unit level.

Revised guide status and rationale:

No change proposed.

No recommendations from five-year review of guide to revise this direction.

Develop conditions on operations to maintain S1, S2, and S3 Natural Heritage Information Centre vegetation communities, Significant Ecological Areas, or rare vegetation communities identified by the Ministry, which are likely to occur in areas of planned operations. A list of any rare vegetation communities will be provided by the Ministry prior to completion of the management direction.

Revised guide status and rationale:

No change proposed.

No recommendations from five-year review of guide to revise this direction.

Best management practices: Retained, revised, or new

Develop strategies to maintain or move average species composition by forest unit in a desirable direction. For example:

- Consider the effect of typical silviculture prescriptions on future species composition and include that information in site-level prescription setting
- Ensure the silvicultural ground rules include options to create the full range of observed/desirable species composition by forest unit
- When selecting stands for harvest, ensure the average species composition of allocated stands does not deviate significantly from the forest unit average.

Revised guide status and rationale:

No change proposed.

No recommendations from five-year review of guide to revise this direction.

Planning teams should consider developing operational prescriptions and conditions for an area of concern for rare vegetation communities that would be difficult for operators to identify, if their geographic location is known prior to operations commencing.

Revised guide status and rationale:

New BMP.

Some rare vegetation communities may not be commonly known by operators and would thus be challenging to identify on the ground. For known rare vegetation communities, application of an AOC (i.e., feature is mapped), instead of conditions on operations, removes some of the responsibility from operators to have to look for and identify these plant types on the ground.

(C&R) 3.2.2 Pattern

Revised guide status and rationale:

Section 3.2.2 text remains largely unchanged. Removed specific direction for FMPs written without the Landscape Guide.

(C&R) 3.2.2.1 Defining residual forest

Revised guide status and rationale:

Added a discussion of ecological significance of residual forest in both stand replacing and gap phase disturbances. Up until recently, most wildfire research focused on the ecological impacts to and responses of burned areas, not the areas left unburned. However, there exists a growing amount of research in the last decade on the function and physical and spatial characteristics of forest residuals (Robinson et al 2013, Perera and Buse 2014, Meddens et al 2018) or more broadly, biological legacies (Franklin et al 2000). This ecological significance of post-disturbance residual forest is especially important for species that are rare, have poor dispersal capabilities, or that are strongly dependent on particular microhabitats or environmental conditions (Bouchard and Hébert 2016).

For the conceptual definition of residual forest, clarification has been provided so that the term “residual forest”, as defined in the guide, is not confused with use of the term “residual” (e.g., residual stocking, residual basal, residual tree spacing) to describe post-harvest retention objectives in partial harvest systems.

No significant changes have been made to the quantifiable definition of residual forest as no new empirical information could be found that would warrant any changes in the six criteria.

For condition (criteria 1) in Table 3.2a, replaced ‘free-to-grow’ with ‘established’ to reflect new regeneration requirements/terminology as per FMPM.

The literature continues to support a minimum patch size for residual forest of 0.1 ha. Perera et al (2009) found that a minimum patch size threshold of 0.25 ha excluded between 2.5 - 6.2% of total fire area of insular residual area, thus considerably underestimating the amount of residual area that occurs within a natural fire footprint.

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The ability to accurately detect and delineate small unburnt residual patches (i.e., <0.09 ha) has been constrained by the 30 m spatial resolution of Landsat imagery which is better suited to analyze the landscape scale fire patterns and severity. However, as remote sensing technology has improved, higher resolution imagery has become more readily available and the ability to detect and map the extent and distribution of small unburnt residual patches has improved (Walker et al 2019). In their study investigating the abundance and spatial patterns of fire refugia in ponderosa pine and dry mixed-conifer forests in western United States, Walker et al (2019) used 1 m resolution imagery to classify and map fire refugia and reported a median patch size of 0.01 ha. They found that the number of patches smaller than 0.09 ha, the minimum classification unit for Landsat-derived burn severity maps, accounted for 11% of the total patch count.

Small residual patches, while considered not effective at maintaining interior forest species assemblages due to edge effect and susceptibility to blowdown (Lee et al 2015), are thought to preserve landscape heterogeneity and complexity and expedite reforestation rates in disturbed areas removed from the fire periphery (Blohm Dahl et al 2018, Walker et al 2019). Although Lee et al (2015) reported that interior forest saproxylic beetle species are not well maintained in post-harvest residual forest patches <1 ha, Bouchard and Hébert (2016) found that beetle species richness was highest in small tree groups of 0.03 – 0.05 ha in size.

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(C&R) 3.2.2.2 Coarse filter pattern emulation and finalizing the harvest area boundary during operational planning

Preamble/Direction

Revised guide status and rationale:

No significant changes made to content to preamble and direction description as no there were no recommendations from five-year review of guide to revise content.

Minor updating of terminology (i.e., established vs. free-to-grow). Removed reference to previous guides (e.g., NDPEG).

Moved the current standard;

Implementation of the guidelines in this section will be consistent with the achievement of biodiversity objectives

and current guideline;

In the event that implementation of any of the direction will compromise achievement of geographically specific (e.g., habitat) or broad landscape level (e.g., pattern) biodiversity objectives, the achievement of biodiversity objectives will take priority over this direction. Any required modification of this direction to ensure consistency with biodiversity objectives will be described in the FMP. The degree and geographic scope of modification will be limited to that required for consistency with biodiversity objectives

in Table 3.2c into the direction description in the revised guide.

Guidelines: Retained, revised, or new

Operational planning will normally follow stand boundaries and/or natural features.

Revised guide status and rationale:

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No change made.

No recommendations from five-year review of guide to revise this direction. The direction and associated original background and rationale remains relevant.

Operational planning will ensure that any point within a planned clearcut harvest area will have at least 25 ha of mapped residual forest within a 500 ha circle about that point.

- Mapped residual forest includes;
 - Unallocated stands or portions of stands that meet the definition of residual forest
 - Stands or portions of stands scheduled for harvest that will retain residual forest
 - Residual forest within AOCs associated with known values.
- Additional mapped residual forest that is required during operational planning will be preferentially retained so it is connected to the shoreline of a lake, pond, river, or stream that is within, or directly adjacent (i.e., <200 m) to, the planned harvest area with a preference for areas of hydrological connection between terrestrial and aquatic ecosystems (e.g., recognizable linear features that channel ephemeral surface and/or shallow groundwater flows to lakes, ponds, rivers, or streams). Otherwise, additional mapped residual may be connected to known values, located to encompass uncommon forest types, or located consistent with expected disturbance behavior.
- A minimum of 5 ha of the mapped residual within any 500 ha circle will belong to a patch greater than 5 ha¹.

¹ The 5 ha requirement can be satisfied by a single 5+ ha patch completely contained within the 500 ha assessment area, a single 5+ ha patch partially within the circle with at least 5 ha within the assessment area, or several 5+ ha patches partially within the 500 ha assessment area whose combined area within the assessment area is at least 5 ha. Refer to Appendix 3.2a for graphic examples.

Revised guide status and rationale:

No significant changes made. Removed reference to hexagon and updated terminology (e.g., hydrological connections).

The recent literature continues to support the direction as an appropriate minimum amount of residual forest to retain in clearcuts:

First bullet – To emulate natural disturbance patterns, the proportion of residual forest retained post-harvest should reflect the proportion of unburned forest post-fire. However, the amount and extent of unburned, residual forest patches reported within boreal fire boundaries varies considerably due to the heterogeneity both among and within wildfires (Perera et al 2009, Araya et al 2015, Meddens et al 2016). This inherent variability makes it difficult to define appropriate and practical thresholds of abundance,

spatial distribution, size, structure and composition of post-harvest residual patches and to evaluate their success (Perera and Buse 2014). A range between 0 and 22% has been reported in the recent literature (Madoui et al 2010, Kolden et al 2012, Perera and Buse 2014, Araya et al 2015, Meddens et al 2016, Walker et al 2019). Thus, the requirement to retain a minimum amount of 5% (25 ha in 500 ha) residual forest continues to correspond to values being reported in the literature. It has also been reported that the mean proportion of residual forest generally decreases with increasing fire severity (Walker et al 2019) and that mean residual patch size increases with fire size (Dragotescu and Kneeshaw 2012). However, Perera and Buse (2014) advise that results of these studies should be interpreted with caution due to the high variability in definitions and mapping methods used.

Second bullet - Perera and Buse (2014) suggest that post-fire residual forest patches are often associated with natural fire breaks such as wet areas including wetlands or open water (both lakes and streams). More specifically, the recent literature suggests a positive relationship between the probability of residual forest and the presence and amount of surrounding lakes (Dragotescu and Kneeshaw 2012, Araya et al 2015, Neilsen et al 2016) and wetlands (Araya et al 2016, Kuntzemann 2021). However, Ouarmim et al (2015), Krawchuk et al (2016), and Meddens et al (2018) suggest that susceptibility to fire and likelihood of forest patches surviving multiple fire events (fire refuges) are more dependent on specific microsite characteristics (e.g., topography, soil moisture, fuel characteristics) than on proximity to natural fire breaks.

Because riparian areas of wet organic soil (often associated with lowland forests) are the most connected to adjacent surface waters, more sensitive to potential site disturbance, and are presumably less likely to burn, retention of residual forest in these areas (*sensu* Kuglerová et al 2014) may help create a more natural riparian forest pattern while addressing riparian groundwater discharge and methylation hotspots (Kuglerová et al 2017). Additionally, Erdozain et al (2020) found these areas of strong hydrological connectivity to be more sensitive to forest management activities (e.g., road construction) than non-connected riparian areas along headwater streams with cumulative effects downstream (Erdozain 2021).

Third bullet – This direction ensures that at least some medium-sized residual forest patches are retained post-harvest. The minimum patch size of 5 ha continues to be supported by the recent literature. Over time, residual patches often contract in size as edges are susceptible to windthrow (Perera and Buse 2014). Lee et al (2015) observed edge effects in patches <2.9 ha and suggest that the larger patches in their study (3.3-5.9 ha) were adequate to minimize long-term negative edge effects on forest interior saproxylic beetle communities. Bouchard and Hébert (2016) reported a similar patch size threshold (2.5 ha) for fungivorous beetle communities.

In terms of forest vegetation structure and composition, Barbé et al (2017) suggested that residual patches 0.2-11.0 ha in size support a bryophyte community most similar to undisturbed forests and seem to enhance the “lifeboat” potential of the residual patches in the boreal forest of Quebec. Meanwhile, Moussaoui et al (2016) recommend retention

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of small forest clumps and large intact forest patches (3-10 ha) in the eastern Canadian boreal black spruce-feathermoss forest maintain much of the natural range of structural complexity (e.g., deadwood volume) found in post-fire residual patches.

Implementation of the harvest plan will ensure that any point within a new clearcut harvest area will have at least 0.5 ha of residual within a 50 ha circle about that point. Develop a condition on regular operations for areas where this residual is not mapped in advance.

Revised guide status and rationale:

No significant changes made. Removed reference to hexagon.

Much of the discussion and rationale for the multi-stand 500 ha direction applies to this individual stand scale direction which remains relevant.

Mapped residual that is not serving any other purpose (e.g., AOC, specific habitat function), and would otherwise be available for harvest, can be moved during operational implementation provided;

- The standards and guidelines in this section are respected.
- The planned harvest area is not exceeded.
- The FMP (e.g., map, data product) specifically identifies those mapped residual polygons that are eligible for movement.
- Appropriate conditions on regular operations are developed to facilitate movement.

Movement of mapped residual that is identified in the FMP as movable will not normally require an amendment, revision, or special reporting.

Revised guide status and rationale:

No changes made.

The direction and associated original background and rationale remains relevant. There is a need to continue to provide operational flexibility to accommodate on-the-ground conditions that could not be foreseen during operational planning.

Best management practices: Retained, revised, or new

When measuring achievement of direction requiring a 50 ha or 500 ha moving window analysis, use a point spacing or grid cell size of no more than 50 m.

When locating unmapped residual forest (i.e., 50 ha), give preference to locations connected to habitat features encountered during operations (e.g., bird nests, furbearer dens, woodland pools) When additional habitat features are not

encountered, give preference to uncommon forest types, locations connected to known values (e.g., water, nests), or located consistent with expected natural disturbance behaviour.

Revised guide status and rationale:

No changes made. BMPs are still relevant.

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(C&R) 3.2.2.3 Catchment considerations

Revised guide status and rationale:

Section 3.2.2.3 remains relatively unchanged. Added reference to calcium and mercury export. No explicit catchment-level direction has been added to the revised guide.

The revised guide continues to recognize catchment-scale effects of forest management operations on calcium and mercury exports to aquatic systems as an emerging issue. Although no specific direction is provided, the five-year review of the guide acknowledged the need to review the growing body of information on this topic and consider explicit mitigative direction.

The literature continues to suggest that forest operations within catchments may lead to a number transitory impacts associated with increased water yield such as increased stream discharge and increased exports of sediments, nitrogen, and phosphorus with the magnitude of effects often (but not always) proportional to the extent of disturbance within a given catchment (e.g., Pelster et al 2008, Prepas et al 2008, Gravelle et al 2009, Abdelnour et al 2011, Zhang and Wei 2012, Bathurst and Iroume 2014). For example, a study of lake catchments in Sweden, Wu et al (2018) suggested that the proportion of catchment harvested influenced mercury levels in fish with the largest increases in Hg in fish occurring in lake catchments with the highest proportion (36-40%) of catchment harvested.

The current guide recognizes that forestry operations within catchments can affect downstream aquatic ecosystems. However, the 5-year review identified three catchment-related topics that need to be addressed in the revision of the guide:

- Creating a more natural pattern of disturbance at the catchment scale.
- Mitigating the effect of forest operations on long-term depletion of calcium on sites with low Ca reserves and weathering rates.
- Mitigating the effect of forest operations on short-term, post-disturbance export of mercury to aquatic systems.

Creating a more natural pattern of disturbance at the catchment scale

A review by Moore and Richardson (2012) suggested that catchment-scale effects of harvesting and wildfire are at least qualitatively similar with the exception of coarse wood inputs into streams. However, at a catchment scale, disturbance from harvesting tends to be less than fire, due in part to the coarse and fine scale direction applied in forest management planning and operations (Rob Mackereth personal communication 2020). An effectiveness monitoring study in Ontario suggested the frequency and spatial extent of disturbance by harvesting and fire was not similar when compared at

the catchment scale (30 km² catchments studied) (Hayes 2016). On average, during 5-year time periods, harvesting occurred in more catchments than did wildfires. However, within affected catchments, wildfires disturbed a greater proportion of catchment area than harvesting; fires frequently disturbed >50% of catchments while harvesting rarely disturbed more than 20%. Thus, if forest operations are to better emulate the pattern created by natural disturbance (and thus presumably the hydrological response), they should occur in fewer catchments but disturb a greater proportion of each catchment.

However, in forest management units within or that intersect the continuous distribution of woodland caribou, harvesting follows a tract based dynamic caribou habitat schedule, in which large landscape patches, usually greater than 10,000 ha in size, are harvested over a 20-year period. This spatially concentrated harvesting pattern results in a greater proportion of disturbance area in a smaller number of catchments more similar to the pattern created by natural disturbance.

In areas south of the discontinuous distribution zone for woodland caribou, the benefits of a spatially dispersed harvesting pattern (i.e., amount of edge for optimal interspersion of food and cover) for some species like moose (see references in background and rationale for Section 3.3.4), may offset the ecological benefits of spatially and temporally concentrating harvest operations to emulate disturbance patterns as a result of fire. Moreover, evidence suggesting a short-term increase in Hg detection in fish associated with larger proportions of catchments harvested (Wu et al 2018, Garcia and Carigan 2005) may potentially warrant emulating natural spatial patterns of disturbance as undesirable.

Future effectiveness monitoring needs to: 1) evaluate the ecological value of better emulating natural catchment disturbance patterns, and 2) compare the differences between frequent, spatially extensive catchment disturbance to infrequent spatially discrete disturbance at a catchment and landscape scale.

Mitigating the effect of forest operations on export of calcium to aquatic systems

Evidence continues to suggest that anthropogenically-driven catchment-scale loss of calcium may have ecologically significant effects on associated aquatic (e.g., Kerr and Eimers 2012, Kim et al 2012, Jeziorski et al 2015, Reid and Watmough 2016) and terrestrial ecosystems (e.g., Schaberg et al 2010, Pabian and Brittingham 2011, Battles et al 2014).

There is growing evidence that forest harvesting may exacerbate the loss of calcium on some sites and in some catchments that were previously subject to high base cation depletion associated with acid deposition (e.g., Philips and Watmough 2012, McLaughlin 2014, Reid 2015, Reid and Watmough 2016). However, the effect of forest harvesting on soil calcium supply appears to be highly variable and may only be significant in/on specific forest/site conditions (see reviews in Wall 2012, Zetterberg et al 2013, McLaughlin 2014, Shabaga 2016, Zetterberg et al 2016, Morris et al 2019). Moreover, the sensitivity of lakes to the potential effects of harvesting may be related to the characteristics of the lake (e.g., lake area, water chemistry), the surrounding

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catchment (e.g., elevation, geology, catchment area, water surface and subsurface flow paths), and the amount, intensity, and/or possibly pattern of harvest (McLaughlin 2014, Reid 2015).

Due to historic (pre-1980s) exposure to high amounts of atmospheric acid deposition and the prevalence of soils with slow mineral weathering rates, the Great Lakes-St. Lawrence (GLSL) forest region soils and surface waters are sensitive to elevated Ca losses (Watmough and Aherne 2008). Forest operations are thought to exacerbate Ca losses from GLSL forest region catchments occurring on Precambrian bedrock causing lake Ca levels to fall to unnaturally low levels (Watmough et al 2003, Reid and Watmough 2016, Treasure et al 2019). However, McLaughlin (2020 - submitted for publication) found that studies in the GLSL forest region have predominantly reported on clearcut operations, with few studies on how shelterwood or selection systems may affect soil calcium gains and losses (e.g., Hendrickson et al. 1989, Munson and Timmer 1995, Hoepting et al 2011, Poirier et al 2016), despite their predominant application in the GLSL forest region. Also, experimental designs used to test site effects on soil nutrients lacked preharvest or non-harvested reference plots and/or did not consider atmospheric or weathering inputs. These observations, combined with inconsistent sampling designs and frequencies of chemical analyses in the studies reviewed, revealed a number of uncertainties associated with testing probable outcomes of calcium in response to forestry operations in GLSL forest region catchments (McLaughlin 2020 - submitted for publication).

Furthermore, McLaughlin's (2020 - submitted for publication) review of the scientific literature (25 published research papers for a data set consisting of 38 measurements of calcium mass of the forest floor and mineral soil, combined with forest stand ages ranging from 2 to 119 years), found that shallow, coarse-textured, and nutrient poor soils are most sensitive to the effects of acid deposition, but are not necessarily sensitive to forestry operations. Across hardwood, conifer, and mixedwood forest types, the combined forest floor and mineral soil Ca mass responded positively (higher soil Ca) or remained unchanged (neutral) nearly 90% of the time regardless of exposure to different acid deposition amounts or harvesting and regeneration experiments. In clearcut harvest boreal sites with coarse-textured, nutrient poor soils, Morris et al (2019) reported little to no Ca depletions in soil pools compared to pre-harvest levels at 20-year post-harvest. Moreover, results of the literature synthesis were inconclusive as to which locations in a catchment are most sensitive to net Ca losses due to acid deposition and provide a recommendation to pursue this question as a research priority for the GLSL forest region. For example, some studies reported high elevation streams and lakes to be the most sensitive to Ca losses because of acid deposition (Reid and Watmough 2016). However, acid neutralizing capacity values in such streams or lakes indicate recovery relative to measurements during peak acid deposition between the 1970s and 1980s (Beall et al 2001, Laudon et al 2004).

Thus, the evidence still continues to support not including specific catchment-level direction to address calcium exports to aquatic systems in the guide and that in general, current direction is sufficient to ensure the conservation of soil and water calcium levels

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in GLSL forests. However, it is recommended that a revised guide effectiveness monitoring priority include future research to answer the following spatial-temporal scale related questions:

1. How does the distribution of forestry operations within catchments function as a mitigative option for Ca conservation?
2. How do episodic acidification events in soils following forestry operations delay recovery of streams and lakes from acid deposition?
3. How does local groundwater discharge into riparian areas contribute to amelioration of acidic waters draining from hillslopes following forestry operations?
4. How do weathering rates vary by site type and impact long-term supply of Ca?

Another area of research requiring future consideration is the application of calcium (in the form of wood ash or lime) to ameliorate calcium loss associated with harvest.

AshNet (<https://www.nrcan.gc.ca/science-data/research-centres-labs/forestry-research-centres/great-lakes-forestry-centre/ashnet/20279>) is a network of scientists, foresters, industry and government (federal and provincial) representatives, actively investigating the potential application of wood ash from bioenergy production to forest soils. Wood ash has the potential to be applied to forest soils to reduce acidity while increasing base cation reserves (Huotari et al 2015) as well as emulating wildfire as a natural disturbance (Hannam et al 2018). In a studies including eight sites across Canada where soils were amended with wood ash, Joseph et al (2022) and Smenderovac et al (2022) found that application of wood ash either had no effect or enhanced soil quality and no effect on soil biota and any detected effects were inconsistent, infrequent, and small.

The beneficial nature of ash application to forest soils has been shown to vary based on the chemical composition of the ash, soil type, tree species, and time elapsed since ash application (Pitman 2006, Augusto et al 2008, Reid and Watmough 2014, Brais et al 2015, Noyce et al 2016). Wood ash and lime additions are not always successful in mitigating calcium losses, and in some cases may have undesirable ecological effects (see review in Reid and Watmough 2014). Additionally, economics (Hope et al 2017) and regulatory requirements (Hannam et al 2016) influence the viability of ash amendment practices at an operational scale. Thus, any direction that recommends calcium additions as a mitigative measure is likely premature.

However, to address some of these uncertainties, 14 wood ash application experiments have been established within the AshNet network involving application of varying ash sources, chemistries and rates at sites representing varying forest stand and soil types, tree species, and stand ages. Building on these current ash application trials across Canada, future research should focus on gaining a better understanding of the key ash and site characteristics that result in beneficial and safe wood ash application to different forest soils and stand types, and to addressing the challenges of ash application at an operational scale.

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Retaining residues may also be an option to help retain Ca in soils exposed to historically high acid deposition in the GLSL forest. In an analysis of data sets from 25 published research papers, McLaughlin (2020 – submitted for publication) found that post-harvest logging residue left on site was positively correlated with mean soil Ca response ratio (treatment Ca mass:control Ca mass) for hardwood and mixedwood forests. However, additional research to confirm this finding has been recommended.

Mitigating the effect of forest operations on export of mercury to aquatic systems

Mercury contamination in aquatic systems is a global concern. Although inorganic mercury (Hg) is a naturally occurring element, mercury levels in the environment have increased from pre-industrial times due to human activities, particularly the burning of coal and other fossil fuels (UNEP 2013). Atmospheric deposition is the primary source of mercury in aquatic systems (Driscoll et al 2007) (although other industrial point sources may result in locally high levels in aquatic systems; e.g., Kinghorn et al 2007). Once deposited in aquatic systems, Hg may be transformed into biologically active methylmercury (MeHg) and bioaccumulated and biomagnified in the aquatic food chain. Humans are exposed to mercury primarily through the consumption of fish (but also through consumption of marine mammals and rice in some parts of the world); high levels of ingested MeHg may impact human health, adversely affecting neurological, cardiovascular, reproductive, and immune systems (see reviews in Mergler et al 2007, Choi and Grandjean 2012, Karagas et al 2012).

The recent literature suggests that forest management practices may exacerbate the effect of elevated levels of Hg in the environment by increasing exports of mercury from terrestrial to aquatic ecosystems. Bishop et al (2020) suggest post-harvest increases in stream MeHg are driven by new MeHg formation in previously well-drained areas. Forestry operations can increase runoff and alter groundwater flow paths that may increase the mobilization of Hg (Eklöf et al 2016, Buttle et al 2018) and potentially disturb soils and create water logged conditions, promoting methylation of inorganic Hg (Kronberg et al 2016). For example, numerous studies suggest that forest operations may result in elevated exports of total Hg and/or MeHg for up to 10 years after operations as a result of increased mobilization, movement, and/or methylation (e.g., see review in Bishop et al 2009 as well as studies by Allan et al 2009; Skjellberg et al 2009; Eklöf et al 2012, 2014, 2016; and Kronberg 2014). While forest operations often do increase Hg levels in runoff and terrestrial Hg loading to aquatic ecosystems, the degree of increase varies extensively, and depending on harvest proximity to surface water, soil structure, depth, chemistry and wetness, topography, and coniferous forest cover, is sometimes not present at all (Eklöf et al, 2016, Lam et al 2022). Since 2010, study findings have reported substantial variability in the effects of forest harvesting on MeHg concentrations in water (increases of 0-325%) as well as Hg and/or MeHg concentrations in biota (increases of 0-80%) with effects generally influenced by increased discharge post-harvest (Bishop et al 2020).

Bishop et al (2009) estimated that 9-23% of mercury in fish in lakes surrounded by forested catchments in Sweden resulted from exports associated with forest operations. However, Eklöf et al (2016) suggest this estimate may be too narrow and high given

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that some more recent studies have reported a lower degree of influence post-harvest. Wu et al (2018) reported an increase of 26% in Hg concentrations of large fish in clearcut lake catchments, however, the year-to-year and lake to lake variation in fish Hg concentrations (-14%-121%) was considerable. Willacker et al (2019) found that mercury concentrations in macroinvertebrates and salamanders in clearcuts (with no riparian reserve) were 50% higher than in non-harvested catchments. However, these concentrations were not correlated with total Hg or MeHg concentrations, but rather treatment effects appeared to correspond with a reduction in utilization of terrestrial and an increase in aquatic basal resources in stream food webs. Negrazis et al (2022) observed that elevated MeHg in water and food sources was linked to higher proportion of a water basin clearcut, however it did not lead to increased Hg concentrations in fish due to low trophic transfer. The high variability in these study results, and in some cases, failure to reveal adverse effects on mercury exports and/or concentrations in aquatic biota (e.g., Misener 2010, deWitt et al 2014), makes it extremely difficult to estimate the contribution of forestry to mercury in aquatic biota as there are multiple ways in which food webs and bioaccumulation may be altered by operations.

Some of this variability may reflect when, where and how forest operations are conducted. For example, deWitt et al (2014) found no significant effect of winter harvest on mercury concentration in stream water in Norway. Sørensen et al (2009) found comparatively low exports of mercury from catchments in Sweden that were harvested in winter following BMPs that avoided disturbance in wetlands and riparian areas. Similarly, Eklöf et al (2014) found that winter harvest did not increase the concentration of total Hg or MeHg in stream water in Sweden. However, soil disturbance associated with site preparation during summer subsequently increased the concentration of total Hg and MeHg in stream water by 30 to 50%.

Some of the observed variability may be related to where harvest occurs within catchments. Wetlands are typically considered net sources of Hg methylation (Selvendiran et al 2008, Gabriel et al 2009, Ward et al 2010, Tjerngren et al 2012). Fens may be especially significant sources of MeHg (Jim McLaughlin personal communication 2015). In contrast to most wetlands, alder-dominated swamps may actually be net sinks for MeHg (e.g., Kronberg et al 2012, Tjerngren et al 2012). Recent literature also suggests that areas of groundwater discharge within riparian zones may be 'hotspots' for the accumulation and methylation of Hg (Mitchell et al 2008, Vidon et al 2010, Kulgerova et al 2014). These areas of groundwater discharge represent hydrological connections between terrestrial and aquatic systems. Thus, it may be important to minimize site disturbance within wetlands, especially fens and alder swamps, and hydrological connections. Research by Eklöf et al (2020) comparing previous studies of catchment disturbance on mercury highlighted the variability among sites but found that soil compaction and disturbance, along with disruption of hydrologic connectivity was most strongly associated with increases in production and/or mobilization of MeHg.

The variation noted above and the incomplete understanding of how forest disturbance may influence the mobilization, movement, and methylation of mercury makes it a

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challenge to develop mitigation practices. For example, given this uncertainty, Bishop et al (2009) did not feel confident recommending ameliorative measures for forestry but did suggest that operations, especially those creating site disturbance, should be minimized in riparian areas or other wet areas. Eklöf et al (2016) also recommend operational guidelines that minimize the mobilization and export of MeHg to aquatic systems.

Based on the above evidence, the five-year review recommended:

- Revisiting direction to ensure operations in wetlands (especially fens and alder swamps) will not create conditions that may increase the potential for the methylation of Hg within, and mobilization and transport of MeHg from, wetlands.
- Revisiting the direction for identifying and managing hydrological connections to ensure operations do not result in site disturbance that may promote methylation, mobilization, and transport of mercury.

The first bullet has been addressed by the revision of Section 4.1.3. The second bullet has been addressed with the addition of BMPs that minimize the risk of disrupting hydrological function within hydrological connections in Section 4.1.4 (hydrological connections) and during revision of Sections 4.1.1 and 4.1.2.

During the five-year review, one stakeholder suggested the guide should provide catchment level disturbance thresholds to limit water flux and minimize movement of mercury. However, the relationship between catchment-level disturbance and mercury export is equivocal. For example, Garcia and Carignan (2005) found a positive relationship between mercury concentrations in fish and the ratio of clearcut area to lake area in nine lakes sampled in northern Quebec. Wu et al (2018) also reported the largest mercury increases in fish occurred in lake catchments with the highest proportion (36-40%) of catchment harvested in Sweden. Huang et al (2024) and Eklöf et al (2014) found that more extensive harvesting (>75 and 64% of a catchment) with minor to no buffers on streams elevated MeHg in streams in Dryden, Ontario and Sweden, respectively. In contrast, Danco (2013) found no relationship between the concentration of mercury in fish in 243 lakes sampled in northern Ontario and the percent of the surrounding catchment disturbed by forest harvesting (or wildfire). Similarly, Lucotte et al (2016) suggested a weak relationship between the concentration of mercury in fish in 90 lakes sampled in northern Quebec and the percent of the surrounding catchment disturbed by forest harvesting. Recently, a study by Thomas et al (2020) of the relationship between multiple lake catchment characteristics and fish mercury levels found no direct linkage between forest harvest and mercury levels. Harvest was related to water chemistry, particularly dissolved organic carbon levels, which are related to mercury. This result suggests that mitigation measures designed to reduce water quality impacts, such as reducing soil disturbance and disruption of hydrologic connections, may be more effective at mitigating potential mercury impacts than arbitrary catchment harvest thresholds.

Thus, the variable response of Hg in forested catchments does not support proposing new catchment-level direction to address mercury exports to aquatic systems.

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(C&R) 3.2.3 Structure

(C&R) 3.2.3.1 Wildlife trees

Preamble/Direction

Revised guide status and rationale:

Content of preamble and direction description remains largely unchanged, however, reorganized paragraphs to describe general functions of wildlife trees in beginning in preamble followed by measurement and dimension specifics in direction description.

A recommendation from the five-year review of the guide suggested terminology (e.g., “wildlife tree”) needs to be reviewed to ensure terms are clearly defined and consistent. As practitioners are now accustomed to the term “wildlife tree” to define individual residual trees retained post-harvest, this term will not be changed. However, a definition of what constitutes a wildlife tree has been added to the glossary.

Included descriptions of living, dead and dying wildlife trees to supplement the revised direction in for clearcut silviculture systems.

Minimum diameter and height requirements for wildlife trees remain unchanged. Simplified text describing the size requirements for wildlife trees.

Moved the standard in the current guide regarding large diameter wildlife tree availability provision into the direction description.

i) Clearcut silviculture system

Standards and guidelines: Retained, revised, or new

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Retain an average of ≥ 25 stems/ha.

Revised guide status and rationale:

No change made.

No new empirical information could be found that would warrant a change from current direction. In addition to the recent literature summarized below, see original Background and Rationale for Direction for rationale for wildlife tree retention density for the clearcut silviculture system.

Zimmerling et al (2017) suggested the current retention of 25 wildlife trees/ha may be especially important for maintaining sufficient nesting and foraging habitat for forest landbirds as fire suppression efforts continue to reduce the amount of younger, burned forests with numerous snags on the landscape.

Roth et al (2014) noted an increase in golden-winged warbler nesting habitat quality at a threshold of 13 residual trees/ha in young aspen-dominated stands in Wisconsin. However, the authors acknowledged that optimal residual densities may be higher as reported by similar studies.

Perera and Buse (2014) identify that a lack of knowledge on wildfire residual abundance and distribution, as well as the range in variability of these parameters, continue to make prescribing emulation criteria, such as the amount of live and dead residual trees, challenging.

Retain a relatively even mix of an average of ≥ 10 large living, dying, and safe dead trees (including large stubs)/ha with a minimum of 5 large living and/or dying trees/ha unless with Ministry approval (see Appendix 1b). Specifically:

- Retain an average of ≥ 1 supercanopy tree/2 ha
- Retain all reasonably identifiable large, living, hollow 'chimney' trees
- Retain all reasonably identifiable living trees with pileated woodpecker nest or roost cavities
- Focus remaining large living tree retention on other cavity trees (living, dying, or safe dead), veteran trees, mast trees and diversity trees.

Revised guide status and rationale:

Direction revised.

Empirical evidence suggests retaining a range of tree ages and decay classes post-harvest will ensure a long term, continuous supply of standing dead and downed wood for wildlife. The importance of considering the retention of standing deadwood in a range of decay stages for maintaining woodpecker assemblages and associated food and nest webs in even-aged management of boreal forests is emphasized by Drapeau et al (2009) and Nappi et al (2015).

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Many other bird species rely on standing dead trees for nesting habitat. The brown creeper nests underneath the peeling barking of dead or dying trees, thus they require continuous recruitment of standing dead trees in a specific decay stage (Poulin et al 2008). Geleynse et al 2016 suggested that the reduction in brown creeper density in selection harvested stands compared to the density observed in control stands in Algonquin Provincial Park was partially the result of the current requirement to retain live, not dead, cavity trees in the guide.

Zimmerling et al (2017) recommended that live trees of various ages and dead wood in various stages of decay be retained to meet the coarse filter habitat needs of boreal forest bird communities. They found that post-disturbance standing dead tree density was lower in harvested versus burned stands in early-aged stands, however, they also found that a majority of the bird species detected (84% for early-aged (0-20 years) and 71% for mid-aged (21-80 years) stands) showed similar abundance between post-harvest and post-fire boreal forests in Ontario.

Moreover, Edworthy and Martin (2013) suggested retaining a range of aspen size and decay classes, including potential cavity trees, to allow for future cavity tree recruitment in harvested stands in interior British Columbia. Cooke and Hannon (2012) also suggested harvest operators retain several live, large aspen with conks and/or broken tops and small diameter aspen (<20 cm) for a sustained supply of suitable trees for cavity excavators in harvested boreal forest areas in northeastern Alberta and northwestern Saskatchewan.

Change made to direction to require specific large stems (supercanopy and chimney trees) to be retained to address species at risk (bats, chimney swifts).

Added requirement to retain at least one supercanopy tree/2 ha (when available) in the clearcut silviculture system to address future species at risk bat roosting habitat. Bats (including species at risk, eastern small-footed myotis, little brown myotis, northern myotis, tri-colored bat, eastern red bat, hoary bat and silver-haired bat) use trees as roost sites for protection against weather and predators as well as a location for thermoregulation, raising pups, and social interaction (Jung et al 2004). Johnson and King (2018) and Silvis et al (2016) recommend the retention and continuous recruitment of large living and safe dead trees (in intermediate stages of decay) with exfoliating bark, large crevices, cracks or cavities as potential roost trees. Multiple roost trees in close proximity are an important characteristic of suitable maternal roosting sites (Johnson and King 2018).

Jung et al (1999) found that between selection harvested and uncut white pine mixedwoods stands in central Ontario, the availability of roost sites may be an important determinant of activity of *Myotis* bat species. They recommended the retention of large live trees and snags (≥ 50 cm dbh) in selection harvests (particularly if the trees remain standing through future cutting cycles). Trees of this size are likely to extend above the

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main canopy, thus be exposed to increased solar heat and possibly easier for bats to relocate (Jung et al 2004).

In a review of data from studies across the range of the northern myotis, roost tree diameter was highly variable ranging from 15 to 65 cm with a mean dbh of 35 cm (Silvis et al 2016).

The tri-colored bat, eastern red bat and hoary bat are considered foliage roosting bats. They typically roost in the foliage of a wide variety of living trees, both evergreen and deciduous. Foliage roosters choose overstory trees with large crowns (COSEWIC 2023)

Numerous recent studies suggest that the brown creeper is less abundant in managed versus unmanaged forests of similar age (Geleynse et al 2016, Rempel et al 2016, Zimmerling et al 2017, Vanderwel et al 2007, Poulin et al 2010). Brown creepers are bark gleaners that prefer very large diameter (>50 cm dbh), rough-barked trees (e.g., white pine and red pine) for foraging. Supercanopy trees have greater surface area and thus are believed to increase foraging efficiency (Franzreb 1985). Additionally, the deeper crevicing of bark on larger trees provides suitable habitat for arthropods and insects (Jackson 1979).

Furthermore, supercanopy trees are important to society for their aesthetic value, as well as cultural and spiritual value for Indigenous communities. We learned during our engagement sessions on the draft revised guide from an Indigenous community in Ontario that veteran and supercanopy trees are seen as survivors that need to be respected. Upreti et al (2013) documented the cultural and spiritual importance and traditional ecological knowledge of white pine of the Kitcisakik Algonquin community in western Quebec. In interviews with community members, several respondents said that supercanopy white pine trees are used as landmarks and for orientation because they tower above the canopy. As part of restoration and management strategies for their ancestral territory, Upreti et al (2017) suggest the protection of current supercanopy white pine trees, as well as younger naturally regenerated white pine trees so that they can become future landmark trees on family hunting grounds.

Added requirement to retain large, living hollow 'chimney' trees to address chimney swift (species at risk) nesting and roosting habitat. The chimney swift, also designated as a species at risk in Ontario, has similar habitat requirements of standing trees to that of bats. Although the chimney swift generally nests and roosts primarily in chimneys and other man-made structures (Peck and James 1983, COSEWIC 2007, Steeves et al 2014), prior to European colonization, it nested and roosted in large hollow trees (Graves 2004). Currently, a small proportion of known nest and roost sites is found in hollow trees but the presence of swifts in remote forested areas suggests that a greater number of them may nest and roost in tree cavities than previously thought (Zanchetta et al 2014). Moreover, if the number of suitable chimneys continues to decline, the supply of man-made nest and roost sites may become limiting (Fitzgerald et al 2014) and there may be an increase in the use of natural sites (Zanchetta et al 2014). However, it is speculated that forest management practices may reduce the supply of

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potential natural nest/roost sites (Environment Canada 2013, Zanchetta et al 2014), which might affect the species' ability to transition back to more natural nesting/roosting features.

Zanchetta et al (2014) describe suitable nest and roost trees used by chimney swifts as live or dead, deciduous (elm, red oak, yellow birch) or coniferous (hemlock, white pine, white spruce) trees with a dbh >50 cm having extensive hollow cavities. Supercanopy trees (normally ≥60 cm dbh), given their age, may contain advanced heartrot, thus providing either existing or potential future nest/roost trees. While veteran trees may be too healthy and small (typically 25-50 cm dbh) to provide immediate nest/roost sites, they have the potential to become large diameter trees with hollow cavities capable of providing nest/roost sites in the future.

The proposed direction continues to prescribe the retention of an average of 10 large stems/ha (≥25 cm dbh) in the clearcut silviculture system. A review of the recent literature indicates that there is continued scientific support for the retention of large wildlife trees as valuable habitat in the clearcut silviculture system. Large diameter trembling aspen are preferred by primary excavators including the yellow-bellied sapsucker, hairy woodpecker, and pileated woodpecker (Cook and Hannon 2012). Tremblay et al (2015) and Craig et al (2019) recommended the retention of large, live and dead trees as suitable nest trees for the black-backed woodpecker and American three-toed woodpecker during harvesting in eastern boreal forests of Canada. Large diameter snags were also found to be more persistent than small snags (Angers et al 2011, Smith et al 2008). Mahon et al (2008) and Gutzat and Dormann (2018) found that large diameter trees, trees with broken tops and trees in early to advanced stages of decay were important to cavity and bark nesters for nesting and foraging in temperate and boreal forests.

The guide's minimum dbh requirement of 25 cm for a large stem or stub also continues to align with what has been published in the recent literature:

- >35 cm dbh (Cooke and Hannon 2012)
- >30 cm dbh (Smith et al 2008)
- >29 cm dbh (Mahon et al 2008, Gutzat and Dormann 2018)
- >27 cm dbh (Tremblay et al 2015)
- >20 cm dbh (Nappi and Drapeau 2011)
- >18 cm dbh (Craig et al 2019)
- >16 cm dbh (Roth et al 2014).

No new empirical information could be found that would warrant a change in the quantity of large stems or stubs/ha. Similar to the current direction in the guide, Tremblay et al (2015) recommended the retention of 10 large (≥27.0 cm dbh) trees/ha as suitable nest trees for the black-backed woodpecker during harvesting in eastern boreal forests of Canada.

The five-year review of the guide recommended revising the wildlife tree direction to address potential viewscape issues associated with resource-based tourism lakes.

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Specifically, the concern was that individual, living, dominant and co-dominant wildlife trees retained on hilltops act to draw attention to cuts as they cause an irregular canopy line. Deviation from the requirement for a minimum of 5 large living trees on each hectare is permissible with Ministry approval to not retain large living trees within the portion of the cut visible from a resource-based tourism lake where a tourism operator has identified this as a concern.

Wildlife trees that fall to the ground, or are purposely felled for worker safety reasons, will be retained on site to become downed woody material (see Section 3.2.3.2) unless with Ministry approval (see Appendix 1b).

Revised guide status and rationale:

No change recommended in five-year review. Minor rewording to clarify intent.

Retain an average of at least 10 well-dispersed, individual stems/ha: the remaining stems may occur in clumps.

Revised guide status and rationale:

Direction revised.

The potential high levels of post-harvest windthrow of wildlife trees, resulting in a less than desirable density, was a concern brought up by forest practitioners in the five-year review of the guide. Perera et al (2011), Rosenvald et al. (2008), and Gibbons et al. (2008) suggested the clumping of some wildlife trees may be desirable over individually dispersed stems to improve long-term retention of standing wildlife trees as they may be more resistant to windthrow. Thus, to encourage more clumping of wildlife trees, the number of individual trees has been reduced from 15 to 10 stems/ha.

Large stems/stubs (i.e., ≥ 25 cm dbh) retained to meet wildlife tree requirements will not be knocked down during renewal and tending treatments unless required for safety reasons or otherwise approved by the Ministry (see Appendix 1b).

Revised guide status and rationale:

Direction revised.

Feedback from the five-year review of the guide included concern with the use of terminology such as 'reasonable efforts' in standards and guidelines. From a compliance perspective, direction that includes terms such as 'reasonable efforts' is difficult to enforce consistently. Thus, this direction has been reworded.

From an operational perspective, it can be expected that some smaller wildlife trees will be inadvertently knocked down during renewal treatments (e.g., mechanical site

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preparation). Therefore, the direction has been split; trees ≥ 25 cm dbh cannot be knocked down and a BMP has been added to avoid prematurely knocking small wildlife trees (>25 cm dbh) over.

The density of living wildlife trees for any given one hectare area, when composed predominantly of poplar and/or white birch, will not exceed:

- 100 stems/ha >15 cm dbh where any of the target species in the silviculture ground rule are very shade intolerant to shade intolerant (e.g., jack pine, poplar, red pine and white birch)
- 150 stems/ha >15 cm dbh where target species in the silviculture ground rule are moderately shade tolerant to shade tolerant (e.g., black spruce, white pine, yellow birch, red oak, eastern white cedar, white spruce).

Revised guide status and rationale:

New direction.

The five-year review recommended establishing a maximum wildlife tree density for the clearcut silviculture system. Where local or regional markets are lacking for trembling aspen and white birch, practitioners were concerned that retaining too many unmarketable trees in clearcut operations may be creating sub-optimal light conditions for the establishment and growth of shade intolerant tree species.

Parker and Sharma (2018) investigated the effects of unmarketable hardwood (trembling aspen, white birch) retention on canopy transmittance in clearcut harvested boreal mixedwood stands across northern Ontario. They developed a model which indicates that to achieve the average light conditions of 70% full sunlight (as defined for the clearcut system in the Silviculture Guide), a maximum 161 stems/ha of mostly white birch or 172 stems/ha of mostly trembling aspen may be retained. The difference in maximum density between species can be attributed to differences in crown characteristics. For simplicity, a single maximum wildlife tree density value of 150 stems/ha was chosen, despite the discrepancy between species.

Additional requirements have been specified to address the relative shade tolerances of common target species in clearcut silvicultural ground rule. Based on Niinemets and Valladares (2006), Baker (1949), and the fact sheets in Appendix 3 in Silviculture Guide, common target tree species in clearcut silvicultural ground rules vary in shade tolerance:

- Very intolerant - trembling aspen, jack pine
- Intolerant - white birch, red pine
- Moderately tolerant - black spruce, white pine, red oak, yellow birch
- Tolerant - white spruce, red maple, eastern white cedar.

Therefore, certain species will perform better at the extreme ends of the acceptable range of light conditions (70-100% full sunlight) in a clearcut system. For example, trembling aspen and jack pine, classified as very shade intolerant, achieve optimum

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performance under 90 to 100% full sunlight. Additionally, optimal light conditions for white birch and red pine, classified as shade intolerant, can be achieved at 80-90% full sunlight. Applying the model developed by Parker and Sharma (2018), a maximum density of roughly 100 stems/ha could be retained while still producing acceptable understory light levels for very shade intolerant and shade intolerant tree species.

It is important to note that Parker and Sharma (2018) looked specifically at light transmittance through canopies composed predominantly of trembling aspen and white birch. Thus, this direction applies to clearcut areas where the wildlife trees are composed predominantly of these intolerant hardwood species. Due to species differences in crown architecture and porosity, levels of light transmittance would be different for residual canopy compositions of other hardwoods (e.g., hardwood species more typically associated with the Great Lakes – St. Lawrence forest region) at similar retention densities. Where the wildlife tree species composition is predominantly comprised of other species, the related direction in Section 3.1.3.2 of the Silviculture Guide still applies in that the quantity of post-harvest residual trees will be consistent with the silviculture objective for the site. In some cases, this may result in a silviculture ground rule change between completion of harvest and establishment to reflect the actual post-harvest conditions within the context of the relative shade tolerance of the target renewal species and the forest level composition objectives in the management direction for the management unit.

A one hectare reference area was selected as it corresponds to minimum polygon size target applied in the forest resource inventory feature class layer for polygons created from forest management activities and supporting silviculture records as per the FIM.

Creating early successional forest with a low density of residual trees and vegetation such as forbs, grasses, shrubs, and small trees provides suitable habitat for early successional bird species such as warblers and sparrows (Hanberry and Thompson 2019). Schieck et al (2000) found that variation in bird communities among harvested mixedwood boreal forests in Alberta was correlated with variation in the type and amount of residual trees retained. Harvested areas with mean residual tree densities of 16 to 36 trees/ha had a higher abundance of shrubby and open forest bird species (e.g., common nighthawk, alder flycatcher, common yellow throat warbler, clay-coloured sparrow, Lincoln's sparrow) than harvested area with residual densities exceeding 70 trees/ha. Rodewald and Yahner (2000) found harvested stands in Pennsylvania with mean residual tree densities of 113 (live and dead) trees/ha were occupied by similar early successional breeding bird communities recorded in other harvested areas in the state where 37-49 trees/ha and 15-20 trees/ha were retained. In a meta-analysis to determine the effects of tree retention on shrubland bird species in northeastern United States, Akresh et al (2021) found that most (62%) shrubland bird densities declined with increasing tree retention and low (5-25%) to moderate (30-70%) tree retention provides habitat for shrubland birds.

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Although it could be argued that it may be more appropriate to include this direction in the Silviculture Guide (e.g., Section 3.1.3.2), the decision to include it in this guide was made because:

- 1) Compliance with this direction (as conditions on regular operations in the FMP) would be undertaken at the same time as the other wildlife tree direction in this guide (i.e., during the compliance inspection for harvest operations)
- 2) Creating and maintaining a diversity of habitat and ecosystem conditions, including the creation of early successional habitat (i.e., recently clearcut sites dominated by herbaceous plants, shrubs, and young trees with low densities of residual trees) required by disturbance-dependent species, falls under the mandate of this guide.

If intentional residual tree manipulation (e.g., felling unmarketable merchantable trees or tops at the stump) to achieve minimum post-harvest light requirements is rationalized and approved in the FMP, it will be implemented in a way as to not impede future silviculture operations or compromise the ability of a site to achieve the regeneration standards associated with the assigned silvicultural ground rule.

Revised guide status and rationale:

New direction.

Under the scaling manual, felling unmarketable merchantable trees or tops at the stump is not considered a wasteful practice provided alternative minimum utilization standards and associated rationale are described in an approved FMP.

From an ecological and emulation perspective (i.e., typically high volumes of recently downed wood after fire or blowdown events), increasing the number of downed trees may be beneficial. Additionally, felling certain tree species may remove undesirable seed sources. However, felled stems and tops left at the stump can cover a large portion of the forest floor. Areal coverage of stems and tree crowns may impede site preparation and planting operations which can reduce regeneration site occupancy and compromise the ability of a site to meet the regeneration standard associated with the assigned silvicultural ground rule.

Guidelines: Removed

When the number of large living cavity trees, large stubs, veteran trees, and supercanopy trees averages <25/ha, additional wildlife tree requirements may be met by retaining safe standing dead trees, small stubs, or any other living trees.

Revised guide status and rationale:

Moved this guideline in the current guide regarding large diameter wildlife tree availability provision into the direction description.

Best management practices: Retained, revised, or new

Avoid knocking down standing wildlife trees <25 cm dbh during renewal and tending treatments.

Revised guide status and rationale:

New BMP. Supplements the guideline to not knock down large (≥ 25 cm dbh) wildlife trees during renewal and tending operations.

To the extent practical and feasible, 'stub' some wildlife trees:

- v. to a height of ≥ 3 m (5 m is preferred);
- vi. do not stub trees with existing cavities (however, it is acceptable to stub a tree with cavities below the stubbing height) or trees that provide other functions (e.g., veteran trees, dead trees, seed trees);
- vii. all boreal tree species can be stubbed, but the preferred species are jack pine and black spruce; and
- viii. stub up to 20 trees/ha in areas that are predominantly jack pine and/or black spruce.

Revised guide status and rationale:

BMP remains largely unchanged. Combined two current BMPs into one.

Stubbing can achieve the objective of retaining windfirm, standing dead trees and may be particularly beneficial to an array of specialized species, such as the black-backed and three-toed woodpeckers. Nappi and Drapeau (2011) studied habitat selection of black-backed woodpeckers in recently burned spruce-dominated boreal forests in Quebec. They found that black-backed woodpecker selected standing dead trees for both nesting (>20 cm dbh) and foraging (>15 cm dbh). They selected fire-killed spruce trees for foraging likely because they represented high quality substrates for wood-boring insects. These findings support the practice of stubbing conifers to emulate some of the physical properties of a tree that recently killed by fire.

Moreover, original rationale for the BMP to stub jack pine to benefit specialized species such as the black-backed and three-toed woodpeckers is further supported by Tremblay et al. (2015). In conifer-dominated forests in central Quebec, where deciduous species are rare, they observed that selection of nest trees by black-backed woodpeckers was partially influenced by tree species and recommended the retention of dead jack pine trees in proportion of their availability in conifer-dominated stands.

Weiss et al (2018) quantified the effects of standing dead tree treatments (including topping) on decay and response of insects and cavity-nesters in jack pine stands in Upper Michigan 9 to 13 years post-treatment. They found topped (stubbed) jack pine trees were more penetrable (i.e., easier to puncture sapwood), used more heavily by insects, decayed faster and had a higher proportion of loose bark than those created by

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the girdling and burn treatments. Maximum heights of topped snags were restricted to >3 m due to logging equipment limitations, which may have impacted use by primary cavity-nesters.

In the absence of tree species preferred for stubbing (jack pine and black spruce), Smith et al (2008) suggested that the topping of live white birch trees reduced their susceptibility to wind and allowed for faster fungal and decomposing bacteria invasion in balsam fir dominated mixedwood stands in western Newfoundland. They recommended that these stubs would support nesting and foraging by species associated with deciduous trees such as downy and hairy woodpeckers, and northern flickers.

Retaining and/or supplementing standing dead tree abundance can also help to minimize post-disturbance differences in stand level structural complexity and biodiversity in harvested and burned forests. The 'stubbing' of live trees may be practiced during harvest operations to emulate some of the physical properties of a tree that died quickly during a catastrophic natural event (e.g., wildfire). It is also a practice that improves the windfirmness of retained trees (i.e., stubs are less likely to be blown over than a canopied tree following clearcutting).

Blowdown of wildlife trees in many recently clearcut stands was identified as a concern of practitioners in the review of the guide as newly exposed trees may be susceptible to strong and turbulent post-harvest winds. Stubbing is recommended as a practice to extend the standing value of dead trees for foraging and cavity nesting before falling and becoming downed wood (Smith et al. 2008).

Intentional creation of standing dead trees and associated decay processes and wildlife responses have been studied extensively in the western United States (Bull and Partridge 1986, Chambers et al 1997, Hallett et al 2001, Brandeis et al. 2002, Arnett et al 2010, Barry et al 2018). Recently, studies in mixed pine forests of the Great Lakes region have also reported on snag treatments including stubbing (Corace et al 2013, Weiss et al 2018).

To the extent practical and feasible, scatter stubs throughout clearcut.

Revised guide status and rationale:

BMP remains largely unchanged. Minor change in wording. BMP is still relevant. See original Background and Rationale for Direction for rationale.

Preferred species to retain as large trees are aspen, red oak, white pine, red pine, white spruce, hemlock, cedar, or any species that are uncommon in the local area, if consistent with silviculture objectives.

Revised guide status and rationale:

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Removed need to identify which species are best to retain as large trees by planning area. Remainder of direction is still relevant. See original Background and Rationale for Direction for rationale.

Large trees providing existing nesting or denning sites are preferred as cavity trees (see also the *Ontario Tree Marking Guide*).

Revised guide status and rationale:

The requirement to retain all large living hollow ‘chimney’ trees is now a guideline associated with SAR (bats and chimney swifts) habitat. The retention of large trees with existing nesting or denning sites is still a recommended BMP.

Where practical and feasible, to minimize the potential for post-harvest blowdown of wildlife trees, operators are encouraged to consider windfirmness when leaving any tree:

- Preferentially retain windfirm species which are generally ordered as:
 - Most windfirm: white pine, red pine, red oak
 - Moderately windfirm: cedar, red maple, white spruce, white birch, aspen, jack pine
 - Least windfirm: black spruce, balsam fir.
- Preferentially retain trees located on lower-middle slopes over trees located on upper slopes and ridge crests
- Avoid retaining trees on shallow or wet soils or stub trees in these areas to reduce blow-down risk
- Preferentially retain trees that are pre-adapted to open-growing conditions.

Revised guide status and rationale:

New BMP. The potential high levels of post-harvest windthrow of wildlife trees, resulting in a less than desirable density, was a concern brought up by forest managers in the five-year review of the guide. Thorpe et al (2008) reported that the first year post-harvest residual tree mortality rate was 12.6 times higher than that of the pre-harvest rate in partially harvested uneven-aged black spruce stands in the clay belt of northern Ontario.

A number of factors and their complex interactions contribute to windthrow susceptibility including wind intensity, species, soil properties, topographic position, and stand characteristics (Mitchell 1995, Nolet et al 2012, Mitchell 2013, Navratil 1995).

Species contributes significantly to windthrow susceptibility (Coates et al 2019, Nolet et al 2012). It has been reported that early successional, shade intolerant species are generally more susceptible to windthrow than late successional, shade tolerant species, likely due to a trade-off between structural strength and resistance and competitive ability (Rich et al 2007). An exception to this general tendency is shade tolerant balsam

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fir as its shallower rooting makes it less resistant to wind damage. (Rosenvald et al 2008). Steil et al (2009) reported that most tolerant hardwood species and white and red pine rated most windfirm, white birch, aspen, and cedar rated moderately windfirm, and jack pine, spruce, and balsam fir rated least windfirm. Turner (2005) reported that red oak, yellow birch, white spruce, white pine, and American elm were the most windfirm, white birch, basswood, red maple, cedar, big-toothed aspen, black ash, and sugar maple were moderately windfirm, and trembling aspen and balsam fir were the least windfirm.

Steil et al (2009) reported that soil depth and moisture impact effective rooting depth, which is an important predictor of windthrow.

Rosenvald et al (2008) recommended retaining trees preadapted to growing in open conditions (e.g., along forest edges, in canopy gaps). Trees exposed to more regular, stronger winds are morphologically better adapted (e.g., rooting pattern, tapered stem of lesser height, crown shape) to resist damage or falling (MacFarlane and Kane 2017).

Best management practices: Removed

Where they occur, oaks and hemlock are also good wildlife tree choices.

Revised guide status and rationale:

Removed BMP as oaks would already be preferentially retained as mast trees in deer direction and hemlock has been added to species list in large tree species preference BMP.

Diversity trees of any size are usually a good choice for retention.

Revised guide status and rationale:

Removed BMP. Has been combined with large tree species preference BMP.

When large wildlife trees are specified, stems ≥ 38 cm dbh are preferred.

Revised guide status and rationale:

Removed BMP. Moved to direction description.

ii) Selection silviculture system; shelterwood silviculture system (preparatory and regeneration cuts, irregular shelterwood cuts)

Standards and guidelines: Retained, revised, or new

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Retain an average of ≥ 10 living cavity trees:

- Retain ≥ 5 living and/or dying cavity trees on each ha
- Retain all reasonably identifiable living trees with pileated woodpecker nest or roost cavities
- Retain all reasonably identifiable large living (≥ 50 cm dbh) hollow 'chimney' trees encountered.

Retain as many large, safe, dead trees as practical and feasible.

Revised guide status and rationale:

Change made to direction to require specific large cavity trees (pileated woodpecker nest/roost cavity and chimney trees) and safe dead trees to be retained to address species at risk (bats, chimney swifts).

Based on a review of recent empirical information, the required retention density of cavity trees in selection and shelterwood (preparatory and regeneration and irregular shelterwood) harvests in the guide is still appropriate. Mancuso et al. (2014) found that selection (single-tree, mixed, and group) harvesting with current direction for wildlife tree retention in Algonquin Provincial Park did not substantially alter the distance that sapsuckers travelled for sap, the use and reuse of sapwell trees, or the foraging behavior of sapsuckers compared to unharvested areas. They suggested that trees with old sapwells and/or large diameters (>30 cm dbh) that are preferred for foraging by sapsuckers, should be retained during tree-marking.

Straus et al (2011) reported that single-tree and group selection harvesting in southwestern Ontario, following the pre-guide direction for retention of trees as recommended by OMNR (2004) (≥ 6 cavity trees/ha), did not result in reduced cavity-nesting bird densities (with the possible exception of group selection) as compared to reference stands. They recommended that careful attention to cavity tree retention during harvest should provide reasonably adequate nesting habitat to support high densities of cavity nesters.

See rationale provided above for the clearcut silviculture system for retention of large pileated woodpecker cavity trees, hollow trees, and dead trees.

Wildlife trees that fall to the ground, or are purposely felled for worker safety reasons, will be retained on site to become downed woody material (see Section 3.2.3.2) unless with Ministry approval (see Appendix 1b).

Revised guide status and rationale:

No changes recommended in the five-year review. Minor rewording to clarify intent.

See original Background and Rationale for Direction for rationale for wildlife trees as future sources of downed wood.

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Wildlife trees will generally be well dispersed. In shelterwood preparatory and regeneration cuts, retain at least half as individual stems; the remaining wildlife trees may occur in clumps.

Revised guide status and rationale:

See rationale provided above for the clearcut silviculture system.

For shelterwood preparation and regeneration cuts, “clumping” of cavity trees may be desirable to increase the probability that they will still be standing at the time of removal cut(s) and to extend their potential habitat value as standing structures.

Retain an average of ≥ 10 mast trees/ha, unless approved by the Ministry (see Appendix 1b).

Revised guide status and rationale:

Direction is still relevant. No new empirical information could be found that would warrant a change from current direction.

The retention of a reduced density of mast trees may be possible in areas where beech bark disease (BBD) infestations have caused high levels of mortality. In Ontario’s tolerant hardwood forests, beechnuts from beech trees are the primary hard mast for many wildlife species including black bears, red squirrels, grey squirrels, chipmunks, and ruffed grouse. In stands where BBD has had a significant impact on the survival and/or condition of beech trees, there is an opportunity to work with local Ministry staff to determine the appropriate mast tree retention density that achieves the intent of the direction. For example, the retention of a reduced density of mast trees may be possible in areas where BBD infestation have caused locally high levels of mortality or beech trees that appear to be resistant to BBD could continue to be retained to meet the mast tree target.

See original Background and Rationale for Direction for rationale.

Retain an average of ≥ 10 scattered coniferous trees/ha.

Revised guide status and rationale:

No change made. Direction is still relevant.

Kirk et al (2020) suggest that current direction in Ontario for scattered conifers appears to be adequate for most species and the retention of 5-10 scattered conifers/ha (preferably ≥ 40 cm dbh) will compare favourably to natural gap phase processes and associated abundances and diversities in bird communities. They reported that the

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abundance of blackburnian warblers, black-and-white warblers, and black-throated green warblers was positively related to the density of large, retained scattered conifers (primarily hemlock) in selection harvested hardwood stands in Algonquin Park.

Retain an average of ≥ 1 supercanopy tree/ha.

Revised guide status and rationale

Increased quantity of supercanopy trees to be retained. In addition to research that has shown that supercanopy white pine are a preferred tree for bears as denning and sanctuary trees (see original background and rationale), supercanopy trees are important for a number of other wildlife species.

In a study by Saalfeld and Conway (2010) in three National Forests in east Texas, bald eagles nested solely in isolated supercanopy pine trees that were on average 13 m taller than the surrounding trees and ranging from 48 to 94 cm dbh. The irregular crowns of supercanopy white pines enable birds with large wingspans to land and nest (Rogers and Lindquist 1992).

Zanchetta et al (2014) identified tree characteristics of suitable nest and roost trees used by chimney swifts. They reported that the provincially threatened species used a variety of live, dead, deciduous (elm, red oak, yellow birch) and coniferous trees (hemlock, white pine, white spruce) in Ontario. All nest or roost trees were described as hollow or having cavities and were >0.5 m dbh with 50% of the trees having a dbh between 0.6 and 1.3 m.

Moreover, recent studies have reported that other bird species are associated with supercanopy coniferous trees, including the black throated green warbler, blackburnian warbler, pileated woodpecker, and brown creeper (Kirk et al 2012, Thompson et al 2016, Kirk et al 2020). Kirk et al (2020) recommend the retention of ≥ 5 conifer supercanopy trees/ha where possible in selection harvests in order to maintain a bird community similar to that found in unmanaged hardwood stands.

Thus, accounting for the potential continuous recruitment of supercanopy trees from the retention of veteran trees during each cutting cycle, revised direction specifies the retention of 1 supercanopy tree per hectare instead of 1 supercanopy tree for every 4 hectares.

It is also important to note the social value of supercanopy trees. Uprety et al (2013) documented the cultural and spiritual importance and traditional ecological knowledge of white pine of the Kitcisakik Algonquin community in western Quebec. In interviews with community members, several respondents said that supercanopy white pine trees are used as landmarks and for orientation because they tower above the canopy. As part of restoration and management strategies for their ancestral territory, Uprety et al (2017) suggest the protection of current supercanopy white pine trees as well as

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younger naturally regenerated white pine tree so that they can become future landmark trees on family hunting grounds.

Best management practices: Retained, revised, or new

Reasonable efforts will be made to avoid knocking down standing trees retained as wildlife trees during renewal and tending.

Revised guide status and rationale:

Feedback from the five-year review of the guide included concern with the use of terminology such as 'reasonable efforts' in standards and guidelines. From a compliance perspective, direction that includes terms such as 'reasonable efforts' is difficult to enforce consistently. Thus, this direction has been moved from a guideline to a BMP.

Best management practices: Removed

'Stub' some wildlife trees (all tree species can be stubbed):

- i. to a height of ≥ 3 m (5 m is preferred);
- ii. generally, do not stub existing cavity trees (however, it is acceptable to stub a tree with cavities below the stubbing height);
- iii. do not stub trees being relied upon as a seed source; and
- iv. do not stub wildlife trees if they are better suited for other wildlife tree functions (e.g., mast trees; fire resistant species like white pine, red pine and hemlock are generally more appropriate to help achieve supercanopy direction).

Stub up to 5 trees/ha.

Revised guide status and rationale:

Removed BMPs. Stubbing is not a common practice in selection harvest systems. Wildlife tree direction is implemented by the tree markers who assess living trees. Retention of dead trees addressed by a new guideline for bats and chimney swifts.

Mast trees, living cavity trees, large stubs, and scattered conifers should be ≥ 38 cm dbh whenever possible.

Revised guide status and rationale:

Removed BMP. Moved to description of preferred diameter of large wildlife trees in direction description.

No new empirical information could be found that would warrant a change from current direction. Large trees continue to be generally more valuable to a diversity of wildlife species than are small trees. Edman et al (2016) found that density of large diameter

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trees from older seral stages strongly influenced the probability of presence of the epiphytic bryophyte *Neckera pannata* in selection cuts in a northern hardwood forest in New Brunswick. Large sugar maple trees (>40 cm dbh) in cut stands had a 16 times higher occupancy of the moss than smaller maples (15-19 cm dbh), likely due to the increased moisture content associated with the thicker bark of larger diameter trees.

Supercanopy trees ≥ 60 cm dbh are preferred.

Revised guide status and rationale:

Removed BMP. Moved to description of preferred diameter of supercanopy trees in direction description.

Large hollow trees and those providing existing nesting or denning sites are preferred as cavity trees (see also the *Ontario Tree Marking Guide*).

Revised guide status and rationale:

The requirement to retain all large, living (≥ 50 cm dbh) hollow 'chimney' trees is now a guideline associated with species at risk (bats and chimney swifts) habitat. The retention of large trees with existing nesting or denning sites is already recommended in the *Ontario Tree Marking Guide*.

iii) Shelterwood removal cuts; white/red pine seed tree cuts

Standards and guidelines: Retained, revised, or new

Retain an average of ≥ 25 stems/ha.

Revised guide status and rationale:

No change made. See rationale provided above for the clearcut silviculture system.

Retain an average of ≥ 10 veteran trees/ha with a minimum of 5 veteran trees on each ha.

Revised guide status and rationale:

No changes made to existing direction. See original Background and Rationale for Direction for rationale.

Retain an average of ≥ 10 living cavity trees:

- Retain ≥ 5 living and/or dying cavity trees on each ha

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- If the number of living cavity trees available is <10/ha (i.e., living cavity trees retained during the preparatory and/or regeneration cut have since died), then retain as many as are available
- Retain all reasonably identifiable living trees with pileated woodpecker nest or roost cavities
- Retain all reasonably identifiable large living (≥ 50 cm dbh) hollow 'chimney' trees encountered

Retain as many large, safe, dead trees as practical and feasible.

Revised guide status and rationale:

The five-year review of the guide recommended revising the wildlife tree direction for shelterwood removal cuts. Under the shelterwood system, blocks are typically thinned from below during the preparation and/or regeneration cuts (especially if harvested prior to the NDPEG retention requirements). Thus, many potential cavity trees have often been removed in the initial cut(s) forcing operators to retain valuable crop trees during the final cut(s) to meet the wildlife tree requirements. Therefore, the requirement to retain ≥ 10 living cavity trees/ha in shelterwood removal cuts will not need to be met where some or all of the living cavity trees retained in the preparation and/or regeneration cut have since died.

See rationale provided above for the clearcut silviculture system for retention of large pileated woodpecker cavity trees, hollow trees, and dead trees.

Wildlife trees that fall to the ground, or are purposely felled for worker safety reasons, will be retained on site to become downed woody material (see Section 3.2.3.2) unless with Ministry approval (see Appendix 1b).

Revised guide status and rationale:

No changes recommended in the five-year review. Minor rewording to clarify intent.

Retain an average of at least 10 well-dispersed, individual stems/ha: the remaining stems may occur in clumps.

Revised guide status and rationale:

No change proposed. See rationale provided above for the clearcut silviculture system.

Retain an average ≥ 1 supercanopy tree/ha.

Revised guide status and rationale:

Increased quantity of supercanopy trees to be retained. See rationale for selection silviculture system.

Guidelines: Removed

When the number of large living cavity trees, large stubs, veteran trees, and supercanopy trees averages <25/ha, additional wildlife tree requirements may be met by retaining safe standing dead trees, small stubs, or any other living trees.

Revised guide status and rationale:

Moved this guideline in the current guide regarding large diameter wildlife tree availability provision into the direction description.

Best management practices: Retained, revised, or new

Reasonable efforts will be made to avoid knocking down standing trees retained as wildlife trees during renewal and tending.

Revised guide status and rationale:

Feedback from the five-year review of the guide included concern with the use of terminology such as 'reasonable efforts' in standards and guidelines. From a compliance perspective, direction that includes terms such as 'reasonable efforts' is difficult to enforce consistently. Thus, this direction has been moved from a guideline to a BMP.

To the extent practical and feasible, 'stub' some wildlife trees:

- iv. to a height of ≥ 3 m (5 m is preferred);
- v. trees with existing cavities above the stubbing height or trees that provide other functions (e.g., mast trees, seed trees, veteran trees, supercanopy trees) should not be stubbed.
- vi. all tree species can be stubbed.

Revised guide status and rationale:

See rationale provided above for clearcut silviculture system.

Large trees providing existing nesting or denning sites are preferred as cavity trees (see also the *Ontario Tree Marking Guide*).

Revised guide status and rationale:

The requirement to retain all large living (≥ 50 cm dbh) hollow 'chimney' trees is now a guideline associated with SAR (bats and chimney swifts) habitat. The retention of large trees with existing nesting or denning sites is still a recommended BMP.

Best management practices: Removed

Stub up to 5 trees/ha.

Revised guide status and rationale:

Removed BMP. Combined with existing stubbing BMP above.

Mast trees, living cavity trees, large stubs, and scattered conifers should be ≥ 38 cm dbh whenever possible.

Revised guide status and rationale:

Removed BMP. Moved to description of preferred diameter of large wildlife trees in direction description.

See rationale provided above for selection silviculture system.

Supercanopy trees ≥ 60 cm dbh are preferred.

Revised guide status and rationale:

Removed BMP. Moved to description of preferred diameter of supercanopy trees in direction description.

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3.2.3.2 Downed woody material

Preamble/Direction

Revised guide status and rationale:

DWM was a new term introduced in the 2010 version of the guide. Minor rewording of preamble to reflect that this is no longer the case for the revised version of the guide.

Subject experts involved in the five-year review of the guide suggested that an additional description of the importance and management of DWM be added to the guide to strengthen the section. Therefore, more text has been added to preamble that specifies to the importance of downed decaying wood for biodiversity, long term productivity and health of forest ecosystems.

As deadwood is part of a continuum from standing live trees to soil (Bunnell and Houde 2010), DWM will continue to be primarily managed by implementation of direction for retention of wildlife trees and residual patches. The literature continues to suggest that

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retention of standing live and dead trees and their stage and rates of decay are important to maintain the continuum of downed dead wood recruitment through time (Bunnell and Houde 2010, Gustafsson et al. 2010, Jonsson et al. 2010, Jones and McPherson 2012).

Guidelines: Retained, revised, or new

Stems retained as wildlife trees (Section 3.2.3.1) that fall down or are felled for worker safety reasons to become DWM will be left on site unless with Ministry approval. Moving such trees for silvicultural purposes is permitted.

Revised guide status and rationale:

No change made.

The five-year review of the guide did not identify any new literature that refutes the current direction for DWM. However, there was a recommendation to consider providing direction for quantitative thresholds of DWM to retain in each block/stand in addition to the existing direction for leaving wildlife trees to become future DWM. Furthermore, subject experts suggested that the direction could be strengthened by addressing the qualitative characteristics (e.g., species, size, decay class) of DWM.

While science cannot currently recommend definitive threshold volumes for each forest type/age combination to meet productivity and biodiversity needs, it is beginning to focus on this question. Recently, minimum retention levels of DWM that would provide suitable habitat for a variety of deadwood dependent species have been reported (e.g., Work et al. 2004, Tremblay et al 2009, Müller and Büttler 2010, Work and Hibbert 2011, Hazlett et al. 2014). However, these studies fall short in providing a definitive minimum threshold amount of DWM to retain post-harvest that would ensure an adequate temporal supply of deadwood common to all forest types, species and species assemblages.

It has been recognized that standing and downed deadwood quantities observed in managed stands tend to be less than those found in comparably-aged natural stands (Franklin 1990, Kerr 1999, Hunt et al 2010, Fischer et al 2012, Moroni et al 2015, Omari and MacLean 2015). Intensive forest management and biomass harvesting in historically dead wood-dependent ecosystems could significantly decrease the amount and quality of deadwood present, which could lead to losses in habitat, reduce carbon storage and impact a broad suite of ecosystem services (Berch et al 2011, Venier et al 2015). These effects have been observed outside North America in Scandinavia where intensive forestry has been practiced for multiple rotations, where the long-term reductions in deadwood have contributed to reductions in forest structural complexity and saproxylic species diversity (Siitonen 2001, Gustafsson et al 2010, Jonsson 2016).

However, post-harvest DWM volumes in managed forests in northeastern North America and Ontario have often been reported to meet and even exceed the threshold

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dead wood volumes for various wildlife species (Vanderwel et al. 2010, Work and Hibbert 2011). Average, post-harvest deadwood volumes for clearcut operations across eastern Canada have been reported to range from 50-144 m³/ha (Pedlar et al 2002, Moroni 2006, Brassard and Chen 2008, Hagemann et al 2009). Jones and McPherson (2012) reported an average DWM volume (standing dead trees not included) of 56 m³/ha and Morneau et al (2004) reported average DWM volumes of 72 m³/ha (no site preparation) and 52 m³/ha (site prepared) after uniform shelterwood regeneration cuts in central Ontario. Vanderwel et al (2008) reported an average DWM volume of 46 m³/ha in selection cuts in the Great Lakes-St. Lawrence forest region in central Ontario.

Furthermore, harvesting operations can contribute a pulse of DWM from slash. Brais et al (2013) reported that there was 2.75 times as much DWM (165 m³/ha) in clearcut stands directly post-harvest versus in control (unmanaged) stands (60 m³/ha) due to a high volume of fresh woody debris from tree-length harvest operations. Vanderwel et al (2010) reported that on average, single-tree selection harvests in the Haliburton Forest in central Ontario added 24 m³/ha of DWM to the forest floor, which represented ~55% and ~45% of the respective DWM pools that were previously documented in selection-managed and unmanaged stands (Vanderwel et al. 2008). The authors suggest that harvest inputs of DWM are projected to sustain DWM stocks in selection harvested stands compared to unmanaged stands over the 20 years between harvest removals.

To compare the temporal patterns of DWM supply between managed (harvest origin) versus unmanaged (natural disturbance origin) stand conditions, Kwiaton et al (2020) analyzed long-term DWM measurements collected from the Ministry's Growth and Yield Program's permanent forest plot network. DWM measurements from ~3,480 plot locations representing managed and unmanaged origins and various developmental stages (establishment, crown closure, self-thinning, mature/over-mature) and spanning 10 ecoregions and 40 forest management units (FMUs) across the boreal (3,414 plots) and Great Lakes-St. Lawrence (66 plots) forest regions of Ontario were analyzed. In the boreal forest region, a large difference in DWM volume (80 m³/ha for unmanaged stands vs. 31 m³/ha for managed stands) was identified during stand establishment (0-20 yrs) but was followed by volume declines in both origin types to near similar levels in the 25-35 m³/ha range during the crown closure (21-40 yrs) that remained through to the early stages of self-thinning (41-60 yrs). DWM volumes recovered by the mature/over-mature (>61 yrs) stage to ~45 m³/ha and ~35 m³/ha for unmanaged and managed forest stands, respectively. Despite the sample size limitation, no overall differences in DWM volumes between unmanaged (32 m³/ha) and managed (24 m³/ha) stands were detected in Pw/Pr and tolerant hardwood stands in the Great Lakes-St. Lawrence forest regions. The authors concluded that the current guidance provided in the SSG (i.e., retention/protection of legacy DWM, logging debris quantities associated with full-tree harvesting, and green tree retention of 25 trees/ha) is an acceptable approach to retain DWM at sufficient quantities out to and beyond the self-thinning stage of stand development.

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Thus, the recent literature on DWM volumes in managed forests of Ontario does not support providing direction specifying the quantity of DWM to be retained post-harvest in managed stands.

More recent literature discusses qualitative characteristics of DWM (e.g., species, piece size, decay class distribution) that need to be considered in addition to volume retention and temporal supply (Vanderwel et al 2010, Densmore 2011, Arsenault et al 2012, Fisher et al 2012). Species of dead wood reflects the likelihood of large hollows and differences in bark and wood chemistry. Size, commonly based on diameter, is indicative of availability for denning by smaller invertebrates. As logs decay, the composition of faunal and floral species associated with them also changes. More advanced decay creates conditions for colonization by vascular plants, fungi, bryophytes, invertebrates, and smaller vertebrates that seek shelter or reproduce in soft wood (Bunnell and Houde 2010). Kwiaton et al (2020) suggest that by retaining/protecting existing DWM, which tends to be more decayed (decay class 3-5), along with the provision of additional DWM for post-harvest logging residues (largely in decay class 1-2) and future DWM from living wildlife tree retention, provides a reasonable mix of material that would be available until the self-thinning stage after which new materials contribute to a rebuilding of the DWM pool.

Furthermore, new direction in Section 3.2.3.1 (wildlife trees) requires that large (>25 cm dbh) wildlife trees be a relatively even mix of living, dying, and dead trees, as well as retaining a range of tree ages and decay classes post-harvest will ensure an extended temporal supply of standing and downed dead wood (see background and rationale for Section 3.2.3.1).

Thus, no additional qualitative direction for the retention of DWM is proposed in the next version of the SSG.

Use of woody biomass for bioenergy is expanding in response to concerns related to the declining forest sector, rising energy costs and the impacts of climate change. Delays in the advancement of biofibre consuming facilities have reduced immediate anticipated demands for biofibre and associated concerns regarding the adequacy of DWM retention levels. If and when more intensive biomass harvesting operations begin to occur on a broad scale, Kwiaton et al (2020) suggested there may be a need to restrict biomass removals.

However, in a metanalysis of experimental studies involving manipulations of dead wood amounts (DWM and/or standing dead trees), Riffel et al (2011) found that operational biomass harvests resulted in smaller post-harvest reductions in dead wood levels than those reported from the experimental studies in their analysis. They attributed minimal differences to existing guidelines in place restricting the removal of dead wood off-site for operational biomass harvesting. They further concluded that operational realities and economic viability may limit the negative impact of biomass harvesting on dead wood resources as operations will not likely occur everywhere at the same time across the landscape. To further substantiate their conclusion, the

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Landscape Guides, which provide direction for the amount and arrangement of different stand types and ages (i.e., natural landscape pattern, composition, and structure), should ensure that dead wood resources (quantity and quality) are available both spatially and temporally across the landscape.

Ontario has an extensive network of experimental and monitoring plots across a range of site conditions (e.g., long-term soil productivity (LTSP) program, Ontario Growth and Yield Program's permanent growth plot network). Results from these ongoing monitoring programs will help to further increase understanding of the effects of biofibre harvesting and biomass removal on forest ecosystems (Berch et al 2011, Puddister et al 2011) and may warrant additional direction in future versions of the guide for limiting removal of forest biofibre (e.g., inclusion of forest biomass retention thresholds).

Downed trees (or pieces of trees) present prior to harvest will be left on site (moving such trees for silvicultural purposes is permitted); where windstorms or other natural events (e.g., snow, ice) have recently caused damage to stands, trees leaning and downed by the recent disturbance, which normally would have been available for harvest, may be harvested and utilized.

Revised guide status and rationale:

No change made. Direction is still relevant. No new literature could be found that contradicts the current direction.

Best management practices: Retained, revised, or new

During all stages of forest operations, mitigative measures should be considered to minimize the:

- Crushing of large, downed logs;
- Smothering of coarse woody material by fine woody material or soil; and
- Windrowing of DWM. Where long windrows do occur, breaks should be provided to allow animals, other forest users, and operations unobstructed access routes. A 10 m break for every 100 m of windrow is a good target.

Revised guide status and rationale:

Direction is still relevant. Hautala et al (2004) suggested that deadwood losses can be caused by felling and scarification (disc trencher) operations that can crush and break logs into smaller pieces, move CWM from its original location, and bury it under the soil. They found that deciduous logs were more susceptible to damage from operations as decaying deciduous wood is softer than coniferous wood. They recommended that damaging and removing logs during operations be avoided.

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Retain as many unmerchantable logs or portions of logs (especially in large diameter classes) on site as logging method and silviculture objectives will permit.

Revised guide status and rationale:

BMP is still relevant but reworded.

Dead trees present prior to harvest, including those lowered to the ground for safety considerations, should be left on site (only safe dead trees will remain standing).

Revised guide status and rationale:

No change made. BMP is still relevant.

Best management practices: Removed

Piles of woody material which are not forecast to be utilized can be burned.

Revised guide status and rationale:

BMP removed. More appropriately covered in Section 5.2.4 (loss of productive forest area).

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(C&R) 3.3 Fine filter adjustments

Preamble

Revised guide status and rationale:

No changes made.

(C&R) 3.3.1 White-tailed deer

Preamble/Direction

Revised guide status and rationale:

Content of preamble changed. The Cervid Ecological Framework (CEF) suggests that management of deer habitat should be emphasized (or even a primary consideration) in Cervid Ecological Zones (CEZs) with moderate or high deer population objectives. Thus, in CEZs with moderate or high deer population objectives for all or part of the zone (see OMNR 2009 or more recent policy direction), winter concentration areas will normally be identified as winter deer emphasis areas (DEAs).

Current direction focuses on stratum I habitat within winter concentration areas. The 5-year review recommended revisiting whether direction should also be provided for stratum II habitat within winter concentration areas.

With moderating winter climatic conditions (see projections in Notaro et al 2014, 2015), deer may be less reliant on dense conifer cover (e.g., Hoving and Notaro 2015) and thus less likely to concentrate in traditional core areas (stratum I habitat). Instead, deer may occupy stratum II habitat throughout most winters and may not be as limited by severe winter conditions into the future (Kennedy-Slaney et al. 2018). These trends are already being observed (Brent Patterson, pers. Comm. 2018). Changing winter climatic conditions can also result in unpredictable severe winters, storm events, and an

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increase in the magnitude of snowfall events (Burnett et al. 2003) Thus, direction is proposed for both stratum I and stratum II habitat within winter concentration areas.

In Ontario, traditional yards typically represent 10-15% of the summer range area occupied by deer (Voigt et al 1997). Where stratum II has been delineated and does not differ substantially from stratum III the winter deer emphasis area should include only stratum I.

Further to climatic considerations, there are several studies that indicate that deer mobility is impaired, and predation risk is markedly increased, at snow depths <50 cm (Nelson and Mech 1986; Patterson and Messier 2000); those depths that deer would encounter in stratum II habitat. Increasing energetic costs associated with snow depths as little as 18 cm were reported (Kelsall and Prescott 1971), and more severe restrictions of movement have been reported at snow depths of 40 cm (Moen 1976). These restrictions in movement can limit browse availability and predation rates (DelGiudice et al. 2013a; Patterson and Messier 2000) and impact both deer condition and productivity (Garroway and Broders 2005, 2007). Considering the evidence presented here, and the advice of subject matter experts, it is likely that deer experience severe winter conditions at snow depths <50 cm; depths experienced by deer residing in stratum II habitat. This further supports the direction proposed for both stratum I and stratum II habitat within winter concentration areas with provisions for providing winter cover.

The 5-year review recommended revisiting whether direction should be provided for stratum III deer habitat. The carrying capacity of stratum III habitat strongly influences reproductive rate of deer populations (see discussion in original Background and Rationale for Direction). Carrying capacity is largely related to factors such as the amount of early successional forest, the area of permanent openings, and the supply of hard mast (beechnuts and acorns) (see discussion in original Background and Rationale for Direction).

Coarse filter direction at the landscape scale (e.g., creating early successional forest) and application of standard silviculture practices (e.g., SGRs for oak forest units) and wildlife tree direction (mast trees) maintains many of the components required by deer within stratum III. Managing additional components of non-winter habitat (e.g., creation of permanent openings) is largely beyond the scope of forest management planning (although semi-permanent openings can be created by roads, landings, and forestry aggregate pits).

Moreover, since deer populations may exceed population objectives in localized regions within the Ontario deer range, enhancing the carrying capacity of stratum III habitat throughout deer range in Ontario may not be consistent with population objectives for deer and other ungulates.

Thus, LLPs delineated as stratum III will normally only be identified as non-winter DEAs in CEZs with moderate to high deer population objectives (see OMNR 2009).

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Moved concept from existing guideline section to direction description.

Simplified and refocused wording with link to the CEF.

Strategic planning direction for winter DEAs focuses on creating a relatively even flow of recently disturbed (browse-producing) habitats and proximity to cover habitat. However, practitioners identified that implementation of this direction is very difficult for small deer yards or those dominated by private land. Advice from practitioners suggested that various factors such as composition of Crown forest, interspersions of Crown and private ownership, and access could influence how much Crown forest is required to make implementation of the strategic planning direction practical and feasible. Thus, flexibility is provided for local practitioners to identify appropriate DEAs.

Operational planning direction does not apply to winter DEAs where the interspersions of Crown and private ownerships makes it impractical or infeasible to implement the direction. For example, it is likely not feasible to meet the cover retention requirements in a 40-ha Crown lot surrounded by private land. Flexibility is provided for local practitioners to identify appropriate DEAs.

i) Winter deer emphasis areas (i.e., stratum I and II)

Standards and guidelines: Retained, revised, or new

To maintain a relatively uniform supply of browse-producing habitat through time:

- For each winter DEA, develop long-term targets (i.e., 100 years) that promote a relatively uniform area of selection cuts, shelterwood preparatory/regeneration cuts, and clearcuts within each 10-year planning period
- If the existing forest condition does not currently support harvest levels consistent with the long-term targets, show movement toward the long-term targets.

Revised guide status and rationale:

Replaces the following BMP:

Schedule similar levels of harvest and chemical tending operations for each year of the 10-year plan.

The 5-year review identified the need to evaluate the necessity/feasibility of adding direction to enhance browse supply.

The carrying capacity of deer yards is determined by the supply of accessible browse. Mature forest generally has relatively little browse; selection cuts, shelterwood preparatory/regeneration cuts, and clearcuts all produce an abundance of browse (see Broadfoot et al 1994). However, since cuts only provide abundant browse until

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regeneration grows beyond the reach of deer (e.g., generally <10 years for selection cuts; Whitlaw et al 1993), high carrying capacity can only be sustained by regular and periodic harvest operations.

Thus, proposed direction requires development of long-term targets that promote a relatively uniform area of selection cuts, shelterwood preparatory/regeneration cuts, and clearcuts within each Winter DEA during each 10-year planning period. For example, in a Winter DEA with 1,000 ha of selection FUs managed using a 30-year cutting cycle, the long-term target for each 10-year plan period would be approximately 330 ha of harvest area.

However, it is recognized that current forest conditions may not permit this level of harvest in the short term for reasons such as:

- An insufficient area of stands may be eligible for harvest based on stand age/time since last harvest
- Some stands eligible for harvest may be needed to meet direction for critical thermal cover (see below) or other values.

Moreover, market conditions may influence the ability to harvest allocated stands.

When achieving long-term targets is not feasible, plans will show short-term movement toward the long-term targets.

For each winter DEA, if the amount of severe winter cover (SWC) or mild winter cover (MWC) in stratum I or II is insufficient to meet retention requirements during operational planning (see below), develop long-term targets to increase the amount of the appropriate type of winter cover, and show movement toward these long-term targets.

Revised guide status and rationale:

Replaces the current guideline requiring the increase in conifer cover to $\geq 10\%$ as critical thermal cover in stratum I.

Direction now applies to both stratum I and II. Focus is on increasing SWC or MWC only where there is insufficient cover to meet retention requirements during operational planning.

The direction provides a terminology change when referring to cover. Previously, cover habitat was referred to as “critical thermal cover”, with the revisions proposing the use of the terms “Severe Winter Cover” and “Mild Winter Cover”. This change in terminology is based on recent research that demonstrates winter temperatures have little effect on deer mortality or habitat use requirements. Snow depth and the interspersed of food and cover (e.g. DelGuidice et al 2013a, b; Gilbert et al 2017, Courbin et al 2017) drive the distribution and survival probability of wintering deer at northern latitudes.

DelGuidice et al (2002, 2006) reported that snow depth imposes a far greater challenge to deer survival than ambient temperature, likely through changes in food habits,

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nutritional restriction, and predation. As such the primary role of cover is snow interception to minimize the energetic cost of locomotion (Parker et al 1984) and facilitate escape from predation (Nelson and Mech, 1986; Patterson and Messier, 2000). This also highlights the importance of having cover well interspersed with food rich stands.

Harvest, renewal, and tending operations within winter DEAs will result in the following distribution of patches of SWC, MWC, security cover and access cover:

- To maximize the area used by deer, any point within winter DEAs will be within 300 m of a mapped winter cover patch of SWC or MWC (i.e., 600 m cover-to-cover distance) that is ≥ 5 ha in size for MWC and ≥ 10 ha for SWC. Based on this spatial arrangement, approximately 10-15% of the winter DEA will be winter cover
- At least 75% of winter cover patches in stratum I and 25% of winter cover patches in stratum II will be SWC
- Harvest, renewal, and tending operations within SWC or MWC will maintain desired species composition, canopy closure, and stand height (see Notes)
- Where no mapped winter cover patches are available that meet the criteria identified the best available winter cover patch will be retained to meet cover-to-cover requirements.
- To enhance access to browse, any point within planned clearcuts within stratum I or II will be within 100 m of a mapped patch of security cover ≥ 2.5 ha in size (i.e., maximum cover-to-cover distance of 200 m)
- Within stratum I and II, if residual canopy closure will be $< 30\%$ in selection cuts, shelterwood preparatory/regeneration cuts, and clearcuts, retain ≥ 10 living conifers/ha that are ≥ 10 m tall to provide access cover. Based on availability, at a minimum, conifer will be retained in 2-3 clumps of a minimum of 3-5 trees with touching crowns (this also fully addresses scattered conifer tree direction for hardwood selection and shelterwood preparatory/regeneration cuts and partially addresses wildlife tree direction for clearcuts in Section 3.2.3.1).

Revised guide status and rationale:

Replaces current guideline for maintaining/enhancing deer winter concentration areas. Provides more specific wording.

First bullet: Critical thermal cover (now referred to as severe and mild winter cover)

Replaces general principle ii) in current guideline for maintaining/enhancing deer winter concentration areas. The 5-year review recommended revisiting characteristics of stands necessary to provide critical thermal cover (CTC) (i.e., are stands representing 'mild/moderate' winter cover sufficient?) in light of climate change considerations and the compatibility of various silviculture practices.

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It also suggested providing direction related to the distribution of CTC within yards. Current direction focuses on retention of 10-30% CTC (i.e., forest that provides thermal cover likely to be used in stratum I) following the recommendation (based on expert opinion) in OMNR (2004). The Background and Rational for Direction suggests that the "...exact amount of critical thermal cover to maintain will depend on deer yard carrying capacity (K) and associated objectives and targets". However, this direction is vague and planning teams have found this direction challenging to implement.

Unfortunately, empirical evidence upon which to base targets for winter cover is limited and equivocal. In one study in Quebec, Potvin and Boots (2004) found highest deer density in small landscapes (1-4 km² in size) with 40-60% preferred winter cover. In a preliminary assessment of conifer cover (based on FRI) in the Shawanaga deer yard near Parry Sound, high density portions of the yard (track index ≥ 3) averaged just over 20% of their area in cover-producing stands (low density areas (track index < 3) averaged under 10% of their area in cover-producing stands) (Brian Naylor, unpublished data). However, another study in Michigan found that distribution of deer was not correlated with the total amount of conifer within the surrounding landscape, but was associated with the interspersed and connectedness of conifer cover (Witt 2010: Appendix 1-6, Witt et al 2012).

Similarly, in New Brunswick, the spatial arrangement of winter cover appeared to be a key factor influencing distribution of deer in yards (Morrison et al 2003). Thus, the proposed direction specifies the composition, size, and spacing of patches of winter cover, rather than the aggregate area of winter cover within the yard.

What constitutes winter cover?

Current direction characterizes winter cover as stands in which the conifer component is ≥ 10 m tall and provides $\geq 60\%$ conifer canopy closure (CCC) (based on Voigt et al. 1997).

Empirical data suggests the height threshold of 10 m is likely still appropriate (perhaps even conservative). For example, in New Brunswick, Telfer (1978) found that occupied and abandoned deer yards differed primarily in the volume of conifer foliage 3-6 m above ground. In New Brunswick, deer preferred mixedwood stands dominated by trees larger than saplings (in NB, saplings are considered to be 2-7 m tall) during periods of deep snow (Sabine et al 2001). In Quebec, deer preferred spruce and balsam fir stands > 7 m in height during winter (Potvin et al 2003). In two yards in Nova Scotia, mean stand height at deer locations was 8 and 12 m (Lock 1997). In central Ontario, deer were more likely to be associated with stands > 12 m tall during winter (included some snow-free months) (Kearney and Gilbert 1976).

Moreover, a similar threshold (either 10 m or 35 ft) is recommended in numerous other jurisdictions (e.g., Reay 2000, Bennett 2010, DIFW 2012, NSDNR 2012, NBDNR 2014) (although Quebec assumes stands provide food and some cover when ≥ 7 m tall and best cover when ≥ 12 m tall (Hebert et al 2013)) and in habitat suitability models for deer

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(e.g., Stocker and Gilbert 1977, Broadfoot et al. 1994) and moose (e.g., Allen et al. 1987).

Thus, the proposed direction continues to assume conifers must be at least 10 m tall to provide adequate winter cover.

Proposed direction increases the CCC threshold to 70% when high value species (i.e., % balsam fir + cedar + hemlock + white spruce $\geq$ % black spruce + jack pine + red pine + white pine) are present. This increase is based on the concept that winter cover is most useful for deer as an interceptor of snow. In addition to the recommendation by subject matter experts, a CCC of 70% is commonly used by other jurisdictions (Reay 2000, DIFW 2012, NSDNR 2012, MDNR 2017). Further to this there are several studies that support maintaining a CCC of at least 70% in deer winter cover patches. In central Ontario, Euler and Thurston (1980) observed high use (at least 50% of peak use) of hemlock stands with canopy closure between 50 and 90%. In New Hampshire, habitat used by deer during winter averaged about 67% CCC but varied from 32-87% (Weber et al. 1983). When snow depth exceeded 50 cm, deer were most likely to be associated with stands with 50-90% CCC in Quebec (Dumont et al. 1998) and > 50% CCC in New Brunswick (Morrison et al. 2003).

However, when low snow interception value species (i.e., % balsam fir + cedar + hemlock + white spruce < % black spruce + jack pine + red pine + white pine) are dominant in the stand, a higher CCC target needs to be applied, with an 80% CCC target.

In mild winters or in parts of deer range where snow depth rarely exceeds 38 cm, deer use stands with lower CCC. For example, in studies in Quebec and New Brunswick when snow depth ranged from 20-50 cm, deer were associated with stands that ranged in CCC from 30% to >50% (Dumont et al. 1998, Morrison et al. 2003). This has led some jurisdictions to distinguish between primary winter shelter and secondary winter shelter (DIFW 2012) or severe winter habitat and moderate winter habitat (NBDNR 2014).

The proposed direction recognizes mild winter cover as stands that are likely to provide sufficient winter cover when snow depth is <38 cm (i.e., when deer are dispersed within stratum II), but not when snow depth exceeds 38 cm. The direction assumes that stands that meet at least 50% CCC (but do not meet the CCC thresholds for SWC) are likely to provide MWC.

Proposed direction focuses on retention of SWC in stratum I but provides some flexibility to retain some MWC where there is a shortage of winter cover patches of SWC. Proposed direction focuses on MWC in stratum II, but requires some retention of SWC recognizing that deer movement may be impeded at depths less than 50 cm, as those experienced in stratum II and to provide some refuge during winter storms.

Size of winter cover patches

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Older sources (expert opinion) recommended thermal cover be maintained in patches 0.4-2.0 ha in size (e.g., Telfer 1978); more recent sources recommend winter cover patches at least 10 ha for severe winter cover and 5 ha for mild winter cover in Nova Scotia (NSDNR 2012) and New Brunswick (NBDNR 2014).

There is limited empirical evidence to suggest an appropriate size threshold for winter cover patches.

In Michigan, size of conifer patches was related to the likelihood of their use by deer (Witt et al 2012) (although larger patches may not always support a higher density of deer; Beyer et al (2010) observed that deer may not use interior portions of large conifer stands in Michigan). In the study by Witt et al, 75% of patches used by deer were >4 ha and 50% were >14 ha in size (Jill Witt, unpublished data), roughly supporting the thresholds used in Nova Scotia and New Brunswick.

Proposed direction adopts the thresholds used in Nova Scotia and New Brunswick and requires winter cover to be retained in patches at least 10 ha in size for SWC and at least 5 ha in size for MWC.

Spacing of winter cover patches

Optimal spacing of cover patches is uncertain. In New Brunswick, deer were more likely to be found within about 300 m of stands with >50% CCC during severe winter conditions (i.e., snow depth > 50 cm) (conditions comparable to those likely to be encountered by deer when confined to stratum I) (Morrison et al. 2003). During moderate snow depths (20-50 cm) (conditions comparable to those likely to be encountered by deer in stratum II), deer were more likely to be found within about 600 m of stands with > 50% CCC and within about 300 m of stands with 30 to 50% CCC. Proposed direction requires retention of winter cover so that deer are always within 300 m (i.e., 600 m cover-to-cover distance) of a patch of SWC or MWC with a focus on SWC in stratum I and MWC in stratum II.

Note - If cover patches are circular – a 600 m distance between 10 ha patches (178 m radius) means that patches cover about 14% of the area. A 600 m distance between 5 ha patches (126 m radius) means patches cover about 9% of the area.

Second bullet: SWC patch proportion

Direction ensures a higher proportion of SWC patches are retained within stratum I where deer will be concentrating their activity under severe winter snow conditions.

Third bullet: SWC and MWC stand condition

Replaces current guideline to apply direction in Appendix 3.3 when harvesting within stratum I critical thermal cover stands.

Direction simplified. Appendix 3.3 is no longer necessary and has been removed.

Fourth bullet: Availability of cover patches meeting requirements

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When planning winter cover patches for retention, circumstances may arise where no stands meet the requirement identified for winter cover patches. In these instances, it is acceptable to retain the patch that most closely meets the cover requirements to ensure cover-to-cover distances are maintained.

Fifth bullet: Conifer stand cover-to-cover distance (security cover)

Replaces general principle i) in current guideline for maintaining/enhancing deer winter concentration areas. Recent clearcuts provide abundant browse but use by deer may be inversely related to distance to forest cover (e.g., Drolet 1978, Campbell et al 2006) (except where predators are absent (e.g., Casabon and Pothier 2007)). Greatest use of clearcuts occurs within 50 to 200 m, but typically occurs within about 100 m, of an uncut forest edge (e.g., Blymyer and Mosby 1977, Tomm et al 1981, Williamson and Hirth 1985, Bunnell 1990, Yeo and Peek 1992, and references cited within).

This evidence supports continued use of the current 200 m cover-to-cover distance threshold in the proposed direction.

There is little empirical evidence to define a minimum threshold for size of security cover patches. Habitat suitability models have used minimum patch size ranging from 0.5 to 8 ha (e.g., Short 1986, Roseberry and Woolf 1998, Anstedt 2016). Thomas et al (1979) suggested optimal patch size between 2.6 and 10.5 ha for mule deer in Oregon. Proposed direction uses a minimum patch size of 2.5 ha.

The restriction on the size of clearcut harvest areas has been removed. It is assumed that direction providing an interspersed of food- and cover-producing habitat (as reflected in cover-to-cover distance) is likely more important than that limiting the size of open browse-producing areas such as clearcuts.

Sixth bullet: Access cover - scattered conifers

Replaces current guideline to apply direction in Appendix 3.3 when harvesting stands within stratum I that are not critical thermal cover (but are sources of browse) regarding scattered conifers. Appendix 3.3 is no longer necessary and has been removed.

The five-year review recommended that direction addressing access cover be revisited given the amount of cover provided by regular application of silviculture systems and climate change considerations.

Proposed direction is simplified considering the following factors:

- Current deer direction requires retention of clumps of 3-5 conifers spaced 10 to 30 m, and no more than 60 m, apart (based largely on expert opinion in OMNR (2004), Naylor 1998 and earlier Ministry documents). Proposed direction (at least 10 conifers/ha retained in 2-3 clumps of 3-5 trees) is simpler and should meet the minimum requirements of the current direction.
- Direction applies in stratum I and stratum II; snow depths encountered in both SI (>50 cm) and SII (>20 cm) are likely to affect access to browse, see discussion above.

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- Direction only applies in stands likely to provide a high density of browse (i.e., selection cuts, shelterwood preparatory/regeneration cuts, and clearcuts).
- Direction only applies in stands if residual CCC will be <30%. Access to browse is generally not limiting when CCC is ≥30% (Broadfoot et al 1994). Thus, direction does not apply to shelterwood preparatory/regeneration cuts in conifer stands.

New roads, landings, forestry aggregate pits, and wood storage yards will not be constructed within SWC or MWC if their construction will result in a contiguous patch area <5 ha (MWC) or <10 ha (SWC).

When in alignment with short and long-term browse and habitat targets, new primary roads will not be constructed within stratum I.

Revised guide status and rationale:

These two pieces of direction replace the current guideline regarding road use management strategies where deer habitat is emphasized.

Current direction is based on recognition that roads are necessary to facilitate regular harvest within DEAs to maintain browse supply, but it is also understood that use of permanent (primary) roads during winter may result in vehicle-deer collisions and linear features can increase both predator encounters (Whittington et al. 2011) and hunting pressure (Farmer et al. 2006). Additionally, Bonnot et al. (2013) concluded that deer modify their habitat use between day and night in order to trade-off between high-quality resources and avoidance of disturbances such as roads.

Moreover, while deer-vehicle collisions can be a significant mortality factor on well-travelled and/or high-speed roads (e.g., Marcoux et al 2005, Grovenburg et al 2008, McShea et al 2008), there is no evidence this is a significant issue on forest access roads in Ontario. In fact, Munro et al (2012) found a positive relationship between deer abundance and density of paved [presumably roads with high mortality risk] in eastern Ontario. So, while the creation of roads should be avoided in deer winter habitat to reduce road facilitated predation, it is recognized that road development is required to facilitate harvest and meet browse targets.

Thus, restriction on construction of new primary roads remains but with consideration of browse habitat targets.

Direction added restricting construction of new roads, landings, and forestry aggregate pits in forest retained as SWC or MWC if their construction will result in a contiguous patch area <5 ha (MWC) or <10 ha (SWC).

Direction regarding use management strategies is vague and has been removed.

Standards and guidelines: Removed

Silviculture prescriptions will be consistent with deer habitat management objectives.

Revised guide status and rationale:

Standard removed. Vague direction. Stand level requirements (e.g., conifer canopy closure, retention of access cover) identified in direction and in Notes.

Where deer over-abundance has been identified as a chronic occurrence, and:

- eco-regional analysis has identified deer winter habitat as abundant (e.g., >15% of the summer range; this analysis is an MNR responsibility); and
- a reduction in the amount of deer winter cover can be achieved while keeping within the applicable Simulated Ranges of Natural Variation (SRNV) for Landscape Guide indicators; then consider reducing the amount of suitable winter deer habitat. Where feasible and desirable, this long-term objective can be accomplished by scheduling clear cutting of conifer stands to reduce the conifer component of strata I and II to below 10%, with mature conifer stands also reduced to <60% canopy closure.

Revised guide status and rationale:

Removed existing guideline and moved concept to Preamble.

Simplified and refocused wording with link to the Cervid Ecological Framework.

Best management practices: Retained, revised, or new

Where practical and feasible and consistent with applicable silvicultural ground rules, schedule harvest operations within stratum I and II for the winter season.

Revised guide status and rationale:

New BMP. Currently a general principle iii) in guideline for maintaining/enhancing deer winter concentration areas.

Within stratum I and II, to the extent possible:

- Maintain conifer canopy closure along known travel routes and in, or adjacent to, suitable night and day bedding areas, such as hemlock ridges and 'knobs' with south-facing slopes. In these areas, maintenance of conifer canopy closure of 80% is desirable, although 60% is often adequate when the conifer species are cedar or hemlock, and trees are 10 m or more in height; clusters of 3-5 conifers with branches touching is desirable.
- Maintenance of conifer canopy closure along known travel routes and in, or adjacent to, suitable night and day bedding areas should be prioritized to areas

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in stratum II immediately adjacent to stratum I to account for shifts in deer use patterns (i.e., the area of the yard identified as stratum I will likely change over time).

Revised guide status and rationale:

Direction for travel routes and bedding areas remains a BMP with the following rationale:

- Travel routes and bedding areas have been identified, however they are rarely known values;
- Fidelity to travel routes and bedding areas are unknown, especially considering influence of changing climate on patterns of deer habitat use;

No empirical evidence that alteration of individual sites adversely affects carrying capacity of winter DEAs.

Best management practices: Removed

Considerations for the management of critical thermal cover should include the maintenance of mature species of conifer trees and stands over time, based in part on their snow interception capabilities (see Table 2 in Section 3.3.4).

When canopy closure information is not available in the inventory, develop an acceptable relationship using other information (e.g., stocking).

Revised guide status and rationale:

BMPs removed and replaced with definitions of severe and mild winter cover (SWC and MWC) and high and low value snow interception tree species as defined in the Notes section. See discussion above related to defining SWC and MWC in terms of height and canopy closure.

When an accurate estimate of height is not available in planning inventories, stands ≥ 35 years old may be considered acceptable. This approximates the age at which most conifers reach a height of about 10 m on average sites (e.g., Carmean et al 1989).

Canopy closure thresholds may be influenced by conifer species present. While all conifers (except tamarack) provide some thermal cover, in Ontario (Voigt et al 1997, OMNR 2004) and elsewhere (e.g., Reay 2000, Bennett 2010, Beyer et al 2010), hemlock and cedar are considered to provide the best winter cover for deer. OMNR (2004) ranked conifer species in terms of their relative value as thermal cover as follows: hemlock, red spruce, and cedar (high value); white spruce, white pine, and balsam fir (moderate value); and red pine, jack pine, and black spruce (low value) (based largely on Allen et al (1987) and Broadfoot et al (1994)).

These rankings appear to be supported by a handful of studies. For example, in a study in the Himsforth Game Preserve in central Ontario, density of deer during winter

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tended to be higher in stands dominated by balsam fir (6.4 deer/km²) or white spruce (4.6/km²) than in those dominated by black spruce (2.1/km²) or red pine (2.3/km²); stands dominated by white pine had intermediate densities (3.6/km²) (Kearney and Gilbert 1976). During winter, deer in northcentral Minnesota used balsam fir-dominated forest more than expected, and jack pine/red pine-dominated forest less than expected (black spruce-dominated forest was used as expected) (Mooty et al 1987). In northern New Brunswick, deer showed a preference for stands dominated by cedar, hemlock, white spruce, red spruce, or balsam fir, but avoided those dominated by pines or larch (Morrison et al. 2003).

The proposed direction provides a simplified classification of cover species. High value species include hemlock, cedar, white spruce, and balsam fir, and low value species include white pine, red pine, jack pine, and black spruce.

The proposed direction specifies a CCC threshold for SWC of $\geq 70\%$. When accurate estimates of CCC are not available in planning inventories, it may be assumed that SWC will be provided by:

- Well-stocked stands (i.e., DEVSTAGE $\neq$ PREPCUT or SEEDCUT or FIRSTCUT or FINALCUT) with $\geq 70\%$ of the stocking comprised of conifers if the conifer component is dominated by high value snow interception tree species (i.e., % balsam fir + cedar + hemlock + white spruce $\geq$ % black spruce + jack pine + red pine + white pine), or with $\geq 80\%$ of the stocking comprised of conifers if the conifer component is dominated by low value snow interception tree species (i.e., % balsam fir + cedar + hemlock + white spruce $<$ % black spruce + jack pine + red pine + white pine).

The proposed direction specifies a CCC threshold for MWC of 50 to 80%. When accurate estimates of CCC are not available in planning inventories, it may be assumed that MWC will be provided by:

- Well-stocked stands with 50 to 70% of the stocking comprised of conifers if the conifer component is dominated by high value snow interception tree species, or 40 to 70% of the stocking comprised of conifers if the conifer component is dominated by low value snow interception tree species.

Moderately-stocked stands (e.g., DEVSTAGE = PREPCUT or SEEDCUT) with $\geq 70\%$ of the stocking comprised of conifers if the conifer component is dominated by high value snow interception tree species, or with $\geq 80\%$ of the stocking comprised of conifers if the conifer component is dominated by low value snow interception tree species.

Poorly stocked stands (e.g., DEVSTAGE = LOWNAT or LOWMGMT or FIRSTCUT or FINALCUT) are not SWC or MWC.

Schedule similar levels of harvest and chemical tending operations for each year of the 10-year plan.

Revised guide status and rationale:

Replaced with direction requiring maintenance of uniform supply of browse-producing habitat through time.

Notes: Retained, revised, or new

Security cover is provided by any vegetation that conceals a standing or bedded deer from predators or humans and includes forest stands ≥ 2 m tall (or $\geq$ sapling development stage), brush and alder (BSH), and treed wetlands (TMS).

Access cover is small patches of conifer trees (at least 3-5 stems) that are at least 10 m tall and retained at a minimum of 2-3 clumps with touching crowns that moderate snow depth, permitting deer to access surrounding browse.

Revised guide status and rationale:

New notes.

Security cover (also referred to as hiding, screening, or escape cover) is provided by any vegetation that conceals a standing or bedded deer from predators or humans. Concealment is generally provided by dense vegetation within 1-2 m above ground and may consist of shrubs, young trees, or understory vegetation in older forest (e.g., Short 1986, Bunnell 1990, Armleder and Dawson 1992, Yeo and Peek 1992, Pollock 1994). Forest stands ≥ 2 m tall (or $\geq$ sapling development stage), brush and alder (BSH), and treed wetlands (TMS) are considered to provide security cover.

Access Cover is used by deer to moderate snow depth when accessing browse. It is provided by small patches of conifer trees (at least 3-5 stems) that are at least 10 m tall and retained at a minimum of 2-3 clumps with touching crowns.

ii) Non-winter deer emphasis areas (i.e., stratum III)

Guidelines: Retained, revised, or new

To enhance access to forage, any point within planned clearcuts will be within 100 m of a patch of security cover ≥ 1 ha in size (i.e., maximum cover-to-cover distance of 200 m).

Revised guide status and rationale:

New direction.

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Recent clearcuts may provide abundant forage until they become dominated by tall woody vegetation if there is adequate security cover. See direction for winter DEAs and 'Notes' for rationale for cover-to-cover distance for clearcuts, definition of security cover, and patch size threshold. Note: patch size threshold is based near the lower end of the range described in the literature (see above), assuming a greater general level of cover during the growing season than during winter.

In northwestern Ontario, if operations are proposed in bur oak stands, or in stands which contain bur oak trees, maintain the bur oak component. See sections 3.2.1 (rare vegetation communities) and 3.2.3.1 (wildlife trees).

Revised guide status and rationale:

Direction remains unchanged.

Bur oak 'stands' are likely to be addressed by direction in Sections 3.2.1 (uncommon vegetation communities) or 4.3.1 (natural grassland habitat). Scattered bur oak trees are typically retained in harvest areas as mast or diversity trees as per Section 3.2.3.1 (also see direction for mast tree retention in BMPs below). However, the referenced sections do not give direction for maintaining bur oaks in DEAs, therefore direction is provided here.

Best management practices: Retained, revised, or new

To create semi-permanent openings valuable to deer, old roads, landings, forestry aggregate pits, and wood storage yards should not be artificially regenerated with forest stands. Seeding with a mixture of non-invasive (preferably native) grasses and forbs that provide cool- season forage will enhance value to deer.

In selection cuts, and shelterwood preparatory and regeneration cuts, preferentially retain hard mast-producing trees, especially red, white, and bur oaks as mast trees.

In clearcuts and shelterwood removal cuts, preferentially retain hard mast-producing trees, especially red, white, and bur oaks, as large wildlife trees (conventional clearcuts) or veteran trees (seed tree clearcuts and shelterwood removal cuts).

Revised guide status and rationale:

BMPs replace current BMP regarding stratum III.

BMPs are listed that are likely to enhance the beneficial effects of regular forest management operations on the carrying capacity of stratum III habitat based on the current guide and Voigt et al (1997).

Old roads, landings, and forestry aggregate pits can provide a semi-permanent supply of forage (especially that preferred by deer in spring and fall) if establishment of woody

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vegetation can be delayed and sites are seeded with a mixture of non-invasive grasses and forbs available during spring and fall (cool-season forage) (see discussion in Background and Rationale for Direction).

Current wildlife tree direction includes explicit targets for mast-producing trees in selection cuts and shelterwood preparatory and regeneration cuts. There are no explicit targets for mast trees in clearcuts or shelterwood removal cuts (although oaks are mentioned in the BMPs for clearcuts and mast trees are often retained as veteran trees). The second and third BMPs explicitly state that hard mast-producing trees (especially oaks) are preferred for retention as mast trees in selection cuts and shelterwood preparatory and regeneration cuts and that hard mast-producing trees (especially oaks) are preferred when retaining large wildlife trees in conventional clearcuts and veteran trees in seed tree clearcuts and shelterwood removal cuts.

Additionally, the current wildlife tree direction references the *Ontario Tree Marking Guide* (OMNR 2004) which indicates that deer feed preferentially from oak.

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(C&R) 3.3.2 Moose

Preamble/Direction

Revised guide status and rationale:

Content of preamble changed. Expanded on characteristics of moose habitat (see discussion in Background and Rationale for Direction). Clarified that application of fine filter direction addresses socio-economic objectives.

Application of the coarse filter in the Landscape Guides should provide a habitat mosaic suitable for moose. However, when objectives are developed that require the application of the fine filter direction presented here, the application of the fine filter direction cannot compromise the achievement of the coarse filter direction as directed in the Boreal and GLSL Landscape Guides. Thus, the proportion of management unit used to apply the fine filter moose direction will be management unit specific. The proportion of the management unit required to achieve moose objectives should be determined at the strategic planning phase of the development of the FMP while not compromising landscape level objectives. A starting point of approximately 15% of the management unit can be used by planning teams when determining the proportion of the management unit to be comprised of moose emphasis areas (MEAs). However, the proportion of MEAs within any management unit should be in alignment with achievement of objectives.

Direction focuses on the principal that moose habitat is influenced by factors such as habitat amount, arrangement, tending and renewal practices, and the influence of access through increased hunting and predation pressure.

Text clarifies that standards, guidelines, and best management practices in this section will be applied only in LLPs specifically identified for the emphasis of moose habitat. The revisions address the recommendation in the five-year review of the guide to revisit whether some direction should be applied in areas outside MEAs. Application outside MEAs is unnecessary and may adversely affect other coarse or fine filter objectives.

Potential LLPs where moose habitat management may be emphasized will normally include those areas within management units:

- Normally moose emphasis area direction does not apply to WMUs outside of the moose range as defined in the CEF (Cervid Ecological Zone: A and E). All

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other WMUs within moose range should be considered as candidate areas unless specific areas have already been identified for focus on another species. Focus selection in WMUs where the current population is below the population objective range, near the bottom range, or is trending downward.

- With habitat currently capable or has the potential of supporting moderate to high moose density (i.e., ≥ 0.35 moose/km²). Areas that are capable of supporting moderate to high moose density will normally be a mosaic of early successional browse-producing habitat, upland conifer providing winter cover, mixedwood forest providing food and cover, and wetlands. In order to achieve moose objectives, it may be necessary to include areas of the forest in MEA selection that do not currently have the characteristics of capable habitat but have the potential through management activities. It also must be noted that carrying capacity estimated for a specific area may not be an accurate measure of actual moose presence. Other factors such as predation and hunting pressure can influence moose abundance and therefore carrying capacity and should only be used as one piece of information when determining MEA location (Crête 1989, Messier and Crête 1984). Planning teams will use the most appropriate habitat suitability model available to identify MEAs. Use of habitat suitability index model in the OLT is suggested (Rempel et al. 2021).
- Ideally, areas where moose habitat is emphasized should be large enough to support a viable local population of moose. Allen et al. (1987) assumed that an area of approximately 10,000 ha could support a viable population if all necessary habitat requirements were present and there was frequent genetic interchange. Annual home range of moose in eastern North America is typically 20-40 km² (Crête 1988, Murray et al. 2012, McLaren et al. 2017). MEAs should normally be at least 2,000 ha in size.
- Where the objective from the Landscape Guide is to maintain a fine-textured landscape. The direction in this section will produce a landscape with high age class interspersation and high edge density. Thus, MEAs should not be located in LLPs that would be expected to support a coarse-textured landscape under a natural disturbance regime, otherwise landscape texture targets will likely be compromised.
- Existing road access may compromise the achievement of moose objectives as access can increase hunting pressure and predation on moose.
- *Crown Land Use Policy Atlas* (CLUPA) direction may compromise moose objectives and therefore areas with CLUPA direction that contradicts moose objectives should be avoided.
- Moose emphasis areas and deer emphasis areas should not overlap. Brain worm and liver fluke are significant concerns for moose management and deer

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are the intermediate host for both. Deer emphasis areas should only be considered within CEZ E or possibly some very specific parts of D1 and D2.

Removed last paragraph in current preamble to section. Relevant direction is now provided below.

Standards and guidelines: Retained, revised, or new

Within MEAs, manage the landscape to maintain an optimal mosaic of food and cover for moose and minimize access to promote moose populations. In addition to the strategic direction below, for each MEA, apply the operational planning direction, for harvest, renewal, tending, and roads as provided below.

To maintain an optimal landscape-level mosaic for food and cover for moose, each MEA will be comprised of:

- Within Boreal Landscape Guide regions:
 - 5-20% forest (all PFTs) <20 years old
 - 2.5-15% **hardwood forest** (PFT = POP, BWT, or TOL) ≥10 m tall
 - 10-30% **mixedwood forest** (PFT = MIX) ≥10 m tall
 - 10-20% **upland conifer forest** (PFT = MCU, PJK, or PWR) ≥10 m tall
 - 0.5-2.0% **lowland conifer forest** (PFT = MCL) ≥10 m tall.
- Within Great Lake-St. Lawrence Landscape Guide regions:
 - 0.5-10% forest (all PFTs) <20 years old
 - 20-50% **hardwood forest** (PFT = POP, BWT, or TOL) ≥10 m tall
 - 5-20% **mixedwood forest** (PFT = MIX) ≥10 m tall
 - 10-30% **upland conifer forest** (PFT = MCU, PJK, or PWR) ≥10 m tall
 - 0.5-5% **lowland conifer forest** (PFT = MCL) ≥10 m tall.

When accurate estimates of height are not available in planning inventories, stands ≥35 years of age may be considered acceptable as a replacement for 10 m in height.

Strategic planning will maintain MEAs within these ranges (or show movement toward these ranges if currently outside the ranges). Modifications to these objectives based on current or desired future forest conditions, consideration of other forest objectives, or compelling socio-economic considerations will be rationalized within the FMP. For definitions of **hardwood**, **mixedwood**, **upland** and **lowland conifer forest**, see Notes section below. Definitions may be adjusted by planning teams and rationalized in the FMP to more appropriately reflect local conditions.

Revised guide status and rationale:

Replaces first general guideline in current direction.

The five-year review identified the need to reduce the complexity of direction in the guide while maintaining its effectiveness.

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In order to assess the effectiveness of the SSG direction, a new moose habitat landscape capability model was developed (Rempel et al 2021) to examine the presence of moose in relation to forest habitat characteristics.

The five-year review suggested that the existing MEA composition targets be revised based on an analysis completed by Rempel et al (unpublished) who developed a new moose habitat suitability index model (HSI). The five-year review presented revised targets based on the characteristics (25th -75th percentile) of habitat supporting relatively high moose densities (top 25%). Proposed targets use a similar approach but are based on the characteristics (25th-75th percentile) of 10,000 ha areas that are likely to support moderate to high moose density (≥ 0.35 moose/km²) using moose HSI models (Rempel et al 2021).

The proposed composition targets presented in the five-year review reflect the theoretical optimal mix of food-, cover-, and food- and cover-producing habitats. Each of the targets now have region specific targets provided, outlining the difference in habitat needs between the Boreal and Great Lakes St. Lawrence Landscape Guide regions.

The analysis and development of region-specific habitat targets focused on the relationship between moose density and the amount of different habitat types but did not consider the effect of other factors such as climate, roads, hunting, or predation. Additionally, moose density was estimated using moose aerial inventories (MAI) which were conducted in the winter, therefore habitat usage in the spring/summer/fall may be underestimated in this analysis. Therefore, it is the intent of the habitat targets to be applied in conjunction with both strategic and operational targets including tending and silviculture, roads planning direction, spatial arrangement of habitat, and in alignment with the coarse filter approach.

The age threshold for browse-producing habitat has been reduced from 35 years (and <10 m tall) to 20 years. The age of onset for the conifer forest habitat type has been updated to be inclusive of forest units that are 10 m tall (≥ 35 years old), compared to the mature serial stage provided in the current SSG direction. This update was based on Allen et al 1987, as well as the results of Rempel et al 2021, landscape moose capability model for moose.

The development of the landscape moose capability model for moose (Rempel et al 2021) was based on provincial forest types. To reduce complexity and to allow implementation into forest management planning, targets have been presented in forest units. Definitions of hardwood, mixedwood, upland and lowland conifer forest may be adjusted by planning teams to more appropriately reflect local conditions, however rationalization is required in the FMP. See Notes section for definitions.

It may not be feasible or practical to meet some or all of these targets based on current or desired future forest conditions or consideration of other compelling forest or socio-

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economic objectives. Planning teams need to rationalize any modification of these targets in the FMP.

To minimize access to promote moose populations, strategic planning will include objectives for road planning in each MEA that are in alignment with direction provided in the operational prescriptions for harvest, renewal, tending, and roads in the operational planning direction (see below).

Revised guide status and rationale:

New direction. Acknowledges and requires that roads planning be undertaken during strategic planning (in addition to operational planning). Reflects that the intent of the direction above associated with habitat targets, needs to be applied in conjunction with both strategic and operational targets including roads planning direction.

Manage each MEA to maintain a preferred mosaic of food and cover for moose and minimize access by implementing objectives identified at strategic planning.

Revised guide status and rationale:

Operational planning direction that compliments the strategic planning direction above. Ensures operations to achieve the strategic-level objectives for optimal food and cover and access are implemented on the ground (i.e., during the AWS).

To enhance access to browse within MEAs, when forest structure permits, any point within planned clearcuts will be within 200 m of a mapped patch of security cover at least 2.5 ha in size (i.e., maximum cover-to-cover distance of 400 m).

Revised guide status and rationale:

New direction.

While the current literature continues to illustrate the importance of food supply and/or habitat productivity to habitat use, home range size, and/or carrying capacity, a number of studies suggest that amount of edge (between habitat providing cover and habitat providing food) may be as, or more, important than the total amount of food (Dussault et al 2005, 2006; Oehlers et al 2011; Lerclerc et al 2012) (except where large predators are absent such as in Scandinavia (Andren and Angelstam 1993)). Thus, the 5-year review of the guide suggested additional direction should be considered to ensure optimal interspersions of food and cover.

Past direction for moose (OMNR 1988) suggested residual forest be arranged to ensure moose using cutovers were within 200 m of suitable cover. Published studies generally support a 200 m threshold, although cows with calves, moose exposed to high levels of human disturbance, or moose subject to significant crusting of snow may rarely forage

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>100 m from cover (Hamilton et al 1980, Thompson and Vukelich 1981, Tonn et al 1981, Allen et al 1987, Molvar and Bowyer 1994, Kunkel and Pletscher 2000). Thus, the proposed direction uses a distance-to-cover threshold of 200 m.

Refer to Notes for the definition of security cover.

The five-year review included the recommendation that the current residual pattern direction be evaluated to determine if it provided adequate direction to provide interspersed food and cover. Residual pattern direction in Section 3.2.2.1 (i.e., 25 ha in 500 ha and 0.5 ha in 50 ha assessments) is not specific enough to provide the required size and spacing of security cover habitat for moose. Additionally, the definition of residual cover in Section 3.2.2.1 is not consistent with the definition of security cover for moose, as it excludes forest stands between 2 and 10 m tall, brush and alder (BSH), and treed wetlands (TMS).

Past direction (OMNR 1988) required patches of cover retained for moose in clearcuts to be 3-5 ha in size. This was based on expert opinion. Unfortunately, there is limited empirical evidence to define minimum patch size requirements for moose. In one clearcut in Ontario, moose used residual patches as small as 0.04 ha as cover (Hamilton et al 1980). In clearcuts in Quebec, moose used patches of mixed and deciduous forest ≥ 0.5 ha in size as nodes of activity (Courbin et al 2014). The proposed direction assumes security cover must be in patches ≥ 2.5 ha in size to align with direction for deer.

To maximize the amount of a MEA used by moose, when forest structure permits, any point within a MEA (excluding water) will be within 750 m of a mapped patch of summer thermal cover (STC) (i.e., maximum cover-to-cover distance of 1,500 m) that is at least 2.5 ha in size. At least 25% of the mapped patches retained as STC will be lowland conifer forest ≥ 10 m tall (or ≥ 35 years old if reliable estimates of height are not available).

Revised guide status and rationale:

Replaces current guideline for summer cover amount, size and distribution, location, and characteristics.

The five-year review continued to support direction in the guide requiring retention of summer thermal cover, especially considering the potential consequences of climate change (see discussion and references in the five-year review). However, the current direction (3% per 500 ha area) has been replaced with a distance-to-cover approach to be consistent with direction for patches of security and winter thermal cover. Distance-to-cover and minimum patch size are based on the literature and analysis of unpublished data on habitat use and movements by radio-tagged moose studied during the Moose Guideline Evaluation Project (MGEP) project in the northwest region (NWR) and by Brent Patterson's students in the southern region (SR) (Algonquin Park and French-Severn Forests).

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Allen et al (1987) suggested a minimum patch size of 2 ha for STC. In the SR, the median size of STC patches used by moose was 5.3 ha with the interquartile range (IQR) between 2.6 and 15 ha. In the NWR, the median size of STC patches used by moose was 3.5 ha with the IQR between 1.8 and 7.7 ha. Thus, a minimum patch size of 2.5 ha is proposed.

Allen et al (1987) suggested that optimal summer range was characterized by at least 8 patches of STC per 600 ha of moose range (about 1 km between patches if evenly spaced). In the SR, the median distance from moose observations to patches of STC at least 2.5 ha in size was 434 m, with the IQR between 195 and 786 m. In the NWR, the median distance from moose observations to patches of STC at least 2.5 ha in size was 367 m, with the IQR between 163 and 650 m. Thus, a maximum distance-to-cover of 750 m is proposed (i.e., 1,500 m maximum cover-to-cover distance).

In both the SR and NWR studies, about four times as many observations of radio-tagged moose were in patches of brush and alder (BSH) or tree wetlands (TMS) relative to lowland conifer forest. Additionally, Lowe et al (2010) observed that wetlands were cooler during the night than other habitat types used as summer thermal cover. Similarly, Olson et al. (2014) observed that open cover types were cooler than forested cover types during the three coldest hours of the day, with dense vegetation actually retaining heat. Thus, moose do not appear to rely primarily on lowland conifer forest as STC. Consequently, much of the existing direction describing 'Location' and 'Characteristics' of STC has been removed or changed to a BMP. However, direction to retain at least 25% of mapped patches of STC as lowland conifer forest ensures a mix of types of STC (BSH, TMS, and lowland conifer) will be retained.

Within their summer home range, cow moose use a wide range of habitat conditions for calving (Addison et al 1990, Langley and Pletscher 1994, Bowyer et al 1999). Calving sites are typically occupied for a few days to a week until calves become mobile (Cederlund et al 1987, Welch 2000). Reuse of specific calving sites appears to be limited and highly variable; mean distance between sites used by individual cows in consecutive years was >3 km in Alaska, Ontario, and Quebec (Chekchak et al 1998, Testa et al 2000, Welch 2000). While some fidelity to site location and a broad preference for some site types has been identified, provision of generally suitable habitat for moose over large expanses of forest is believed to provide moose with suitable sites where they can raise young (Welch 2000). Based on present knowledge and the information available, no direction has been provided with respect to management of calving and nursery habitat.

To maximize the area used by moose, when forest structure permits, any point within a MEA (excluding water) will be within 550 m of a mapped patch of winter thermal cover (WTC) (i.e., 1,100 m cover-to-cover distance) that is at least 10 ha in size

Revised guide status and rationale:

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Replaces current guideline for winter cover amount, size and distribution, location, and characteristics.

The five-year review continued to support direction in the guide requiring retention of winter thermal cover (see discussion and references in the five-year review). However, the proposed direction focuses on retaining winter thermal cover throughout each MEA since data are rarely available to identify 'concentration areas'.

Distance-to-cover and minimum patch size are based on the literature and analysis of unpublished data on habitat use and movements by radio-tagged moose studied during the MGEM project in the NWR, and by Brent Patterson's students in the SR (Algonquin Park and French-Severn Forests).

In the SR, the median size of WTC patches used by moose was 19 ha with the IQR between 9 and 41 ha. In the NWR, the median size of WTC patches used by moose was 15 ha with the IQR between 5 and 46 ha. Thus, a minimum patch size of 10 ha is proposed.

Allen et al (1987) suggested that optimal winter range was characterized by a supply of browse within 100 m of 'dormant season cover'. In SR, the median distance from moose observations to patches of WTC at least 10 ha in size was 286 m, with the IQR between 107 and 578 m. In NWR, the median distance from moose observations to patches of WTC at least 10 ha in size was 257 m, with the IQR between 106 and 510 m. A maximum distance-to-cover of 550 m is proposed (i.e., maximum 1,100 m cover-to-cover distance).

Renewal and tending prescriptions will have regard for the availability and abundance of moose browse over the short and long term and will be consistent with creating future stand compositions that will maintain moose habitat categories within their optimal ranges.

Revised guide status and rationale:

Builds upon current guideline for renewal/tending that provides for short and long-term moose browse and the BMPs related to moose feeding habitat and herbicide tending.

The five-year review recommended that the revised guide improve the integration of browse supply objectives in the planning of renewal and tending operations.

Thorough literature reviews by Lautenschlager (1993), Lautenschlager and Sullivan (2002), and Sullivan and Sullivan (2003) describing the effects of herbicide treatments on biotic components of forest ecosystems, including the supply of browse for moose and other ungulates, show that stand-level reductions in browse supply of at least 50% are common during the first year after treatment, with measurable effects typically persisting one to five years.

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It is appropriate to place restrictions on the use of herbicides within MEAs to maintain food supply for moose. Restrictions on chemical tending should not affect the ability to regenerate conifers required to provide cover. Similar to cover, calving areas generally occur in conifer stands as well as open rocky and grass meadows and therefore should not affect these areas (McLaren et al. 2017, Dussault et al. 2005; McGraw et al. 2011) for moose. However, it is important to restrict the application of herbicides on available forage in proximity to cover. McGraw et al. (2011) observed that cows with calves selected areas with larger proportions of lowland conifer, shrublands, and regenerating forests in post-parturition areas, than did cows without calves, suggesting that these cover types could have been used for cover and for foraging, respectively. Also, the availability of forage in proximity to cover is important for calf survival, Severud et al. (2019) observed that mortalities of calves occurred once females and their calves departed calving sites.

Evidence (cited in the sources noted above) from naturally-regenerating sites (information for artificially-regenerated sites is lacking) suggests that the initial reduction in browse supply following herbicide application may be compensated for by increased browse supply on, and use by moose of, treated sites (relative to untreated sites) 7-11 years after treatment. This may occur because browse on untreated sites has largely grown beyond the reach of moose and/or treated sites provide more cover. However, it is probable that moose have largely vacated the area before the onset of increased browse supply, because it is initially devoid of browse in proximity to cover for several years following herbicide application.

Given this information, chemical tending operations should only be implemented when needed to ensure maintenance of the habitat categories (i.e. upland conifer forest).

New roads will not split stands retained as winter or summer cover (unless the remnant stands still meet minimum patch size requirements).
During strategic planning, areas of no to low road density will be preferred in selection of MEAs.
To facilitate the achievement of moose habitat objectives, the re-use of existing roads and roadbeds will be preferred. When not available, new branch and operational roads will be permitted within the MEA with road use management strategies that are consistent with maintaining low levels of access.
During the use of roads required for harvest, renewal, and tending activities, access restrictions techniques will be identified based on local experience, considering access requirements needed to ensure forest operations are dispersed through space and time and to conduct post-harvest silviculture.

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Road use management strategies that align with MEA objectives will include decommissioning strategies and/or locally appropriate access restrictions. Road use management strategies will be documented in the FMP.

Revised guide status and rationale:

Replace current guideline for roads planning consistent with moose management objectives.

The five-year review recommended that the revised guide clarify ‘the effect of access on habitat suitability/moose population response and provide more explicit direction regarding road density, location, access control measures etc. within MEAs’.

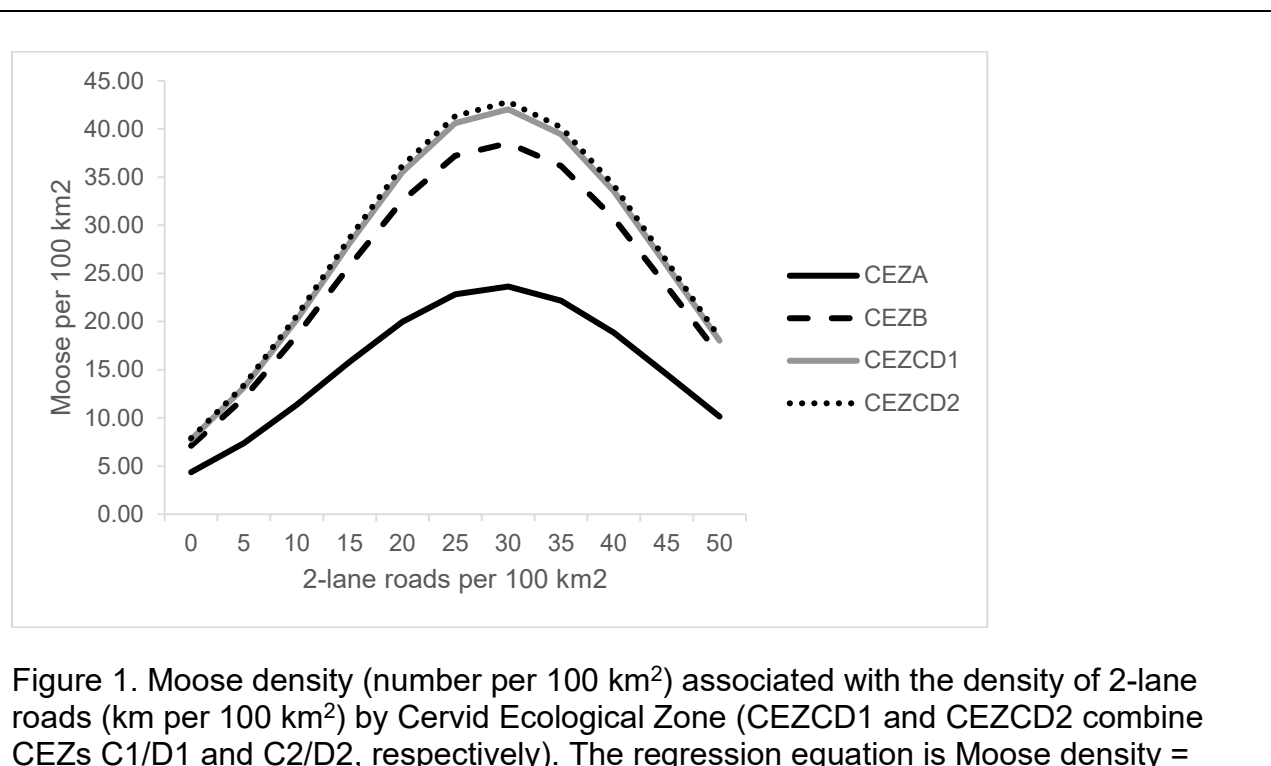
New forest access roads potentially pose a challenge to meeting moose population objectives. While recently disturbed sites are typically food-rich habitats, the literature generally suggests that the beneficial effects of harvesting on food supply may be at least partially offset by adverse effects associated with access roads. Roads may affect moose populations in multiple ways, including facilitating increased harvest by hunters (e.g., Timmerman and Gollat 1982, Rempel et al 1997, Schmidt et al 2005, Brown 2011, Hunt 2013), affecting use of space by moose (e.g., Dussault et al 2007, Laurian et al 2008, McLoughlin et al 2011, Shanley and Pyare 2011, Beyer et al 2013), and/or potentially facilitating increased access to moose populations by wolves, thereby contributing to increased moose mortality (Street et al 2015a).

A recent poll of subject matter experts across Canada indicated that access may be the most important factor contributing to moose declines since access contributes to increased hunter harvest and predator foraging efficiency (Marrotte et al 2022, P. Hubert and B. Patterson pers. comm. 2021). Crichton et al. (2004) and Eason et al. (1981) suggested complete closures or removal of roads are required once forest operations are complete to prevent the risk of further moose declines from hunting or increased predation. Further to this, Rempel et al. (1997) demonstrated that moose populations did not increase in modified clear-cuts (restricted maximum cutover-size to ensure that forage was close to cover provided by semi-mature to mature conifer stands) because hunter access increased as a consequence of high road density.

A comprehensive analysis demonstrates that moose abundance in Ontario is limited primarily by predation, with hunting playing a secondary role (Marrotte et al 2022). Additionally, Severud et al. 2019, observed that predation was the leading cause of death of calves (84% of mortalities), with wolves (*Canis lupus*) accounting for 77% of these. While wolves may travel more rapidly along linear features (e.g., McKenzie et al 2012, Zimmerman et al 2014, Dickie et al 2017) and higher rate of travel may lead to higher prey encounter and/or kill rates (McKenzie et al 2012, McPhee et al 2012, Vander Vennen et al. 2016), increases in road density are not always associated with increased rate of predation. For example, wolves may avoid roads associated with high human use (e.g., Popp et al 2016) or areas with a high density of roads (e.g., Whittington et al 2005). Also, since moose frequently avoid areas close to roads, encounter rates (e.g., Courbin et al 2013) and likelihood of kill sites (e.g., Kunkel and

Pletscher 2000) may be lower in areas with high road density. However, these findings are from areas of high human density and high road density which would not be a preferable location for MEAs, as it is also noted by these studies that moose also avoid areas close to roads, therefore negating the intent of MEAs. Finally, prey density may influence the use of linear features by wolves (Kittle et al 2017) or the influence of linear features on prey encounter rate (McKenzie et al 2012).

Moreover, the cumulative effect of these factors on the demographics of moose populations is complex. For example, while Brown (2011) found a negative relationship between sex ratio of moose populations in Ontario and density of two-lane roads, he found no relationship between density of two-lane roads and the rate of population growth or recruitment. However, Brown (2011) also observed a positive correlation existed between the proportion of males harvested and road density, suggesting that hunter access may have augmented harvest pressure. Moreover, Bowman et al (2010) observed a positive relationship between moose density and road density in their study in NWR. Unpublished analysis of Len Hunt's data (see Hunt 2013) suggests a quadratic association between population density and the density of two-lane roads that peaked between about 0.25 and 0.39 km/km² (Figure 1). However, it is difficult to separate the presence of roads from increased forage availability, as Bowman et al (2010) also observed a positive relationship with deciduous forest which may have been a result of harvest activities in higher density road areas. Additionally, the study by Bowman et al. (2010) did not include an analysis of hunting pressure and indicated that there was low human density within the location of study, which was just south of the northern logging extent in Ontario and thus on the northern extent of roads in Ontario.



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EXP ($1.47257 + 0.48846 \cdot \text{CEZB} + 0.57566 \cdot \text{CEZCD1} + 0.59404 \cdot \text{CEZCD2} + 0.11560 \cdot \text{Road Density} - 0.001975 \cdot \text{Road Density}^2$) where the dummy variables representing CEZs are 0 or 1 ($P \leq 0.001$, $R^2 = 0.77$). The curve peaks at a road density of about 29 km/100 km² with a 95% confidence interval from 25-39 km/100 km².

Brown (2011) noted that the ratio of bulls to cows was significantly lower where male moose were harvested and where road density was >0.185 km of road per km². Beyer et al (2013) noted a threshold in the association between density of two-lane roads and road crossing occurrence of moose in Algonquin Park of 0.2-0.4 km/km² depending on season. However, this study was in an area of moose protection and had low commercial harvest activities.

Defining a single threshold for road density may be problematic since effects of access on moose populations are likely context-specific and the associations presented here may or not be causal (L. Hunt, R. Rempel, A. Rodgers, pers. comm. 2018). For example, one study in northern Quebec found little effect of increased road density on harvest of moose (Courtois and Beaumont 1999); moose harvest was largely determined by density of traditional hunt camps. Thus, proposed direction is provided as a best management practice which permits the road density threshold to be used in consideration of access restriction and intended to be modified based on moose population objectives and expected hunter demand using local knowledge and experience as needed.

In order to reduce hunting access, access restriction techniques may range from road closures using signs or gates to deactivation. The most locally effective (e.g., Hunt and Hupf 2014) and socially acceptable (e.g., Mihell and Hunt 2011) techniques should be used, considering access requirements needed to ensure forest operations are dispersed through space and time and conduct post-harvest silviculture.

Standards and guidelines: Removed

Silvicultural prescriptions will be consistent with moose habitat management objectives.

Revised guide status and rationale:

Standard removed. Vague direction. MEA composition targets and stand level requirements (e.g., conifer canopy closure) identified in direction and in Notes.

Normally, an area or LLP with an objective to emphasize moose habitat management will be $\geq 2,000$ ha and, preferably, $\geq 10,000$ ha.

Revised guide status and rationale:

Standard removed. The minimum size patch of suitable habitat that could function as a MEA is already incorporated into the approach used to identify MEAs.

Best management practices: Retained, revised, or new

When selecting patches of security cover, summer thermal cover, and winter thermal cover, retain patches that provide for a range of cover-to-cover distances for the specific cover type (i.e., avoid selecting patches that are always the maximum distance apart by cover type).
When identifying patches of winter thermal cover, avoid selecting narrow patches.
Preferentially retain patches of STC that are at least 5 ha in size and within 200 m of MAFAs (especially class 3 or 4 MAFAs (based on the methodology described by Ranta 1998) >4 ha in size).
Develop silvicultural strategies for creating high-value feeding habitat along selected edges of operations such as cover patches and manage these sites as high-browse production sites.
When applying herbicides on rich mixedwood sites, use hand application methods (i.e., backpack sprayer) to avoid spraying shrubs that are preferred by moose as browse (e.g., dogwood, willow, mountain ash) and are not directly competing for resources with crop trees.

Revised guide status and rationale:

BMPs 1-3 compliment mandatory direction for cover patch requirements to assist in cover patch selection. When combined with the mandatory direction, replaces current BMPs (3) for suitable summer cover size, distribution, and stocking. See rationale for the guideline for summer thermal cover patch requirements.

BMPs 4-5 retained from current guide with minor edits.

To the extent practical and feasible, decommissioning opportunities of existing roads within MEAs will be documented in the road use management strategies.
When existing road density (all roads) exceeds 0.2 km/km ² within a MEA, to the extent practical and feasible, the density of existing roads should be decreased to <0.2 km/km ² using locally appropriate access restrictions or decommissioning activities.
To the extent practical and feasible, new roads should not be located within 100 m of class 3 or 4 MAFAs (based on the methodology described by Ranta 1998) that are ≥4 ha in size.

Revised guide status and rationale:

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Compliments standards and guidelines for roads planning consistent with moose management objectives.

When combined with the standards and guidelines, these BMPS replace current BMPs (2) for roads planning consistent with moose management objectives.

It is now mandatory that new roads will not be constructed in patches retained as winter or summer thermal cover unless the remnant stands still meet minimum patch size requirements (i.e., the road will not functionally fragment the cover patch).

To the extent practical and feasible, new roads should not be located within 100 m of class 3 or 4 MAFAs that are ≥ 4 ha in size. While there is no empirical information linking proximity of roads to use of MAFAs, numerous studies suggest reduced use/suitability of habitat near roads, with detectable effects $>1,000$ m from roads in some studies (e.g., Dussault et al 2007, Shanley and Pyare 2011, Laurian et al 2012). In a study of forest access roads (boreal Quebec), Laurian et al (2012) found that male and female moose avoided the area within 100 m of forest access roads (all classes pooled) during all seasons. Use within 100-250 m varied by sex and season; use beyond 250 m did not appear to be related to proximity to roads. While McLaren et al (2017) found that minimum distances of calving sites to primary, secondary, and tertiary roads in central Ontario were 260, 165, and 30 m, respectively. Additionally, Bowman et al (2010) indicated that moose use roadsides as forage. Thus, restrictions are placed on new roads within 100 m. Direction applies to MAFAs most likely to be used by moose (see Background and Rationale for Direction).

Notes: Retained, revised, or new

Hardwood forest is defined as productive forest dominated by hardwood tree species (normally the POP, BWT, and TOL provincial forest types (PFT); northwest region forest units: PODOM, BWDOM, OTHHD; northeast region forest units: PO1, BW1, LH1; GLSL forest units: PO, BW, BY, OAK, HDSL2, HDSL1, HDUS).

Mixedwood forest is defined as productive forest dominated by a mix of hardwood and conifer tree species (normally the MIX PFT, northwest region forest units: HRDOM, HRDMX, CONMX; northeast region forest units: MW1, MW2, GLSL forest units: LWMW, MWUS, MWD, MWR).

Upland conifer forest is defined as productive forest on upland sites dominated by conifer tree species (normally the MCU, PWR, and PJK PFT; northwest region forest units: PWDOM, PRDOM, PRWMX, UPLCe, SBDOM, SBMX1, PJMX1, BFDOM, PJDOM, northeast region forest units: PR1, PRW, PJ2, SP1, SF1, PJ1; GLSL forest units: PR, PWUS4, PWOR, PWUSC, PWUSH, PWST, PJ2, HE, SP1, SF, PJ1).

Lowland conifer forest is defined as forest on moist to wet or organic soils on lowland sites dominated by conifer tree species (normally the MCL PFT; northwest

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region forest units: OCLOW, SBLOW; northeast region forest units: BOG, SB1, LC1; GLSL forest units: CE, SB, LC).

Revised guide status and rationale:

New notes.

MEA composition targets are based on the habitat suitability index model (HSI) (Rempel et al 2021). These models are based on the area of habitat as defined by provincial forest type (PFT). However, forest units are also provided as an alternate to PFTs when classifying habitat types.

Security cover (SC) is provided by any vegetation that conceals a standing or bedded moose from predators or humans and includes forest stands ≥ 2 m tall (or ≥ 10 years old if reliable estimates of height are not available), brush and alder (BSH), and treed wetlands (TMS).

Revised guide status and rationale:

New notes.

Security cover (also referred to as hiding, screening, or escape cover) is provided by any vegetation that conceals a standing or bedded moose from predators or humans. Crête (1988) and Tape et al (2016) assumed that woody vegetation at least 2 m tall provided moose with security cover and appears to be consistent with observations from the MGEM project (Art Rodgers pers. comm. 2019). This aligns with the definition for deer (see references in Section 3.3.1) and other ungulates (e.g., Borkowski and Ukalski 2012, Carr et al 2007). Forest stands ≥ 2 m tall, brush and alder (BSH), and treed wetlands (TMS) are considered to provide security cover. When accurate information on stand height is not available, forest stands ≥ 10 years old may be assumed to be at least 2 m tall (this should be conservative for most forest units – see height-age curves in Payandeh 1973).

Summer thermal cover (STC) is considered to be represented by:

- **Well-stocked** lowland conifer forest that is ≥ 10 m tall (or ≥ 35 years old if reliable estimates of height are not available)
- Wetlands identified as brush and alder (BSH) or treed wetlands (TMS)
- If local knowledge of habitat is used to adjust this definition, rationale must be documented in the FMP

Well-stocked refers to stands that have not received a recent shelterwood regeneration (DEVSTAGE = SEEDCUT), release (DEVSTAGE = FIRSTCUT), or removal cut (DEVSTAGE = LASTCUT) or that are not otherwise identified as low stocking (DEVSTAGE = LOWNAT or LOWMGMT).

Revised guide status and rationale:

Replaces current characteristics of summer cover.

Numerous studies show increased use of conifer-dominated forest within thermally stressful periods during summer (e.g., Dussault et al 2004, Broders et al 2012, van Beest and Milner 2013, Street et al 2015b, Wattles 2015). Most studies do not distinguish between upland and lowland sites. However, in northwest Ontario summer-use of lowland conifer was positively related to air temperature but use of upland conifer was not (Street et al 2015b). Moreover, Allen et al (1987) assumed that lowland conifer was more suitable than upland conifer as summer cover. Thus, the definition of summer thermal cover (STC) focuses on lowland conifer stands (moreover, upland conifer is addressed by direction for winter thermal cover). Use of provincial forest type to identify STC is suggested, and standard forest units have been provided, but Landscape Guide forest units or any other habitat classification considered to provide the best local definition of suitable habitat may be used. However, any modification to habitat definitions needs to be justified and documented in the FMP.

In the studies cited above, canopy closure of conifer-dominated forest selected as thermal cover is not specified. However, in B.C., moose selected stands with 56-65% canopy closure during thermally stressful periods of summer (Demarchi and Bunnell 1995). Also, in B.C., Schwab and Pitt (1991) reported data related to canopy closure, indicating that the greatest proportional of seasonal locations were in 77% canopy closure. Moreover, Demarchi and Bunnell (1993) suggested that canopy closure needed to maintain moose near or below their upper critical temperature ranged from 36-85% depending on ambient air temperature. Thus, the definition of STC assumes that any well-stocked stands (i.e., stands that have not received a recent shelterwood regeneration (DEVSTAGE = SEEDCUT), release (DEVSTAGE = FIRSTCUT), or removal cut (DEVSTAGE = LASTCUT), or that are not otherwise identified as low stocking (DEVSTAGE = LOWNAT or LOWMGMT)), are suitable.

In the studies cited above, the age of conifer-dominated forest selected as thermal cover is either not defined (Broders et al 2012, Street et al 2015b), simply described as mature (Wattles 2015), or defined as >30 (Dussault et al 2004) or >40 years of age (van Beest and Milner 2013). Demarchi and Bunnell (1995) assumed that stands providing summer thermal cover were at least 10 m tall (although dense willow stands >5 m tall also appeared to provide suitable cover). Jacqmain et al (2008) found selection for stands >7 m tall during summer in Quebec. Thus, the definition of STC continues to include the criteria '≥10 m tall (or ≥35 years old)'. Stand height is likely a better reflection of stand structure and thermal cover. However, when an accurate estimate of height is not available in a planning inventory, stands ≥35 years old may be considered acceptable (approximate age at which most conifers reach a height of 10 m on average sites, e.g., Carmean et al 1989).

Understory shrub density is removed from the definition of STC. Its importance cannot be empirically supported and cannot normally be assessed using available inventories.

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Some wetland types also appear to be used as STC. For example, use by moose of brush and alder (BSH), and marshes (open (OMS) and treed (TMS) wetland) (Street et al 2015b, Wattles 2015), was positively related to air temperature during summer. Moose showed selection for BSH during summer in northern Quebec (Jacqmain et al 2008). Moreover, during summer in Algonquin Park and the French-Severn Forests, about four times as many locations of radio-tagged moose were in BSH or TMS relative to stands of lowland conifer (MCL) (analysis of unpublished data supplied by Brent Patterson). Schwab and Pitt (1991) indicated there was a positive relationship between moose and wetlands during the summer, suggesting not only do wetlands provide heat stress relief, but also sodium rich forage. It should also be noted that it appears that there is a trade-off between habitats that can protect moose from solar radiation (more canopy cover), and those that allow greater penetration of wind (less canopy cover) (Schwab and Pitt 1991, McCann et al 2013).

Thus, the definition of STC includes BSH and TMS. OMS polygons are not included; while they may play an important role in thermoregulation, they are unlikely to provide sufficient overhead cover to ameliorate air temperature.

Winter thermal cover (WTC) is considered to be represented by:

- **Well-stocked** upland conifer forest that is ≥ 10 m tall (or ≥ 35 years old if reliable estimates of height are not available) with $\geq 60\%$ canopy closure
- If local knowledge of habitat is used to adjust this definition, rationale must be documented in the FMP

Revised guide status and rationale:

Replaces current characteristics of winter cover.

Recent studies evaluating the importance of conifer cover in winter are equivocal. Some studies show increased use of at least some types of conifer forest during at least some portions of winter (e.g., Courtois et al 2002, Proulx and Kariz 2005, Dussault et al 2005, Jacqmain et al 2008, Kerckhoff et al 2013). In contrast, other studies show either proportional use or less use of conifer habitats (e.g., Poole and Stuart-Smith 2006, Jung et al 2009, Lenarz et al 2011, Courbin et al 2014, Street et al 2015c). In studies where mixedwood forest was present, moose showed either similar or greater use of mixedwood forest compared to conifer forest (e.g., Courtois et al 2002, Dussault et al 2005a, Jacqmain et al 2008, Lenarz et al 2011, Kerckhoff et al 2013). Moreover, use of conifer forest is not related to air temperature during winter (e.g., Dussault et al 2004, Street et al 2015b).

Thus, the five-year review recommended that targets for winter cover in the guide should also likely consider the importance of mixedwood forest.

However, Rempel et al (2021) found that both the amount of conifer and mixedwood forest independently influenced the density of moose in aerial inventory plots across Ontario. Moreover, the relative importance of mixedwood and conifer forest may vary

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during different periods of the winter, with conifer forest frequently assuming more importance during periods of deep snow during late winter (e.g., Jackson et al 1991, Courtois et al 2002, Dussault et al 2005a, Jacqmain et al 2008).

Thus, while there are separate targets for the percentage of conifer and mixedwood forest within MEAs (see above), the proposed direction for the spacing of winter thermal cover (WTC) focuses on forest that is likely to be used during severe winter conditions (similar to previous concepts of late winter cover; Timmermann and McNicol 1988).

WTC is defined as well-stocked upland conifer forest that is ≥ 10 m tall (or ≥ 35 years old) and has a $\geq 60\%$ canopy closure (Allen et al 1987, Jackson et al 1991, OMNR 2004).

Although the relative value of conifers varies in terms of snow interception capability (Allen et al 1987), most of the studies cited above do not distinguish between cover provided by different species. Thus, any well-stocked conifer-dominated forest that occurs on upland sites is potentially considered WTC.

The studies cited above do not specify canopy closure of stands considered to be suitable WTC. The proposed direction assumes that any conifer stands that have not received a recent shelterwood regeneration (DEVSTAGE = SEEDCUT), release (DEVSTAGE = FIRSTCUT), or removal cut (DEVSTAGE = LASTCUT) or that are not otherwise identified as low stocking (DEVSTAGE = LOWNAT or LOWMGMT)) are suitable.

In their HSI model, Allen et al (1987) defined optimal winter cover as stands with trees ≥ 10 m tall. Empirical studies have characterized suitable winter cover as stands > 7 m tall or from ≥ 30 - ≥ 60 years of age (Courtois et al 2002; Dussault et al 2004, 2005a; Proulx and Kariz 2005; Poole and Stuart-Smith 2006; Jacqmain et al 2008). Thus, the definition of WTC continues to include the criteria ' ≥ 10 m tall (or ≥ 35 years old)'. Stand height is likely a better reflection of stand structure and thermal cover. However, when an accurate estimate of height is not available in a planning inventory, stands ≥ 35 years old may be considered acceptable (approximate age at which most conifers reach a height of 10 m on average sites; Carmean et al 1989).

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(C&R) 3.3.3 Other species

Preamble

Revised guide status and rationale:

Content of section remains unchanged from current version.

Refer to original Background and Rationale for Direction for rationale.

(C&R) 4.0 CONSERVING BIODIVERSITY – Management of site-specific habitats

Preamble

Revised guide status and rationale:

Existing preamble to Section 4.0 remains largely unchanged. Additional context and clarification is provided for when AOCs overlap and the most restrictive direction is not intended to be followed, that it will be considered an exception to the guide. Preamble provides advice to be considerate of areas with high densities of values when making strategic landscape decisions to avoid potential conflicts between landscape level objectives and application of AOC prescriptions.

(C&R) 4.1 Maintaining ecological functions of aquatic and wetland ecosystems and shoreline forest including habitat suitability and productive capacity

Preamble

Revised guide status and rationale:

Minor changes to existing preamble to Section 4.1:

- Minor revision to indicate that there is no current catchment scale direction outside of the coarse/fine filter approach.
- Revised based on recommendations by Fisheries and Oceans Canada (DFO) during the five-year review of the guide (Richard Kavanagh, July 2015). For example, the *Practitioner's Guide to the Risk Management Framework for DFO Habitat Management Staff* (2007) is no longer used by DFO, so reference to this document was removed.
- Removed paragraph on impacts of road access to fisheries - discussion more appropriate in Section 4.1.5 which provides restrictions on access near self-sustaining brook and lake trout lakes.

At our Indigenous engagement sessions for the draft revised guide, we heard from many First Nation community and Métis representatives of the importance of protecting and conserving water, and that water is sacred and the source of all life. This is acknowledged and discussed in Section 4.1 as another example of the significance of aquatic ecosystems to society.

Direction

Revised guide status and rationale:

At our Indigenous engagement sessions on the draft of the revised guide, we heard from First Nation community and Métis representatives of the importance of the

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retention of shoreline forests. Thus, have added another example for why a planning team may choose to retain a specific area of shoreline forest on a particular water feature. Have added a set of conditions on regular operations to Section 4.1 that will be followed during any work around water features in the following sections including lakes, ponds, rivers, and streams and open water wetlands (woodland pools and mapped fens and marshes). During the five-year review, practitioners suggested reducing repetition by moving direction that applies to all water features to one section on general rules for working around water.

Standards and guidelines: Retained, revised, or new

No harvest, renewal, or tending operations are permitted within the AOC associated with a water feature that will result in damage to littoral zones, shorelines, beds, banks and associated stabilizing vegetation, or deposition of sediment within lakes, ponds, rivers, or streams. Operations specifically prohibited within the AOC include:

- Machine travel/site disturbance within the inner 3 m of the AOC
- Felling of trees into water features or the inner 3 m of the AOC. Trees accidentally felled into water features will be left where they fall
- Disturbance of the forest floor that leaves ruts (especially those that channel water into a water feature) or a significant area of exposed mineral soil between the height of land and the water feature or within the inner 15 m of the AOC (see Section 5.2, Figure 4.1a), whichever is less. Ruts and significant patches of exposed mineral soil will be promptly rehabilitated to prevent sediment from entering a water feature. Patches of mineral soil exposed by natural events are excluded.

Revised guide status and rationale:

The five-year review recommended revisiting the 3 m no machine zone around water (Bullet 1) given distances used in other provinces, information on sediment movement from the literature, and operational considerations.

No machine zones prescribed in other provinces that permit operations within shoreline areas range from 5-20 m. Models developed from agricultural studies suggest 3 m buffers of undisturbed vegetation will trap about 67-76% of sediment flowing from agricultural fields (see models in Liu et al 2008: Fig. 2, Yuan et al 2009; Fig. 1, Zhang et al 2010; Fig. 3a). A 5 m buffer would trap about 79-81% of sediment, a 10 m buffer would trap about 84-90% of sediment, and a 20 m buffer would trap about 89-97% of sediment.

Moving to a 5 m no machine (no site disturbance) zone would provide slightly better protection for water quality, align better with other jurisdictions, and still permit harvest to shore (feller bunchers generally have a reach of about 7 m), however, 3 m still provides protection for water quality and is operationally feasible.

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Bullet 3 in the current direction was removed since it is vague and difficult to enforce as mandatory direction. It has been reclassified as a BMP.

Bullet 3 in the revised direction (formerly bullet 4 in the current direction) permits some rutting/mineral soil exposure in low-risk portions of the inner 15 m of AOC provided it occurs beyond the height of land (i.e., portions of the inner 15 m that slope away from the water feature).

Bullet 5 in the current direction was removed since it is now covered in detail in Section 4.1.4.

No contamination of lakes, ponds, rivers, or streams by a deleterious substance is permitted. Specifically, no equipment maintenance (e.g., washing or changing oil) is permitted within 30 m of HPS lakes, ponds, rivers, or streams and within 15 m of LPS ponds and streams.

Application of pesticides is permitted (provided the product label permits) within the AOC as per the following:

- Aerial application of pesticides for renewal, tending, or protection is permitted within the AOC but will follow the *Ontario Ministry of Environment/Ontario Ministry of Natural Resources Buffer Zone Guidelines for Aerial Application of Pesticides in Crown Forests of Ontario* (1992)
- Machine-based ground application of herbicides for renewal, tending, or roadside brush control is permitted within the AOC; spray buffer zones will be 30 m for significant areas and 60 m for sensitive areas
- Hand-based ground application of herbicides (e.g., backpack sprayers) is permitted within the AOC; by applying a 3 m spray buffer
- All spray buffer zones will be measured from the edge of the water feature
- If increased buffers are required as per product label direction, increased buffer distances will follow manufacturer's application requirements.

Revised guide status and rationale:

Direction remains largely unchanged.

Replaced 'foreign materials' in current direction with 'deleterious substances' to be consistent with terminology in the *Fisheries Act*. Provide definition of deleterious substance in Notes section.

Within shoreline AOCs, the direction for retention of wildlife trees in harvest areas (see Section 3.2.3) will be followed with the specification to retain at least two living trees per 10 m of shoreline as a potential source of future aquatic coarse woody material preferably with the following characteristics:

- Dominant or co-dominant crown position (generally ≥ 15 m tall)

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- Close to the shoreline (ideally within $\frac{1}{2}$ the height of the tree)
- Leaning toward the water
- Not directly adjacent to other retained wildlife trees
- Conifers are preferred (but a mix of conifers and hardwoods is acceptable).

Additional wildlife tree retention will focus on living trees with preferential retention of windfirm trees that provide the following special habitat features for wildlife:

- Supercanopy trees (all forest units) of value to eagles and ospreys such as white and/or red pine (and trembling aspen in the boreal forest)
- Large living hardwood trees with existing cavities or the potential to develop cavities (all forest units)
- Scattered coniferous trees (selection forest units) or veteran trees (clearcut and shelterwood forest units).

Revised guide status and rationale:

Direction revised to require the retention of two living trees per 10 m of shoreline compared with one living tree per 10 m of shoreline in the current guide. Revised direction acknowledges that harvest of trees within riparian areas reduces large wood inputs to lakes compared to unharvested riparian areas (Pearce et al., 2022). Indigenous knowledge received during the preparation of the guide highlighted that the current shoreline tree retention requirements do not provide sufficient shoreline structure in lake and pond ecosystems.

The five-year review recognized that hardwood trees provide more allochthonous inputs than conifer trees (e.g., Muto et al 2009). Thus, revised direction places slightly less emphasis on retention of conifers.

Refer to the current Background and Rationale for Direction for rationale.

Best management practices: Retained, revised, or new

Machine travel should be minimized within the inner 15 m of the AOC.

Piling of felled trees should be minimized within the inner 15 m of the AOC.

Removal or damage of sapling-sized trees (<10 cm dbh) and shrubs within the inner 3 m of the AOC should be minimized.

Revised guide status and rationale:

BMPs moved up to Section 4.1 from Sections 4.1.1 and 4.1.2 to be included in generic rules for working around all water.

First two BMPs remain unchanged. Third BMP is new – currently a bullet in the standard for harvest, renewal, and tending operations within the AOC.

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(C&R) 4.1.1 Standing waters: lakes and ponds

Preamble

Revised guide status and rationale:

No changes made. No changes recommended in the five-year review.

Direction

Revised guide status and rationale:

Content remains largely unchanged. Minor changes include:

- Reference to OHN (Ontario Hydrological Network) more appropriate than operations maps
- All LPS ponds are addressed through AOCs, not with conditions on operations
- Content associated with hydrological linkages is now covered in a separate section (Section 4.1.4 – hydrological connections).

Description of value

Revised guide status and rationale:

Description of lakes and ponds changed.

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The five-year review recommended reducing complexity of the direction for water features. The proposed direction includes the following simplifications:

- Lake size (small, medium, and large) no longer used to prescribe most of the direction. All ponds are addressed through AOCs.
- Sensitivity is defined in two rather than three classes (as per recommendation in the five-year review).
- Sensitivity of ponds is simply based on the presence of trout (cold-water species), SAR fish, or the sensitivity of connected streams. The existing risk management framework is overly complicated, is generally poorly supported by inventory data, and is no longer used by DFO.

AOC dimensions (widths) moved from a current AOC operational prescription standard to the description of value section.

The five-year review supported the existing AOC widths for HPS features and have thus been retained (see literature summary in the five-year review). These widths are likely sufficient to capture 95% of sediment potentially flowing from major potential sources such as roads and landings (based on modelling described in the Background and Rationale for Direction, page 108-109). Note - this capture rate is likely an underestimate since the proposed direction for hydrological connections (Section 4.1.4) provides enhanced direction for features that are most likely to transport sediment to water features.

The five-year review recommended revisiting the adequacy of the 15 m AOC for LPS features given the growing recognition of the ecological importance of small (often headwater) aquatic features and the potential impacts on water quantity and quality in lower reaches (Ploum et al 2020, Richardson et al 2019). Thus, a slope-based approach is now applied for LPS features that is similar to that used for HPS features, with the exception that AOC widths are halved. Proposed AOC widths are likely sufficient to capture 80% of sediment potentially flowing from major potential sources such as roads and landings (based on modelling described in the Background and Rationale for Direction, page 108-109). Note – as above, this capture rate is likely an underestimate since the proposed direction for hydrological connections provides enhanced direction for features that are most likely to transport sediment to water features.

Direction on where to measure AOC in field moved from a current AOC operational prescription standard to the description of value section. Minor revisions made as where to measure AOC based on experience implementing the existing direction.

In some cases, the height-of-land (as defined in the glossary) may occur within the 30-90 m AOC for HPS lakes and ponds, or the 15-45 m AOC for LPS ponds. In these instances, certain activities such as harvesting and road construction may occur within the AOC beyond the height of land provided all other standards and guidelines for these features are followed such as residual shoreline forest proportion requirements, the

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maintenance of residual forest corridors on select features as well as the retention of shoreline wildlife trees.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to the following conditions:

- Harvest, renewal, and tending operations will follow the conditions on regular operations for working around water (see Section 4.1)
- $\geq 50\%$ of the area of the AOC (based on delineation of the AOC around the entire water feature, both inside and outside the harvest area) associated with small lakes (≥ 8 and < 100 ha) and HPS ponds, $\geq 75\%$ of the area of the AOC associated with medium lakes (≥ 100 and $< 1,000$ ha), and $\geq 90\%$ of the area of the AOC associated with large lakes ($\geq 1,000$ ha) will be retained as forest that meets the definition of residual (see Section 3.2.2)
- Harvest that retains forest that does not meet the definition of residual (e.g., conventional clearcutting) is permitted within the AOC where:
 - Slope to the water feature is $\leq 30\%$
 - Beyond the height of land (i.e., portion of the AOC that slopes away from the lake/pond) within the 30-90 m AOC for HPS lakes and ponds or the 15-45 m AOC for LPS ponds, provided all other standards and guidelines for these features are followed including the maintenance of at least 30 m of residual shoreline forest on sections of HPS lakes and ponds identified for the retention of forest that meets the definition of residual.

Revised guide status and rationale:

Direction revised.

Added reference (**first bullet**) to generic conditions on regular operations for working around all water features in Section 4.1.

No change proposed to **second bullet**. To emulate natural disturbance patterns, the Stand and Site Guide enables harvesting of riparian forest to create early successional shoreline habitat, while protecting fish habitat and water quality, so that habitat for a broad range of riparian plant, animal, and microbial communities are maintained. Emulating natural disturbance residual patterns in riparian forest in forest management practices continues to evolve (Moore and Richardson et al 2012, Kreutzweiser et al 2012, Naylor et al 2012, and Sibley et al 2012). However, clearcut harvesting to shoreline continues to be constrained by operational reluctance, stakeholder opposition, and overlapping direction for protection of other forest values, (Naylor et al 2012, Sibley et al 2012). Dragotescu and Kneeshaw (2012) reported that the quantity and size of residual patches post-clearcut harvest were significantly greater than post-fire which was partially attributed to regulations in place to retain residual forest buffers around water features. Although theoretically rationalized from an ecological perspective, there remains a need for further empirical evidence that the operational application of

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emulating natural disturbance principles in riparian forests and associated mitigative direction are both practical and effective. Thus, this direction will remain a high priority for effectiveness monitoring to ensure implementation of the direction maintains riparian forest structural and functional heterogeneity within the range of natural variation (Naylor et al 2012, Sibley et al 2012).

The literature continues to indicate that the spatial distribution and amount of post-natural disturbance residual patches is highly variable near water features. For example, Perera et al (2009) found a weak correlation between the area of residual patches (both insular and peninsular) and the proximity to water or wetlands within 11 lightning-originated, unsuppressed fires in boreal Ontario. Madoui et al (2010) reported that post-fire residual forest patches were associated with water bodies in only 33% of fires and failed to find any association at all with wetlands in boreal Quebec.

Conversely, Perera and Buse (2014) suggest that patches of post-fire residual forest are often associated with natural fire breaks such as wet areas including wetlands or open water (both lakes and streams). More specifically, Neilsen et al (2016) found that long-term fire refuges were more likely near shorelines of irregular-shaped lakes $\geq 5,000$ ha and in areas surrounded by a high coverage of water in the boreal forest of Saskatchewan. Dragotescu and Kneeshaw (2012) and Araya et al (2015) suggest that a majority of residual forest patches occur in close proximity (within 200 m) to surface water. Araya et al (2016) and Kuntzemann (2021) reported positive relationships between the probability of residual forest and the presence and amount of surrounding wetlands in boreal Ontario and Alberta, respectively. Ouarmim et al (2015), Krawchuk et al (2016), and Meddens et al (2018) suggest that susceptibility to fire and likelihood of forest patches surviving multiple fire events (fire refuges) are more dependent on specific microsite characteristics (e.g., topography, soil moisture, fuel characteristics) than on proximity to natural fire breaks.

Recently, Newaz et al (2020) modelled post-fire residual forest patterns in the boreal forest of Ontario to inform the redesigning of lake buffers to better emulate natural disturbance patterns. They showed that the amount of shoreline forests consumed by fire (0 to 100%) and the amount and distribution of residual forests within 123 boreal lakesheds affected by 26 fires was highly variable. Dragotescu and Kneeshaw (2012) also found that post-fire residual forest varied substantially from almost absent to representing 60% of the area adjacent to water features in 16 fires in boreal Quebec with a tendency for residual forest to be more concentrated near sinuous rivers versus more linear rivers. However, when specifically looking at proportion of shoreline disturbed by lake size, Newaz et al (2020) found that the percentage of shoreline burned was negatively correlated with lake size; lakes < 100 ha had an average if approximately 47% of their shoreline burned, lakes between 100 and 1,000 ha had approximately 25% of their burned, and lakes $> 1,000$ ha had approximately 8% of their shoreline burned. Thus, their results continue to support the current direction for the proportion of shoreline (by lake size) that needs to be retained as residual forest.

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Removed requirement to retain mature forest with $\geq 60\%$ canopy closure in the inner 15 m (second bullet in current standard). Recommendation in the five-year review of the guide was to reduce complexity of direction. Removal of this specific direction (for standing water only) reduces complexity of direction and is believed to have minimal impact on potential use of shoreline forest strip as a travel corridor and on visual screening.

No change to **third bullet** (slope requirement ($\leq 30\%$) for clearcutting within the AOC). No new empirical evidence could be found to dispute this direction. Existing background and rationale remains valid. Includes new sub-bullet to allow for additional harvesting within the AOC beyond the height of land. When the height of land has been identified within the AOC for an HPS lake or pond, additional harvest may occur beyond the height of land provided all standards and guidelines for the feature are followed. If the section of the AOC where the height of land has been identified is intended to be maintained as residual forest, then the width of the residual forest must not be less than 30 m to continue to function as a travel corridor.

Removed requirement to retain 1 ha of residual shoreline forest for every 1 ha clearcut (fourth bullet in current standard). Recommendation in five-year review of the guide was to reduce complexity of direction. By the definition of residual forest in Section 3.2.2, and as per direction in first bullet above, at least 50% of an AOC area on standing water features must be retained as forest that ≥ 35 years of age or ≥ 10 m tall. Thus, retention of some shoreline forest that will develop old growth characteristics is already required.

Removed requirement to follow DWM direction within AOC (fifth bullet in current standard). Section 3.2.3.2 (DWM) already states that DWM direction will be applied to all harvest areas.

Some or all of the requirements for the retention of residual forest within the AOC may be met by residual shoreline forest outside the harvest area, residual shoreline forest retained in overlapping AOCs, or residual shoreline forest retained in areas with steep slopes ($>30\%$). Additional requirements for residual shoreline forest may be met by retaining residual shoreline forest:

- To maintain the suitability of special habitats associated with lakes and ponds. For example, preferentially retaining residual shoreline forest:
 - Associated with recharge areas associated with brook trout spawning sites (see Section 4.2.1)
 - Adjacent to moose aquatic feeding areas (MAFAs) (see Section 4.2.4), especially in specific areas (e.g., LLPs) identified for enhanced moose management.
- Where there is a high potential for hydrological connections between terrestrial and aquatic ecosystems that channel ephemeral surface and/or shallow groundwater flows to lakes, ponds, rivers, or streams (see Section 4.1.4). The Ministry's hydrological flow accumulation modelling spatial product, which

identifies the potential locations of hydrological connections (flowpaths), is available on the Natural Resources Information Portal (NRIP) for the managed forest.

- To maintain internal and external connectivity. Within the AOC, a relatively continuous corridor (average width of gaps <50 m; maximum width of gaps <200 m) of residual forest at least 30 m wide retained along at least 1 side of each HPS lake or pond to connect special habitat features (e.g., osprey nests, MAFAs) associated with the lake or pond and link with residual forest on connected lakes, ponds, rivers, and streams.
- To emulate natural disturbance patterns. For example, preferentially retaining residual shoreline forest:
 - On the leeward side of a lake or pond
 - Comprised of forest types with lower fire susceptibility (e.g., lowland conifer)
 - Where there is an opportunity to incorporate it into a larger patch of residual forest (see Section 3.2.2)
 - That has the highest likelihood of being windfirm .

Revised guide status and rationale:

Some minor rewording throughout direction.

Second bullet – Direction pulled out of first bullet in current guideline to stand alone as a new bullet. Recently, the Ministry's CNFER (Dr. R. Mackereth) mapped flow paths for the managed forest using flow accumulation and digital elevation models. Planning teams will be provided a spatial product (available for download on the Natural Resources Information Portal (NRIP)) that identifies the potential location of hydrological connections (flowpaths) based on this hydrological modelling.

The hydrological and biogeochemical processes occurring in soils in riparian areas adjacent to lakes, ponds, rivers, and streams, have a stronger influence on water quality compared to more upland, non-connected soils. Areas of hydrological connections have been shown to be an important source of dissolved organic carbon in boreal headwater catchments (Ploum et al 2020). Headwaters can represent a significant length of stream which can make it operationally not feasible to protect during forest operations. The extent to which forest operations (e.g., off-road heavy machinery traffic) may alter groundwater flow paths and potentially impact downstream water quality through sediment transport, methylmercury production, export and bioaccumulation, and nutrient leakage depends on the extent of hydrological connectivity between disturbed location and adjacent streams (Laudon et al 2016). The strong influence of local topography on hydrological flowpaths and soil biogeochemical properties allows for the use of high-resolution LiDAR capable of providing digital elevation models, which when coupled with hydrological modelling algorithms, can accurately predict the location of these hydrological flowpaths for appropriate protection measures during forestry operations (Kuglerová et al 2014, Ågren et al 2015, Laudon et al 2016, Leach et al 2016)

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Fourth bullet - Because wet organic soils (often associated with lowland forests) in riparian zones are the most connected to adjacent surface waters, are more sensitive to potential site disturbance caused by heavy machinery traffic, and are presumably less likely to burn (Araya et al 2016, Ouarmim et al 2016), retention of residual forest associated with these areas of hydrological connections (*sensu* Kuglerová et al 2014) may help create a more natural riparian forest pattern while addressing riparian groundwater discharge and methylation hotspots (Kuglerová et al 2017). Additionally, Erdozain et al (2020) found these areas of strong hydrological connectivity to be more sensitive to forest management activities (e.g., road construction) than non-connected riparian areas along headwater streams with cumulative effects downstream (Erdozain 2021).

To emulate natural patterns in residual shoreline forest, a shift from systematic, fixed-width buffers to site-specific, variable-width buffers combined with some carefully implemented shoreline harvest could better maintain the ecological structure, function, and heterogeneity of riparian forest ecosystems (Webster et al 2015, Kulgerová et al 2014, Kreutzweiser et al 2012, Naylor et al 2012, Sibley et al 2012). Musetta-Lambert et al (2017, 2019) found that fire-derived, early successional riparian forests provided significantly greater and compositionally distinct leaf litter material and resulted in more abundant aquatic invertebrate communities in headwater streams compared to harvested (with 30 m riparian buffers) and undisturbed riparian forests.

Currently, the direction for retention of residual shoreline forests prescribes the application of fixed-width riparian buffers that may result in “donuts” around lakes and “ribbons” along streams of older forest. It has been argued that traditional, fixed width buffer zones adjacent to water features do not effectively address the spatial heterogeneity of hydrological conditions and biogeochemical processes as a result of site-scale topographic variation in riparian forests (Kulgerová et al 2014, Oldén et al 2019, Erdozain et al 2020, Jyväsjärvi et al 2020, Chellaiah and Kulgerová 2021). Thus, it is recommended that a revised guide effectiveness monitoring priority (Section 7) include additional research to examine this hypothesis and to enhance the direction to create of a more natural pattern of residual forest in riparian areas.

Construction of new landings and use of existing landings are not permitted within the AOC.

Revised guide status and rationale:

Minor wording revisions to clarify that direction applies to new and existing landings. Landings are a potential major source of sediment. Thus, construction of new landings and use of existing landings are not permitted within the AOC.

New roads that are not associated with an approved water crossing are not permitted within the AOC except :

- In extraordinary circumstances and the road, including specific location, is identified and justified through the FMP AOC planning process

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- Where the road is constructed beyond the height of land and its construction does not compromise other standards and guidelines for the water feature.

Revised guide status and rationale:

Minor wording change for consistency with other direction including allowances for road construction beyond the height of land.

New roads within the AOC that are not associated with an approved crossing will:

- Use fill material that is erosion-resistant and/or protected from erosion for portions of the road built below the normal high-water mark
- Limit grubbing to only that required to address engineering and safety concerns (e.g., remove hazards)
- Have ditches designed to minimize the possibility of sediment entering the water feature.

Revised guide status and rationale:

Direction moved from section 5.1.1.2 (Roads within areas of concern). Applies only to roads approved/constructed under extraordinary circumstances.

When new roads traverse residual forest within the AOC, the width of the cleared corridor will be as narrow as practical and feasible, and will not exceed 20 m.

Revised guide status and rationale:

No change to direction.

Construction of new forestry aggregate pits and wood storage yards and use of existing forestry aggregate pits and wood storage yards are not permitted within the AOC.

Revised guide status and rationale:

Minor wording revisions to clarify that direction applies to new and existing aggregate pits and wood storage yards. Forestry aggregate pits are a potential major source of sediment. Thus, construction of new pits and use of existing pits are not permitted within the AOC.

Standards and guidelines: Removed

No harvest, renewal, or tending operations are permitted within the AOC that will result in damage to littoral zones or shorelines and associated stabilizing vegetation,

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or deposition of sediment within lakes or ponds. Operations specifically prohibited within the AOC include: (5 additional bullets).

No contamination of lakes or ponds by foreign materials is permitted. Specifically, (3 additional bullets).

Revised guide status and rationale:

These two current standards moved up to Section 4.1 from Section 4.1.1 where they are included in generic rules for working around all water.

Harvest, renewal, and tending operations will follow appropriate operating practices to minimize rutting, compaction, and mineral soil exposure that could lead to erosion and subsequent transport and deposition of sediment in lakes or ponds (see Section 5.2). Particularly, (1 additional bullet).

Revised guide status and rationale:

Current guideline moved up to Section 4.1 from Section 4.1.1 where it is included in generic rules for working around all water and direction for hydrological connections in Section 4.1.4.

Harvest, renewal, and tending operations will, to the extent practical and feasible, encourage perpetuation of the distinctive character of the shoreline forest while emulating natural disturbances and/or succession (unless conversion is required to meet other ecological objectives).

Revised guide status and rationale:

Removed current guideline and reclassified as BMP. The concept is still valid, but the direction is vague and not enforceable as mandatory direction.

Within the inner 15 m of the AOC, at least 10 trees/100 m of shoreline spaced about 10 m apart will be retained as a potential source of future aquatic coarse woody material. Living trees with the following characteristics will be preferentially retained: (4 additional bullets).

Within the remainder of the AOC, the general direction for retention of wildlife trees in harvest areas (see Section 3.2.3) will be followed. However, the focus will be on living trees with preferential retention of windfirm trees that provide the following special habitat features for wildlife: (3 additional bullets).

Revised guide status and rationale:

These two current guidelines moved up to Section 4.1 from Section 4.1.1 where they are included in generic rules for working around all water.

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New roads that traverse the AOC will be planned to avoid areas with a high potential to contain ephemeral streams, springs, seeps, and other areas of groundwater discharge. Crossings of recognizable ephemeral streams, springs, seeps, and other areas of groundwater discharge will consider the design principles in Section 5.1 to minimize the risk of sediment delivery and disruption of hydrological function.

Revised guide status and rationale:

Removed from Section 4.1.1, now included in Section 5.1.1 (roads) as direction applies to all roads both within and outside shoreline AOCs.

No harvest, renewal, or tending operations are permitted that will result in damage to littoral zones or shorelines and associated stabilizing vegetation, or the deposition of sediment within ponds. Operations specifically prohibited include: (4 additional bullets).

No contamination of ponds by foreign materials is permitted. Specifically, (2 additional bullets).

Landings and aggregate pits are not permitted within 15 m of ponds.

New roads will not be located within 15 m of ponds unless there is no practical or feasible alternative and appropriate mitigative measures are taken to minimize the risk of sediment entering ponds and disruption of hydrological function (see Section 5.1).

Revised guide status and rationale:

Specific direction for LPS ponds found on page 44 of current guide removed. As LPS ponds now receive similar protection as HPS features, but with AOC widths halved, separate standards and guidelines for LPS ponds are no longer required.

Best management practices: Retained, revised, or new

Harvest, renewal, and tending operations will, to the extent practical and feasible, encourage perpetuation of the distinctive character of the shoreline forest while emulating natural disturbances and/or succession (unless conversion is required to meet other ecological objectives).

Revised guide status and rationale:

This is a guideline in the current guide and has been reclassified as BMP as the direction is vague and not enforceable as mandatory direction.

Best management practices: Removed

Machine travel should be minimized within the inner 15 m of the AOC.

Piling of felled trees should be minimized within the inner 15 m of the AOC.

Revised guide status and rationale:

BMPs moved up to Section 4.1 from Section 4.1.1 where they are included in generic rules for working around all water.

Prescribed burns should be considered as an option for renewing shoreline forest.

Revised guide status and rationale:

BMP removed – not practical.

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(C&R) 4.1.2 Flowing waters: rivers and streams

Preamble

Revised guide status and rationale:

No changes made. No changes recommended in the five-year review.

Direction

Revised guide status and rationale:

Content remains largely unchanged.

Removed the following items:

- Reference to LPS streams being addressed by CROs (all streams are now addressed by AOCs).
- Discussion of hydrological linkages (now addressed in Section 4.1.4 (hydrological connections)).

Description of value

Revised guide status and rationale:

Description of rivers and streams changed.

The five-year review recommended reducing complexity of the direction for water features. The proposed direction includes the following simplifications:

- Stream sensitivity is defined using two rather than three classes as per the recommendation in the five-year review
- The sensitivity of streams is simply based on stream size (which is assumed to reflect the complexity of the aquatic community) and the presence of trout (cold-water species) or SAR fish. The existing risk management framework is overly complicated, is generally poorly supported by inventory data, and is no longer used by DFO
- Flow regime is no longer used to define sensitivity since it is generally poorly defined in available inventories
- Proximity to lakes or large streams is no longer used to elevate small streams to the HPS category. The five-year review suggested this was overly restrictive and is likely unnecessary given the new slope-based AOCs and approach to the protection of hydrological connections for all streams.

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AOC dimensions (widths) moved from a current AOC operational prescription standard to the description of value section.

The five-year review supported the existing AOC widths for HPS features and have thus been retained (see literature summary in the five-year review). These widths are likely sufficient to capture 95% of sediment potentially flowing from major potential sources such as roads and landings (based on modelling described in the Background and Rationale for Direction, page 108-109). Note - this capture rate is likely an underestimate since the proposed direction for hydrological connections (Section 4.1.4) provides enhanced direction for features that are most likely to transport sediment to water features.

The five-year review recommended revisiting the adequacy of the 15 m AOC for LPS features given the growing recognition of the ecological importance of small (often headwater) aquatic features and the potential impacts on water quantity and quality in lower reaches (Ploum et al 2020, Richardson et al 2019), as well as their potential response to forest management operations and role in the mobilization and export of methylmercury (MeHg) to aquatic systems (Negrazis et al 2022, Eklöf et al 2020, Eklöf et al 2016). Thus, a slope-based approach is proposed for LPS features that is similar to that used for HPS features, with the exception that AOC widths are halved. Proposed AOC widths are likely sufficient to capture 80% of sediment potentially flowing from major potential sources such as roads and landings (based on modelling described in the Background and Rationale for Direction, page 108-109). Note – as above, this capture rate is likely an underestimate since the proposed direction for hydrological connections provides enhanced direction for features that are most likely to transport sediment to water features. Additionally, in the initial one-year post-harvest results coming from a study near Dryden, Ontario, Huang et al (2024) found evidence of elevated concentrations and production of MeHg in stream sediment, likely a result of increased total Hg and carbon (from organic matter mobilized from adjacent upland soils due to harvest) in streams with minimal buffer protection (current 15 m AOC for LPS features), and increased riparian soil disturbance. In a companion study at the same location, Lam et al (2024) reported increased concentrations and export of MeHg during harvest where an upstream machine crossing (i.e., non-road water crossing) resulted in hydrologically-connected soil disturbance that altered natural water movement. The results of the studies support the more restrictive direction regarding site disturbance and tree retention being proposed in the riparian zones of smaller headwater streams.

Direction on where to measure AOC in field moved from a current AOC operational prescription standard to the description of value section. Minor revisions made as where to measure AOC based on experience implementing the existing direction.

In some cases, the height-of-land (as defined in the glossary) may occur within the 30-90 m AOC for HPS rivers and streams or the 15-45 m AOC for LPS streams. In these instances, certain activities such as harvesting and road construction may occur within

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the AOC beyond the height of land provided all other standards and guidelines for these features are followed.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to the following conditions:

- Harvest, renewal, and tending operations will follow the conditions on regular operations for working around water (see Section 4.1)
- Forest that meets the definition of residual (see Section 3.2.2) must be retained within the AOC (based on delineation of the AOC along the entire water feature, both within and outside the harvest area) on at least one side of rivers and HPS streams to provide a travel corridor
- To provide shade, mature forest with relatively uniform canopy closure $\geq 60\%$ (canopy openings not to exceed individual tree crowns) must be retained within the inner 15 m of the AOC on both sides of HPS and LPS **stream segments known to support fish that are sensitive to changes in water temperature**, and **streams that are sensitive to changes in water temperature** unless the inner boundary of the AOC is >15 m from the active channel. If forest is not mature or does not have an initial canopy closure $\geq 60\%$, no harvest is permitted
- Harvest that retains forest that does not meet the definition of residual (e.g., conventional clearcutting) is permitted within the AOC:
 - Where slope to the water feature is $\leq 30\%$
 - Beyond the height of land (i.e., portion of the AOC that slopes away from the river/stream) within the 30-90 m AOC for HPS rivers and streams or the 15-45 m AOC for LPS streams, provided all other standards and guidelines for these features are followed including the maintenance of at least a 30 m width of residual forest along HPS rivers and streams to provide a travel corridor.

Revised guide status and rationale:

Direction revised.

Added reference (**first bullet**) to generic conditions on regular operations for working around all water features in Section 4.1.

No change to **second bullet**. No new empirical evidence could be found to dispute this direction. Existing background and rationale remains valid.

Third bullet only applies to streams known or suspected to support fish that are sensitive to changes in water temperature (see Notes at end of Section 4.1.2 for definition).

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No change to **fourth bullet** regarding slope to water feature. No new empirical evidence could be found to dispute this direction. Existing background and rationale remains valid. Includes new sub-bullet to allow for additional harvesting within the AOC beyond the height of land. When the height of land has been identified within the AOC for an HPS river or stream, additional harvest may occur beyond the height of land provided all standards and guidelines for the feature are followed. If the section of the AOC where the height of land has been identified is intended to be maintained as residual forest then the width of the residual forest must not be less than 30 m to continue to function as a travel corridor.

Removed requirement to follow DWM direction within AOC (fifth bullet in current standard). Section 3.2.3.2 (DWM) already states that DWM direction will be applied to all harvest areas.

Some or all of the requirements for the retention of residual forest within the AOC may be met by residual shoreline forest outside the harvest area, residual shoreline forest retained in overlapping AOCs, or residual shoreline forest retained in areas with steep slopes (>30%). Additional requirements for residual shoreline forest may be met by retaining residual shoreline forest:

- To maintain the suitability of special habitats associated with rivers and streams as described in Section 4.2. For example, preferentially retaining residual shoreline forest:
 - Associated with recharge areas associated with brook trout spawning sites (see Section 4.2.1)
 - Adjacent to moose aquatic feeding areas (MAFAs) (see Section 4.2.4), especially in specific areas (e.g., LLPs) identified for enhanced moose management
- Where there is a high potential for hydrological connections between terrestrial and aquatic ecosystems that channel ephemeral surface and/or shallow groundwater flows to lakes, ponds, rivers, or streams (see Section 4.1.4). The Ministry's hydrological flow accumulation modelling spatial product, which identifies the potential locations of hydrological connections (flowpaths), is available on the Natural Resources Information Portal (NRIP) for the managed forest.
- To maintain internal and external connectivity. Within the AOC, a relatively continuous corridor (average width of gaps <50 m; maximum width of gaps <200 m) of residual forest at least 30 m wide retained along at least 1 side of each river or HPS stream to connect special habitat features (e.g., osprey nests, MAFAs) associated with the river or stream and link with residual forest on connected lakes, ponds, rivers, and streams.
- To emulate natural disturbance patterns. For example, preferentially retaining residual shoreline forest:
 - On the leeward side of a river or stream

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- Comprised of forest types with lower fire susceptibility (e.g., lowland conifer)
- Where there is an opportunity to incorporate it into a larger patch of residual forest (see Section 3.2.2)
- That has the highest likelihood of being windfirm.

Revised guide status and rationale:

Some minor rewording throughout direction.

See [summary of recent science](#) that continues to support this direction in equivalent direction for lakes and ponds in Section 4.1.1.

Construction of new landings and use of existing landings are not permitted within the AOC.

Revised guide status and rationale:

Minor wording revisions to clarify that direction applies to new and existing landings. Landings are a potential major source of sediment. Thus, construction of new landings and use of existing landings are not permitted within the AOC.

New roads that are not associated with an approved crossing are not permitted within the AOC except:

- In extraordinary circumstances and the road, including specific location, is identified and justified through the FMP AOC planning process
- Where the road is constructed beyond the height of land and its construction does not compromise other standards and guidelines for the water feature.

Revised guide status and rationale:

Minor wording change for consistency with other direction including allowances for road construction beyond the height of land.

New roads within the AOC that are not associated with an approved crossing will:

- Use fill material that is erosion-resistant and/or protected from erosion for portions of the road built below the normal high-water mark
- Limit grubbing to only that required to address engineering and safety concerns (e.g., remove hazards)
- Have ditches designed to minimize the possibility of sediment entering the water feature.

Revised guide status and rationale:

Direction moved from section 5.1.1.2 (Roads within areas of concern). Applies only to roads approved/constructed under extraordinary circumstances.

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When new roads traverse residual forest within the AOC, the width of the cleared corridor will be as narrow as practical and feasible, and will not exceed 20 m.

Revised guide status and rationale:

No change to direction.

Construction of new forestry aggregate pits and wood storage yards and use of existing forestry aggregate pits and wood storage yards are not permitted within the AOC.

Revised guide status and rationale:

Minor wording revisions to clarify that direction applies to new and existing forestry aggregate pits and wood storage yards. Aggregate pits are a potential major source of sediment. Thus, construction of new pits and use of existing pits are not permitted within the AOC.

Standards and Guidelines: Removed

No harvest, renewal, or tending operations are permitted within the AOC that will result in damage to littoral zones or shorelines and associated stabilizing vegetation, or deposition of sediment within lakes or ponds. Operations specifically prohibited within the AOC include: (5 additional bullets).

No contamination of lakes or ponds by foreign materials is permitted. Specifically, (3 additional bullets).

Revised guide status and rationale:

These two current standards moved up to Section 4.1 from Section 4.1.2 where they are included in generic rules for working around all water.

Harvest, renewal, and tending operations will follow appropriate operating practices to minimize rutting, compaction, and mineral soil exposure that could lead to erosion and subsequent transport and deposition of sediment in lakes or ponds (see Section 5.2). Particularly, (1 additional bullet).

Revised guide status and rationale:

Current guideline moved up to Section 4.1 from Section 4.1.1 where it is included in generic rules for working around all water and direction for hydrological connections in Section 4.1.4.

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Harvest, renewal, and tending operations will, to the extent practical and feasible, encourage perpetuation of the distinctive character of the shoreline forest while emulating natural disturbances and/or succession (unless conversion is required to meet other ecological objectives).

Revised guide status and rationale:

Removed current guideline and reclassified as BMP. The concept is still valid, but the direction is vague and not enforceable as mandatory direction.

Within the inner 15 m of the AOC, at least 10 trees/100 m of shoreline spaced about 10 m apart will be retained as a potential source of future aquatic coarse woody material. Living trees with the following characteristics will be preferentially retained: (4 additional bullets).

Within the remainder of the AOC, the general direction for retention of wildlife trees in harvest areas (see Section 3.2.3) will be followed. However, the focus will be on living trees with preferential retention of windfirm trees that provide the following special habitat features for wildlife: (3 additional bullets).

Revised guide status and rationale:

These two current guidelines moved up to Section 4.1 from Section 4.1.2 where they are included in generic rules for working around all water.

New roads that traverse the AOC will be planned to avoid areas with a high potential to contain ephemeral streams, springs, seeps, and other areas of groundwater discharge. Crossings of recognizable ephemeral streams, springs, seeps, and other areas of groundwater discharge will consider the design principles in Section 5.1 to minimize the risk of sediment delivery and disruption of hydrological function.

Revised guide status and rationale:

Removed from Section 4.1.2, now included in Section 5.1.1 (roads) as direction applies to all roads both within and outside shoreline AOCs.

No harvest, renewal, or tending operations are permitted that will result in damage to stream channels or banks and stabilizing vegetation, or deposition of sediment within stream. Operations specifically prohibited include: (4 additional bullets).

No contamination of ponds by foreign materials is permitted. Specifically, (2 additional bullets).

Landings and aggregate pits are not permitted within 15 m of the active channel.

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Extraction trails may cross LPS streams. However, crossings will be minimized and will follow the operating practices described in Section 5.2 to minimize rutting, compaction, and mineral soil exposure that could lead to erosion and subsequent transport and deposition of sediment in streams. Temporary crossing structures will be used when appropriate and construction will follow the principles described in Section 5.1.

New roads will not be located within 15 m of ponds unless there is no practical or feasible alternative and appropriate mitigative measures are taken to minimize the risk of sediment entering ponds and disruption of hydrological function (see Section 5.1).

Revised guide status and rationale:

Specific direction for LPS streams found on page 53-54 of current guide removed. As LPS streams now receive similar protection as HPS features, but with AOC widths halved, separate standards and guidelines for LPS streams are no longer required.

Best management practices: Retained, revised, or new

Harvest, renewal, and tending operations will, to the extent practical and feasible, encourage perpetuation of the distinctive character of the shoreline forest while emulating natural disturbances and/or succession (unless conversion is required to meet other ecological objectives).

Revised guide status and rationale:

This is a guideline in the current guide and has been reclassified as BMP as the direction is vague and not enforceable as mandatory direction.

Best management practices: Removed

Machine travel should be minimized within the inner 15 m of the AOC.

Piling of felled trees should be minimized within the inner 15 m of the AOC.

Revised guide status and rationale:

BMPs moved up to Section 4.1 from Section 4.1.1 where they are included in generic rules for working around all water.

Prescribed burns should be considered as an option for renewing shoreline forest.

Revised guide status and rationale:

BMP removed – not practical.

Notes: Retained, revised, or new

Recognizable unmapped stream segments are those that can reasonably be identified at the time of operations. During some seasons it may be difficult to accurately identify unmapped streams and/or determine their width. However, forest workers are expected to exercise due diligence in identifying and protecting these features. For example, distinct channels that are bordered by alders and that lead from lakes, ponds, or mapped wetlands likely contain streams. Forest workers should use their professional judgement to determine the likely location and characteristics of the stream and apply the appropriate course of action. Where there is significant uncertainty, a conservative approach should be used. For guidance on determining stream presence, refer to The Stream Permanency Handbook for South-Central Ontario. For guidance on methodology used to measure stream width, refer to the in the Ontario Stream Assessment Protocol (Section 4, Module 10).

Revised guide status and rationale:

New note.

The 5-year review suggested the revised guide clarify how to address unmapped aquatic features encountered during winter when identification and classification of permanency are difficult. This text clarifies that forest workers are expected to exercise due diligence in identifying unmapped streams (e.g., by looking for clues such as linear depressions bordered by alders) and applying the appropriate course of action.

Streams segments known to support fish that are sensitive to changes in water temperature are those with inventory data showing the presence of coldwater fish species such as brook trout, American brook lamprey, or slimy sculpin.

Streams that are sensitive to changes in water temperature are those identified to be cold and clear through values maps, local knowledge, or through review of available classification tools as well as those within 500 m of self-sustaining brook trout lakes. When using available classification tools, cold streams are defined as those having a July average temperature <18.5 Celsius.

Revised guide status and rationale:

New note.

Streams that support fish that are sensitive to changes in water temperature are those with inventory data showing the presence of coldwater fish species such as brook trout, American brook lamprey, or slimy sculpin.

Streams that are sensitive to changes in water temperature are those:

- That have been identified through values maps, local knowledge and/or through the review of available classification tools

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- Likely to contain brook trout because they are connected to and occur within 500 m of self-sustaining brook trout lakes. For example, these streams are likely to serve as nurse creeks for a distance of up to 500 m from the lake (see original B&R for discussion).

A temperature threshold of <18.5 Celsius is used by Jones and Schmidt (2019) based on knowledge of Ontario's streams and relationships with brook trout occupancy and stream temperature.

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(C&R) 4.1.3 Wetlands

Preamble

Revised guide status and rationale:

Discussion still relevant. Minor editing and moved last sentence in first paragraph for better organization. Removed references to flooded jellyskin as an SAR (has been delisted).

Direction

Revised guide status and rationale:

Content remains largely unchanged.

Reorganized to discuss each of the wetlands in the order they are presented.

The AOC prescription for PSWs and adjacent lands in the current guide has been problematic because it describes a process rather than a prescription. Thus, the group AOC prescription/process for PSWs has been removed and replaced with a statement in the preamble that says PSWs are to be addressed by an individual (rather than group) AOC prescription developed by the planning team that maintains the natural features and ecological functions of that specific wetland and its adjacent lands.

i) Provincially significant wetlands

Description of value

Revised guide status and rationale:

No changes made.

Guidelines: Retained, revised, or new

Provincially significant wetlands (PSWs) will be addressed by individual AOC operational prescriptions and conditions developed by planning teams that will:

- Result in no loss of natural features or ecological functions that make the wetland provincially significant
- May result in some loss of the natural features or ecological functions that make the wetland provincially significant, but the loss is deemed by the Ministry to be minimal and necessary to avoid undesirable ecological or socio-economic impacts of other feasible alternatives.

Appendix 4.1a includes considerations for planning teams developing individual AOC operational prescriptions and conditions for PSWs and adjacent lands.

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Revised guide status and rationale:

New direction.

Replaces the standards and guidelines in the operational prescription and conditions for the PSW AOC currently found in the guide. The AOC prescription for PSWs in the current guide has been problematic because it describes a process rather than a prescription. Moreover, the requirement to conduct a formal environmental impact study (EIS) prior to conducting any harvesting, renewal, and tending operations within the PSW has created an unnecessary additional layer of complexity and workload. In the five-year review of the guide, practitioners also questioned the value of this requirement when the necessary protection measures are generally addressed by direction for individual species (especially SAR turtles) and operations are conducted under the CFSA.

Therefore, the revised direction requires planning teams to develop AOC prescriptions for individual PSWs that result in no loss or some acceptable loss of natural features or ecological functions that make the wetland provincially significant.

Appendix 4.1a includes considerations for planning teams developing individual AOC prescriptions for PSWs and adjacent lands to promote consistency in prescription development. Appendix 4.1a suggests treating PSWs as if they are HPS or LPS standing water features depending on hydrological sensitivity. If the direction in section 4.1.1. is sufficient to maintain the integrity of standing water, it should be conservative for wetlands.

Considerations in Appendix 4.1a are provided by the key wetland function groupings (e.g. hydrological, biological, and attribute) that would be assessed in a scoped environmental impact study (EIS), as outlined in the Ministry's *Wetland Environmental Impact Study Requirements Technical Manual* (1995) and the *Natural Heritage Reference Manual* (2010) (or updated or amended versions of these documents), and are consistent with Ontario's Provincial Policy Statement (PPS).

Standards and guidelines: Removed

120 m AOC surrounding the delineated PSW.
No contamination of PSWs by foreign materials is permitted. Specifically, (3 additional bullets).
Harvest, renewal, and tending operations are not permitted within the PSW unless an Environmental Impact Study (EIS), and subsequent review and approval by MNR, demonstrates that the proposed operations will either: (2 additional bullets).
Harvest, renewal, and tending operations are permitted within the AOC (outside the PSW) without an EIS if they retain residual forest (see Section 3.2.2) and will not

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result in direct damage to vegetation within the PSW or deposition of sediment within the PSW. Planning teams may elect to further restrict harvest, renewal, or tending operations within a portion of the AOC based on characteristics of the PSW. Operations specifically prohibited within the AOC include: (5 additional bullets).

Harvest, renewal, and tending operations that do not retain residual forest, will result in direct damage to vegetation within the PSW, or will deposit sediment within the PSW are only permitted within the AOC (outside the PSW) if an EIS, and subsequent review and approval by MNR, demonstrates that the proposed operations will either: (2 additional bullets).

Harvest, renewal, and tending operations within the PSW and AOC will follow the appropriate operating practices described in Section 5.2 to minimize rutting, compaction, and mineral soil exposure that could lead to erosion and subsequent transport and deposition of sediment within the PSW or the disruption of hydrological function.

New roads, landings, and aggregate pits are not permitted within the PSW or AOC unless an EIS, and subsequent review and approval by MNR, demonstrates that the proposed operations will either: (2 additional bullets).

Revised guide status and rationale:

Direction removed.

See rationale above for new guideline for PSWs.

ii) All wetlands (rich lowland hardwood-dominated forest, mapped forested and non-forested wetlands, and woodland pools) not addressed by operational prescriptions and conditions for AOCs

Description of value

Revised guide status and rationale:

New description of value.

Standards and guidelines: Retained, revised, or new

When a road must cross a wetland, identify the associated type of surface and ground water flow to help determine the design and construction methods required to minimize the disruption of hydrological and wetland function. Hydrological function will be considered to have been disrupted if:

- Surface water is not equalized on both sides of the road

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- Mortality of trees and vegetation has occurred on one side of the road due to prolonged inundation.

A good reference source is FPIInnovations/Ducks Unlimited Canada's *Resource roads and wetlands: A guide for planning, construction and maintenance*.

Revised guide status and rationale:

New direction.

Forest access roads that cross wetlands (bogs, swamps, fens, marshes) can potentially alter wetland hydrology. Roads that impede natural hydrological flow as a result of inadequate or misplaced cross drainage can result in ponding on the upland side and insufficient water on the downhill side, which may affect the long-term composition and health of adjacent plant communities (Partington and Gillies 2010). Due to the low bearing capacity of wetland soils and/or road and foundation settlement, water crossing and drainage structures in a wetland may need to be replaced or maintained on an ongoing basis. With careful road planning and construction techniques, it is anticipated that both wetland and road function can be maintained.

Since the Stand and Site Guide was released in 2010, FPIInnovations (Partington and Gillies 2010, Gillies 2011, Partington et al. 2016) and Ducks Unlimited Canada et al (2014) have released several resource documents on building roads across wetlands. They emphasize the importance of pre-identifying the wetland type to be crossed and its associated characteristics (e.g., hydrological flow), and the need to modify traditional forestry operational access approaches to better manage for water movement. They suggest that where avoidance of wetlands is not possible in road location, forest planners should:

- Identify wetlands/wetland networks and associated water features using photo imagery and other GIS related information (e.g. wetland data from LIO)
- Conduct road location reconnaissance and collect information on water flow (location, direction, and level of flow).

An understanding of how water moves through a wetland will better inform road construction strategies that help minimize disturbance to the wetland and reduce operational costs. Partington et al. (2016) recommend that knowing the wetland type to be crossed and associated surface and subsurface flow characteristics is important in making decisions on:

- Road and crossing location
- Water course crossing/water passage/ requirements (e.g., culvert, bridge, corduroy, log bundle)
- Season of construction and use
- Duration of use (permanent or temporary)
- Construction methods that best fit the local site conditions
- Future decommissioning and/or removal of water crossings/conduits

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- Badiou and Page (2014) found that impacts of a single crossing were fairly minor overall, however, multiple crossings may lead to cumulative effects at the watershed level.

Badiou and Page (2014) found that impacts of a single crossing were fairly minor overall, however, multiple crossings may lead to cumulative effects at the watershed level.

The Stand and Site Guide generally does not provide guidance on the specific technical operations to be selected and implemented to meet the requirements of the direction in this section. As such, readers are referred to the FPInnovations/Ducks Unlimited publication for a more in-depth overview of the design and construction techniques for building forest access roads across soils with low bearing capacity.

Construction of new roads is not permitted within 15 m of mapped marshes and fens or the high-water mark of woodland pools unless approved by the Ministry.

Construction of new landings is not permitted within wetlands or within 15 m of mapped marshes and fens or the high-water mark of woodland pools.

Construction of new forestry aggregate pits and wood storage yards and use of existing forestry aggregate pits and wood storage yards are not permitted within 15 m of mapped non-forested wetlands or the high-water mark of woodland pools.

Revised guide status and rationale:

These current guidelines have been moved from non-forested wetlands/woodland pool-specific direction and grouped with the single set of conditions for roads, landings, forestry aggregate pits, and wood storage yards that apply in all wetlands (unless otherwise specified) to reduce repetition.

Best management practices: Retained, revised, or new

To the extent practical and feasible, when planning the location of roads, identify any wetland areas and minimize the amount of roads built across wetlands.

If wetlands must be crossed to conduct forest operations, to the extent practical and feasible, consider using temporary winter crossings.

Revised guide status and rationale:

Moved wetland-specific road BMPs from section 5.1.1 (roads) to this section for a better fit.

iii) Herb-rich, lowland, hardwood-dominated (black ash, green ash, red ash, silver maple, white elm) forest

Description of value

Revised guide status and rationale:

Description still relevant. Added corresponding ecosites for clarity.

Standards: Retained, revised, or new

No harvest, renewal, or tending operations are permitted that exceed the rutting and compaction standards and guidelines for selection, shelterwood, and commercial thinning operations (see Section 5.2.1) or disrupt hydrological function. Hydrological function will be considered to have been disrupted if operations have:

- Impeded water movement by restricting flow, creating pools of standing water (e.g., caused by deep ruts perpendicular to the flow path)
- Accelerated water movement by channelizing flow (e.g., caused by long ruts parallel to the direction of flow)
- Diverted water movement by changing the location of the path of flow (e.g., caused by ruts that create a new flow path).

Revised guide status and rationale:

Direction still relevant. No recommendations for revision in the five-year review.

Examples added to illustrate when water movement has been disrupted to assist in compliance.

Harvest will follow direction for the lowland hardwood group found in the Ministry's Silviculture Guide.

Revised guide status and rationale:

Direction still relevant.

The revised 2015 Silviculture Guide provides direction (management interpretations) for lowland hardwoods as a group. The guide identifies silviculture systems, methods, and treatments that may be used in lowland hardwood management with an emphasis on the hydrological sensitivity of these sites, the types of natural disturbances to be emulated, and concerns about damage, windthrow, watering up, etc.

Standards and guidelines: Removed

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Landings and aggregate pits are not permitted within rich lowland hardwood-dominated forest.

Reasonable efforts will be made to avoid constructing new roads within rich lowland hardwood-dominated forest. When necessary, road construction will follow the design principles in Section 5.1 to minimize disruption of hydrological function.

Revised guide status and rationale:

Moved current conditions to a single set of conditions for roads, landings, forestry aggregate pits, and wood storage yards that apply to all wetland areas. During the five-year review, practitioners suggested reducing repetition in the guide. Revision avoids roads direction repetition in the wetlands section.

Reasonable efforts will be made to avoid crossing rich lowland hardwood-dominated forest with extraction trails during the frost-free period. During all seasons, crossings will be minimized and will follow the appropriate operating practices described in Section 5.2 to minimize potential site damage and effects on hydrological function.

Revised guide status and rationale:

Removed as a guideline and reclassified/reworded as BMP (see below).

Best management practices: Retained, revised, or new

To the extent practical and feasible, extraction trails will be minimized and will follow the appropriate operating practices described in Section 4.1.4 to minimize potential disruption of hydrological function.

Revised guide status and rationale:

Current guideline reclassified to BMP with minor rewording. Points to new BMPs to minimize disruption of hydrological function during forest management operations in Section 4.1.4.

Best management practices: Removed

Develop *conditions on regular operations* for other locally uncommon or sensitive forested wetland types as per Section 3.2.1.

Revised guide status and rationale:

Removed BMP.

This BMP is covered in Section 3.2.1 under the standard to develop conditions on operations for S1, S2, and S3 NHIC vegetation communities and other rare vegetation communities. This inclusion of other rare vegetation communities recognizes that S1,

S2, and S3 vegetation communities have not been assessed for many ecoregions within the managed forest.

iv) Mapped non-forested wetlands

Description of value

Revised guide status and rationale:

Description revised.

In the five-year review of the guide, subject matter experts recommended that standard wetland classification (i.e., Canadian Wetland Classification System) be integrated into the description of non-forested wetlands.

The revised description for non-forested wetlands integrates standard wetland classification by using inventory polygon type and/or ecosite to approximate wetland type as defined by the *Ontario Wetland Evaluation System* (OMNRF 2014). Wetland type-specific direction is provided based on the hydrological sensitivity of the wetland type. Marshes and fens are in most cases more hydrologically sensitive than bogs and swamps, and therefore receive additional protection.

Added corresponding ecosites in a cross-reference table for clarity.

Standards: Retained, revised, or new

Mapped marshes and fens

- No harvest, renewal, or tending operations are permitted that will result in significant damage to mapped fen or marsh vegetation or disruption of hydrological function. Operations specifically prohibited within 15 m of mapped fens or marshes include:
 - Machine travel/site disturbance during the frost-free period within 3 m of the mapped fen or marsh
 - Felling of trees during the frost-free period into mapped fens or marshes or within 3 m of mapped fens or marshes. Trees accidentally felled into mapped fens and marshes will be left where they fall
 - Disturbance that leaves ruts (especially those that channel water into a wetland) or a significant area of exposed mineral soil within 15 m of mapped fens or marshes (see Section 5.2.1). Ruts and significant patches of exposed mineral soil will be promptly rehabilitated to prevent sediment from entering mapped fens and marshes. Patches of mineral soil exposed by natural events are excluded

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- Spills of deleterious substances (e.g., fuel, oil) that will contaminate mapped fens and marshes.

Mapped bogs and swamps

- No harvest, renewal, or tending operations are permitted that will result in:
 - Disturbance that leaves ruts or a significant area of exposed mineral soil within the mapped bog or swamp (see Section 5.2.1). Patches of mineral soil exposed by natural events are excluded
 - Spills of deleterious substances (e.g., fuel, oil) that will contaminate mapped bogs or swamps.

Revised guide status and rationale:

Direction revised.

In the five-year review of the guide, subject experts recommended that the standard wetland classification (i.e., Canadian Wetland Classification System) be integrated into the permanent non-forested wetland description and associated direction to the extent practical and feasible.

Fens and marshes are in most cases, more hydrologically sensitive than bogs and swamps. Fens have slow lateral surface and subsurface flow and are highly connected through groundwater, whereas bogs have little to no vertical or lateral surface or subsurface flow and are isolated from groundwater and surface run-off (OMNRF 2014). Marshes and most fens typically have a greater soil moisture and connection to adjacent aquatic systems than bogs and swamps, thus making them more susceptible to changes in hydrological flow (Ducks Unlimited Canada 2015). Thus, the revised direction addresses mapped fens and marshes (as approximated by polygon type and/or ecosite type in the EFRI) with additional protection (similar to that for LPS ponds).

Restrictions on operations for mapped fens and marshes follow conditions on regular operations for working around water (see rationale for conditions on regular operations for ‘working around water’ in Section 4.1) with the exception that restrictions only apply during the frost-free period for wetlands.

Replaced “foreign materials” with “deleterious substances”, as defined by the *Fisheries Act*, to be more specific. Reference to the *Liquid Fuels Handling Code*, which regulates the storage and handling of gasoline and associated products in Ontario, is redundant since it must be followed irrespective of the guide.

Standards and guidelines: Removed

Aggregate pits are not permitted within 15 m of non-forested wetlands.

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Landings are not permitted within the wetland itself or within adjacent forest that is <15 m from those portions of the wetland dominated by open water or non-woody vegetation.

Reasonable efforts will be made to avoid construction of new all-weather roads within wetlands or portions of wetlands characterized by open water or non-woody vegetation. When construction of all-weather roads in wetlands is necessary, it will follow appropriate design principles in Section 5.1 to minimize risk of sediment entering the wetland and disruption of hydrological function.

Revised guide status and rationale:

Moved current conditions to a single set of conditions for roads, landings, forestry aggregate pits, and wood storage yards that apply to all wetland areas. During the five-year review, practitioners suggested reducing repetition in the guide. Revision avoids roads direction repetition in the wetlands section.

No contamination of wetlands by foreign materials is permitted. Specifically, (2 bullets).

Revised guide status and rationale:

Moved this current standard to a sub-bullet in the harvest, renewal, and tending direction above.

Best management practices: Retained, revised, or new

To the extent practical and feasible, extraction trails will be minimized within 15 m of mapped marshes and fens and within the boundary of mapped bogs and swamps and will follow the appropriate operating practices described in Section 4.1.4 to minimize potential disruption of hydrological function.

Revised guide status and rationale:

Current guideline reclassified to BMP with minor rewording. Points to new BMPs to minimize disruption of hydrological function during forest management operations in Section 4.1.4.

Best management practices: Removed

Apply above direction to unmapped non-forested wetlands ≥ 0.5 ha in size encountered during operations.

Revised guide status and rationale:

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Removed BMP regarding applying direction to unmapped non-forested wetlands ≥ 0.5 ha in size. Revised/new direction for hydrological impacts/hydrological connections in Section 4.1.4 is intended to address hydrologically important unmapped wetlands.

v) Woodland pools

Description of value

Revised guide status and rationale:

No changes made.

No new scientific evidence could be found that would support a different pool size threshold. Hydroperiod or pool volume are likely better indicators of pool significance/value, however, these attributes are more difficult to measure in the field by tree markers and/or forest operators.

Standards and guidelines: Retained, revised, or new

No harvest, renewal, or tending operations are permitted that will result in deposition of sediment within, or reduction of the water-holding capacity of, woodland pools.

Operations specifically prohibited include:

- Machine travel within 3 m of the high-water mark of pools during the frost-free period
- Felling of trees into pools or within 3 m of the high-water mark of pools during the frost-free period. Trees accidentally felled into pools will be left where they fall
- Disturbance that leaves ruts (especially those that channel water into a woodland pool) or a significant area of exposed mineral soil (see Section 5.2.1) within 15 m of the high-water mark of pools. Ruts or significant patches of exposed mineral soil will be promptly rehabilitated.

Revised guide status and rationale:

Direction revised.

Second bullet in current standard (removal/damage of sapling-sized trees) was removed since the direction is vague and difficult to enforce.

In the five-year review of the guide, it was recommended that direction for woodland pools be revisited to ensure the conditions on regular operations maintain hydrological flow and avoid interrupting surface and groundwater inputs. The direction prohibits excessive site disturbance within 15 m of pools, which should maintain hydrological flow within pools. Revised direction for hydrological impacts/hydrological connections in Section 4.1.4 should largely address concerns with interruption of surface and groundwater inputs.

Prevent spills of deleterious substances (e.g., fuel, oil) from contaminating woodland pools.

Revised guide status and rationale:

Reworded current direction and replaced “foreign materials” with “deleterious substances”, as defined by the *Fisheries Act*, to be more specific. Reference to the *Liquid Fuels Handling Code*, which regulates the storage and handling of gasoline and associated products in Ontario, is redundant since it must be followed irrespective of the guide.

Retention of residual forest within and adjacent to pools will be based on forest unit as follows:

- Selection and shelterwood forest units – Trees will be retained in, and within, 3 m of the high-water mark of pools to provide $\geq 70\%$ canopy cover; residual forest will be retained within 15 m of the high-water mark of pools to provide amphibian cover.
- Clearcut forest units – Unmapped residual patches required to meet the direction in Section 3.2.2 will preferentially be connected to pools. When connecting residual patches to pools, trees will be retained in and within 3 m of the high-water mark to provide overhead shade and residual forest will be retained within at least 15 m of the high-water mark to provide amphibian cover.

Revised guide status and rationale:

No changes made.

In selection harvested areas, residual forest will be retained by default adjacent to woodland pools, providing amphibian cover. As the retention objective in areas shelterwood harvested is to eventually provide full light conditions ($\geq 70\%$ full sunlight) similar to that in clearcut harvested areas, the requirement to retain residual forest within 15 m of pools has been removed.

Literature (Friedenfeld et al 2011, Veysey Powell and Babbitt 2015) summarized in the five-year review of the guide suggested woodland pools in clearcuts receive significantly reduced amphibian use in Maine, even with 30 and 100 m treed buffers. Therefore, it is likely not practical to effectively mitigate the effects of clearcutting on use of seasonal pools with narrow treed buffers, supporting the current emulating natural disturbance-based approach in the guide which focuses on avoiding site disturbance (application of conditions on regular operations for working around water during the frost-free period).

However, we heard at our Indigenous engagement sessions across the province that Indigenous communities have a deep connection to water and view it as a sacred

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resource. Thus, given the potential negative effects of climate change on hydroperiod of woodland pools, the direction has been retained.

Standards and guidelines: Removed

Landings and aggregate pits are not permitted within 15 m of the high-water mark of pools.

New roads are not permitted within 15 m of the high-water mark of pools unless there is no practical or feasible alternative and appropriate mitigative measures are taken to minimize the risk of sediment entering pools and disruption of hydrological function (see Section 5.1).

Revised guide status and rationale:

Moved current conditions to a single set of conditions for roads, landings, forestry aggregate pits, and wood storage yards that apply to all wetland areas. During the five-year review, practitioners suggested reducing repetition in the guide. Revision avoids roads direction repetition in the wetlands section.

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(C&R) 4.1.4 Hydrological connections

Preamble/Direction

Revised guide status and rationale:

New section. Have moved the direction currently covered in Section 5.2.5 (Hydrological impacts) to Section 4.1 with the rest of the water direction.

The five-year review of the guide recognized the importance of linear features that channel ephemeral surface and/or shallow groundwater flows to lakes, ponds, rivers, or streams (i.e., hydrological connections between terrestrial and aquatic ecosystems) as 'hotspots' for biogeochemical processes, especially potential for mercury methylation (see discussion and references in the five-year review). The five-year review included the following recommendations related to hydrological connections:

- Revisit the direction for hydrological connections to ensure operations do not result in site disturbance that may promote methylation, mobilization, and transport of mercury
- Revise direction for hydrological connections to ensure it maintains the key ecological functions of these features and is easier to implement (e.g., clarify how to delineate) and assess for compliance.

Thus, direction in this new section focuses on mitigating potential effects of forest management operations on hydrological connections.

Description of value

Revised guide status and rationale:

Provides definition for hydrological connections and recognizes the potential challenges of identifying these features in the field.

As additional protection measures are being included for hydrological connections, more information has been provided to define and identify these features. Specifically, from a GIS perspective, a flow initiation threshold of 3.2 ha (i.e., the upstream contributing area at which point flow initiation can reasonably be identified on the ground) has been established if a sustainable forest licensee chooses to undertake flow

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accumulation modelling with a LiDAR-derived digital elevation model (R. Mackereth pers. comm. 2024). In addition to a minimum flow initiation threshold, for identification on the ground, any flow path that would be keyed out to ephemeral flow using The Stream Permanency Handbook for South-Central Ontario (OMNR 2013) or equivalent stream permanency key for northern Ontario, would be considered a hydrological connection.

Guidelines: Retained, revised, or new

Harvest, renewal, and tending operations will not disrupt hydrological function within recognizable linear features that channel ephemeral surface and/or shallow groundwater flows to lakes, ponds, rivers, or streams (i.e., hydrological connections between terrestrial and aquatic ecosystems). Hydrological function will be considered to have been disrupted if operations:

- Impede water movement by restricting flow, creating pools of standing water (e.g., caused by deep ruts perpendicular to the flow path)
- Accelerate water movement by channelizing flow (e.g., caused by long ruts parallel to the direction of flow)
- Divert water movement by changing the location of the path of flow (e.g., caused by ruts that create a new flow path).

The natural “watering up” process associated with the removal of forest cover is not considered a hydrological disruption.

Revised guide status and rationale:

The five-year review of the guide recognized the growing concern of forest operations related site disturbance on the disruption of hydrological function between terrestrial and aquatic ecosystems. The review recommended that the direction for hydrological connections needed to be easier to assess for compliance. Thus, examples have been added to the definition for hydrological disruption to illustrate when water movement has been impeded, accelerated or diverted to assist in compliance.

Forestry workers will be vigilant for evidence suggesting the presence of hydrological connections throughout harvest areas (but especially near mapped predicted flow paths) such as changes in:

- Topography – e.g., presence of a gully or other linear depression
- Soil texture or moisture – e.g., presence of organic or saturated mineral soils
- Vegetation structure – e.g., change in canopy height/presence of a linear canopy gap
- Vegetation composition – e.g., presence of indicators of ephemeral surface and/or shallow groundwater flows such as alder, cedar, tamarack, black ash, and/or grasses/sedges.

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Forestry workers will use their professional judgement to determine the likely location and characteristics of hydrological connections, and apply the appropriate course of action. Where there is significant uncertainty, a conservative approach will be used.

Revised guide status and rationale:

New direction.

Reinforces the requirement to exercise due diligence in identifying and protecting features and provides some additional direction regarding what constitutes due diligence.

Guidelines: Removed

Based on local conditions, explore reasonable alternatives to crossing organic and saturated mineral soils during the frost-free period. Conditions on regular operations will be developed to minimize the potential for hydrological disruption when crossing during the frost-free period cannot be avoided.

Revised guide status and rationale:

Removed current guideline as it does not provide any specific direction and already covered under direction for rutting and compaction (Section 5.2.1).

Best management practices: Retained, revised, or new

Movement of heavy equipment within hydrological connections (especially along extraction trails) should be avoided to the extent practical and feasible, especially during the frost-free period.

When avoidance is not practical or feasible, heavy equipment should cross hydrological connections:

- At as few locations as possible
- At the narrowest point possible
- As far from connected aquatic features as possible
- At locations with the highest soil bearing capacity possible (look for indicators of drier soil conditions)
- Using techniques to increase bearing capacity and avoid creating soil disturbance including use of corduroy mats, brush mats, or chipper debris.

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Where restoring surface water flow will not further impact water movement and/or cause additional damage to the site:

- Remove material (e.g., displaced soil/organic matter, brush mats, corduroy) that may be impeding surface water flow so that natural drainage patterns are re-established.
- Any rehabilitation work should occur within one year of completion of operations using the appropriate equipment and during optimal conditions (e.g., summer).

Revised guide status and rationale:

BMPs are based on current literature (e.g., Bishop et al 2009, Eklöf et al 2016, Labelle et al 2022) and subject matter expert advice, and were added to provide more direction to help operators avoid disrupting water movement.

Train field staff, especially equipment operators, in the recognition and significance of disruption of hydrological function.

Operations staff should use maps from hydrological modeling tools (e.g., flow accumulation, topographic index) prior to start-up of operations to help identify possible unmapped drainage, localized wet areas, mapped drainage that is misplaced or may not exist, or hydrological connections. Note: Accuracy of predicted locations of hydrological connections will vary depending on the DEM used in the hydrological modelling and the outputs of these tools should not replace normal field reconnaissance.

Refer to Appendix 5.2c for a partial list of strategies and techniques that will minimize site disturbance (e.g., rutting) during operations and thereby indirectly minimize some of the risk of disrupting surface and subsurface water flow in areas of hydrological connection between terrestrial and aquatic ecosystems.

Revised guide status and rationale:

BMPs retained from Section 5.2.5. BMPs still relevant.

Best management practices: Removed

On very dry sites, careful logging practices that retain some trees, shrubs, advanced growth, and slash can reduce overall ground temperature and reduce excess drying. Refer to Section 3 for a more detailed discussion of retaining structure on site.

Where possible, locate roads and landings so skidding and forwarding does not have to cross natural drainage patterns.

Revised guide status and rationale:

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Removed BMPs. First BMP is too vague to implement to be useful for achieving objective of direction in Section 4.1.4. Second BMP moved to Section 5.1.1 under road design and location.

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(C&R) 4.1.5 Self-sustaining brook and/or lake trout lakes and ponds with a high risk of threat to sustainability from new or improved access

Preamble/Direction

Revised guide status and rationale:

New section/direction.

Based largely on concerns identified by stakeholders, the five-year review included a recommendation to review the current coarse and fine filter direction for forest management operations that may directly affect brook trout and/or lake trout habitat to determine whether additional fine filter direction is required.

Direction in Section 4.1 is still considered to maintain the various ecological functions of aquatic ecosystems, including the productive capacity that supports fish (see discussion in Section 4.1). However, in some cases, roads constructed during forest management operations may improve or introduce new access to specific fisheries, that may result in either unsustainable harvest or introduction of alien aquatic species that undermine the sustainability of fish populations. Lakes and ponds supporting self-sustaining populations of brook and/or lake trout may be especially vulnerable to these types of impacts (Fraser 1972, 1978, Gunn and Sein 2000, Dupont and Bernier 1984,

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Lachance and Magnan 1990, Vander Zanden et al 1999, Selinger et al 2006, Weidel et al 2007, Kaufman et al 2009).

When vulnerable lakes and ponds are identified through other planning exercises or in other policy documents (e.g., CLUPA, fisheries management plans, Ministry regional direction (e.g., Northeastern Regional Benchmark for the Development of Lake Trout AOC Prescriptions in Forest Management Plans)), planning teams will consider the direction from these sources. When not specifically identified by other planning exercises or policy documents, planning teams will follow direction in this section.

Road access is only one factor that influences selection of lakes by anglers (Hunt 2005, Hunt et al 2007, Hunt and Lester 2009, Hunt and Dyck 2011, Hunt et al 2019). The relative importance of access at influencing fishing effort is, however, contested. For example, in lake trout lakes in northeastern Ontario, the type of access (defined by quality and proximity to lake) only explained approximately 2%, while lake size explained 44% of the variation in angler effort, which was measured in hours of fishing (Kaufman et al 2009). In other instances, type of access was strongly related to the amount of vehicle traffic to northern Ontario lakes (Hunt and Dyck 2011).

The results above might mask important changes to fishing effort that occur immediately following changes to access. Evidence exists that the level of angling effort can spike immediately following the lifting of a closure (Gunn and Sein 2000) and following stocking efforts (Mee et al 2016) on lakes resulting in significant declines to fishing quality, fish populations, and in the longer-term, declines to fishing effort.

Direction in this section only applies to lakes and ponds where there is a high or uncertain risk that new or improved access associated with forest operations will lead to unsustainable impacts from harvest and/or introduction of alien aquatic species.

Angling can facilitate intentional and unintentional dispersal of alien aquatic species across natural barriers into new lakes (Alofs et al 2014, Davis and Darling 2017, Cazelles et al 2019). Alien aquatic species introduction can be especially harmful to lake trout that rely on littoral prey fish (Vander Zanden et al 1999) and brook trout in general (Fraser 1972, 1978). Given the lack of information to predict alien aquatic species introduction, the criteria to identify high risk lakes and ponds differs for lake trout populations relying on littoral versus pelagic prey fish for food. (see Appendix 4.1b). Additionally, self-sustaining populations of brook trout and lake trout that focus on littoral prey fish are generally found in smaller lakes and ponds, which may be more vulnerable to overexploitation than populations in larger lakes when a new source of access is established. Analysis of unpublished Aquatic Habitat Inventory (AHI) data for 9,437 Ontario lakes supplied by Nigel Lester indicates that the probability of the presence of brook trout is <10% when lake surface area exceeds 150 ha.

Description of value

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Revised guide status and rationale:

New description of value.

Description references using Appendix 4.1b (new appendix) when determining whether a self-sustaining brook and/or lake trout lake is at a high risk of threat to sustainability from new or improved access. See Appendix 4.1b for rationale and science supporting the risk assessment.

The size of the AOC is based on the distance that primary/branch roads were associated with the likelihood of road/trail access development to formerly remote lakes in Ontario (Hunt and Lester 2009). Unpublished research on lakes with float plane/train only accessible tourism establishments also provides support for the 1,000 m distance. This research notes a 150% reduction in the presence of all-terrain vehicle (ATV) access to a lake when roads are 1,000 to 2,000 m when compared to <1,000 m from a lake (Len Hunt pers. comm. 2019). While the presence of ATV access to a lake does not necessarily result in unsustainable angler harvest or introduction of alien aquatic species, these trails reduce the costs to anglers of accessing a lake and, therefore, should increase fishing effort.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to restrictions for lakes and ponds (Section 4.1 and 4.1.1).

Revised guide status and rationale:

New direction.

Direction for lakes and ponds (Sections 4.1 and 4.1.1) is considered to mitigate potential effects of harvest, renewal, and tending operations on the productive capacity of self-sustaining trout lakes (see relevant discussion/rationale for direction).

New or improved primary and branch roads and landings are not permitted:

- | |
|--|
| <ul style="list-style-type: none">• Within 400 m of the lake or pond except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process• Within 401-1,000 m of the lake or pond unless approved by the Ministry. |
|--|

All new or improved primary/branch roads will be subject to locally appropriate/effective access control measures (i.e., the least restrictive approach that is likely to achieve the desired results).

New or improved operational roads must be decommissioned following completion of operations.

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New or improved operational roads and landings are not permitted within 400 m of the lake or pond unless approved by the Ministry.
While operations are in progress, new or improved operational roads within 1,000 m of the lake or pond will be subject to temporary and locally appropriate/effective access control measures operations (i.e., the least restrictive approach that is likely to achieve the desired results) when operations will be temporarily stopped for a period of greater than 3 months.
Operations associated with new and existing forestry aggregate pits and wood storage yards are permitted within the AOC while operations are in progress.
Forestry aggregate pits must be rehabilitated prior to or at the same as road decommissioning activities within the AOC.
New forestry aggregate pits and wood storage yards are not permitted within 400 m of the lake or pond unless approved by the Ministry.

Revised guide status and rationale:

New direction.

Hunt and Lester (2009) showed that the likelihood of a road/trail access to formerly remote lakes was negatively associated with the distance of a lake to a major (e.g., primary/branch) road and positively associated with road density within 1,000 m of a lake. Thus, restrictions are placed on construction of new primary and branch roads within 1,000 m of self-sustaining trout lakes and ponds.

Hunt and Lester (2009) noted that the relationship between access and distance from a lake to a major (e.g., primary/branch) road followed a negative decay function, with a strong tendency for access when roads were within 400 m. Kaufman et al (2009) also observed higher open-water season angling effort in lake trout lakes in Ontario that had primary or branch roads within 500 m compared to remote lakes. Thus, new or improved primary and branch roads are only permitted within 400 m in extraordinary circumstances. The Ministry may approve new primary or branch roads within 401 to 1,000 m based on an assessment of risk (e.g., likelihood of anglers accessing lake considering distance to lake, terrain) and the likely effectiveness of access control measures.

Restrictions for operational roads are different from primary and branch roads given that they are only intended to provide short-term access and normally not maintained. Additionally, primary/branch road placement was strongly associated with road/trail access to lakes (Hunt and Lester 2009). Restrictions on the use and persistence of operational roads within the AOC is supported by:

- The positive association between road density (including operational roads) within 1,000 m of a lake and road/trail access to the lake (Hunt and Lester 2009);

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- The increased tendency for the existence of ATV trails from road networks to lakes with tourism establishments only accessible via float plane/train (i.e., an approximately 150% estimated reduction in trail development to lakes with roads 1,000 to 2,000 m when compared to lakes with roads less than 1,000 m from a lake (Len Hunt pers. comm. 2019);
- The potential for a pulse of short-term fishing effort to occur following the opening of a lake that can imperil the sustainability of lake trout populations (Gunn and Sein 2000); and
- A predicted 76% increase in demand for water-based recreation when access via a low-quality road (i.e., operational road) was compared to trail access (Hunt and Dyck 2011).

When new primary, branch, or operational roads are permitted within the AOC, they will be subject to locally appropriate access control measures. See Hunt and Hosegood (2008) and Hunt and Hupf (2014) for a discussion of the effectiveness of different access control measures.

There is little evidence that the presence alone of landings or forestry aggregate pits contribute to lake or pond access. Forestry aggregate pits are permitted to be used within the AOC while operations are in progress. The presence of a forestry aggregate pit can result in the associated access road being open longer and/or more regularly maintained, which may be of concern within the AOC. However, the access control requirements for primary/branch roads and decommissioning requirements for operational roads within the AOC as per the direction are believed to address this concern.

Best management practices: Retained, revised, or new

Existing primary and branch roads within the AOC should be subject to locally appropriate/effective access control measures when practical and feasible.
Existing operational roads within the AOC should be subject to locally appropriate/effective access control measures where practical and feasible.
To the extent practical and feasible, plan and construct operational roads to the minimal standard required to reduce future efforts and costs associated with decommissioning (e.g., construct winter roads and crossings, use temporary bridges).

Revised guide status and rationale:

See rationale for standards and guidelines above for primary, branch, and operational roads.

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(C&R) 4.2 Special habitat features

(C&R) 4.2.1 Groundwater recharge areas associated with brook trout spawning sites

Preamble/Direction

Revised guide status and rationale:

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Minor revisions made to preamble and direction description. Discussion is still relevant. Direction description largely unchanged with a statement recommending a field verification process be conducted. Modeling approaches and data availability can be highly variable in some areas with high variability in the geological landscape across the province. Therefore, it is recommended that where forest operations are going to occur, groundwater recharge areas identified by modeling approaches be verified in the field.

Groundwater remains an important component of the hydrologic cycle in forest ecosystems and has a significant effect on aquatic habitats and their biota. The work of Brookfield et al (2021) indicated that groundwater can influence algal blooms through control of in-stream chemistry. Larsen and Woelfle-Erskine (2018) suggested that maintaining relatively high groundwater levels in coastal aquifers may be imperative to the persistence of vulnerable salmonid populations in a changing climate. There is evidence that hydrologic conditions exert significant influence on aquatic ecosystem species composition (e.g., Jones et al 2017). Food source availability also appears to be influenced by groundwater transport, such as the availability of an indicator of ecosystem health, prokaryotes (Smith et al 2016).

Authors continue to suggest that forest management practices have the potential to influence groundwater discharge (Adane and Gate 2015 and Schenk et al 2020). In addition, many studies from around the world have looked at the impacts of land use and land cover change in an urbanization and agricultural context on groundwater availability (Adhikari et al 2020, Kroes et al. 2019, Li et al 2014, and Barua et al. 2021).

There have been no recent studies documenting the effects of forest management operations on groundwater flow from recharge areas associated with brook trout spawning sites or testing the effectiveness of the direction in the guide. However, recent literature continues to describe the important role of groundwater discharge in the selection of spawning sites in lakes and rivers (e.g., Guillemette et al 2011, Van Grinsven et al 2012, Warren et al 2012), although the significance of groundwater upwelling to spawning site selection in northern streams appears to be equivocal (e.g., Franssen et al 2013).

It has been suggested that forest operations are unlikely to affect deep groundwater flows implying that direction in the guide needs only to be applied where local groundwater flows exist. However, absence of information on geological overburden depth and composition, mainly in the northern area of the province, makes it difficult to evaluate the potential for local groundwater sources, even when spawning sites are known. With the lack of information, developing a specific tool to determine where groundwater is regionally versus locally is not feasible. To compensate, this guide attempts to take a watershed management approach to supplement the direction provided here, which should provide protection for both mapped and unmapped groundwater recharge areas.

There are several studies outlining and testing various methodologies to determine the location of ground water recharge areas (O'Sullivan et al 2019, Riley et al 2019, Sass et

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al 2014, Marchildon et al 2016 Aldous and Gannett 2021). However, methodologies are highly variable, often specific to local geological classifications, and are based on data that can either be highly variable, not complete, or not available. Because of those factors it is recognized that while a modeling approach to determining the location and extent of ground water recharge areas associated with brook trout spawning areas may be feasible and reliable in some areas, it can't always be relied upon, and when a specific methodology is selected it should be rationalized to ensure appropriate geological and data assumptions are met. Also considering the variability in the reliability of modeling approaches, when forest operations are proposed in areas that overlap suspected ground water recharge areas, a field verification process is completed to confirm the value.

While recharge areas associated with brook trout spawning areas are not commonly known across the province, there has been work conducted in select Ministry districts (southern and northwest regions) where brook trout lakes are common to try to improve value identification and where the current guide's direction and implementation have been beneficial. It is recognized that the lack of inventory could possibly be interpreted as also lacking protection of these features. However, the watershed protection provided within this guide should provide adequate protection for groundwater recharge areas that are not currently identified. In combination with the direction presented here, the watershed direction that minimizes interrupting and redirecting local groundwater flow and minimizes the altering of infiltration capacity of forest operations within watersheds is addressed within the direction minimizing rutting and compaction (Section 5.2.1), maintaining hydrological connections (Section 4.1.4), and protecting self-sustaining lake and brook trout lakes (Section 4.1.5), and should provide adequate protection to those recharge areas that are not readily identified.

Description of value

Revised guide status and rationale:

Moved current standard defining the AOC (mapped recharge area) to description of value.

Standards and guidelines: Retained, revised, or new

Regular harvest, renewal, and tending operations are permitted within the AOC.
Extraction trail location and design will follow the operating practices described in Section 5.2 to minimize rutting that could disrupt shallow groundwater flow.
New all-weather roads and landings are not permitted within the AOC except in extraordinary circumstances, appropriate mitigative measures are taken to minimize the risk of interrupting or redirecting shallow groundwater flow (e.g., no ditching or grubbing, appropriate cross drainage is provided; see Section 5.1), and the road,

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including specific location, is identified and justified through the FMP AOC planning process.

Forestry aggregate pits and wood storage yards are not permitted within the AOC.

Revised guide status and rationale:

Direction remains largely unchanged. Current background and rationale still applies.

There have been no further studies documenting the effects of forest management operations on groundwater flow from recharge areas associated with brook trout spawning sites or testing the effectiveness of the direction in the guide. However, recent literature continues to describe the important role of groundwater discharge in the selection of spawning sites in lakes and rivers (e.g., Guillemette et al 2011, Van Grinsven et al 2012, Warren et al 2012), although the significance of groundwater upwelling to spawning site selection in northern streams appears to be equivocal (e.g., Franssen et al 2013). This more recent information supplements the current background and rationale and continues to support the current direction.

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(C&R) 4.2.2 Bird nest sites

Preamble

Revised guide status and rationale:

Preamble expanded.

The five-year review recommended expanding the discussion of incidental take (including defining this term) and the *Migratory Bird Convention Act, 1994* (MBCA), making reference to Environment [and Climate Change] Canada's guidance to avoid harm to migratory birds.

The revised text is based on the following considerations:

Forest operations may unintentionally kill, harm, disturb, and/or destroy nesting birds, their eggs or young (effects collectively known as incidental take). For example, approximately 269 million bird deaths are associated with human infrastructure or activities annually in Canada, with predation by cats, and collisions with windows, vehicles, and transmission lines responsible for >95% of all mortality (Calvert et al 2013). While forest operations likely have a relatively small effect on mobile adults, subadults, and juvenile birds, commercial forest harvesting in Canada is estimated to affect 0.6 to 2.1 million bird nests per year (Hobson et al 2013), more than all other sectors combined (Calvert et al 2013). Although some of the assumptions used by Hobson et al (2013) are problematic (e.g., all nests within harvest areas are assumed to be affected), their results suggest nest loss is not inconsequential.

Unfortunately, the ecological consequences of incidental take of nests are equivocal. Calvert et al (2013) suggested that total loss of nests to all human activities (including forest operations) represented less than 1% of the overall estimated human impact when converted to potential adult breeders. However, effects are likely to vary by species with the potential population-scale effects of the loss of individual nests likely inversely related to population size.

Despite this uncertainty, incidental take of nesting birds, eggs, and young may have significant legal implications since:

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- The regulations to the MBCA state that ... "A person must not engage in the following activities... damage, destroy, remove or disturb a nest, egg, nest shelter, eider duck shelter or duck box, however, the following may be damaged, destroyed, removed or disturbed without a permit... a nest shelter, eider duck shelter or duck box that does not contain a live bird or a viable egg, a nest that was built by a species that is not listed as a species of conservation value if that nest does not contain a live bird or viable egg" (s. 5 (1) and s. 5 (2))
- Ontario's *Fish and Wildlife Conservation Act, 1997* states that ... "A person shall not destroy, take or possess the nest or eggs of a bird that belongs to a species that is wild by nature" (s. 7 (1)).

Forest operations may also unintentionally remove or destroy nesting structures used by breeding birds. When these structures are enduring features that are likely to be reused by breeding birds (e.g., bald eagle stick nests), their loss may also be considered incidental take.

Forest operations may further alter the suitability of habitat used by individual pairs of breeding birds. It is assumed that the coarse filter approach (see Section 1.3.1) will maintain an adequate supply of habitat to support widely dispersed healthy populations of most native bird species². Some recent research supports the assumption that a coarse filter approach is generally effective in maintaining both landbird and waterbird populations (e.g., Borger and Nudds 2014, Rempel et al 2016). Moreover, this approach is advocated by *Landbird Conservation Plans* for Ontario's boreal and Great Lakes - St. Lawrence forest regions (Ontario Partners in Flight 2008a, 2008b).

In some cases, coarse-filter direction may need to be supplemented with species-specific direction to support widely dispersed healthy populations. This species-specific direction is generally included for species that are uncommon (and for which loss of individual nests or nesting areas may have population consequences), show strong fidelity to specific nesting structures or nesting areas, and are sensitive to habitat alteration.

Direction

Revised guide status and rationale:

Direction description expanded to better address incidental take of birds nests.

Standards and guidelines: Retained, revised, or new

² The coarse filter approach may not be adequate for species that are identified as species at risk. For these species, nests and associated habitat are protected by the provisions in section 4.3.

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All forest workers will be reminded of their legal obligation under the MBCA and the FWCA to avoid incidental take of nesting birds, their nests (including trees with pileated woodpecker nesting cavities), eggs, and young.

When conducting any operations from mid-April to late August, all forest workers will be vigilant for nests of all protected bird species containing nesting birds, eggs, or young. This includes being alert for evidence of nesting activity such as birds flushing from nests, birds carrying food or nesting material, and birds behaving defensively. When encountered, these new values/important ecological features will be reported as per requirements in FIM and the appropriate AOC direction or conditions on operations will be followed.

When conducting any operations throughout the year, all forest workers will be vigilant for enduring nest structures that are likely to be reused. This includes stick nests and trees with large cavities that could be used by nesting or roosting birds such as chimney swifts, falcons, owls, or ducks (see also Section 3.2.3.1). When encountered, the appropriate AOC direction or conditions on operations will be followed.

Best management practices: Retained, revised, or new

Whenever practical and feasible, operations that have a high potential to unintentionally kill, harm, disturb, and/or destroy nesting birds, their eggs or young (e.g., operations involving heavy equipment such as harvest, site preparation, and road building) will be scheduled outside the time period when birds may be nesting (generally mid-April to late August) and especially during the peak period of nesting (generally mid-May to late July).

Minimize the ground covered by machine and extraction trails. Many species of birds (e.g., grouse, waterfowl, some songbirds) nest on or near the ground.

Preferentially retain wildlife trees (3.2.3.1) with existing cavities (they may contain nests with eggs or young birds).

Minimize operations within AOCs associated with ponds and wetlands. There is a high likelihood of encountering nesting waterfowl near these features.

Revised guide status and rationale:

New direction (conditions on regular operations that need to be included in FMPs) has been added to Section 4.2.2.

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Environment and Climate Change Canada (ECCC) has developed guidance to address the incidental take of bird nests³. ECCC's guidance includes 3 components:

1. Know your legal obligations;
2. Avoid engaging in potentially destructive or disruptive activities in key sensitive periods and locations, in order to reduce the risk of affecting birds, their nests or eggs;
3. Develop and implement appropriate preventive and mitigation measures to minimize the risk of incidental take and to help maintain sustainable populations of migratory birds.

The following direction builds on recommendations in FPAC/NCASI (2016) and DUC (2018).

To address component 1 above (legal obligations), the following CRO will be added to FMPs:

- All forest workers will be reminded of their legal obligation under the MBCA and the FWCA to avoid incidental take of nesting birds, their nests, eggs, and young.

SFLs may choose to deliver this message using any approach deemed to be appropriate. This may be most efficiently done during annual start-up meetings.

In the boreal and Great Lakes – St. Lawrence forest regions of Ontario, bird nests containing eggs or young may be encountered from as early as mid-April to as late as the end of August, with peak nesting activity occurring from mid-May to late July (see above). Moreover, bird nests may be found in:

- all types and ages of forest,
- in open habitats such as clearcuts, burns, wetlands, shorelines, and rock outcrops,
- in overstory or midstory trees, shrubs, or on the ground,
- in living, dead, or declining trees, or on upturned roots, or
- in or on human infrastructures such as bridges, culverts, and aggregate pits.

Thus, it is generally not practical or feasible to completely avoid operating when (and where) birds may be nesting. Instead, to address component 2 (avoiding the risk of incidental take) the guide provides the following BMP:

- Whenever practical and feasible, operations that have a high potential to unintentionally kill, harm, disturb, and/or destroy nesting birds, their eggs or young (e.g., operations involving heavy equipment such as harvest, site preparation, and road building) will be scheduled outside the time period when birds may be nesting (generally mid-April to late August) and especially during the peak period of nesting (generally mid-May to late July).

To address component 3 (minimizing and mitigating the risk of incidental take associated with operations conducted during the breeding season) the third CRO focuses on protection of nests identified before or during operations (i.e., known nests),

³ <https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds.html>

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identification and retention of nests that are enduring features, and minimizing the risk of inadvertently affecting nests not identified before or during operations (i.e., unknown nests).

Known nests

The ECCC guidance suggests that ... “except when the nests searched are known to be easy to locate without disturbing them, active nest searches are generally not recommended; they have a low probability of locating all nests and are likely to cause disturbance to nesting birds”. Thus, targeted nest searches are generally not required. However, when conducting any operations from mid-April to late August, all forest workers will be vigilant for nests of all protected bird species containing nesting birds, eggs, or young. This includes being alert for evidence of nesting activity such as birds flushing from nests, birds carrying food or nesting material, and birds behaving defensively. When encountered, these new values/important ecological features will be reported as per requirements in FIM and the appropriate AOC direction or conditions on operations will be followed.

The nesting structure used by most birds is a transitory feature, being used during only a single breeding season. However, some nesting structures are enduring, being used for multiple seasons. When conducting any operations throughout the year, all forest workers will be vigilant for enduring nest structures that are likely to be reused. This includes stick nests and trees with large cavities that could be used by nesting or roosting birds such chimney swifts, falcons, owls, or ducks. Cavity trees that are especially valuable include hollow trees ≥ 50 cm dbh and trees ≥ 25 cm dbh containing, pileated woodpecker nest or roost cavities, northern flicker nest cavities, or other large (opening ≥ 7.5 cm across) natural nest or den cavities (see discussion in Section 3.2.3.1). When encountered, the appropriate AOC direction or conditions on operations will be followed.

Unknown nests

Retaining residual forest and wildlife trees (as per Sections 3.2.2 and 3.2.3) will reduce the number of unknown nests potentially affected within harvest areas (e.g., DUC 2018). In addition the following BMPs will normally reduce the risk of incidental take of unknown nests during harvest operations in the breeding season:

- Minimize the ground covered by machine and extraction trails. Many species of birds (e.g., grouse, waterfowl, some songbirds) nest on or near the ground
- Preferentially retain wildlife trees with existing cavities. Many birds nest in cavities in trees (see Section 3.2.3). Trees with existing cavities may contain unknown nests containing eggs or young.

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(C&R) 4.2.2.1 Cliff-nesting birds **(Formerly 4.2.2.1 Peregrine falcons)**

Preamble/Direction

Revised guide status and rationale:
Content revised.

The peregrine falcon has been down-listed to special concern. Thus, reference to 'damage and destruction prohibited without authorization under the ESA' and the habitat regulation (revoked in 2013) have been removed.

While nests are typically on ledges on tall steep cliffs (White et al. 2002), other features may also occasionally be used for nesting (e.g., short cliffs or other natural features such as rock outcrops). Thus, direction applies to a broader range of natural nest sites than described by the original habitat regulation.

Direction for turkey vulture moved from Section 4.2.2.7 to improve organization.

i) Active peregrine falcon nest site on cliffs

Description of value

Revised guide status and rationale:

Description revised.

The habitat regulation applied to cliff sites occupied by peregrines within the past 15 years. However, peregrines exhibit strong nest site fidelity (White et al 2002, ECCC 2017). Nesting cliffs are often used by successive generations of birds. For example, in Great Britain, 42 of 49 nesting cliffs known to be used between the 1500's and 1800's were still occupied in the 1930's (Ferguson-Lees 1951).

Moreover, sites used then abandoned may become reoccupied as the population continues to increase. Thus, direction is more conservative than the habitat regulation and applies to nest sites occupied by a pair of peregrines falcons within the past 30 years.

The nest site extends vertically from the base to the top of the cliff face. The cliff face includes the talus slope at the base of the cliff and the rock barren at the top of the cliff. The specific ledge used for nesting may change through time. In Ontario, pairs may use different ledges on the same cliff face in different years, with nests from 250-1,250 m apart (Ted Armstrong, personal communication 2006). Thus, the nest site extends horizontally across the cliff face to include ledges used for nesting and any part of the cliff face within 500 m of used ledges (see OMNR 1998).

In some cases individual nests may be on distinct cliffs from 1-4 km apart (Ted Armstrong, personal communication 2006). When nests used by the same pair in different years are on distinct cliffs, each cliff face is a separate nest site. A 400 m radius AOC reflects the distance required to mitigate the potential effects of high impact operations (see below).

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:

- Harvest is not permitted within 100 m of the top or bottom of nest sites
- Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 101-200 m of the top or bottom of nest sites. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning,

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preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure <60%.

Revised guide status and rationale:

New direction.

There is no published empirical evidence to suggest how forest management operations affect habitat suitability. In the Lakehead Forest, 25 occupied nest sites were >3 times further from recent (≤ 20 years old) clearcuts than were 25 suitable but unoccupied sites (Brian Naylor et al, unpublished data). However, distance to clearcuts was not included in the model that best predicted (based on Akaike's information criterion (AIC) analysis) habitat occupancy; the best predictors were the amount of open water and private land within 2 km of nest sites. The apparent negative relationship between occupancy and distance to clearcuts may simply reflect selection for nest sites with high amounts of open water and private land, which by default means less crown land where forest operations have been conducted.

The influence of habitat and/or landuse patterns in landscapes surrounding nest sites on occupancy is equivocal. While numerous studies suggest significant effects on location of occupied nest sites (Sergio et al 2004, Brambilla et al 2006, Rodriguez et al 2007, Peck et al 2018), other studies suggest limited influence on occupancy (or reproductive success) (e.g., Mearns and Newton 1988, Jenkins and Benn 1998, Gainzarain et al 2000, Coulton et al 2013).

Moreover, there is little evidence that nest sites are selected based on the amount of forest cover. Peregrines routinely nest in landscapes devoid of significant tree cover, ranging from the Canadian arctic and Greenland, to the Cape Peninsula of South Africa and southwestern Iran. In 4 landscape-scale studies, nest site selection appeared to be either independent of, or negatively related to, the amount of forest or woodland surrounding nest sites (Gainzarain et al 2000, Sergio et al 2004, Brambilla et al 2006, Rodriguez and Siverio 2006). Similarly, in the Lakehead Forest study noted above, there was slightly less (but not significantly so) mature and older forest within 1 km and 2 km of occupied compared to unoccupied but suitable nest sites.

Lack of selection for forest cover is not surprising since peregrines hunt over open areas such as wetlands, lakes, ponds, rivers, fields, and early successional forest, where they prey on a diversity of small- to medium-sized birds (Hunter et al. 1988, Holroyd et al 1995). Preferred prey may be less abundant in landscapes that are largely forested compared to those that are a mosaic of forest and open habitats (e.g., Dzialak et al 2005, 2009). Thus, some harvesting may actually increase suitability by creating foraging habitat (Lanier and Foss 1989).

Because nests are typically on steep, sparsely vegetated cliffs, forest management operations are rarely likely to have a direct physical impact on the nest ledge. However, harvest is restricted within the inner 200 m of the AOC to protect the physical

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environment in the immediate vicinity of the nest site and to reduce potential access created by extraction trails.

Harvest, renewal, and tending operations are not permitted within the following distances of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 400 m for high potential impact operations
- 200 m for moderate potential impact operations
- 100 m of low potential impact operations.

Revised guide status and rationale:

New direction.

Peregrines are generally considered to be quite sensitive to a variety of human activities (Fyfe and Olendorff 1976), especially recreational activities such as rock-climbing (Olsen and Olsen 1980). Unfortunately, there is little quantitative information on effects of human activities around nests. In extreme cases, human activities may cause abandonment of nest sites (White et al 2002). However, the reaction of individual birds varies considerably; birds may be most sensitive to disturbance early in the nesting season and those nesting in remote locations may be more sensitive than those nesting in developed areas (Windsor 1977, Barclay 1986).

Recommended setback distances (SBDs) for human activities (based largely on expert opinion) range from 200-2000 m around occupied nest sites (Windsor 1977, Barclay 1986, OMNR 1987, Erickson et al 1988, Kurvits 1989, Lanier and Foss 1989, Richardson and Miller 1997, Scobie and Faminow 2000).

SBDs for other raptors are based on flushing distance (FD). The model in Naylor (2009) suggests an average FD of about 56 m based on body mass. This estimate is consistent with results from an experimental study in NWT that found FD of nesting peregrines varied from 0-160 m with a weighted mean of 40 m (N=41 FDs). In contrast, an earlier and smaller study in NWT (Windsor 1977) found FD varied from 0-1500 m. However, in only 1 case did peregrines flush at a distance >350 m and in about half the cases flushed at distances < 200 m (see data in Windsor 1977:Appendix C).

Moreover, an opinion survey of 31 European peregrine falcon experts suggested a median FD of 175 m (averaged for incubation and chick rearing periods) (Whitfield et al 2008).

This information suggests a SBD of 400 m (for high potential impact operations) would likely be conservative.

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Activities that are not visible are typically less likely to disturb nesting peregrine falcons than are those that are visible (Windsor 1977). Visibility is one factor used to assess the potential impact of forest management operations on nesting birds (see OMNR 2010:192-193). Thus, operations that are not detectable from a nest because they are behind a cliff face will generally represent a lower potential impact than those in front of a cliff face. For example, following the approach in OMNR (2010:192-193), a mechanical harvest operation in front of a cliff will typically represent a high potential impact. A similar operation behind a cliff may only represent a moderate potential impact if it cannot be seen (or heard) from the nest.

New primary and branch roads and landings that provide increased access to nest sites are not permitted within 200 m of the top or bottom of nest sites.
New primary and branch roads and landings that provide increased access to nest sites are not permitted within 201-400 m of the top or bottom of nest sites unless approved by the Ministry.
New operational roads and landings that provide increased access to nest sites are not permitted within 200 m of the top or bottom of nest sites except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
New forestry aggregate pits and wood storage yards are not permitted within 200 m of the top or bottom of nest sites.

Revised guide status and rationale:

New direction.

Disturbance of nesting birds associated with forestry-related traffic can be minimized by using timing restrictions (see below). However, noise associated with other users of new roads may disturb nesting birds. Moreover, new roads may facilitate access to cliffs by recreationists; nesting pairs may be especially adversely affected by rock climbers (Olsen and Olsen 1980, Mearns and Newton 1988, Brambilla et al 2004).

However, information on how roads influence nest site occupancy is largely equivocal. For example, outside North America, four studies reported a mean distance between nest sites and paved roads that ranged from 737 to 1479 m; three studies reported a mean distance to unpaved roads that ranged from 373 to 1065 m; and one study reported a mean distance to any class of road as 582 m (Gainzarain et al 2000, Sergio et al 2004, Brambilla et al 2006, Rodriguez et al 2007, Shafaeipour et al 2016). Only one study reported the minimum distance from occupied nests to the nearest road; 480 m for paved roads and 230 m for unpaved roads (Shafaeipour et al 2016). Four studies compared the distance to roads from occupied and unoccupied but suitable nest sites. In only one of these studies were nests significantly further from roads (both paved and

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unpaved) than expected by chance. In two of the studies nests were actually significantly closer to paved and/or unpaved roads than expected by chance.

In the Lakehead Forest study noted above, occupied nests were >2.5 times further from forest access roads than were unoccupied but suitable sites. However as noted above, habitat occupancy was best predicted (based on AIC analysis) by the amount of open water and private land within 2 km of nest sites so the apparent negative relationship between occupancy and distance to forest access roads may simply be spurious. This contention is supported by the fact that occupied sites were about two times further from forest access roads than they were from highways or municipal roads (which would presumably represent a greater risk of disturbance). Moreover, occupied and unoccupied but suitable sites did not differ in the distance to highways or municipal roads.

There is also anecdotal evidence suggesting that peregrines will nest close to busy roads. For example, Ritchie et al (1998) described two occupied nests in rock cuts along the Alaska Highway where traffic volume was >600 vehicles/day. However, in the Lakehead Forest study, no occupied nests were <377 m from the nearest road. Thus, despite the equivocal effects of roads, restrictions are placed on construction of new roads within the entire AOC, with the greatest restrictions within the inner half m of the AOC.

Direction focuses on new roads that provide new access to the nest site. For example, if there is an existing road right at the base of the cliff face that already provides access, restrictions on roads within the remainder of the AOC do not apply. Landings are not permitted within portions of the AOC where mature forest with high canopy closure is to be retained.

Given the more permanent nature of primary and branch roads (and thus potential for longer term disturbance associated with recreational use of the roads), restrictions are greater for primary and branch than for operational roads.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 400 m for high potential impact operations
- 200 m for moderate potential impact operations
- 100 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

New direction.

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See discussion/rationale for operational prescription (harvest, renewal and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. This is based on the assumption that, in this situation, the nesting birds have likely habituated to low impact activities.

Best management practices: Retained, revised, or new

To the extent practical and feasible, new operational roads and landings will not be constructed within 201-400 m of the top or bottom of nest sites.

When new operational roads are constructed within the AOC, temporary water crossings will be used whenever practical and feasible to limit future access and disturbance.

Revised guide status and rationale:

New BMPs for operational roads and landings.

See rationale for standards and guidelines for roads and landings above.

Notes

The critical breeding period is defined... (table).

Revised guide status and rationale:

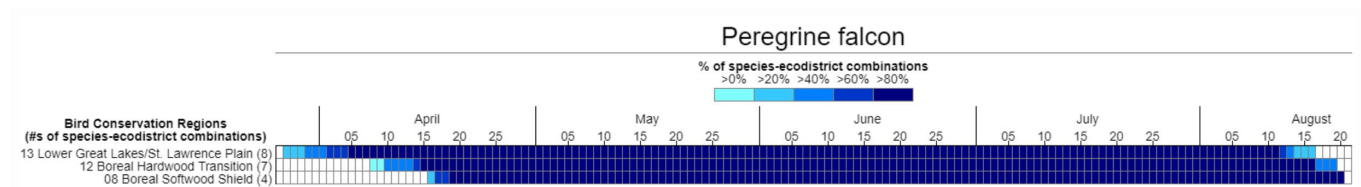
Cliff-nesting birds generally return to nesting territories in Ontario in mid to late March; young generally fledge by mid-August (Brian Ratcliffe and Ted Armstrong, unpublished data).

Moreover, models in Rousseu and Drolet (2017) suggest:

- 10% of nests contain at least 1 egg by late March in BCR 13, early April in BCR 12 and mid-April in BCR 8.
- 90% of young fledge by mid August in BCR 13 and late August in BCRs 8 and 12.

‘Nest building’ takes from 2 weeks - 2 months (White et al 2002), suggesting a critical breeding period of about March 1 - August 15 for BCR 13 and March 15 - August 31 for BCRs 8 and 12.

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ii) Active peregrine falcon nest site on other natural features

Description of value

Revised guide status and rationale:

New description.

The majority of known peregrine nests occur on cliff faces. A few nests occur on other natural features such as rock outcrops. First-time breeders in expanding populations may be especially likely to select atypical sites (White et al 2002).

Direction for peregrine nests on cliffs focuses on the cliff face since the face may contain numerous ledges that have been or may be used for nesting. Direction for nests on other natural features focuses on the individual nest.

Direction applies to nests occupied at least once within the past 15 years following the previous habitat regulation.

When a pair of peregrines has occupied more than 1 nest within the past 15 years, each nest is associated with an AOC.

The size of the AOC reflects the distance required to mitigate the potential effects of high impact operations (see Peregrine falcon nest sites on cliffs).

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:

- Harvest is not permitted within 100 m of active nests
- Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 101-200 m of active nests. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure $< 60\%$.

Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the critical breeding period based on potential

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impact of the operation, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process: • 400 m for high potential impact operations • 200 m for moderate potential impact operations • 100 m of low potential impact operations.
New primary and branch roads and landings that provide increased access to nest sites are not permitted within 200 m of active nests.
New primary and branch roads and landings that provide increased access to nest sites are not permitted within 201-400 m of active nests unless approved by the Ministry.
New operational roads and landings that provide increased access to nest sites are not permitted within 200 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
New forestry aggregate pits and wood storage yards are not permitted within 200 m of active nests.
Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process: • 400 m for high potential impact operations • 200 m for moderate potential impact operations • 100 m of low potential impact operations. However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

New direction.

See associated rationale for peregrine falcon nest sites on cliffs.

Best management practices: Retained, revised, or new

To the extent practical and feasible, new operational roads and landings will not be constructed within 201-400 m of active nests.
When new operational roads are constructed within the AOC, temporary water crossings will be used whenever practical and feasible to limit future access and disturbance.

Revised guide status and rationale:

New BMPs for operational roads and landings.

See associated rationale for peregrine falcon nest sites on cliffs.

iii) Active turkey vulture nests on natural features

Description of value

Revised guide status and rationale:

Direction for turkey vulture nests moved from Section 4.2.2.7 to Section 4.2.2.1 to improve organization.

Description revised. Direction applies to sites used at least once within the past 15 years since the turkey vulture shows strong nest site fidelity, with records of individual sites used >10 years (Kirk and Mossman 1998).

The size of the AOC is based on the distance considered necessary to mitigate effects of high potential impact operations (see operational prescription and conditions for the AOC).

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:

- Harvest is not permitted within 75 m of active nests
- Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 76-150 m of active nests. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure $< 60\%$.

Revised guide status and rationale:

While roads and open habitats are used for foraging, suitable nest (and roost) sites appear to be associated with forested habitats (Coleman and Fraser 1989). How much forest needs to be retained at each nest site is unknown. However, Coleman and Fraser (1989) noted that habitat use associated with nests was limited to the area within about 200 m of nests. Thus, mature forest that may provide potential perch and roost sites is retained within the entire AOC, with greatest restrictions within the inner half.

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Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 150 m for high potential impact operations
- 75 m for moderate potential impact operations
- 40 m of low potential impact operations.

Revised guide status and rationale:

Suitable nest sites are generally thought to be relatively free from human disturbance (see Kirk and Mossman 1998).

The current direction is based on an estimated SBD of about 260 m (based on body mass equation in Naylor (2009)) which was reduced to 150 m assuming ground-nesting birds are less sensitive to disturbance than tree-nesting birds.

Unfortunately, there is no empirical information for the turkey vulture to evaluate the current SBD. Weighted average FD from 3 studies of European cinereous and bearded vultures was about 280 m (N=132 FDs; Arroyo and Razin 2006 [estimated from Fig. 1], Margalida et al 2011, Kirazli 2016). However, these European vultures are about 3 to 5 times larger than the turkey vulture. Body mass alone would suggest an average FD for these species of about 450 to 700 m (see equation in Naylor (2009)), about double that observed in the studies noted above. Thus, the assumption that SBD estimated from body mass can be halved for the turkey vulture is likely still reasonable and the current SBD of 150 m for high potential impact operations is retained.

New primary and branch roads and landings are not permitted within 75 m of active nests.

New all-weather primary and branch roads and landings are not permitted within 76-150 m of active nests unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 20 m.

New operational roads and landings are not permitted within 75 m of active nests unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 15 m.

New landings associated with operational roads are not permitted within 76-150 m of active nests unless approved by the Ministry.

New forestry aggregate pits and wood storage yards are not permitted within 75 m of active nests.

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New forestry aggregate pits and wood storage yards are not permitted within 76-150 m of active nests except in extraordinary circumstances.

Revised guide status and rationale:

Effects of roads (and associated traffic) are somewhat equivocal. Home ranges of turkey vultures in Pennsylvania had proportionally more roads than found within the larger area studied by Coleman and Fraser (1989). Roads may be the primary source of carrion in forested landscapes (e.g., Kelly et al 2007). However, within home ranges, nest sites tended to be in relatively roadless areas (Coleman and Fraser 1989).

In other vulture species, proximity of roads and associated traffic may affect nest site occupancy, behavior of nesting birds, or reproductive success (e.g., Arroyo and Razin 2006, Zuberogoitia et al 2008, Kiralzi 2016).

Thus, direction restricts new roads within the AOC. Restrictions are greatest for relatively permanent roads (primary and branch) and within the inner half of the AOC (where mature forest with high canopy closure is being retained).

New landings, forestry aggregate pits, or wood storage yards are not permitted where mature forest with high canopy closure is being retained.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 150 m for high potential impact operations
- 75 m for moderate potential impact operations
- 40 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

See discussion/rationale for operational prescription (harvest, renewal and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest. This is based on the assumption that, in this situation, the nesting birds have likely habituated to low impact activities.

Notes

The critical breeding period is defined... (table)

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Revised guide status and rationale:

Critical breeding period revised.

Based on models in Rousseu and Drolet (2017):

- 10% of nests contain at least 1 egg by late March in BCR 13, mid-April in BCR 12, and late April in BCR 8.
- 90% of young fledge by mid-September in all BCRs.

No time is required for nest construction (Kirk and Mossman 1998), suggesting a critical breeding period of about March 15 - September 15 for BCR 13, April 1 - September 15 for BCR 12, and April 15 - September 15 for BCR 8.

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(C&R) 4.2.2.2 Bald eagle and osprey nests

Preamble/Direction

Revised guide status and rationale:

Content revised.

In the five-year review, practitioners suggested the current direction was confusing and difficult to implement. Inventory limitations generally restrict the ability to classify nests as primary, alternate, or inactive, and thus take greatest advantage of flexibility in the guide (the potential to pool primary and alternate nests as active nests and then apply timing restrictions as a CRO was discussed as one way to simplify the direction). Thus, primary and alternate nests have been combined as active nests.

Continue to include separate direction for inactive nests, however, there is a low likelihood of inactive nests being reused (see below). Text simplified to reflect focus on active and inactive nests.

Portion of preamble (status of nest as a value) moved to Section 4.2.2 as it applies to all species.

Watts (2015) noted that only about 10% of trees that lost nests were eventually reused by bald eagles in the Chesapeake Bay area. He suggested limited value in protecting trees that lose nests.

Given the status of the bald eagle and osprey, the complexity and restrictiveness of current direction is likely unnecessary to sustain healthy populations.

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Direction for operations not consistent with AOC prescription prior to nest discovery, that occurred within the direction for each species, has been generalized and moved to the preamble.

i) Active bald eagle nests

Description of value

Revised guide status and rationale:

Description simplified to reflect similar treatment of primary and alternate nests.

Based on analysis of 1,463 bald eagle nests in Chesapeake Bay, Watts and Duerr (2010) estimated an annual reoccupancy rate of 0.739 (i.e., 73.9% of nests occupied in year X were reoccupied in year X+1). This estimate is consistent with smaller studies of other eagle populations (although one study in Alaska suggested a much lower rate of 37.3%; see summary in Watts and Duerr (2010)). Assuming a reoccupancy rate similar to that documented by Watts and Duerr (2010), the likelihood of an occupied nest being reoccupied after 5 years is <20%. This supports the current 5-year 'rule'.

Watts (2015) suggested low residual value of nests that have not been used for >3 consecutive years. This supports the current 3-year 'rule'.

Moved reference to size of AOC (a standard in current direction) to description. The size of the AOC is based on the distance required to mitigate potential effects of high impact operations (see below).

Removed statement about insufficient inventory data - unnecessary detail since no distinction between primary and alternate nests.

Removed statement about direction applying to nests known before or found during operations and moved to preamble for Section 4.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:

- Harvest is not permitted within 100 m of primary nests
- Harvest that retains mature forest with ≥60% relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 101-200 m of active nests. Harvest that retains relatively uniform canopy closure ≥60% is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure <60%
- Within harvested portions of the AOC, wildlife trees that may function as potential nest, perch, and roost sites will be preferentially retained, based on

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the following order of priority: 1) supercanopy trees, 2) veteran trees, 3) cavity trees, and 4) other live dominant or codominant trees that are windfirm. White pine, red pine, and/or trembling aspen will be favoured when available.

Revised guide status and rationale:

Direction revised.

First and second bullets in revised direction remain unchanged from current guide direction. During the five-year review, two subject experts suggested that the species may not need as much closed canopy forest in the vicinity of nest trees as prescribed. This latter contention seems to be supported by the literature. For example, Saalfeld and Conway (2010) found that nest site selection was negatively related to tree basal area immediately around eagle nest trees in Texas. Mundahl et al (2013) found that successful eagle nests in Minnesota and Wisconsin were in areas with lower tree basal area compared to unsuccessful nests. Letto et al (2015) found less forested habitat associated with sites used vs not used in Newfoundland.

However, some practitioners believed the current AOC was too small and did not provide nest trees with sufficient protection from severe wind events (which some thought were increasing in frequency as a result of climate change). Given this uncertainty, the existing direction remains unchanged.

Third bullet is a guideline in current direction. Removed reference to Section 3.2.3. Moved the requirement to follow wildlife tree and downed woody material direction in all AOCs to the preamble to Section 4. See original Background and Rationale for Direction for rationale for wildlife tree priority ranking.

Removed third bullet (regular harvest permitted within 201-400 m) in current direction. The five-year review identified that this direction was confusing. Deemed to be unnecessary so removed.

Removed fourth bullet (renewal and tending operations leaving residual below the minimum) in current direction. Deemed to be unnecessary so removed.

Harvest, renewal, and tending operations are not permitted within the following distances of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 400 m for high potential impact operations
- 200 m for moderate potential impact operations
- 100 m of low potential impact operations.

Revised guide status and rationale:

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Current direction is based on the following rationale ... “detailed research on the response of eagles to human activities suggests that only about 25% of nesting birds flush when disturbances are further than 200 (Grubb et al. 1992) to 300 m (Grubb and King 1991) from nests. Thus, [a SBD of 400 m] should likely be adequate to protect 95% of nests”.

The weighted average FD based on means/medians from studies of nesting bald eagles in Minnesota (Fraser et al 1985), Arizona (Grubb and King 1991), Michigan (Grubb et al 1992), and Louisiana (Linscombe et al 1999) is around 200 m, suggesting a SBD of around 400 based on approach outlined in Appendix 1 (i.e., SBD=2 times mean FD).

Thus, the SBDs in the current guide are retained.

New primary and branch roads and landings are not permitted within 200 m of active nests.
New primary and branch roads within 201-400 m of active nests unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.
New operational roads and landings are not permitted within 200 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 15 m.
New operational roads and landings permitted within 201-400 m of active nests with Ministry notification.
New forestry aggregate pits and wood storage yards are not permitted within 200 m of active nests.

Revised guide status and rationale:

See the original Background and Rationale for Direction for discussion of the effects of roads. Recent literature continues to suggest a negative response to roads and other sources of human activity (Shannon 2008, Saalfeld and Conway 2010, Smith 2014, Jordan 2016), although no studies identify forestry-relevant thresholds.

However, eagles generally appear to show higher (and perhaps increasing) tolerance to human activity or development near nests than previously suspected (Whitney 2008, Guinn 2013, Jim Grier pers. comm. 2019).

Thus, restrictions on new roads are still prudent but some additional flexibility is likely acceptable. Restrictions are greatest for roads with more permanent effects (i.e.,

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primary and branch) and those close to nests where mature forest with high canopy closure is desired.

Landings prohibited in parts of the AOC where mature forest with high canopy closure is desired.

Forestry aggregate pits and wood storage yards not permitted in parts of the AOC where mature forest with high canopy closure is desired.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 400 m for high potential impact operations
- 200 m for moderate potential impact operations
- 100 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

No changes to direction.

See discussion/rationale for operational prescription (harvest, renewal and tending) for the AOC.

Standards and guidelines: Removed

400 m radius AOC centred on primary nests.

Revised guide status and rationale:

Current standard moved to description of value.

If harvest that retains <60% relatively uniform canopy closure occurs within 200 m of a primary nest prior to its discovery, an additional patch of unharvested forest equivalent to the area harvested will be retained, preferably attached to the remaining unharvested forest surrounding the nest (to provide a supply of potential nest and roost trees).

Revised guide status and rationale:

Current guideline moved to preamble.

ALL direction for bald eagle alternate nests.

Revised guide status and rationale:

Removed current direction for bald eagle alternate nests. Addressed by direction for active bald eagle nests.

Best management practices: Retained, revised, or new

New operational roads constructed within 201-400 m of active nests will have a cleared right-of-way width as narrow as practical/feasible which does not exceed 15 m.

If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access.

Revised guide status and rationale:

Both BMPs are currently guidelines – moved to BMPs as wording not consistent with direction that is mandatory.

ii) Inactive bald eagle nests

Description of value

Revised guide status and rationale:

Current description modified to reflect removal of primary and alternate nest terminology.

Third bullet in current description removed - common condition for all values – move reference to introductory preamble of Section 4.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within 30 m of nest trees.

Revised guide status and rationale:

Direction revised.

Replaces first two standards in AOC operational prescription in current direction.

Inactive nests considered to have a low likelihood of reuse (Watts and Duerr 2010). Thus, addressed by retention of a smaller residual patch; 30 m radius provides some visual screening and protection from windthrow.

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New [all roads, landings, forestry aggregate pits, and wood storage yards] are not permitted within 30 m of inactive nests unless with Ministry approval (see Appendix 1b).

Revised guide status and rationale:

Some additional flexibility considered appropriate given likelihood of nest reuse and apparent increase in tolerance to human development.

No timing restrictions on operations associated with [all roads, landings, forestry aggregate pits and wood storage yards] around inactive nests.

Revised guide status and rationale:

Direction retained with no changes.

Standards and guidelines: Removed

Within the AOC, renewal and tending operations that will leave a residual stand structure below the minimum described above are not permitted; all other renewal and tending operations are permitted.

Wildlife trees and downed woody material will be retained within harvested portions of the AOC as per general direction in Section 3.2.3. Wildlife trees that may function as potential nest, perch, and roost sites will be preferentially retained, based on the following order of priority: 1) supercanopy trees, 2) veteran trees, 3) cavity trees, and 4) other live dominant or codominant trees that are windfirm. White pines, red pines, and poplars will be favored when available.

Revised guide status and rationale:

Removed current standard and guideline. Unnecessary direction – no harvest, renewal, or tending permitted within 30 m.

iii) Active osprey nests

Description of value

Revised guide status and rationale:

Description simplified to reflect similar treatment of primary and alternate nests.

Reoccupancy rate of osprey nests reported as 95% for artificial platforms and 70 to 80% for natural nest sites (Bierregaard et al 2016). Thus, reoccupancy rate for natural sites appears similar to that for bald eagles, supporting the continued use of the 5-year 'rule' used for that species.

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Three-year 'rule' also retained for consistency with the bald eagle direction.

Moved reference to size of AOC (a standard in current direction) to description. The size of the AOC is based on the distance required to mitigate potential effects of high impact operations (see below).

Removed statement about insufficient inventory data - unnecessary detail since no distinction between primary and alternate nests.

Removed statement about direction applying to nests known before or found during operations and moved to preamble for Section 4.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:

- Harvest is not permitted within 75 m of primary nests.
- Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 76-150 m of active nests. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure $< 60\%$.

Within harvested portions of the AOC, wildlife trees that may function as potential nest, perch, and roost sites will be preferentially retained, based on the following order of priority: 1) supercanopy trees, 2) veteran trees, 3) cavity trees, and 4) other live dominant or codominant trees that are windfirm. White pine, red pine, and/or trembling aspen will be favoured when available.

Revised guide status and rationale:

Direction revised.

Two bullets in first piece of direction remain unchanged from current guide direction. During the five-year review, two subject experts suggested that the species may not need as much closed canopy forest in the vicinity of nest trees as prescribed. However, some practitioners believed the current AOC was too small and did not provide nest trees with sufficient protection from severe wind events (which some thought were increasing in frequency as a result of climate change). Given this uncertainty, the existing direction remains unchanged.

Removed third bullet (regular harvest permitted within 151-300 m) in current direction. The five-year review identified that this direction was confusing. Deemed to be unnecessary so removed.

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Removed fourth bullet (renewal and tending operations leaving residual below the minimum) in current direction. Deemed to be unnecessary so removed.

Second piece of direction is a guideline in current direction. Removed reference to Section 3.2.3. Moved the requirement to follow wildlife tree and downed woody material direction in all AOCs to the preamble to Section 4. See original Background and Rationale for Direction for rationale for wildlife tree priority ranking.

Harvest, renewal, and tending operations are not permitted within the following distances of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 300 m for high potential impact operations
- 150 m for moderate potential impact operations
- 75 m of low potential impact operations.

Revised guide status and rationale:

Current SBDs were based on estimated FD from body mass as described in Appendix 4 of the current Background and Rationale for Direction.

Unfortunately, there is little empirical information on FD for nesting ospreys. European species experts surveyed by Whitfield et al (2008) suggested a median FD of 200 m (incubation and chick rearing periods pooled), suggesting a SBD of 400 m (based on 2 times mean FD as per Appendix 1). However, based on body mass, mean FD was estimated as 123 m (see Appendix 4 in the B&R), suggesting a SBD of about 250 m.

Thus, the SBDs in the current guide are retained.

New primary and branch roads and landings are not permitted within 150 m of active nests.

New primary and branch roads and landings are not permitted within 151-300 m of active nests unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

New operational roads and landings are not permitted within 150 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and ≤ 15 m.

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New operational roads and landings permitted within 151-300 m of active nests with Ministry notification.

New forestry aggregate pits and wood storage yards are not permitted within 150 m of active nests.

Revised guide status and rationale:

See the original Background and Rationale for Direction for discussion of the effects of roads. Recent literature continues to suggest a negative response to roads and other sources of human activity (Rodriguez et al 2013, Siverio et al 2014), although no studies identify forestry-relevant thresholds.

However, ospreys generally appear to show higher (and perhaps increasing) tolerance to human activity or development near nests than previously suspected (Walsh 2013, Washburn 2014).

Thus, restrictions on new roads are still prudent but some additional flexibility is likely acceptable. Restrictions are greatest for roads with more permanent effects (i.e., primary and branch) and those close to nests where mature forest with high canopy closure is desired.

Landings prohibited in parts of the AOC where mature forest with high canopy closure is desired.

Forestry aggregate pits and wood storage yards not permitted in parts of the AOC where mature forest with high canopy closure is desired.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 300 m for high potential impact operations
- 150 m for moderate potential impact operations
- 75 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

No changes to direction.

See discussion/rationale for operational prescription (harvest, renewal and tending) for the AOC.

Standards and guidelines: Removed

300 m radius AOC centred on primary nests

Revised guide status and rationale:

Current standard moved to description of value.

If harvest that retains <60% relatively uniform canopy closure occurs within 150 m of a primary nest prior to its discovery, an additional patch of unharvested forest equivalent to the area harvested will be retained, preferably attached to the remaining unharvested forest surrounding the nest (to provide a supply of potential nest and roost trees).

Revised guide status and rationale:

Current guideline moved to preamble.

ALL direction for osprey alternate nests.

Revised guide status and rationale:

Removed current direction for osprey alternate nests. Addressed by direction for active osprey nests.

Best management practices: Retained, revised, or new

New operational roads constructed within 151-300 m of active nests will have a cleared right-of-way width as narrow as practical/feasible which does not exceed 15 m.

If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access.

Revised guide status and rationale:

Both BMPs are currently guidelines – moved to BMPs as wording not consistent with direction that is mandatory.

iv) Inactive osprey nests

Description of value

Revised guide status and rationale:

Current description modified to reflect removal of primary and alternate nest terminology.

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Third bullet in current description removed - common condition for all values – move reference to introductory preamble of Section 4.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within 30 m of nest trees.

Revised guide status and rationale:

Direction revised.

Replaces first two standards in AOC operational prescription in current direction.

Inactive nests considered to have a low likelihood of reuse. Thus, addressed by retention of a smaller residual patch; 30 m radius provides some visual screening and protection from windthrow.

New [all roads, landings, forestry aggregate pits, and wood storage yards] are not permitted within 30 m of inactive nests unless with Ministry approval.

Revised guide status and rationale:

Some additional flexibility considered appropriate given likelihood of nest reuse and apparent increase in tolerance to human development.

No timing restrictions on operations associated with [all roads, landings, forestry aggregate pits and wood storage yards] around inactive nests.

Revised guide status and rationale:

Direction retained with no changes.

Standards and guidelines: Removed

Within the AOC, renewal and tending operations that will leave a residual stand structure below the minimum described above are not permitted; all other renewal and tending operations are permitted.

Wildlife trees and downed woody material will be retained within harvested portions of the AOC as per general direction in Section 3.2.3. Wildlife trees that may function as potential nest, perch, and roost sites will be preferentially retained, based on the following order of priority: 1) supercanopy trees, 2) veteran trees, 3) cavity trees, and

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4) other live dominant or codominant trees that are windfirm. White pines, red pines, and poplars will be favored when available.

Revised guide status and rationale:

Removed current standard and guideline. Unnecessary direction – no harvest, renewal, or tending permitted within 30 m.

Notes

The critical breeding period is defined... (table)

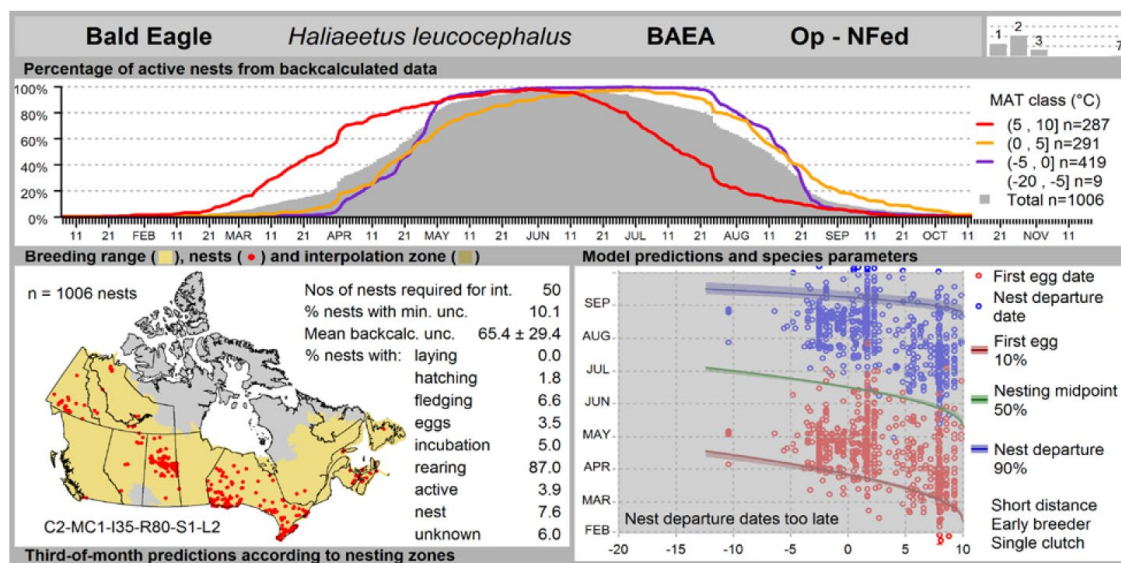
Revised guide status and rationale:

Critical breeding periods for bald eagle and osprey revised.

The current critical breeding period was defined largely based on egg dates from Ontario pre-1980. The 5-year review recommended the most recent nest record data be used to refine (if necessary) the critical breeding period to reflect perceived changes in nesting behaviour as a result of climate change. Based on models in Rousseu and Drolet (2017):

Bald eagle

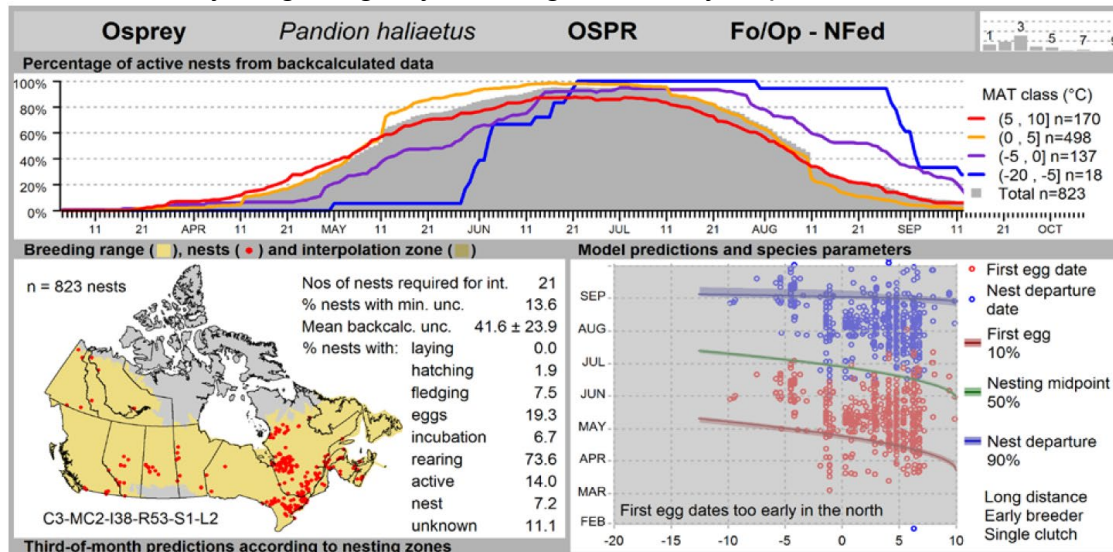
- 10% of nests contain at least 1 egg by early March in BCR 13, mid-March in BCR 12, and late March in BCR 8.
- 90% of young fledge by late August or early September in all BCRs (although the authors note that the model seems to predict nest departure dates that are too late).



Nest building takes anywhere from <1 week - 3 months (Buehler 2000), suggesting a critical breeding period of about February 1 - August 31 for BCR 13, February 15 - August 31 for BCR 12, and March 1 - August 31 for BCR 8.

Osprey

- 10% of nests contain at least 1 egg by early April in BCR 13, mid-April in BCR 12, and late April in BCR 8.
- 90% of young fledge by late August or early September in all BCRs.



Nest building takes anywhere from about 1 - 3 weeks (Bierregaard et al 2016), suggesting a critical breeding period of about March 15 - August 31 for BCR 13, April 1 - August 15 for BCR 12, and April 15 - August 31 for BCR 8.

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(C&R) 4.2.2.3 Colonial-nesting birds

(Formerly 4.2.2.3 Colonial-nesting birds (great blue heron, Bonaparte's gull, bank swallow))

Preamble/Direction

Revised guide status and rationale:

Content revised.

Direction for the bank swallow removed (now included in Section 4.3 (species at risk)). During the five-year review, a subject expert suggested the Bonaparte's gull nests in loose colonies with individual nests up to 1 km apart. Thus, it is likely more appropriate to provide direction that focuses on individual nests, rather than colonies (as per great blue heron). Consequently, direction for Bonaparte's gull has been moved to Section 4.2.2.4.

Direction for the black tern moved to this section from Section 4.3.6 to improve organization.

Portion of preamble (status of colony as a value) moved to Section 4.2.2 as it applies to all species.

i) Active great blue heron colonies

Description of value

Revised guide status and rationale:

Description revised.

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The five-year review supported continued distinction between large and small colonies based on their longevity. See original Background and Rationale for Direction for rationale. However, the distinction between direction for large and small colonies included minimal differences. Therefore, direction for both small and large colonies is now included in one section simplifying the direction.

The current threshold separating small and large colonies (i.e., 4 occupied nests) was based on assessment of 799 colonies located within the managed forest documented by surveys conducted circa 1980 and 1990 as part of the Ontario Heronry Inventory (OHI data provided by Bird Studies Canada). Large colonies were defined as ≥ 4 occupied nests since those contained about 95% of the nesting herons in the managed forest.

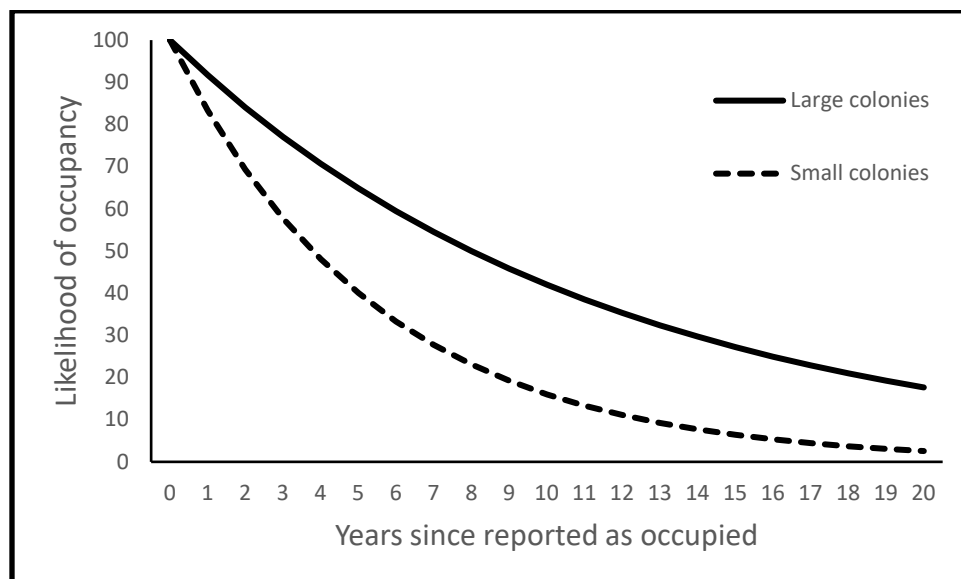
A significant part of the rationale for treating small and large colonies differently (i.e., accepting less risk for large colonies) is the anticipated greater longevity of large colonies. Based on logistic regression, longevity of colonies in the OHI database (likelihood that a colony occupied in 1980 was still occupied in 1990) was significantly related to colony size ($P = 0.0014$) (Brian Naylor unpublished data). The threshold separating colonies with relatively high versus low longevity was about 20 nests. Large colonies (i.e., those with ≥ 20 nests) were significantly ($P=0.000$) more likely to be occupied at the end of the 10-year survey period (42%) than were small colonies (16%). Thus, the description has been revised to address the differences in longevity between large and small colonies and a revised definition of large colonies as those with ≥ 20 occupied nests is proposed.

Based on the OHI database, large colonies are expected to account for about 20% of all colonies and 60% of all nests within the managed forest.

Based on the likelihood of colony longevity noted above (i.e., 42% for large colonies and 16% for small colonies over 10 years) and assuming a negative decay function, data from the OHI suggest about 92% of large colonies occupied in one year would be occupied the following year (83% for small colonies).

This suggests that the likelihood of occupancy drops below 20% after 18 years for large colonies (after 8 years for small colonies) (see below), suggesting the 'rules' be revised to 20 and 10 years for large and small colonies, respectively.

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The size of the AOC is based on the distance required to mitigate potential effects of high impact operations. In the 5-year review, a subject expert suggested that key foraging habitats within about 1 km of colonies may warrant special management consideration, suggesting a larger AOC.

Colony size has been correlated with the supply of suitable foraging habitat. Small fish comprise the majority of the diet, but herons also consume amphibians, rodents, aquatic insects, crayfish, snails, and carrion. Foraging is generally conducted in the shallow water of marshes, ponds, lake and river shorelines, and forested wetlands (see review in the original Background and Rationale for Direction).

In landscapes where land use activities are likely to adversely (and permanently) affect the supply or suitability of foraging habitats, a larger AOC that addresses foraging habitats may be warranted. However, there is no evidence to suggest that forest management operations adversely affect the supply or suitability of habitats likely to be used for foraging, especially considering current direction for aquatic features in Section 4.1.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:

- Harvest is not permitted within 75 m of the polygon connecting peripheral nests.
- Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 76-150 m of the polygon connecting peripheral nests. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial

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- thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure <60%.
- Harvest that retains forest with $\geq 50\%$ stocking comprised of trees ≥ 3 m tall is permitted within 151-300 m of the polygon connecting peripheral nests.

Revised guide status and rationale:

First and second bullets in revised direction remain unchanged from current guide direction. Clarified that distances are measured from the polygon connecting peripheral nests. No evidence that existing direction is inadequate.

Third bullet - Past direction that permitted selection and shelterwood harvest but not clearcutting within 151-300 m of colonies was considered to be effective but conservative (see discussion in current Background and Rationale for Direction). To prohibit clearcutting, existing direction required retention of residual forest. However, requirement to retain residual forest precludes some stages of the shelterwood system. Direction revised to preclude clearcutting but permit all stages of shelterwood harvest.

Removed fourth bullet (renewal and tending operations leaving residual below the minimum) in current direction. Deemed to be unnecessary so removed.

Removed fifth bullet (retention of wildlife trees/downed woody material) in current direction. Moved the requirement to follow wildlife tree and DWM direction in all AOCs to the preamble in Section 4.

Harvest, renewal, and tending operations are not permitted within the following distances of occupied nests within colonies during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 300 m for high potential impact operations
- 150 m for moderate potential impact operations
- 75 m of low potential impact operations.

Revised guide status and rationale:

Direction retained with no changes.

Current SBDs are based on the approach described in Appendix 4 of the guide. Mean FD predicted from body mass (185 m; see Appendix 4 in the current Background and Rationale for Direction) suggests a setback distance of around 370 m based on the methodology described in Appendix 1.

However, three 'experimental' studies with human intruders noted an overall mean FD of 77 m in Colorado (Vos et al 1985; calculated from data in Table 4), 32 m in Florida (Rodgers and Smith 1995), and 32 m in coastal British Columbia (Vennesland 2010).

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The weighted mean FD of about 55 m suggests a SBD of about 110 m. These studies were conducted in areas with significant human activity. Thus, it is possible these colonies were more habituated to human disturbance than those typically encountered in more remote sites in the managed forest.

Given this uncertainty, the current SBDs have been retained for both large and small colonies.

New primary and branch roads and landings are not permitted within 150 m of the polygon connecting peripheral nests.
New primary and branch roads and landings are not permitted within 151-300 m of the polygon connecting peripheral nests unless approved by the Ministry or constructed on an existing (where the vegetation is predominantly <8 m tall) roadbed provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.
New operational roads and landings are not permitted within 150 m of the polygon connecting peripheral nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
New operational roads are permitted within 151-300 m of active nests with Ministry notification.
New landings associated with operational roads are not permitted within 151-300 m of the polygon connecting peripheral nests unless approved by the Ministry.
New forestry aggregate pits and wood storage yards are not permitted within 150 m of the polygon connecting peripheral nests.
New forestry aggregate pits and wood storage yards are not permitted within 151-300 m of the polygon connecting peripheral nests unless approved by the Ministry.

Revised guide status and rationale:

Direction revised.

Past research suggested the proximity of roads may influence the location, size, and occupancy of heronries, with effects potentially extending up to 800 m from colonies (see summary in the current Background and Rationale for Direction). However, a recent study in coastal British Columbia found that colonies were not significantly further from human development (mainly roads) than expected by chance, with no relationship between proximity of human disturbance and colony productivity (Knight et al 2016). In contrast, colonies were closer to major foraging areas than expected by chance, suggesting that supply of foraging habitat may be more critical than human disturbance.

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The most relevant forestry-related study continues to be that reported in Naylor (2009) in which colony occupancy was weakly related to the proximity of primary and branch roads (but unrelated to the proximity of operational roads).

Thus, restrictions on new roads are still likely prudent but some additional flexibility is likely acceptable. Restrictions greatest for roads with more permanent effects (i.e., primary and branch) and those close to nests where mature forest with high canopy closure is desired.

Landings prohibited in parts of the AOC where mature forest with high canopy closure is desired with some allowance for landings in the outermost portion of the AOC.

Forestry aggregate pits and wood storage yards prohibited in parts of the AOC where mature forest with high canopy closure is desired with some allowances for aggregate pits and wood storage yards in the outermost portion of the AOC.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied nests within colonies during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 300 m for high potential impact operations
- 150 m for moderate potential impact operations
- 75 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony.

Revised guide status and rationale:

No changes to direction.

See discussion of SBDs and rationale for operational prescription (harvest, renewal and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. This is based on the assumption that, in this situation, the nesting birds have likely habituated to the low impact activity.

Standards: Removed

300 m radius AOC centred on primary nests.

Revised guide status and rationale:

Current standard moved to description of value.

Best management practices: Retained, revised, or new

New operational roads constructed within 151-300 m of the polygon connecting peripheral nests will have a cleared right-of-way width as narrow as practical/feasible which does not exceed 15 m.

If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access.

Revised guide status and rationale:

Both BMPs are currently guidelines – moved to BMPs as wording not consistent with direction that is mandatory.

ii) Inactive great blue heron colonies

Description of value

Revised guide status and rationale:

Description changed to reflect new definition of large and small active colonies.

Third bullet in current description removed - common condition for all values – move reference to introductory preamble in Section 4.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within 30 m of the polygon connecting peripheral nests.

Construction of [all roads, landings, forestry aggregate pits, wood storage yards] is not permitted within 30 m of the polygon connecting peripheral nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

No timing restriction on operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] within 30 m of the polygon connecting peripheral nests.

Revised guide status and rationale:

Direction simplified given the low likelihood of reuse of inactive colonies (especially considering the revised description of what is considered inactive).

No timing restrictions on operations associated with existing roads, landings, and forestry aggregate pits within 30 m of nest trees since inactive colonies are unoccupied.

ii) Active black tern colonies

Description of value

Revised guide status and rationale:

Direction for black terns moved to Section 4.2.2.3 from Section 4.3.6 to improve organization.

Black terns show weak fidelity to nesting areas; about 25-40% of birds return to breed in the same cluster of nests each year (see references in Heath et al 2009, Burke 2012).

Thus:

- Direction focuses on mitigating the effect of operations on occupied colonies, rather than on maintaining the suitability of specific wetlands
- Colonies are considered active if occupied at least once within the past 5 years.

The size of the AOC is based on the distance required to mitigate potential effects of high impact operations (see operational prescription for the AOC).

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below).
Operations that significantly alter hydrological regime within occupied wetlands to the extent that habitat is no longer suitable for nesting, are not permitted.

Revised guide status and rationale:

New direction.

Black terns typically nest in marshes dominated by cattails or bulrushes, or the marshy borders of lakes, rivers, and ponds (Peck and James 1983, Heath et al 2009). Thus, harvest, renewal, and tending operations are unlikely to directly affect nesting habitat.

Moreover, habitat selection appears to be related to type and density of wetland vegetation, water depth, flooding regime, cover, water ratio, proximity/amount of open water, and size of individual wetlands or wetland complexes (e.g., Hickey and Malecki 1997, Mazzocchi et al 1997, Naugle et al 2000, Gilbert 2001, Maxson et al 2007, Steen and Powell 2012, Wyman and Cuthbert 2016). There is no evidence that the amount of forest surrounding colonies affects habitat selection. In Poland, the area of woodlands within 1 km of the centre of colonies ranged from <1-150 ha (Golawski et al 2015).

Moreover, direction in Section 4.1.3 ensures harvest, renewal, and tending operations will not adversely affect the occupied wetland.

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Thus, harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions.

Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests with colonies during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 100 m for high potential impact operations
- 50 m for moderate potential impact operations
- 25 m of low potential impact operations.

Revised guide status and rationale:

New direction.

Terns are generally considered to be sensitive to human activities. Sources recommend SBDs ranging from 50-200 m for various species of terns (note – no recommendations for black terns) (e.g., Erwin 1989, Rodgers and Smith 1995, Burger 1998, Carney and Sydeman 1999, Hillman et al 2015, Mallory 2016).

However, the species addressed by these recommendations nest in open habitats with little vegetative cover. In contrast, black terns tend to nest in relatively dense wetland vegetation (Heath et al 2009). Moreover, while there is anecdotal evidence of disturbance by recreational activities such as fishing and boating (Kudell-Ekstrum and Rinaldi 2004), black terns are generally considered to be tolerant of human activity unless a colony is entered (Heath et al 2009). Even intense disturbance by investigators did not influence hatching or fledging success (Shealer and Haverland 2000).

Flushing distance of the similarly-sized least tern is reported as about 60 m (Erwin 1989, Rodgers and Smith 1995) and recommended SBDs for least tern range from 50 to 150 m (Erwin 1989, Rodgers and Smith 1995, Carney and Sydeman 1999, Hillman et al 2015).

Thus, the proposed SBD of 100 m should be conservative.

New primary and branch roads and landings are not permitted within 50 m of the polygon connecting peripheral nests.

New primary and branch roads and landings are not permitted within 51-100 m of the polygon connecting peripheral nests unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the

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cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

New operational roads are not permitted within 50 m of the polygon connecting peripheral nests except in extraordinary circumstances or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 15 m.

Revised guide status and rationale:

Roads may reduce habitat suitability either directly (by removing wetland vegetation) or indirectly (by altering hydrological regime) and thus are restricted within the AOC. Restrictions are greatest for more permanent roads and those closest to the colony.

No restrictions on landings, forestry aggregate pits; already covered by direction in Section 4.1.3.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied nests within colonies during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 100 m for high potential impact operations
- 50 m for moderate potential impact operations
- 25 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony.

Revised guide status and rationale:

No changes to direction.

See discussion of SBDs and rationale for operational prescription (harvest, renewal and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. This is based on the assumption that, in this situation, the nesting birds have likely habituated to the low impact activity.

Best management practices: Retained, revised, or new

New operational roads should not be constructed within 51-100 m of the polygon connecting peripheral nests unless there is no practical and feasible alternative or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall)

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provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 15 m.

Revised guide status and rationale:

BMP is currently a guideline – moved to BMP as wording not consistent with direction that is mandatory. See rationale for direction for roads above.

Notes

The critical breeding period is defined... (table)

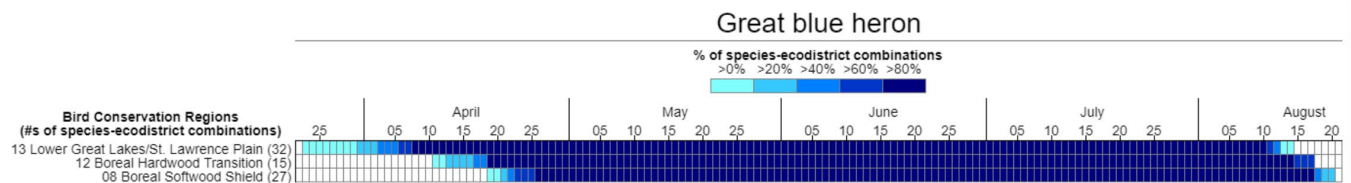
Revised guide status and rationale:

The current critical breeding period was defined largely based on egg dates from Ontario pre-1980. The five-year review recommended the most recent nest record data be used to refine (if necessary) the critical breeding period to reflect perceived changes in nesting behaviour as a result of climate change.

Based on models in Rousseu and Drolet (2017):

Great blue heron

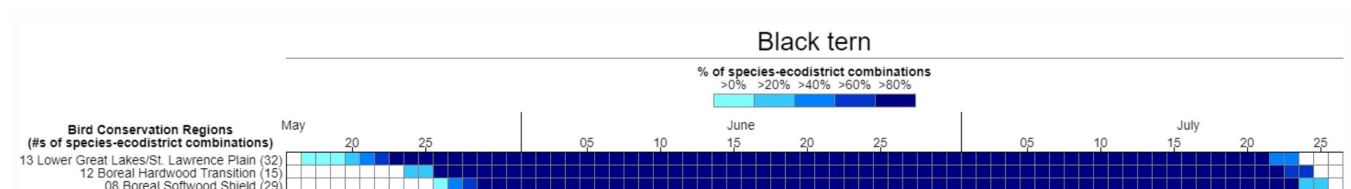
- 10% of nests contain at least 1 egg by late March in BCR 13, early April in BCR 12, and late April in BCR 8.
- 90% of young fledge by early August in BCR 13 and late August in all BCRs.



Nest building takes 3 days to 2 weeks (Vennesland and Butler 2011), suggesting a critical breeding period of about March 1 - August 15 for BCR 13, March 15 - August 31 for BCR 12 and April 1 - August 31 for BCR 8.

Black tern

- 10% of nests contain at least 1 egg by late May in all BCRs.
- 90% of young fledge by late July in all BCRs.



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Nest-site selection and nest-building are rapid (as little as 4 days between occupation of the colony and the start of laying) (Heath et al 2009), suggesting a critical breeding period of about May 1 - July 31 for all BCRs.

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(C&R) 4.2.2.4 Uncommon stick-nesting birds **(Formerly 4.2.2.4 Uncommon stick-nesting raptors)**

Preamble/Direction

Revised guide status and rationale:

Content revised.

During the five-year review, a subject expert suggested that the Bonaparte's gull nests in loose colonies with individual nests up to 1 km apart. Thus, it is likely more appropriate to provide direction that focuses on individual nests, rather than the colony (as per great blue heron). Consequently, direction for Bonaparte's gull has been moved from Section 4.2.2.3 to Section 4.2.2.4.

In the five-year review, practitioners suggested that classifying nests as primary, alternate, or inactive is difficult given limited inventory information. Thus, primary and alternate nests have been combined as 'active nests'. Continue to include a separate AOC for 'inactive nests'. Second paragraph in the current preamble to the section removed since it is now unnecessary to distinguish between primary and alternate nests.

During the 5-year review, practitioners in the GLSL forest region expressed concern about the impacts of beech bark disease on their ability to maintain desired stand structure within the AOC (primarily for red-shouldered hawk but this situation could also apply to nests of American goshawk in tolerant hardwood forest).

Where beech is a significant overstory component and beech bark disease is a significant threat, an alternate prescription may be identified and rationalized as necessary to address beech bark disease.

i) Active Bonaparte's gull nest sites

Description of value

Revised guide status and rationale:

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Description revised.

During the five-year review, a subject expert suggested the species nests in loose colonies with individual nests up to 1 km apart. Thus, it is likely more appropriate to consider individual nests, rather than the colony, as the value.

Refers to 'nests' instead of 'colonies'.

Second paragraph removed - common condition for all values – moved reference to introductory preamble of Section 4.

Size of AOC based on distance required to mitigate effects of high potential impact operations.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:

- Harvest is not permitted within 50 m of active nests.
- Harvest that retains mature forest with $\geq 60\%$ relatively uniform canopy closure (canopy openings not to exceed individual tree crowns) is permitted within 51-100 m of active nests. Harvest that retains relatively uniform canopy closure $\geq 60\%$ is generally restricted to commercial thinning, preparatory shelterwood harvest, or single tree selection harvest; no harvest is permitted if initial canopy closure $< 60\%$.

Revised guide status and rationale:

Current direction based on AOC for small heron colonies. No new empirical information to identify how much forest cover is required for nesting. However, nests are generally within about 100 m of forest and water/wetland edges (Burger and Gochfeld 2002) so species presumably does not require large patches.

Existing direction modified to revised AOC size.

Removed third bullet (renewal and tending operations leaving residual below the minimum) in current direction. Deemed to be unnecessary so removed.

Removed fourth bullet (retention of wildlife trees/downed woody material) in current direction. Moved the requirement to follow wildlife tree and DWM direction in all AOCs to the preamble in Section 4.

Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 100 m for high potential impact operations
- 50 m for moderate potential impact operations

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- 25 m of low potential impact operations.

Revised guide status and rationale:

There is no new data to help define appropriate SBDs. Existing direction prescribed a 150 m AOC based on the range of SBDs recommended for gull and tern colonies (see references in the current Background and Rationale for Direction). However, these recommendations addressed species that nest in large colonies on the ground with little vegetation cover and are thus likely conservative for a forest-dwelling, tree-nesting species. Moreover, since the revised direction applies to individual nests rather than colonies, it is likely more appropriate to define SBD based on the approach used for other solitary stick-nesting species.

There is no empirical information on FD of Bonaparte's gull. Based on body mass (190 g), the model in Naylor (2009) suggests a mean FD of about 15 m, thus a SBD of about 30 m. However, given the apparent intolerance of this species to human activity (see current Background and Rationale for Direction), a conservative SBD of 100 m is prescribed for high potential impact operations.

New primary and branch roads and landings are not permitted within 50 m of active nests.

New primary and branch roads and landings are not permitted within 51-100 m of active nests unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

New operational roads and landings are not permitted within 50 m of active nests unless approved by the Ministry.

New forestry aggregate pits and wood storage yards are not permitted within 50 m of active nests.

New forestry aggregate pits and wood storage yards are not permitted within 51-100 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

Revised guide status and rationale:

Current direction based on AOC for small heron colonies. No empirical information to identify effect of roads or landings on nest use. However, roads and landings are potential sources of disturbance and remove forest cover. Thus, proposed direction continues to restrict roads and landings within the AOC but provides some flexibility, especially for operational roads since these create smaller canopy gaps and represent a lower potential source of disturbance.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied active nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 100 m for high potential impact operations
- 50 m for moderate potential impact operations
- 25 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

See discussion of SBDs and rationale for operational prescription (harvest, renewal and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. This is based on the assumption that, in this situation, the nesting birds have likely habituated to the low impact activity.

Standards: Removed

150 m radius AOC centred on primary nests.

Revised guide status and rationale:

Current standard moved to description of value and AOC width revised.

Best management practices: Retained, revised, or new

If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

Revised guide status and rationale:

BMP is currently a guideline – moved to BMP as wording not consistent with direction that is mandatory. See rationale for direction for roads above.

ii) Active great gray owl or American goshawk nest sites

Description of value

Revised guide status and rationale:

Description revised.

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In the five-year review, practitioners suggested that classifying nests as primary, alternate, or inactive is difficult given limited inventory information. Thus, description simplified as primary and alternate nests have been combined as 'active nests'. Continue to include a separate AOC for 'inactive nests'.

The current guide provides similar direction for the great gray owl and American goshawk based on the high degree of overlap in habitat requirements (see current Background and Rationale for Direction) (great gray owls also frequently use abandoned American goshawk nests). The five-year review (and subsequent literature review) found no compelling evidence to change this approach. Thus, proposed direction continues to combine the two species and assumes that changes that address American goshawk requirements will also benefit great gray owl.

Moved reference to size of AOC to description. Size of AOC based on the amount of habitat required by nesting hawks or owls (see operational prescription for the AOC).

Removed statement about insufficient inventory data - unnecessary detail since no distinction between primary and alternate nests.

Removed statement about direction applying to nests known before or found during operations and moved to preamble for Section 4.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:

- Harvest is not permitted within 50 m of active nests.
- A total of 28 ha of suitable nesting habitat will be retained within the AOC. The 50 m radius (0.8 ha) patch of unharvested forest surrounding the active nest (and any inactive nests) contributes to the 28 ha patch of suitable nesting habitat.
- 7 of the 28 ha of suitable nesting habitat will be retained within 200 m of the active nest and will be mature forest with a relatively uniform canopy closure $\geq 70\%$ and canopy openings not to exceed individual tree crowns.
- The remaining 21 ha of suitable nesting habitat may be located anywhere within the 400 m AOC and will be mature forest with a relatively uniform canopy closure $\geq 50\%$ and a maximum size of canopy gaps ≤ 0.1 ha.
- Harvest that changes development stage, reduces canopy closure below 50%, or creates canopy gaps > 0.1 ha is not permitted within 200 m of the active nest.

Suitable nesting habitat will be retained as a contiguous patch that encompasses the active nest and any inactive nests within the AOC.

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Suitable nesting habitat will be retained as a circular patch centred on the active nest (300 m radius circle) if the active nest occurs in a large patch of uniform block of habitat. Suitable nesting habitat will be retained as an irregularly-shaped patch (contained within the 400 m AOC) if this configuration better encompasses active and inactive nests.

Revised guide status and rationale:

Direction mostly unchanged with minor edits.

Direction describing what to do if some habitat is harvested before discovery of nest has been moved to the preamble to Section 4.2.2.4.

Current direction requires 7 ha of suitable nesting habitat with $\geq 70\%$ canopy closure within 200 m of nests and a total of 28 ha of suitable nesting habitat with at $\geq 50\%$ canopy closure within 400 m of nests. Empirical evidence continues to suggest that across the range of the American goshawk, nest sites typically average about 6-9 ha of suitable habitat within about 200 m of active nests, and about 20 and 40 ha of suitable habitat within 300-500 m of active nests (Daw and DeStefano 2001, Finn et al 2002a, McGrath et al 2003, DeSimone and DeStefano 2005, Bush 2006, Harrower et al 2007, Donner et al 2013, Smith 2013). Empirical evidence continues to suggest this direction will also likely maintain suitable habitat for the great gray owl (see current Background and Rationale for Direction) (Note: patches of habitat used for nesting may be larger in the western US; e.g., an average of about 85% 'forest' occurred within 450 m of nests in California (Polasik et al 2016; % reported for the area within 900 m of nests – the % within 450 m was not specified but was reported as not significantly different) and 500 m of nests in Wyoming (Bedrosian et al 2016) – however, most nests are typically within 300 m of open foraging habitat (e.g., Wu et al 2015) and recent large fires in California appeared to have little effect of habitat occupancy (Siegel et al (2019)).

During the five-year review, practitioners said they generally found the direction overly complicated, making it difficult to develop an AOC prescription and even harder to implement in the field. However, an AOC that uses direction based on a fixed radius from the nest results in an overall AOC area significantly larger than 28 ha when accounting for variability in the forested landscape and available suitable habitat. Thus, the option to arrange the AOC as an irregular polygon has been carried forward in the proposed direction. Where mapping 28 ha of suitable habitat is not desired due to complexity, time delays, or otherwise, planning teams may choose to treat the area as a 400 m radius reserve AOC.

Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 200 m for high potential impact operations

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- 100 m for moderate potential impact operations
- 50 m of low potential impact operations.

Revised guide status and rationale:

There is no new data to help define appropriate SBDs for either species. Mean FDs of 74 and 84 m for American goshawk and great gray owl, respectively, based on the body mass equation in Naylor (2009), suggests SBDs of about 150 to 170 m (see Appendix 1). Thus, an SBD of 200 m continues to be proposed for high potential impact operations (recognizing this is somewhat conservative).

New primary roads and landings are not permitted within 200 m of active nests.
New primary roads and landings are not permitted within 201-400 m of active nests unless approved by the Ministry or constructed on an existing roadbeds (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.
New branch roads and landings are not permitted within 400 m of active nests unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.
New landings >0.1 ha in size associated with primary and branch roads are not permitted within 201-400 m unless approved by the Ministry.
New operational roads are not permitted within 200 m of active nests unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 15 m.
New forestry aggregate pits and wood storage yards are not permitted within 200 m of active nests.
New forestry aggregate pits and wood storage yards are not permitted within 201-400 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

Revised guide status and rationale:

Direction revised.

The five-year review concluded that recent studies continue to suggest that proximity of roads has an equivocal effect on use of nest sites. Thus, additional flexibility has been provided, with greatest restrictions on features creating large gaps, especially within portions of the AOC where high canopy closure is desired.

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Since forestry aggregate pits create large canopy gaps that are not consistent with stand structure objectives in the operational prescription of the AOC, they continue to be restricted within the AOC.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied active nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 200 m for high potential impact operations
- 100 m for moderate potential impact operations
- 50 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

See discussion of SBDs and rationale for operational prescription (harvest, renewal, and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. This is based on the assumption that, in this situation, the nesting birds have likely habituated to the low impact activity.

Standards and guidelines: Removed

400 m radius AOC centred on primary nests.

Revised guide status and rationale:

Current standard moved to description of value.

Wildlife trees and downed woody material will be retained within harvested portions of the AOC as per general direction in Section 3.2.3.

Revised guide status and rationale:

Removed current guideline - include requirement to follow wildlife tree and DWD direction in all AOCs in preamble to Section 4.

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Within the entire AOC, renewal and tending operations that will leave a residual stand structure below the minimum described above are not permitted; all other renewal and tending operations are permitted subject to timing restrictions (see below).

Revised guide status and rationale:

Removed current guideline - renewal and tending included in conditions noted above.

When mature forest is retained as suitable nesting habitat within the AOC, to the extent practical and feasible,

- Suitable nesting habitat will be retained as a contiguous patch that encompasses the primary nest and any alternate nests.
- Suitable nesting habitat will be retained that is classified as preferred based on the regional habitat matrices.
- Suitable nesting habitat will be retained as a circular patch centred on the primary nest (300 m radius circle) if the primary nest occurs in a large uniform block of habitat. Suitable nesting habitat will be retained as an irregularly-shaped patch (contained within the 400 m AOC) if this configuration better encompasses primary and alternate nests as well as preferred habitat.
- Retention of 70% canopy closure in dominant/codominant trees can generally be obtained in tolerant hardwood forest units through single tree selection harvests with a residual basal area of 20 m²/ha and a residual stand structure following the ideal for central Ontario (6-6-5-3 m²/ha of poles, small logs, medium logs, and large logs, respectively; see the *Ontario Tree Marking Guide*). Targets for residual basal area and stand structure for other forest units and silviculture systems should be developed using canopy closure – BA – tree size relationships such as presented in the *Ontario Tree Marking Guide* (page 84).

Revised guide status and rationale:

Removed current guideline. The first 3 bullets are unnecessary since identifying an irregular polygon of suitable habitat is no longer required. The fourth bullet is unnecessary. Planning teams are free to use any approach that will ensure retention of 70% canopy closure.

ALL direction for great grey owl/American goshawk alternate nests.

Revised guide status and rationale:

Removed current direction for great grey owl/American goshawk alternate nests. Addressed by direction for active great grey owl/American goshawk nests.

Best management practices: Retained, revised, or new

If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

Revised guide status and rationale:

BMP is currently a guideline – moved to BMP as wording not consistent with direction that is mandatory. See rationale for direction for roads above.

iii) Active red-shouldered hawk nest sites

Description of value

Revised guide status and rationale:

Description revised.

In the five-year review, practitioners suggested that classifying nests as primary, alternate, or inactive is difficult given limited inventory information. Thus, description simplified as primary and alternate nests have been combined as 'active nests'. Continue to include a separate AOC for 'inactive nests'.

Size of AOC based on the amount of habitat required by nesting hawks (see Operational prescription for the AOC). In the current direction, the AOC may be arranged as a 300 m circle surrounding a nest or an irregular polygon 28 ha in size. During the five-year review, practitioners said they generally found the direction overly complicated, making it difficult to develop an AOC prescription and even harder to implement in the field. Thus, the option to arrange the AOC as an irregular polygon has been removed in the proposed direction.

Removed statement about insufficient inventory data - unnecessary detail since no distinction between primary and alternate nests.

Removed statement about direction applying to nests known before or found during operations and moved to preamble for Section 4.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions:

- Harvest is not permitted within 75 m of active nests
- Within the remainder of the AOC, mature forest with a relatively uniform canopy closure $\geq 70\%$, average size of canopy openings not to exceed individual tree crowns, and maximum size of canopy gaps ≤ 0.1 ha will be retained

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Within 76-150 m of active nests, at least half the basal area retained will be comprised of trees ≥ 38 cm dbh (if available).

Revised guide status and rationale:

Direction revised.

Direction describing what to do if some habitat is harvested before discovery of nest has been moved to the preamble to Section 4.2.2.4.

Naylor et al (2004) concluded that the impact of harvesting on the use of nesting areas could be mitigated by prohibiting heavy cuts (canopy closure $< 60\%$) within 300 m of nests and retaining ≥ 20 ha of suitable habitat (i.e., forest dominated by tolerant and mid-tolerant hardwood trees, ≥ 18 m tall, with $\geq 70\%$ canopy closure) around nests.

Revised direction is simplified and focuses on retaining mature forest with canopy closure at least 70% with no large canopy openings (> 0.1 ha) within the AOC to ensure no heavy cuts within 300 m. It is assumed a 300 m radius circle (28 ha) will normally include at least 20 ha of suitable habitat.

Early direction for this species required a 150 m (7 ha) reserve around primary nests (see Szuba and Naylor 1998). The current direction prescribes a 50 m (0.8 ha) reserve and 6.2 ha of suitable habitat that had a residual stand structure following the targets for creation of old growth forest conditions (i.e., 5-5-5-5 m^2/ha of basal area in poles, small logs, medium logs, and large logs, respectively; see the *Ontario Tree Marking Guide*, page 100).

During the five-year review, practitioners felt the residual stand structure requirements for this 6.2 ha area were too difficult to achieve (e.g., many sites did not have 5 m^2/ha of large sawlog basal area prior to harvest). There was also concern about the impacts of beech bark disease on the ability to maintain desired stand structure within the AOC. However, the evidence summarized in the five-year review continues to support the assessment in the current Background and Rationale for Direction, suggesting that the basal area (or density) of large trees (especially those > 50 cm dbh) contributes to the suitability of nesting habitat. For example, in four studies the average basal area of trees > 38 cm (or > 40 cm) dbh at nest sites ranged from about 7-17 m^2/ha (Szuba et al 1991, McLeod et al 2000, Woodford et al 2008, King et al 2011). In 6 studies, the average basal area of trees > 50 cm dbh at nest sites ranged from about 3-12 m^2/ha (Titus and Moser 1981, Morris and Lemon 1983, Woodrey 1986, Preston et al 1989, Dijak et al 1990, Szuba et al 1991) (note - for most studies basal area was estimated from data on stem density).

These studies continue to support targets for higher than average basal area of trees ≥ 38 cm dbh in the area closest to the nest. To achieve this objective, the proposed direction includes a larger reserve (75 m radius; 1.8 ha) where high basal area of large trees will be maintained, and a smaller modified zone (75 m radius; 5.3 ha) where the

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residual basal area will include more trees ≥ 38 cm dbh (if available) but with more flexibility than current direction.

Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 150 m for high potential impact operations
- 75 m for moderate potential impact operations
- 40 m of low potential impact operations.

Revised guide status and rationale:

Direction revised.

There is no new data to help define appropriate SBDs. However, a mean FD of 49 m based on the body mass equation in Naylor (2009), suggests an SBD of about 100 m (see Appendix 1). However, the red-shouldered hawk is generally considered to be sensitive to human disturbance (see discussion in current Background and Rationale for Direction). Thus, an SBD of 150 m is proposed for high potential impact operations.

New primary roads and landings are not permitted within 150 m of active nests.

New primary roads and landings are not permitted within 151-300 m of active nests unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly < 8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

New branch roads and landings are not permitted within 300 m of active nests unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly < 8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

New landings > 0.1 ha in size associated with primary and branch roads are not permitted within 151-300 m unless approved by the Ministry.

New operational roads are not permitted within 150 m of active nests unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly < 8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 15 m.

New forestry aggregate pits and wood storage yards are not permitted within 150 m of active nests.

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New forestry aggregate pits and wood storage yards are not permitted within 151-300 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

Revised guide status and rationale:

Direction revised.

The five-year review concluded that recent studies continue to suggest that proximity of roads has an equivocal effect on use of nest sites. Thus, additional flexibility has been provided, with greatest restrictions on features creating large gaps, especially within portions of the AOC where high canopy closure is desired.

Since forestry aggregate pits create large canopy gaps that are not consistent with stand structure objectives in the operational prescription of the AOC, they continue to be restricted within the AOC.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied active nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 150 m for high potential impact operations
- 75 m for moderate potential impact operations
- 40 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

See discussion of SBDs and rationale for operational prescription (harvest, renewal and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. This is based on the assumption that, in this situation, the nesting birds have likely habituated to the low impact activity.

Standards and guidelines: Removed

400 m radius AOC centred on primary nests.

Revised guide status and rationale:

Current standard moved to description of value.

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Wildlife trees and downed woody material will be retained within harvested portions of the AOC as per general direction in Section 3.2.3.

Revised guide status and rationale:

Removed current guideline - include requirement to follow wildlife tree and DWD direction in all AOCs in preamble to Section 4.

Within the entire AOC, renewal and tending operations that will leave a residual stand structure below the minimum described above are not permitted; all other renewal and tending operations are permitted subject to timing restrictions (see below).

Revised guide status and rationale:

Removed current guideline - renewal and tending included in conditions noted above.

When mature forest is retained as suitable nesting habitat within the AOC, to the extent practical and feasible,

- Suitable nesting habitat will be retained as a contiguous patch that encompasses the primary nest and any alternate nests.
- Suitable nesting habitat will be retained that is classified as preferred based on the regional habitat matrices.
- Suitable nesting habitat will be retained as a circular patch centred on the primary nest (300 m radius circle) if the primary nest occurs in a large uniform block of habitat. Suitable nesting habitat will be retained as an irregularly-shaped patch (contained within the 400 m AOC) if this configuration better encompasses primary and alternate nests as well as preferred habitat.
- Retention of 70% canopy closure in dominant/codominant trees can generally be obtained in tolerant hardwood forest units through single tree selection harvests with a residual basal area of 20 m²/ha and a residual stand structure following the ideal for central Ontario (6-6-5-3 m²/ha of poles, small logs, medium logs, and large logs, respectively; see *the Ontario Tree Marking Guide*). Targets for residual basal area and stand structure for other forest units and silviculture systems should be developed using canopy closure – BA – tree size relationships such as presented in the *Ontario Tree Marking Guide* (page 84).

Revised guide status and rationale:

Removed current guideline. The first 3 bullets are unnecessary since identifying an irregular polygon of suitable habitat is no longer required. The fourth bullet is unnecessary. Planning teams are free to use any approach that will ensure retention of 70% canopy closure.

ALL direction for red-shouldered hawk alternate nests.

Revised guide status and rationale:

Removed current direction for red-shouldered hawk alternate nests. Addressed by direction for active red-shouldered hawk nests.

Best management practices: Retained, revised, or new

If roads are constructed within the AOC, temporary roads and/or water crossings will be used whenever practical and feasible to limit future access cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

Revised guide status and rationale:

BMP is currently a guideline – moved to BMP as wording not consistent with direction that is mandatory. See rationale for direction for roads above.

iv) Inactive nests of Bonaparte's gull, great gray owl, American goshawk, or red-shouldered hawk

Description of value

Revised guide status and rationale:

Description revised.

There is no existing direction for inactive Bonaparte's gull nests. It is not known whether inactive nests may be reoccupied by Bonaparte's gulls or other stick-nesting species. As a conservative approach, treat as inactive nests of uncommon stick-nesting raptors.

Direction simplified. Removed detail no longer necessary since primary and alternate are no longer identified.

Removed third paragraph - common condition for all values – move reference to introductory discussion of Section 4.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within 20 m of inactive nests.

Revised guide status and rationale:

Direction simplified.

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New roads, landings, forestry aggregate pits, and wood storage yards are not permitted within 20 m of inactive nests unless approved by the Ministry.

Revised guide status and rationale:

Direction revised - replaced 'reasonable efforts' with 'approved by the Ministry'.

No timing restrictions on harvest, renewal, or tending operations or operations associated with roads, landings, forestry aggregate pits, and wood storage yards around inactive nests.

Revised guide status and rationale:

Direction revised. Combined two previous guidelines for simplicity. Inactive nests are not occupied so no need for timing restrictions.

Notes

The critical breeding period is defined... (table)

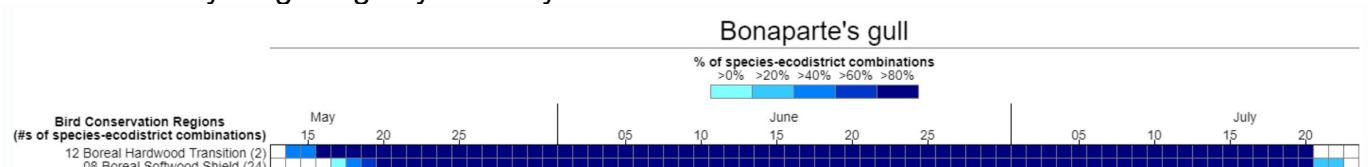
Revised guide status and rationale:

The current critical breeding period was defined largely based on egg dates from Ontario pre-1980. The 5-year review recommended the most recent nest record data be used to refine (if necessary) the critical breeding period to reflect perceived changes in nesting behaviour as a result of climate change.

Based on models in Rousseu and Drolet (2017):

Bonaparte's gull

- 10% of nests contain at least 1 egg by mid-May in BCRs 8 and 12.
- 90% of young fledge by late July 20 in BCRs 8 and 12.

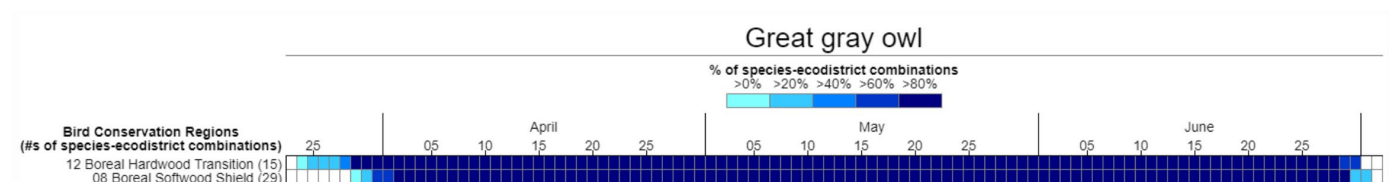


Assume nest building takes 2-3 weeks, suggesting a critical breeding period of about April 15-July 31 for both BCRs 8 and 12.

Great gray owl

- 10% of nests contain at least 1 egg by late March in BCRs 8 and 12.
- 90% of young fledge by late June/early July in BCRs 8 and 12.

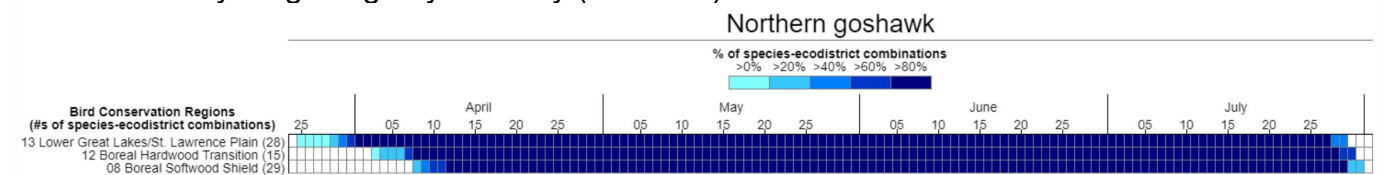
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Uses existing nest structures (does not add material to nest) (Bull and Duncan 1993), suggesting a critical breeding period of about March 15-July 15 for both BCRs 8 and 12.

American goshawk

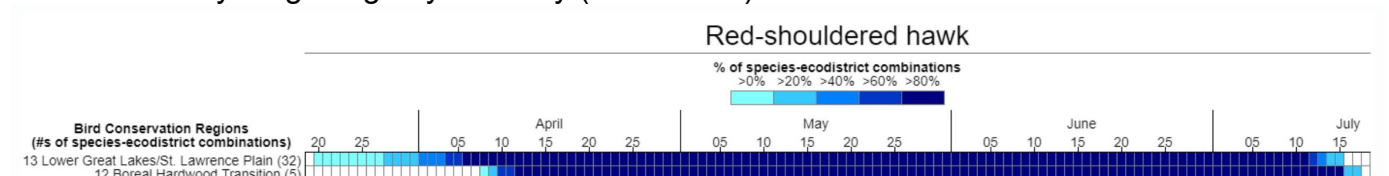
- 10% of nests contain at least 1 egg by late March in BCR 13 and early April in BCRs 8 and 12.
- 90% of young fledge by late July (all BCRs).



Time for nest building not reported (Squires et al 1997). Assume 2-4 weeks as per other similar-sized species, suggesting a critical breeding period of March 1-July 31 for BCR 13 and March 15-July 31 for BCRs 8 and 12.

Red-shouldered hawk

- 10% of nests contain at least 1 egg by mid- March in BCR 13 and early April in BCR 12.
- 90% of young fledge by mid-July (both BCRs).



Nest building takes from <1 week to up to 5 weeks (Dykstra et al 2008), suggesting a critical breeding period of March 1-July 15 for BCR 13 and March 15-July 15 for BCR 12.

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(C&R) 4.2.2.5 Common stick-nesting birds

(Formerly 4.2.2.5 Common stick-nesting raptors, tree-nesting common ravens, and unknown stick nests)

Preamble/Direction

Revised guide status and rationale:

Content revised.

Use of active nest and inactive nest terminology is consistent with other species. For active nests, focus is on nests that have been used.

i) Active barred owl, broad-winged hawk, common raven, Cooper's hawk, great horned owl, long-eared owl, merlin, red-tailed hawk, or sharp-shinned hawk stick nests

Description of value

Revised guide status and rationale:

Description revised.

Five- and three-year 'rules' used for consistency with other species.

Size of AOC moved to the description. AOC sizes are based on the distance required to mitigate potential effects of high impact operations.

Second bullet in current description removed - common condition for all values – moved reference to introductory preamble of Section 4.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and:

- Active nest trees will be retained.
- Harvest not permitted within 20 m of active nests of barred owl, Cooper's hawk, common raven, great horned owl, long-eared owl, or red-tailed hawk.

Revised guide status and rationale:

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Directions remains unchanged with removal of option to not retain the nest tree if a safety concern. See current Background and Rationale for Direction for rationale for direction.

Harvest, renewal, and tending operations are not permitted within the following distances of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 100 m for high potential impact operations
- 50 m for moderate and low potential impact operations.

Revised guide status and rationale:

Current SBDs were defined based on estimated FD (see Appendix 4 in the current Background and Rationale for Direction).

No empirical data on FD for any of these species. The estimated FD based on body mass (Naylor 2009) and the approach in Appendix 1 ($SBD=2 \times \text{mean FD}$) suggests the following SBDs:

- 216 m for great horned owl
- 186 m for common raven
- 168 m for red-tailed hawk
- 112 m for barred owl
- 70 m for Cooper's hawk
- 60 m for broad-winged hawk
- 40 m for long-eared owl
- 30 m for merlin
- 22 m for sharp-shinned hawk.

As per the current guide, since great horned owls and red-tailed hawks appear to habituate to/exploit human activity/development (Preston et al 2009, Artuso et al 2013 and other references in the current Background and Rationale for Direction), SBDs for these species can likely be halved. Since common ravens are highly adaptable to human activity/development (Boarman and Heinrich 1999 and other references in the current Background and Rationale for Direction), SBDs can likely be reduced even further. Considering these studies and the species' SBD, the direction was simplified to include 100 m for high potential impacts and 50 m for moderate or low potential impacts. Thus, current SBDs are retained with the exception that SBDs for high potential impact operations are reduced to 100 m for barred owl.

New roads and landings are not permitted within 20 m of active nests of the barred owl, Cooper's hawk, common raven, great horned owl, long-eared owl, or red-tailed hawk except in extraordinary circumstances or when constructed on an existing

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roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

New forestry aggregate pits and wood storage yards will not be constructed within 20 m of active nests of the barred owl, Cooper's hawk, common raven, great horned owl, long-eared owl, or red-tailed hawk except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

Revised guide status and rationale:

Direction revised.

Additional flexibility provided since species likely to use a large stick nest in a small residual patch (e.g., common raven, great horned owl, red-tailed hawk) tend to be relatively tolerant of roads and other human development.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distances of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- For barred owl:
 - 150 m for high potential impact operations
 - 75 m for moderate potential impact operations
 - 40 m of low potential impact operations.
- For Cooper's hawk, broad-winged hawk, great horned owl, and red-tailed hawk:
 - 100 m for high potential impact operations
 - 50 m for moderate potential impact operations
 - 25 m of low potential impact operations.
- For common raven, long-eared owl, merlin, and sharp-shinned hawk:
 - 50 m for high potential impact operations
 - 25 m for moderate and low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

See discussion above of SBDs and rationale for operational prescription (harvest, renewal and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. This is based on the assumption that, in this situation, the nesting birds have likely habituated to the low impact activity.

Standards: Removed

50-200 m radius AOC centred on primary nests.

Revised guide status and rationale:

Current standard moved to description of value and AOC width revised.

Best management practices: Retained, revised, or new

Nest trees used by broad-winged hawk, merlin, or sharp-shinned hawk that are a potential safety risk should be retained in an unharvested residual patch (≥ 20 m radius).

To the extent practical and feasible, avoid constructing new roads and landings within 20 m of active nests of the broad-winged hawk, merlin, and sharp-shinned hawk.

To the extent practical and feasible, avoid constructing new forestry aggregate pits and wood storage yards within 20 m of active nests of the broad-winged hawk, merlin, and sharp-shinned hawk.

Revised guide status and rationale:

First BMP is new and provides a recommendation on how to address nest trees that appear as potential safety risks.

Second and third BMPs are currently guidelines – moved to BMPs as wording not consistent with direction that is mandatory. See rationale for direction for roads above.

ii) Inactive barred owl, broad-winged hawk, common raven, Cooper's hawk, great horned owl, long-eared owl, merlin, red-tailed hawk, or sharp-shinned hawk stick nests

Description of value

Revised guide status and rationale:

Description revised.

Definition captures nests occupied or built by the barred owl, broad-winged hawk, common raven, Cooper's hawk, great horned owl, long-eared owl, merlin, red-tailed hawk, or sharp-shinned hawk that are not an active nest.

Standards and guidelines: Retained, revised, or new

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Harvest, renewal, and tending operations are permitted subject to the following restrictions:

- Nest trees will be retained
- Harvest, renewal, and tending operations are not permitted within 20 m of inactive nests of barred owl, Cooper's hawk, common raven, great horned owl, long-eared owl, or red-tailed hawk or other large inactive nests if species is uncertain.

No timing restriction on harvest, renewal, or tending operations or on operations associated with roads, landings, forestry aggregate pits, and wood storage yards around inactive nests.

Revised guide status and rationale:

Directions remains unchanged with removal of option to not retain the nest tree if a safety concern. See current Background and Rationale for Direction for rationale for direction.

New roads, landings, forestry aggregate pits, and wood storage yards are not permitted within 20 m of inactive nests of the barred owl, Cooper's hawk, common raven, great horned owl, long-eared owl, or red-tailed hawk or other large inactive nests if species is uncertain unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

Revised guide status and rationale:

Direction revised.

Additional flexibility provided since species likely to use a large stick nest in a small residual patch (e.g., common raven, great horned owl, red-tailed hawk) tend to be relatively tolerant of roads and other human development.

Best management practices: Retained, revised, or new

Nest trees used by broad-winged hawk, merlin, or sharp-shinned hawk that are a potential safety risk should be retained in an unharvested residual patch (≥ 20 m radius).

To the extent practical and feasible, avoid constructing new forestry aggregate pits within 20 m of inactive nests of the broad-winged hawk, merlin, and sharp-shinned hawk or other small inactive nests if species unknown.

Revised guide status and rationale:

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First BMP is new and provides a recommendation on how to address nest trees that appear as potential safety risks.

Second BMP is currently a guideline – moved to BMP as wording not consistent with direction that is mandatory. See rationale for guideline for roads above.

Notes

The critical breeding period is defined... (table)

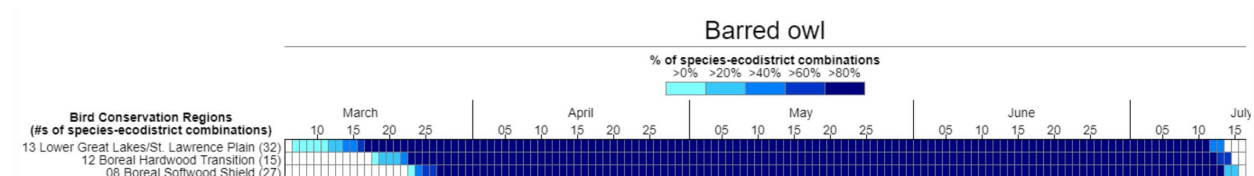
Revised guide status and rationale:

The current critical breeding periods were defined largely based on egg dates from Ontario pre-1980. The 5-year review recommended the most recent nest record data be used to refine (if necessary) the critical breeding period to reflect perceived changes in nesting behaviour as a result of climate change.

Based on models in Rousseu and Drolet (2017):

Barred owl

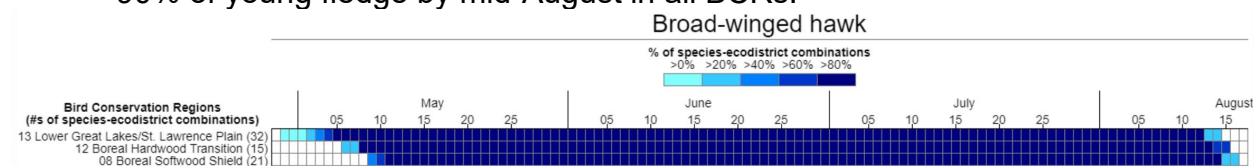
- 10% of nests contain at least 1 egg by early March in BCR 13, mid-March in BCR 12, and late March in BCR 8.
- 90% of young fledge by mid-July in all BCRs.



Does not construct a nest but may slightly modify existing structures (Mazur and James 2000), suggesting a critical breeding period of about February 15 to July 15 for BCR 13, March 1 to July 15 for BCR 12, and March 15 to July 15 for BCR 8.

Broad-winged hawk

- 10% of nests contain at least 1 egg by late April in BCR 13, early May in BCR 12, and mid-May in BCR 8.
- 90% of young fledge by mid-August in all BCRs.

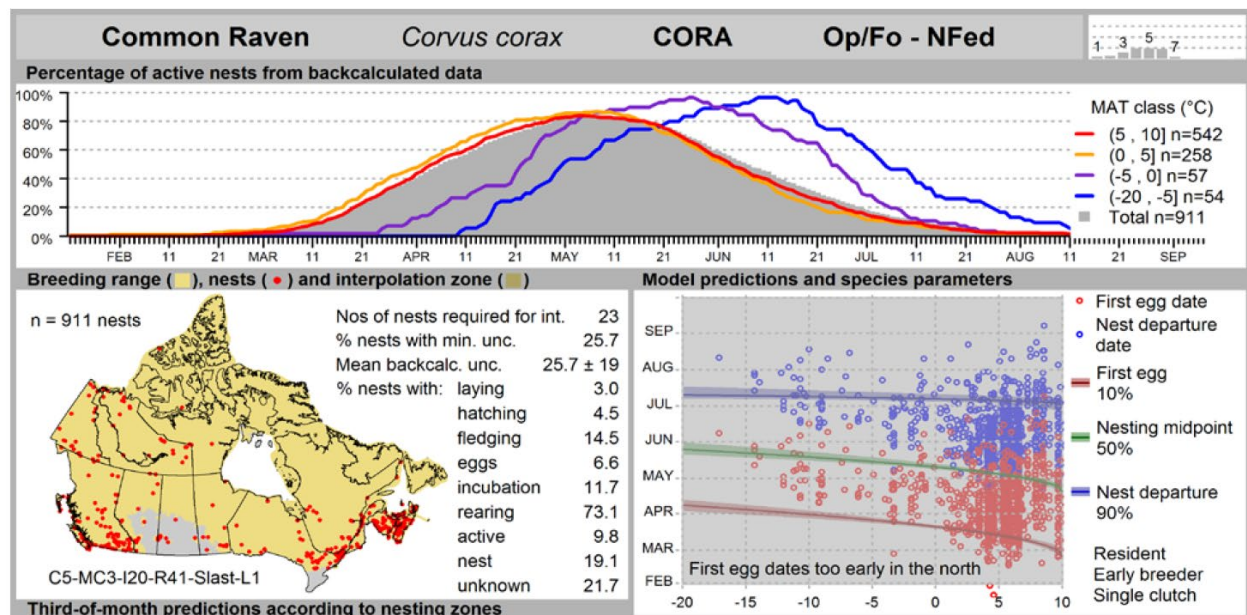


Nest building takes 2 to 4 weeks (Goodrich et al 2014), suggesting a critical breeding period of about April 1 to August 15 for BCR 13 and April 15 to August 15 for BCRs 8 and 12.

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Common raven

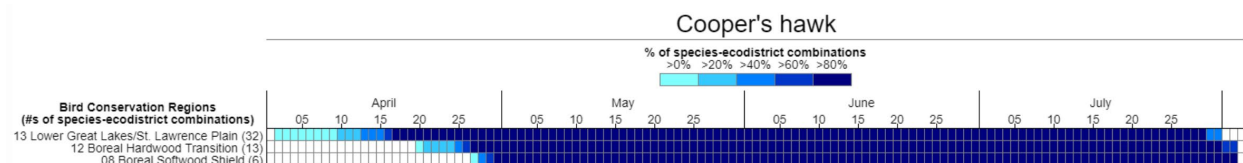
- 10% of nests contain at least 1 egg by early March in BCR 13, mid-March in BCR 12, and late March in BCR 8 (although the authors note that the model seems to predict egg dates that are too early in the north).
- 90% of young fledge by early July in all BCRs.



Nest building takes about 2 to 3 weeks (Boarman and Heinrich 1999), suggesting a critical breeding period of about February 1 to June 30 for BCR 13, February 15 to June 30 for BCR 12, and March 1 to June 30 for BCR 8.

Cooper's hawk

- 10% of nests contain at least 1 egg by early April in BCR 13, mid-April in BCR 12, and late April in BCR 8.
- 90% of young fledge by late July/early August in all BCRs.



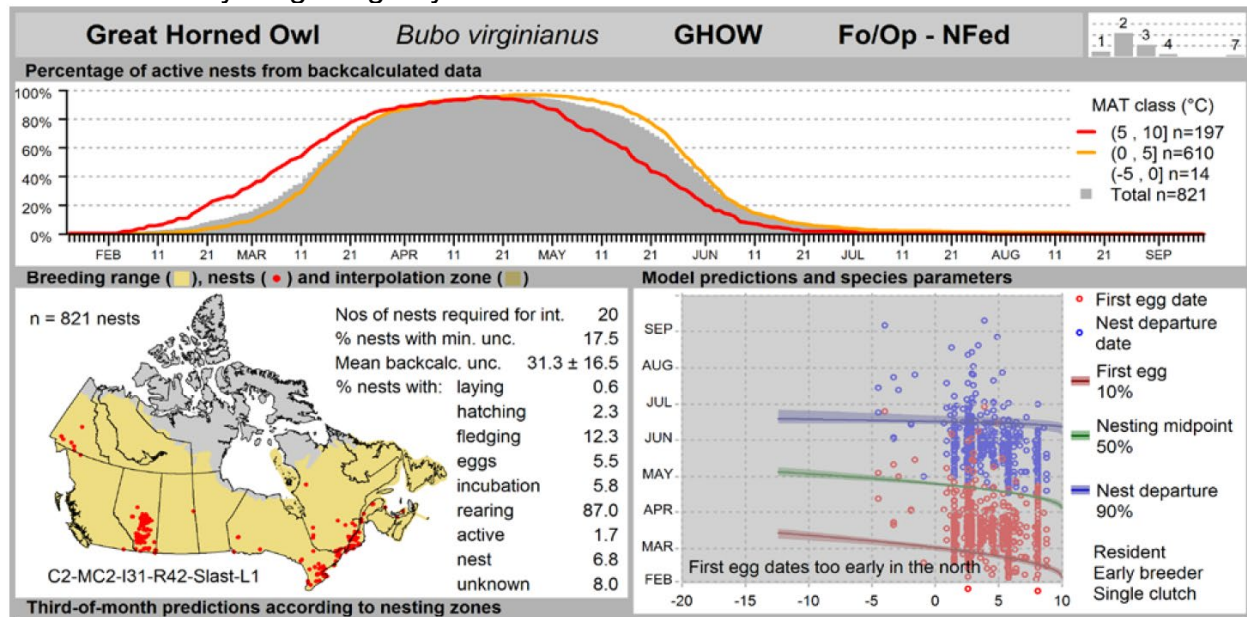
Nest building takes about 2 weeks (Curtis et al 2006), suggesting a critical breeding period of about March 15 - July 31 for BCR 13, April 1 - July 31 for BCR 12, and April 15 - July 31 for BCR 8.

Great horned owl

- 10% of nests contain at least 1 egg by mid-February in BCR 13, late February in BCR 12, and late February to early March in BCR 8 (although the authors note that the model seems to predict egg dates that are too early in the north).

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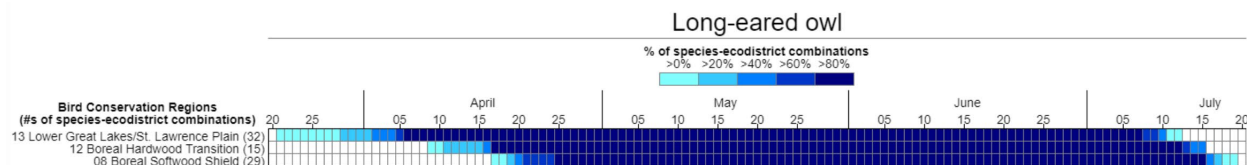
- 90% of young fledge by mid to late June in all BCRs.



Does not construct a nest (Artuso et al 2013), suggesting a critical breeding period of about February 1 - June 30 for BCR 13, February 15 - June 30 for BCR 12, and March 1 - June 30 for BCR 8.

Long-eared owl

- 10% of nests contain at least 1 egg by late March in BCR 13, early April in BCR 12, and mid-April in BCR 8.
- 90% of young fledge by mid-July in all BCRs.

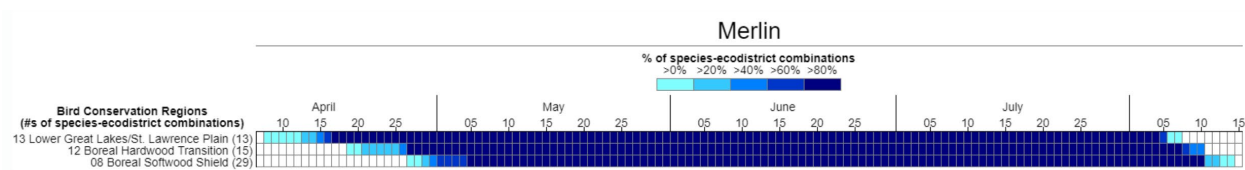


Does not construct a nest (Marks et al 1994), suggesting a critical breeding period of about March 15 - July 15 for BCR 13, April 1 - July 31 for BCR 12, and April 15 - July 31 for BCR 8.

Merlin

- 10% of nests contain at least 1 egg by early April in BCR 13, mid-April in BCR 12, and late April in BCR 8
- 90% of young fledge by early/mid-August in all BCRs.

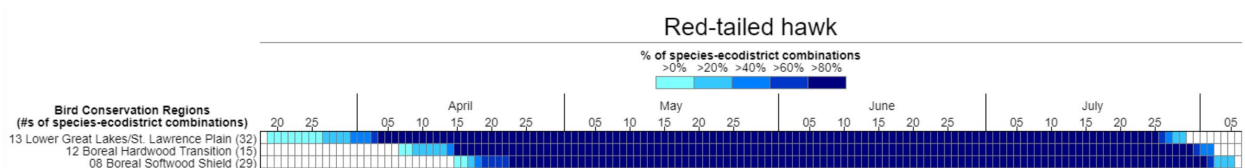
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Does not construct a nest (Warkentin et al 2005), suggesting a critical breeding period of about April 1 to August 15 for BCR 13 and April 15 to August 15 for BCRs 8 and 12.

Red-tailed hawk

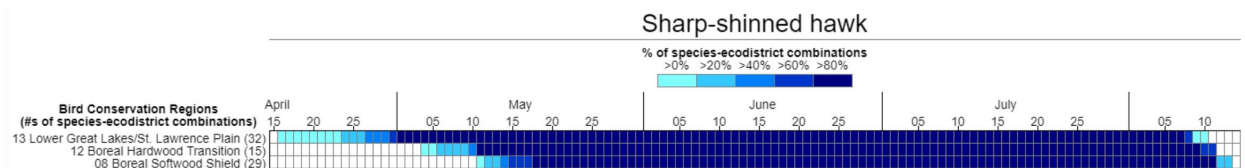
- 10% of nests contain at least 1 egg by mid-March in BCR 13, early April in BCR 12, and mid-April in BCR 8.
- 90% of young fledge by late July/early August in all BCRs.



Nest building takes 4 to 7 days (Preston and Beane 2009), suggesting a critical breeding period of about March 1 to July 31 for BCR 13, March 15 to July 31 for BCR 12, and April 1 to July 31 for BCR 8.

Sharp-shinned hawk

- 10% of nests contain at least 1 egg by mid-April in BCR 13, early May in BCR 12, and mid-May in BCR 8.
- 90% of young fledge by mid-August in all BCRs.



Nest building takes 3-4 weeks (Bildstein and Meyer 2000), suggesting a critical breeding period of about March 15 - August 15 for BCR 13 and April 1 - August 15 for BCRs 12, and April 15 - August 15 for BCR 8.

Large nest is about the size of a large pick-up truck tire.
 Small nest is about the size of a compact car tire.

Revised guide status and rationale:

Nest size currently described by dimensions (i.e., >1m wide, ≥0.75 m wide, <0.75 m wide). Through guide field transfer sessions throughout the province, we have found

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that this description (i.e., tire sizes) of nest size has proven to be more effective with field staff.

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(C&R) 4.2.2.6 Common cavity-nesting raptors
(Formerly 4.2.2.5 Cavities used by nesting raptors or nesting/communally-roosting chimney swifts)

Preamble/Direction

Revised guide status and rationale:

Content revised.

Used active nest and inactive nest terminology to be consistent with other species. For active nests, focus is on nests known to have been used.

Removed reference to communal roosts of chimney swifts – addressed in SAR section.

i) Active American kestrel, barred owl, boreal owl, eastern screech-owl, great horned owl, northern hawk owl, or northern saw-whet owl cavity nests

Description of value

Revised guide status and rationale:

Description revised.

Five- and three-year ‘rules’ used for consistency with other species.

Size of AOC moved to the description. AOC sizes are based on the distance required to mitigate potential effects of high impact operations.

Second bullet in current description removed - common condition for all values – moved reference to introductory preamble of Section 4.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and:

- Cavity nest trees will be retained
- Harvest not permitted within 20 m of active cavity nests of barred owl or great horned owl.

Revised guide status and rationale:

Directions remains unchanged with removal of option to not retain the nest tree if a safety concern. See current Background and Rationale for Direction for rationale.

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Harvest, renewal, and tending operations are not permitted within the following distances of occupied nests during the critical breeding period based on potential impact of the operation, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- For barred owl and great horned owl:
 - 100 m for high potential impact operations
 - 50 m for moderate or low potential impact operations.
- For American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl:
 - 25 m for high, moderate, and low potential impact operations.

Revised guide status and rationale:

Minor changes to existing direction.

Current SBDs were defined based on estimated FD (see Appendix 4 in the current Background and Rationale for Direction).

No empirical data on FD for any of these species. The estimated FD based on body mass (Naylor 2009) and the approach in Appendix 1 ($SBD=2 \times \text{mean FD}$) suggests the following SBDs:

- 216 m for great horned owl
- 112 m for barred owl
- 50 m for northern hawk owl
- 28 m for eastern screech-owl
- 22 m for boreal owl
- 18 m for American kestrel
- 12 m for northern saw-whet owl.

As per the current guide, cavity-nesting birds are likely less sensitive to disturbance than stick-nesting birds. Thus, current SBDs are likely conservative but are retained with the exception that SBDs for high potential impact operations are reduced to 25 m for northern hawk owl.

New roads and landings are not permitted within 20 m of active nests of the barred owl or great horned owl except in extraordinary circumstances or when constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

New forestry aggregate pits and wood storage yards are not be constructed within 20 m of active nests of the barred owl or great horned owl except in extraordinary

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circumstances as specifically identified and justified through the FMP AOC planning process.

Revised guide status and rationale:

Direction revised.

Additional flexibility provided since species likely to use a large stick nest in a small residual patch (e.g., common raven, great horned owl, red-tailed hawk) tend to be relatively tolerant of roads and other human development.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied active cavity nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- For barred owl:
 - 100 m for high potential impact operations
 - 50 m for moderate potential impact operations
 - 25 m of low potential impact operations.
- For great horned owl:
 - 50 m for high potential impact operations
 - 25 m for moderate and low potential impact operations.
- For American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl:
 - 25 m for high, moderate, and low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

See discussion above of SBDs and rationale for operational prescription (harvest, renewal and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. This is based on the assumption that, in this situation, the nesting birds have likely habituated to the low impact activity.

Standards: Removed

25-100 m radius AOC based on species as follows:...

Revised guide status and rationale:

Current standard moved to description of value and AOC width revised.

Best management practices: Retained, revised, or new

Cavity nest trees used by American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl that are a potential safety risk should be retained in an unharvested patch (≥ 20 m radius).

To the extent practical and feasible, avoid constructing new roads and landings within 20 m of active cavity nests of the American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl.

To the extent practical and feasible, avoid constructing new forestry aggregate pits and wood storage yards within 20 m of active cavity nests of the American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl.

Revised guide status and rationale:

First BMP retained. Although American kestrel, boreal owl, eastern screech-owl, northern hawk owl, and northern saw-whet owl do not exhibit high fidelity to nest sites, the cavities themselves may be used by other species in the future. Not retaining a tree with a pileated woodpecker cavity is contrary to the *Migratory Bird Convention Act*.

Second and third BMPs are currently guidelines – moved to BMPs as wording not consistent with direction that is mandatory. See rationale for direction for roads above.

ii) Inactive American kestrel, barred owl, boreal owl, eastern screech-owl, great horned owl, northern hawk owl, or northern saw-whet owl cavity nests

Description of value

Revised guide status and rationale:

Minor revisions to description to make wording consistent with other species.

Definition captures nests occupied by the American kestrel, barred owl, boreal owl, eastern screech-owl, great horned owl, northern hawk owl, or northern saw-whet owl that are not an active nest.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted subject to the following restrictions:

- Cavity nest trees will be retained

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- Harvest not permitted within 20 m of inactive cavity nests of barred owl or great horned owl.

No timing restriction on operations associated with roads, landings, forestry aggregate pits, and wood storage yards around unoccupied cavity nests/communal roosts.

Revised guide status and rationale:

Directions remains unchanged with removal of option to not retain the nest tree if a safety concern. See current Background and Rationale for Direction for rationale for direction.

New roads, landings, forestry aggregate pits, and wood storage yards are not permitted within 20 m of inactive cavity nests of the barred owl or great horned owl unless approved by the Ministry or constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical/feasible and does not exceed 20 m.

Revised guide status and rationale:

Direction revised.

Additional flexibility provided since species likely to use a large stick nest in a small residual patch (e.g., common raven, great horned owl, red-tailed hawk) tend to be relatively tolerant of roads and other human development.

Best management practices: Retained, revised, or new

Cavity nest trees used by American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl that are a potential safety risk should be retained in an unharvested residual patch (≥ 20 m radius).

To the extent practical and feasible, avoid constructing new roads, landings, forestry aggregate pits, and wood storage yards within 20 m of inactive cavity nests of the American kestrel, boreal owl, eastern screech-owl, northern hawk owl, or northern saw-whet owl.

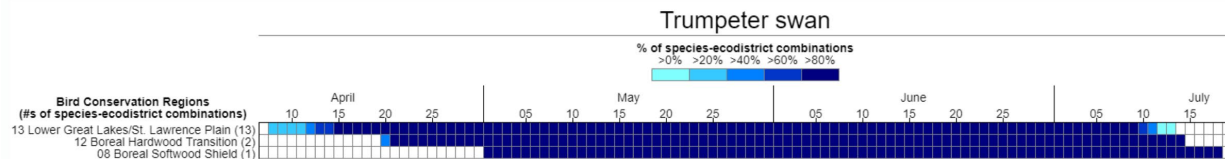
Revised guide status and rationale:

First BMP retained. Although American kestrel, boreal owl, eastern screech-owl, northern hawk owl, and northern saw-whet owl do not exhibit high fidelity to nest sites, the cavities themselves may be used by other species in the future. Not retaining a tree with a pileated woodpecker cavity is contrary to the *Migratory Bird Convention Act*.

Second BMP is currently a guideline – moved to BMP as wording not consistent with direction that is mandatory. See rationale for guideline for roads above.

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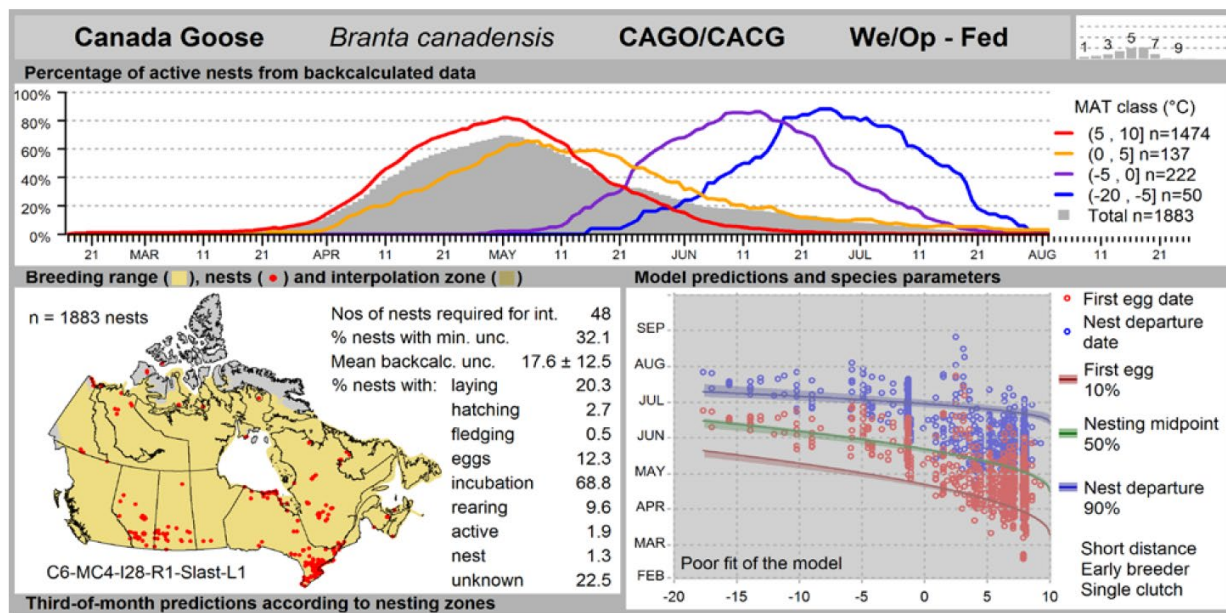
- 10% of nests contain at least 1 egg by early April in BCR 13, mid-April in BCR 12, and early May in BCR 8.
- 90% of young fledge by mid-July in all BCRs.



Nest building takes 14-35 days (Mitchell and Eichholz 2010), suggesting a critical breeding period of about March 1-July 15 for BCR 13, March 15-July 15 for BCR 12, and April 1-July 15 for BCR 8.

Canada goose

- 10% of nests contain at least 1 egg by early April in BCR 13, mid-April in BCR 12, and late April in BCR 8.
- 90% of young fledge by late June/early July in all BCRs.

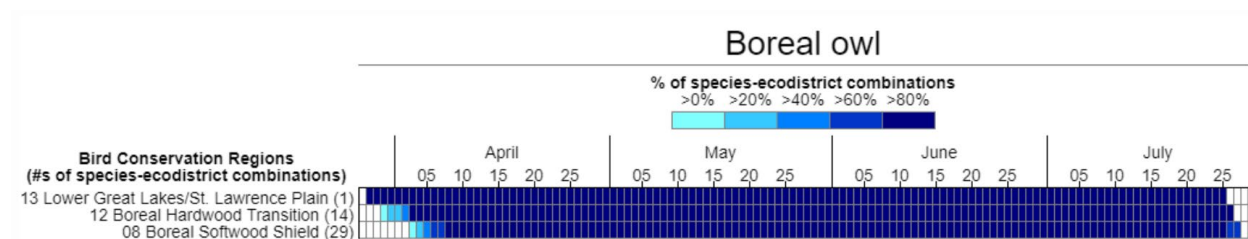


Nest building period not specified (Mowbray et al 2002) but presumably ≤ 14 days, suggesting a critical breeding period of about March 15-June 30 for BCR 13, April 1-June 30 for BCR 12, and April 15-June 30 for BCR 8.

Sandhill crane

- 10% of nests contain at least 1 egg by early April in BCR 13, late April in BCR 12, and early May in BCR 8

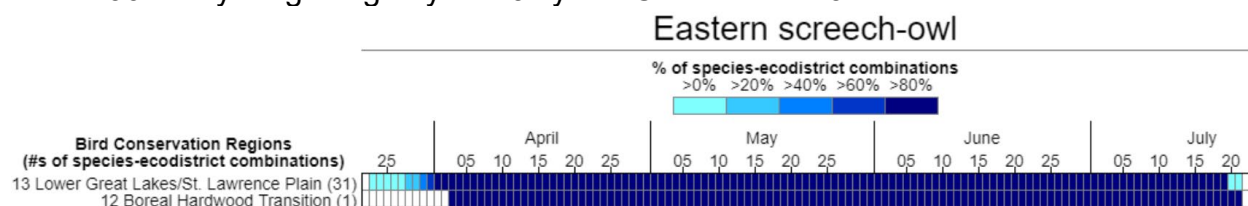
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Minimal nest construction (Hayward and Hayward 1993), suggesting a critical breeding period of about April 15-July 31 for BCRs 8 and 12.

Eastern screech-owl

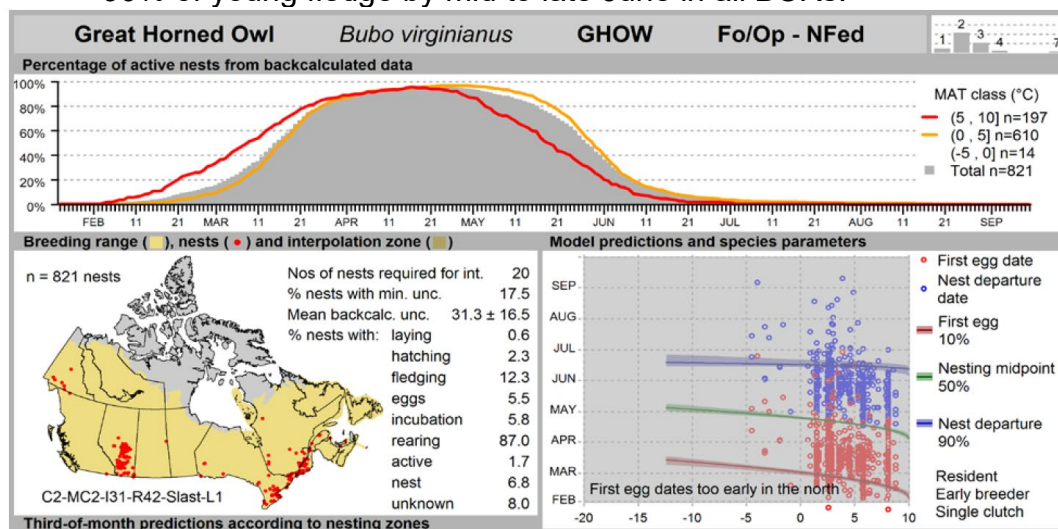
- 10% of nests contain at least 1 egg by late March/early April in BCRs 12 and 13 (unlikely to nest in BCR 8).
- 90% of young fledge by late July in BCRs 12 and 13.



No nest construction (Ritchison et al 2017), suggesting a critical breeding period of about March 15 to July 31 for BCRs 12 and 13.

Great horned owl

- 10% of nests contain at least 1 egg by mid-February in BCR 13, late February in BCR 12, and late February to early March in BCR 8 (although the authors note that the model seems to predict egg dates that are too early in the north).
- 90% of young fledge by mid to late June in all BCRs.

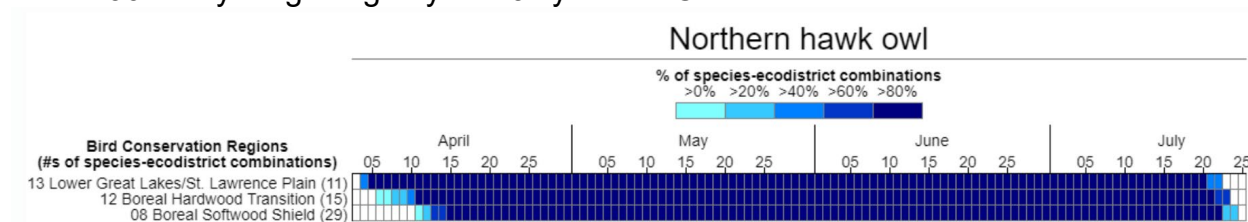


Does not construct a nest (Artuso et al 2013), suggesting a critical breeding period of about February 1-June 30 for BCR 13, February 15-June 30 for BCR 12, and March - June 30 for BCR 8.

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Northern hawk owl

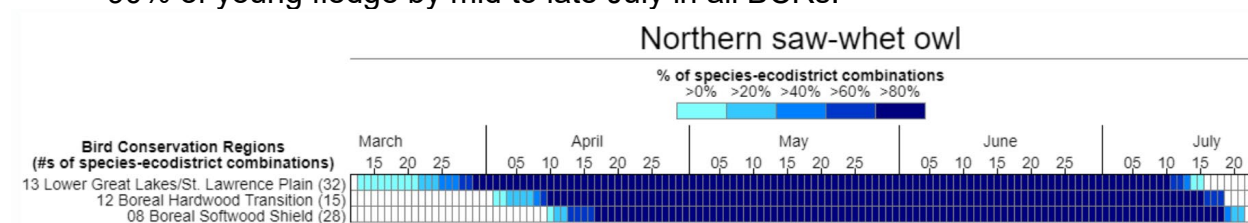
- 10% of nests contain at least 1 egg by early April in BCRs 12 and 13 and mid-April in BCR 8.
- 90% of young fledge by late July in all BCRs.



No nest construction (Duncan and Duncan 2014), suggesting a critical breeding period of about March 15-July 31 for BCRs 12 and 13 and April 1-July 31 for BCR 8.

Northern saw-whet owl

- 10% of nests contain at least 1 egg by mid-March in BCR 13, early April in BCR 12, and mid-April in BCR 8.
- 90% of young fledge by mid to late July in all BCRs.



No nest construction (Rasmussen et al 2008), suggesting a critical breeding period of about March 1-July 31 for BCR 13, March 15-July 31 for BCR 12, and April 1-July 31 for BCR 8.

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(C&R) 4.2.2.7 Ground-nesting raptors

Preamble/Direction

Revised guide status and rationale:

Content revised.

Section 4.2.2.7 currently provides direction for northern harrier, short-eared owl, and turkey vulture. Direction for turkey vulture has been moved to the Section 4.2.2.1 which addresses cliff-nesting birds.

Northern harriers and short-eared owls appear to only occasionally reuse old nests (Wiggins et al 2006, Smith et al 2011). Moreover, nests are typically in habitats not subject to direct alteration by forest operations. The northern harrier typically nests and hunts in marshes, bogs, swales, swamps, beaver meadows, and marshy edges of lakes or rivers, but may also use agricultural fields and plantations (Peck and James 1983, Wiggins et al 2006). The short-eared owl typically nests and hunts in a wide range of open habitats from grasslands and agricultural fields to marshes and bogs to recent clearcuts and young plantations (Peck and James 1983, Smith et al 2011).

Thus, coarse filter direction is likely to maintain sufficient nesting habitat to sustain populations. Consequently, direction focuses on mitigating potential disturbance of nesting birds.

i) Active northern harrier or short-eared owl ground nests

Description of value

Revised guide status and rationale:

Description revised.

Size of AOC moved to the description. AOC sizes are based on the distance required to mitigate potential effects of high impact operations.

Second bullet in current description removed - common condition for all values – moved reference to introductory preamble of Section 4.

Standards and guidelines: Retained, revised, or new

Regular harvest, renewal, and tending operations are permitted with timing restrictions (see below).

Revised guide status and rationale:

Directions remains unchanged. See current Background and Rationale for Direction for rationale.

Harvest, renewal, and tending operations are not permitted within the following distance of occupied ground nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 50 m for high potential impact operations
- 25 m for moderate or low potential impact operations.

Revised guide status and rationale:

Direction revised.

There is little empirical data on FD for the northern harrier or short-eared owl. Body mass suggests an average FD of 33 m for the northern harrier and 27 m for the short-eared owl (see Appendix 1). Median FD during incubation estimated by species experts was 30 m for the northern harrier and 5 m for the short-eared owl (Whitfield et al 2008). Moreover, Lehman et al (1999) noted that incubating or brooding harriers did not typically flush until observers were within 10 m of nests; Wiggins et al (2006) suggested that female short-eared owls are reluctant to flush until humans are just a few meters from nests. This suggests that a 50 m SBD is likely sufficient for these species.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied active cavity nests

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during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 50 m for high potential impact operations
- 25 m for moderate or low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

See discussion above of SBDs and rationale for operational prescription (harvest, renewal and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. This is based on the assumption that, in this situation, the nesting birds have likely habituated to the low impact activity.

Notes

The critical breeding period is defined... (table)

Revised guide status and rationale:

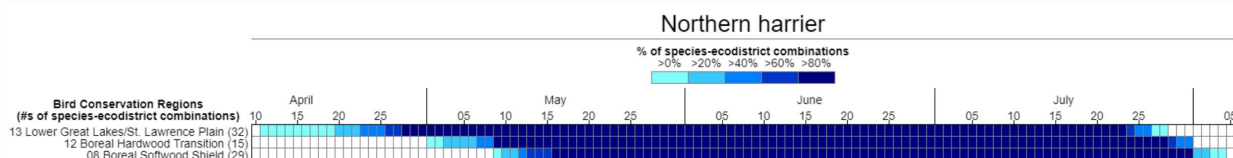
Direction revised.

Direction applies to the critical breeding period (which includes nest building) to be consistent with other species addressed through AOCs.

Based on models in Rousseu and Drolet (2017):

Northern harrier

- 10% of nests contain at least 1 egg by mid-April in BCR 13, early May in BCR 12, and mid-May in BCR 8.
- 90% of young fledge by late July/early August in all BCRs.

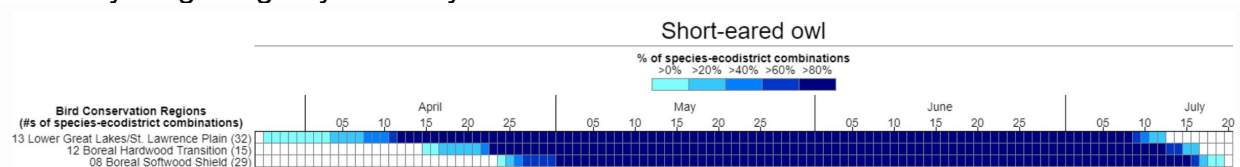


Nest building takes 7-14 days (Smith et al 2011), suggesting a critical breeding period of about April 1-July 31 for BCR 13, April 15-July 31 for BCR 12, and May 1-July 31 for BCR 8.

Short-eared owl

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- 10% of nests contain at least 1 egg by late March in BCR 13 and mid-April in BCRs 8 and 12
- 90% of young fledge by mid-July in all BCRs.



Nest building period not specified (Wiggins et al 2006), but presumably ≤ 14 days, suggesting a critical breeding period of about March 15-July 15 for BCR 13, April 1-July 15 for BCR 12, and April 15-July 15 for BCR 8.

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(C&R) 4.2.2.8 Forest-nesting birds not covered by direction in previous sections

Preamble/Direction

Revised guide status and rationale:
Content revised.

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Removed some detail; preamble of Section 4.2.2 already discusses requirement for forest workers to be vigilant for bird nests.

Except for the trumpeter swan, most species addressed in this section do not show strong fidelity to nest sites. Moreover, while forest operations may adversely affect the nesting habitat of individual pairs, the coarse filter is assumed to maintain sufficient habitat to sustain populations across forested landscapes. Thus, direction largely focuses on protecting occupied nests from destruction and mitigating disturbance of nesting birds.

i) Active trumpeter swan nests

Description of value

Revised guide status and rationale:

New description - no current species-specific direction for trumpeter swan nests. Currently covered under conditions on regular operations for waterfowl nests.

In one study area in Alaska, nests monitored over an 11-year period were reused 5-10 times (average of 8 times) (Hansen et al 1971: Table 9). Thus, direction applies to nests known or suspected to have been occupied within 10 years.

The size of the AOC is based on the distance considered necessary to mitigate effects of high potential impact operations.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted subject to timing restrictions (see below) and the following condition: residual forest will be retained within portions of the shoreline AOC associated with the HPS or LPS water feature containing the nest site that fall within the nest site AOC.

Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 400 m for high potential impact operations
- 200 m for moderate potential impact operations
- 100 m of low potential impact operations.

Revised guide status and rationale:

New direction.

Suitability of aquatic habitats appears to be primarily related to their size, depth, shoreline irregularity, abundance of emergent and submerged plant communities,

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and/or presence of suitable nest sites (e.g., beaver or muskrat lodges) (Maj 1983, Squires et al 1992, Schmidt et al 2009). There is no evidence to suggest that the amount of surrounding forest cover affects suitability. In fact, Schmidt et al (2009) found greater use of aquatic habitats that occurred within the boundary of large wildfires, presumably because release and movement of nutrients from burns to adjacent aquatic habitats increased their productivity. However, forest cover can act as a visual screen, reducing potential disturbance of nesting swans by adjacent human activities (e.g., Henson and Grant 1991). Thus, proposed direction requires that residual forest be maintained within the shoreline AOC associated with the aquatic feature containing the nest site (only within the boundaries of the trumpeter swan nest site AOC).

Trumpeter swans are generally considered to be sensitive to human disturbance (e.g., Henson and Grant 1991, Schmidt et al 2009, Looft 2014). Unfortunately, there is little information to define SBDs for nesting swans. Henson and Grant (1991) noted that 6 cases of pedestrian activity along roads that averaged 230 m from nests flushed incubating trumpeter swans 3 times. Moreover, researchers “walking near the nest wetland or through the forest on slopes above the nesting area” caused incubating females to flush 17 times. Based on their observations, they suggested a 300 m SBD from pedestrian activities (viewing areas).

In Alberta, adult trumpeter swans with cygnets reacted to observers at an average distance of 736 m (Looft 2014). Average FD reported for foraging or loafing swans (Bewick’s swan, black swan) varies among studies, ranging from 3.6 to 160 m (Mori et al 2001, Weston et al 2012).

Monda et al (1994) present the only empirical information for incubating swans. Median FD for tundra swans in Alaska was between 200-500 m (about 40% of FDs were <200 m and about 40% of FDs were >500 m), suggesting a SBD of 400-1000 m. An SBD of 400 m is proposed since this value is relatively consistent with the recommendation of Hanson and Grant (1991).

New roads and landings are not permitted within 200 m of active nests except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

New forestry aggregate pits are not permitted within 200 m of active nests.

Revised guide status and rationale:

New direction.

Suitability of nest sites/breeding habitats may be adversely affected by human development (Holton 1982, Hanson and Grant 1991, Schmidt et al 2009, Looft 2014). However, the effects of roads are somewhat equivocal. For example, Schmidt et al (2009) noted a negative effect of roads within about 400 m on occupancy of aquatic

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habitats in Alaska. In contrast, Looft (2014) found no relationship between cygnet production in occupied habitats and proximity of roads in Alberta (LaMontagne et al 2003 also found no effect of road proximity on habitats being used as spring stopovers). Thus, restrictions on new roads, landings, forestry aggregate pits, and wood storage yards are limited to within 200 m of nests.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied active cavity nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 400 m for high potential impact operations
- 200 m for moderate potential impact operations
- 100 m of low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

New direction.

See discussion above of SBDs and rationale for operational prescription (harvest, renewal and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. This is based on the assumption that, in this situation, the nesting birds have likely habituated to the low impact activity.

Best management practices: Retained, revised, or new

When practical and feasible, avoid constructing new roads and landings within 201-400 m of active nests.

When practical and feasible, avoid constructing new forestry aggregate pits and wood storage yards within 201-400 m of active nests.

Revised guide status and rationale:

New BMP.

See rationale for direction for roads above.

ii) Active Canada goose or sandhill crane nests

Description of value

Revised guide status and rationale:

New description - no current species-specific direction for Canada goose or sandhill crane nests. Canada goose nests are currently addressed by generic direction for waterfowl in Section 4.2.2.8. Nests of sandhill crane are not explicitly addressed in the current guide. The five-year review suggested revisiting setback distances and using a more formal AOC approach (similar to stick-nesting birds) for large-bodied birds such as swans, geese, and cranes.

The sandhill crane does not reuse nest sites. The Canada goose frequently reuses nest sites but is an abundant, adaptable species. Moreover, given habitat typically used for nesting, forest operations are unlikely to have long term effects on potential reuse of nest sites if operations during the critical breeding period are restricted. Thus, direction only applies to sites known or suspected to be occupied.

The size of the AOC is based on the distance considered necessary to mitigate effects of high potential impact operations.

Standards and guidelines: Retained, revised, or new

Regular harvest, renewal, and tending operations are permitted with timing restrictions (see below).
Harvest, renewal, and tending operations are not permitted within the following distance of occupied ground nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process: • 50 m for high potential impact operations • 25 m for moderate or low potential impact operations.

Revised guide status and rationale:

New direction.

Nests of Canada geese and sandhill cranes are typically in non-forested habitats (Mowbray et al 2002, Gerber et al 2014), and thus are not likely to be directly affected by harvest, renewal, and tending operations. Moreover, there is no evidence that forest operations alter surrounding habitat in a manner that would affect future use of nest sites.

Average FD for nesting sandhill cranes in Idaho was 32.5 m (N=471 FDs) (Austin and Buhl 2008). In Florida, Dwyer and Tanner (1992) reported FDs ranged from 3-75 m for nesting sandhill cranes (41 nests, average not presented). In Michigan, sandhill cranes often did not flush from nests until pedestrians approached to within <5 m (Walkinshaw 1949 cited in Austin and Buhl 2008).

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Average FD for nesting Canada geese in a study in Nunavut was 21 m (N=105 FDs) (Miller et al 2013), within the range reported for other geese (e.g., 16 m for greylag geese in Poland (Osiejuk and Kuczynski 2007) and 27 m for 3 species in Norway (Madsen et al 2009)).

Thus, a SBD of 50 m is proposed for both species based on the approach in Appendix 1 (i.e., $SBD = 2 \times \text{average FD}$).

Moderate and low potential impact operations are combined to simplify direction.

Operations associated with [all roads, landings, forestry aggregate pits, wood storage yards] are not permitted within the following distance of occupied active cavity nests during the critical breeding period based on potential impact of the operation (see Appendix 4.2), except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process:

- 50 m for high potential impact operations
- 25 m for moderate or low potential impact operations.

However, there is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the nest.

Revised guide status and rationale:

New direction.

See discussion above of SBDs and rationale for operational prescription (harvest, renewal and tending) for the AOC.

There is no timing restriction on hauling or low potential impact road maintenance operations (e.g., grading) if the road predates the colony. This is based on the assumption that, in this situation, the nesting birds have likely habituated to the low impact activity.

iii) Active nests occupied by other protected birds

Description of value

Revised guide status and rationale:

Description revised.

Simplified and replaces description/direction for:

- Nests of waterfowl, grouse, or wild turkeys containing eggs encountered during forest management operations (other than trumpeter swan and Canada goose)
- Nests of songbirds or other small birds containing eggs or young encountered during forest management operations.

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Added explicit reference to protected birds.

The MBCA/FWCA applies to any occupied nests (i.e., those containing adult birds, eggs, or young) of protected species (excludes American crow, brown-headed cowbird, common grackle, house sparrow, red-winged blackbird, and European starling).

Direction applies to nests not already covered by other AOC direction.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within the following distance of occupied nests:

- Nest not in cavity:
 - 10 m for species robin-sized and larger
 - 5 m for species smaller than a robin.
- Nest in cavity:
 - 5 m for species robin-sized and larger
 - 0 m (but retain tree with cavity) for species smaller than a robin.

Operations associated with roads, landings, forestry aggregate pits, and wood storage yards are not permitted within similar distances of occupied nests unless the operation will not physically disturb the nest and its contents and there is compelling evidence to suggest habituation to the activity (e.g., nest built next to an existing road with existing traffic flow).

Revised guide status and rationale:

Direction revised.

Combined direction for species not covered in previous sections into groups based on body size for simplicity. Revised setback distances based largely on empirical information on FD in the literature. To address concerns about incidental take, direction is now mandatory.

Weighted average FD for various species of North American ducks was about 2 m (N= 2930 FDs) (Forbes et al 1994, Mallory et al 1998, Gunness and Weatherhead 2002, Dassow et al 2012). However, average FD for large ducks (>750 g) such as common goldeneyes, gadwalls, and mallards was >3 m; average FD for small ducks such as blue-winged teal, hooded merganser, and northern shoveler was <3 m. Thus, the current BMP suggesting a 10 m SBD is likely appropriate for large ducks but may be conservative for small ducks.

There is little published information on FD for North American grouse or wild turkeys. One study in Vermont suggested that wild turkeys typically flushed from nests when pedestrians approached to within 5 m (Wallin 1983). One study in Norway noted

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average FD of 3.8 m for nesting capercaillies (about half the size of a wild turkey) and 2.0 m for black grouse (about twice the size of a ruffed grouse) (N=94 FDs) (Storaas et al 1999). Thus, the current BMP suggesting a 10 m SBD is likely appropriate for wild turkeys but may be conservative for grouse.

Weighted average FD for birds smaller than an American robin (i.e., <50 g) was about 3 m (N=457 FDs) (Burhans and Thompson 2001, Smith-Castro and Rodewald 2010, Barron et al 2012, Meillere et al 2015). [However, a study of barn swallows showed an average FD of 12.3 m (Möller 2014), although this may be more representative of the FD of colonial nesters.] This suggests the current setback distance of 3 m should likely be increased to 5 m.

There is little empirical information for birds smaller than grouse but larger than or equal to the size of an American robin (i.e., approximately 50-500 g). Weighted average FD for nesting common nighthawks was 5.3 m (N=30) in two studies (Gramza 1967, Lohnes 2010). Similarly, average FD of 3 species of African nightjars (similar to North American nighthawks and whip-poor-wills) was about 2 m (N=118 FDs) (Wilson-Aggarwal et al 2016). Thus, the current BMP suggesting a 3 m SBD is likely not appropriate.

A 10 m SBD is proposed for species about the size of a robin or larger (5 m for species smaller than a robin) for harvest, renewal, and tending operations since the empirical evidence suggests this is likely acceptable or conservative for the species addressed. A similar SBD is proposed for operations associated with roads, landings, and forestry aggregate pits unless the operation will not physically disturb the nest and its contents and there is compelling evidence to suggest habituation to the activity (e.g., nest built next to an existing road with existing traffic flow).

A smaller SBD is proposed when nests are in cavities (assuming birds in cavities are less likely to be disturbed by forest operations). For example, FD estimated from body mass for the pileated woodpecker is 23 m (using the equation in Naylor 2009). However, incubating pileated woodpeckers may be reluctant to flush, even if the nesting tree is struck by an observer (Harestad and Keisker 1989).

Notes

The critical breeding period is defined... (table)

Revised guide status and rationale:

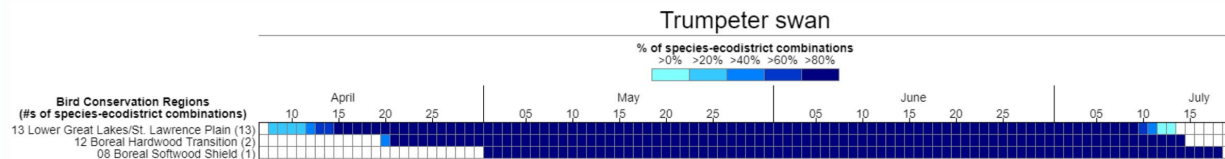
Proposed direction applies to the critical breeding period (which includes nest building) to be consistent with other species addressed through AOCs.

Based on models in Rousseu and Drolet (2017):

Trumpeter swan

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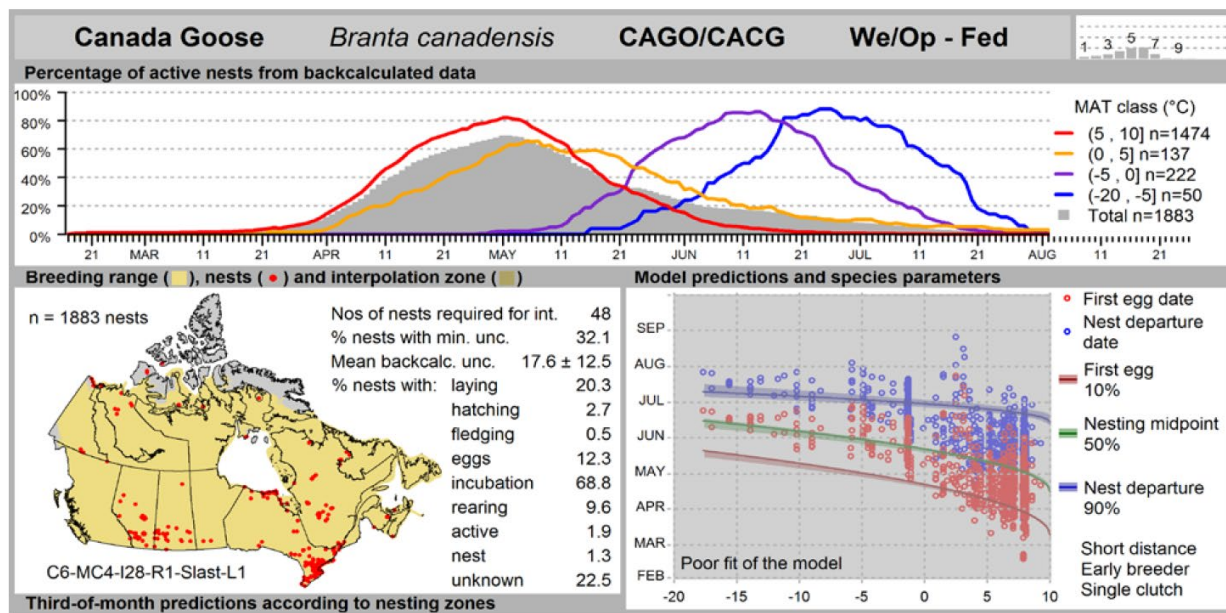
- 10% of nests contain at least 1 egg by early April in BCR 13, mid-April in BCR 12, and early May in BCR 8.
- 90% of young fledge by mid-July in all BCRs.



Nest building takes 14-35 days (Mitchell and Eichholz 2010), suggesting a critical breeding period of about March 1-July 15 for BCR 13, March 15-July 15 for BCR 12, and April 1-July 15 for BCR 8.

Canada goose

- 10% of nests contain at least 1 egg by early April in BCR 13, mid-April in BCR 12, and late April in BCR 8.
- 90% of young fledge by late June/early July in all BCRs.



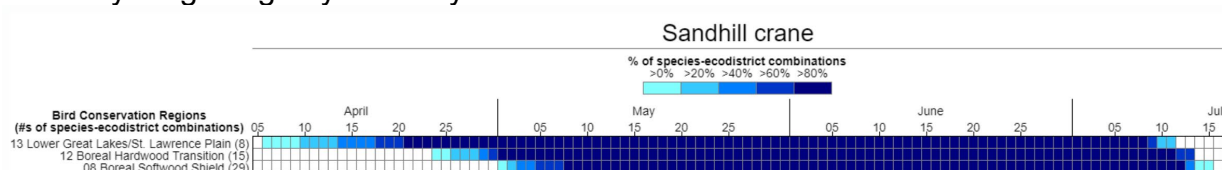
Nest building period not specified (Mowbray et al 2002) but presumably ≤ 14 days, suggesting a critical breeding period of about March 15-June 30 for BCR 13, April 1-June 30 for BCR 12, and April 15-June 30 for BCR 8.

Sandhill crane

- 10% of nests contain at least 1 egg by early April in BCR 13, late April in BCR 12, and early May in BCR 8

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- 90% of young fledge by mid-July in all BCRs.



Nest building takes 1-14 days (Gerber et al 2014), suggesting a critical breeding period of about March 15-July 15 for BCR 13, April 1-July 15 for BCR 12, and April 15-July 15 for BCR 8.

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(C&R) 4.2.3 Beaver habitat

Preamble

Revised guide status and rationale:

No changes made. Discussion still relevant.

See current Background and Rationale for Direction for rationale.

Direction

Revised guide status and rationale:

Minor revisions – overall content remains unchanged.

Moved statements that direction for aquatic features that apply to beaver ponds needs to be followed in addition to direction in Section 4.2.3.

Description of value

Revised guide status and rationale:

No changes made to description.

Guidelines: Retained, revised, or new

Harvest, renewal, and tending operations within the AOC will promote establishment or perpetuation of intolerant hardwood or mixedwood forest units, to the extent practical and feasible, unless inconsistent with other ecological objectives.

Best management practices: Retained, revised, or new

For clearcut silviculture system:

- In the AOC, as much of the shoreline forest should be clearcut to the edge of water as is practical and feasible, considering residual forest requirements in Section 4.1. Clearcut portions of the AOC should ideally be ≥ 200 m long and within 50 m of water.
- When clearcutting, shoreline forest with >10% trembling aspen (or other intolerant hardwoods) in the overstory, limited conifer advanced regeneration in the understory, and on low slopes should be targeted.
- Conifer advanced regeneration (especially balsam fir) should be removed to the extent practical and feasible. Use of prescribed fire should be considered.

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- Aerial or machine-based ground application of herbicides should not be conducted within 50 m of the beaver pond or beaver meadow (applies to shorelines where regenerating hardwoods will be accessible to beavers).

For selection and shelterwood silviculture systems:

- In the AOC, small clearcuts or large group openings in patches of intolerant hardwood, mixedwood, other conifer, or poor-quality pine or hardwood shoreline forest should be created whenever practical and feasible, considering residual forest requirements in Section 4.1. Openings should be >0.1 ha in size (ideally >0.2 ha) and within 50 m of the pond.

Revised guide status and rationale:

No changes made to standards, guidelines, or BMPs.

There have been no recent studies to test the effectiveness of the direction in the guide. Moreover, no recent compelling evidence could be found that would suggest the need to revise the current direction.

Numerous studies continue to show the importance of beaver-controlled wetlands to various taxa including rare plants (e.g., Bonner et al 2009), aquatic, semi-aquatic and terrestrial riparian vegetation (e.g., Dee et al 2018), aquatic invertebrates (e.g., Hood and Larson 2014, Bush and Wissinger 2016), fish (Smith and Mather 2013), amphibians (e.g., Cunningham et al 2007), birds (e.g., Aznar and Desrocher 2008), and mammals (e.g., Morris 2014); Stoffyn-Egli and Willison (2011) considered beavers to represent an umbrella species for obligate riparian animals. Moreover, beavers may mitigate the effects of a warming and drying climate (including extreme droughts) on the supply of open water wetlands (Hood and Bayley 2008). However, beaver ponds may also be significant sources of greenhouse gases (e.g., Lazar et al 2014) and sites of mercury methylation (e.g., Roy et al 2009).

Recent studies continue to suggest the importance of shoreline disturbance to maintain beaver activity. For example, presence of beavers in Illinois was predicted by the width of riparian forest and the % of stems <15 cm dbh (Cox and Nelson 2009). In Maine, the number of beaver ponds peaked 30 years after a large fire (Little et al 2012). In Michigan, the number of beaver ponds was correlated with the area of young (10-19 years old) aspen forest within the study watershed (Martin et al 2015).

Direction: Removed

Standards and guidelines for the aquatic features associated with these values apply (see Section 4.1) with the following additions. [for Operational prescription for the AOC]

Standards and guidelines for the aquatic features associated with these values apply (see Section 4.1). [for Conditions on Roads, Landings, and Aggregate Pits]

Revised guide status and rationale:

Direction removed – moved to a single statement in direction description (see above).

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Morris, D.M. 2014. Aquatic habitat use by North American moose (*Alces alces*) and associated richness and biomass of submersed and floating-leaved aquatic vegetation in north-central Minnesota. MScF thesis, Lakehead Univ., Thunder Bay, ON.

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(C&R) 4.2.4. Moose aquatic feeding areas and mineral licks

Preamble

Revised guide status and rationale:

No changes made. Discussion still relevant.

See current Background and Rationale for Direction for rationale.

Direction

Revised guide status and rationale:

Minor revisions – overall content remains unchanged.

Moved statement that direction (i.e., operational prescription and conditions on roads, landings, forestry aggregate pits, and wood storage yards) for aquatic features that are associated with MAFAs needs to be followed.

i) Moose aquatic feeding areas

Description of value

Revised guide status and rationale:

No changes made to description.

Direction: Removed

There is no specific AOC associated with MAFAs. Mandatory direction for the aquatic feature associated with the MAFA apply (Section 4.1.1 or 4.1.2). If retaining residual shoreline forest adjacent to MAFAs, the following best management practices should be considered.

Revised guide status and rationale:

Requirement moved to direction description (see above).

Best management practices: Retained, revised, or new

Residual shoreline forest should be retained preferentially when it:

- Is adjacent to higher quality MAFAs (i.e., class 4 MAFAs are better than class 3 MAFAs which are better than class 2 MAFAs),
- Is adjacent to larger MAFAs (i.e., MAFAs >8 ha are better than MAFAs 4-8 ha which are better than MAFAs <4 ha),
- Is adjacent to MAFAs without features that restrict access such as steep terrain,
- Will provide screening from roads,
- Connects MAFAs to other residual forest (especially identified patches of summer thermal shelter; see Section 3.3.2) and/or travel corridors, or
- Minimizes the distance between the aquatic vegetation and cover.

Roads should be planned and constructed to avoid high quality MAFAs (e.g. roads should be ≥ 100 m away from MAFAs ranked 3 or 4 that are ≥ 4 ha in size).

Revised guide status and rationale:

No changes made to first BMP.

There have been no recent studies to test the effectiveness of the direction in the guide. Moreover, we could find no recent compelling evidence that would suggest the need to revise the current direction.

A recent review continues to suggest aquatic areas are important as feeding habitat (Morris 2014). Moreover, Street et al (2015a) found that selection of aquatic habitats was correlated with summer temperature in NW Ontario, suggesting the potential importance of aquatic habitats in thermoregulation (which might become increasingly important in a warming climate). Some evidence supports the guide in encouraging management that promotes beaver activity. For example, Morris (2014) found that the supply of aquatic plants potentially used by moose in Minnesota was significantly influenced by beaver activity; beaver ponds contained 4 times the biomass of aquatic vegetation compared to lakes.

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Second BMP is new and addresses the potential long-term impact on MAFA use from adjacent roads. To the extent practical and feasible, new roads should not be located within 100 m of class 3 or 4 MAFAs that are ≥ 4 ha in size. While there is no empirical information linking proximity of roads to use of MAFAs, numerous studies suggest reduced use/suitability of habitat near roads, with detectable effects $>1,000$ m from roads in some studies (e.g., Dussault et al 2007, Shanley and Pyare 2011, Laurian et al 2012). In a study of forest access roads (boreal Quebec), Laurian et al (2012) found that male and female moose avoided the area within 100 m of forest access roads (all classes pooled) during all seasons. Use within 100-250 m varied by sex and season; use beyond 250 m did not appear to be related to proximity to roads. While McLaren et al (2017) found that minimum distances of calving sites to primary, secondary, and tertiary roads in central Ontario were 260, 165, and 30 m, respectively. Additionally, Bowman et al (2010) indicated that moose use roadsides as forage. BMP applies to MAFAs most likely to be used by moose.

ii) Mineral licks

Description of value

Revised guide status and rationale:

No changes made to description. However, size of AOC moved from Operational Prescription for the AOC.

Standards and guidelines: Retained, revised, or new

No harvest, renewal, or tending operations are permitted within the AOC.
Operations associated with existing roads are permitted within the AOC.
New roads and landings are not permitted within the AOC except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.
Operations associated with existing forestry aggregate pits and wood storage yards are permitted within the AOC.
New forestry aggregate pits and wood storage yards are not permitted within the AOC except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.

Revised guide status and rationale:

No changes made to direction.

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The only recent study found on moose mineral licks suggests that use (at least in British Columbia) is not restricted to summer months (Rea et al 2013), further supporting an AOC prescription for mineral licks. See current Background and Rationale for further rationale.

Standards: Removed

120 m radius AOC measured from the edge of woody vegetation averaging at least 2 m tall and with $\geq 25\%$ canopy cover.

Revised guide status and rationale:

Requirement moved to description of value (see above).

LITERATURE CITED

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Rea, R.V., D.P. Hodder, and K.N. Child. 2013. Year-round activity patterns of moose (*Alces alces*) at a natural mineral lick in north central British Columbia, Canada. Can. Wildl. Biol. Manage. 2:36-41.

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(C&R) 4.2.5 Dens

Preamble/Direction

Revised guide status and rationale:

Minor changes to preamble and direction description to reflect denning direction for species at risk being moved to Section 4.3. Section 4.2.5 now only includes direction for black bear and other furbearing mammal dens.

The guide provides direction to minimize disturbance of occupied dens and protect denning structures used by black bears and other furbearing mammals (excluding red foxes and skunks). The guide assumes that a sufficient supply of habitat will be maintained by the coarse filter direction within the Landscape Guide.

See current Background and Rationale for Direction for further rationale.

i) Black bear dens

Description of value

Revised guide status and rationale:

Minor changes made to description.

Second bullet moved to direction description above.

Size of AOC moved to description.

Standards and guidelines: Retained, revised, or new

Regular harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below).
Harvest, renewal, and tending operations involving heavy equipment are not permitted within the AOC during the denning period, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
Other harvest, renewal, and tending operations that might potentially disturb denning bears are not permitted within the AOC during the first 4 weeks of the denning period, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
Road construction is not permitted within the AOC during the denning period, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
Hauling and road maintenance operations are not permitted within the AOC during the denning period, unless the road predates the den, is required for safety reasons or environmental protection, or except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
Aggregate extraction and operations associated with wood storage yards are not permitted within the AOC during the denning period, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

Revised guide status and rationale:

No change to the guide direction is proposed.

There have been no recent studies to test the effectiveness of the direction in the guide. No recent compelling evidence could be found that would suggest the need to revise

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the current direction. Further to this, during the five-year review, a subject expert suggested no changes to the direction in the guide for black bear dens.

The recent literature on black bears continues to suggest that characteristics of den sites influence use. However, the effect of human disturbance (at least as reflected by proximity or density of roads) is equivocal and may be very context specific. For example, denning black bears strongly avoided roads in Mississippi (Waller et al 2014), did not strongly avoid roads and trails in central British Columbia (however roads had little winter traffic) (Hodder et al 2014), and repeatedly reused a den site in coastal British Columbia that was 50 m from a road (Davis et al 2012).

Occupied bear dens are protected by the *Fish & Wildlife Conservation Act, 1997*. Dens are normally not reused. Thus, direction identifies only occupied dens as AOCs and focuses on mitigating disturbance.

Standards: Removed

100 m radius AOC centred on den entrance.

Revised guide status and rationale:

Current standard moved to description of value.

ii) Dens of furbearing mammals in enduring features

Description of value

Revised guide status and rationale:

Minor change made to description.

Second bullet moved to direction description above.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within 20 m of the den entrance.

New roads and landings are not permitted within 20 m of the den entrance.

Road construction is not permitted within 20 m of occupied dens, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

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Hauling and road maintenance operations are not permitted within 20 m of occupied dens unless the road predates the den, is required for safety reasons or environmental protection, or except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

New forestry aggregate pits and wood storage yards are not permitted within 20 m of the den entrance.

Aggregate extraction and operations associated with wood storage yards are not permitted within 20 m of occupied dens, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.

Revised guide status and rationale:

No change to guide direction is proposed.

During the five-year review, it was suggested that direction for dens of ‘other’ furbearing mammals should address dens even when not known to be/have been occupied. Providing direction for denning sites when the species is not identified can be complex. Where denning behavior has been studied, denning use and requirements can vary widely among species and throughout the year (Table 4.2c in the current Background and Rationale for Direction). Further to the direction that is presented here, potential denning sites are also considered within direction for wildlife trees (Section 3.2.3.1) and downed woody material (Section 3.2.3.2) that provide direction to maintain cavity trees and coarse woody material which can serve as denning sites for furbearing mammals. Understanding these challenges, the provisions for wildlife trees and coarse woody material, and the lack of evidence to support changing the direction, protection of occupied denning sites is maintained as standards and guidelines by applying conditions on operations within 20 m of dens.

The background and rationale was reviewed and updated. There were minimal updates to the recent studies. Specifically, there were no recent studies describing the use of den sites by coyotes. However, recent studies suggest that lynx use up to six dens per year (Olson et al 2011), show low site fidelity (Squires et al 2007), and that suitable denning habitat is likely not limiting (Organ et al 2008). Thus, there is no compelling evidence to suggest that the direction for ‘other’ furbearing mammals that use caves, excavated burrows, under large piles of coarse woody material, or other enduring features is not sufficient.

iii) Dens of furbearing mammals in transitory features

Description of value

Revised guide status and rationale:

No changes made to description.

Standards and guidelines: Retained, revised, or new

Known occupied dens encountered during operations will not be destroyed.
Minimize disturbance of furbearers occupying known dens encountered during operations.

Best management practices: Retained, revised, or new

Harvest, renewal, and tending operations should be avoided within 3 m of dens known to be occupied. Specifically, • Trees should be retained within 3 m of dens known to be occupied (patch may be counted as a clump of wildlife trees) • Trees should not be felled into the area within 3 m of dens known to be occupied • Heavy equipment should not travel within 3 m of dens known to be occupied.
New roads and landings should not be constructed within 3 m of dens known to be occupied.
New forestry aggregate pits and wood storage yards should not be constructed within 3 m of dens known to be occupied.

Revised guide status and rationale:

No change proposed to guide direction.

During the review of the current direction, a few recent studies provided information on the characteristics of den sites used by martens (e.g., Hughart et al 2013) and fishers (e.g., Zhao et al 2012). However, they contain no compelling evidence to suggest that the current direction for 'other' furbearing mammals that den in tree cavities, hollow logs, brush piles, or other transitory features is not sufficient.

During the five-year review, the effectiveness of the 3 m protection zone for dens in tree cavities, hollow logs, brush piles, or other transitory features was questioned. There is no published information on restrictions required to minimize disturbance of denning furbearers such as fishers, martens, or raccoons. Direction is based on the precautionary principal and is similar to the prescriptions for songbirds and other small birds (see Section 4.2.2.8).

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Hodder, D.P., C.J. Johnson, R.V. Rea, and A. Zedrosser. 2014. Application of a species distribution model to identify and manage bear den habitat in central British Columbia, Canada. *Wildl. Biol.* 20: 238-245.

Hughart, R., J. Jacquot, and P. Keenlance. 2013. Den site characteristics and kit survival of American marten in Manistee National Forest Michigan. Student Summer Scholars Paper 113. <http://scholarworks.gvsu.edu/sss/113>.

Olson, L.E., J.R. Squires, N.J. DeCesare, and J.A. Kolbe. 2011. Den use and activity patterns in female Canada lynx (*Lynx canadensis*) in the northern Rocky Mountains. *Northwest Sci.* 85:455-462.

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Waller, B.W., J.L. Belant, B.D. Leopold, B.W. Young, S.L. Simek, and D.L. Evans. 2014. Influence of landscape attributes on American black bear den-site selection in Mississippi. *Mammal Study* 39:115-119.

Zhao, F., R.A. Sweitzer, Q. Guo, and M. Kelly. 2012. Characterizing habitats associated with fisher den structures in the southern Sierra Nevada, California using discrete return lidar. *For. Ecol. Manage.* 280:112-119.

(C&R) 4.3 Protection of species at risk

Preamble

Revised guide status and rationale:

Preamble expanded.

Species at risk direction was not included in the five-year review of the guide.

All references to the *Endangered Species Act* have been removed with the exception of Ontario Regulation 230/08 SARO list.

Species at risk in Ontario list (ESA O. Reg 230/08, January 2024) with rationale for including/excluding species-specific direction within this guide.

Taxonomic group	Species	SARO list status	Found in managed forest?	Direction
Mosses	Spoon-leaved moss <i>Bryoandersonia illecebra</i>	THR	No	No species-specific direction
Lichens	Golden-eye lichen (Great Lakes population) <i>Teloschistes chrysophthalmus</i>	END	No	No species-specific direction
Lichens	Pale-bellied frost lichen <i>Physconia subpallida</i>	END	Yes	Species specific direction in Section 4.3.3
Lichens	White-rimmed shingle lichen <i>Fuscopannaria leucosticta</i>	END	Yes	Species specific direction in Section 4.3.3
Vascular Plants	American chestnut <i>Castanea dentata</i>	END	No	No species-specific direction.
Vascular Plants	American columbo <i>Fraseria caroliniensis</i>	END	No	No species-specific direction.
Vascular Plants	Bent spike-rush <i>Eleocharis geniculata</i>	END	No	No species-specific direction.
Vascular Plants	Bird's-foot violet <i>Viola pedata</i>	END	No	No species-specific direction.
Vascular Plants	Black ash <i>Fraxinus nigra</i>	END	Yes	Exemption under the <i>ESA</i> for forestry operations on Crown lands under the <i>CFSA</i> allowing possession, transport, buying and selling of black ash. No species-specific direction.
Vascular Plants	Bluehearts <i>Buchnera americana</i>	END	No	No species-specific direction
Vascular Plants	Blunt-lobed woodsia <i>Woodsia obtusa</i>	END	No	No species-specific direction
Vascular Plants	Butternut <i>Juglans cinerea</i>	END	Yes	Species specific direction in Section 4.3.2

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Vascular Plants	Cherry birch <i>Betula lenta</i>	END	No	No species-specific direction
Vascular Plants	Colicroot <i>Aletris farinosa</i>	END	No	No species-specific direction
Vascular Plants	Cucumber tree <i>Magnolia acuminata</i>	END	No	No species-specific direction
Vascular Plants	Downy yellow false foxglove <i>Aureolaria virginica</i>	END	No	No species-specific direction
Vascular Plants	Drooping trillium <i>Trillium flexipes</i>	END	No	No species-specific direction
Vascular Plants	Eastern flowering dogwood <i>Cornus florida</i>	END	No	No species-specific direction
Vascular Plants	Eastern prairie fringed-orchid <i>Platanthera leucophaea</i>	END	Yes	Wetland plants and insect direction in Section 4.3.1
Vascular Plants	Eastern prickly-pear cactus <i>Opuntia cespitosa</i>	END	No	No species-specific direction
Vascular Plants	Engelmann's quillwort <i>Isoetes engelmannii</i>	END	Yes – 2 locations in southern edge (French-Severn FMU)	Planning teams can develop direction as per the FMPP if necessary.
Vascular Plants	False hop sedge <i>Carex lupuliformis</i>	END	No	No species-specific direction
Vascular Plants	Few-flowered club-rush <i>Trichophorum planifolium</i>	END	No	No species-specific direction
Vascular Plants	Forked three-awned grass <i>Aristida basiramea</i>	END	No	No species-specific direction
Vascular Plants	Four-leaved milkweed <i>Asclepias quadrifolia</i>	END	No	No species-specific direction
Vascular Plants	Gattinger's agalinis <i>Agalinis gattingeri</i>	END	No	No species-specific direction
Vascular Plants	Gillman's goldenrod <i>Solidago gillmanii</i>	END	No	No species-specific direction
Vascular Plants	Heart-leaved plantain <i>Plantago cordata</i>	END	No	No species-specific direction
Vascular Plants	Hoary mountain-mint <i>Pycnanthemum incanum</i>	END	No	No species-specific direction
Vascular Plants	Horsetail spike-rush <i>Eleocharis equisetoides</i>	END	No	No species-specific direction
Vascular Plants	Juniper sedge <i>Carex juniperorum</i>	END	No	No species-specific direction
Vascular Plants	Large whorled pogonia <i>Isotria verticillata</i>	END	No	No species-specific direction

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Vascular Plants	Lowland toothcup <i>Rotala ramosior</i>	END	Yes – along shoreline of 2 lakes in Mazinaw-Lanark FMU	Section 4.1 provide direction to address lake shorelines. Planning teams can develop direction as per the FMPM if necessary.
Vascular Plants	Nodding pogonia <i>Triphora trianthophoros</i>	END	No	No species-specific direction
Vascular Plants	Ogden's pondweed <i>Potamogeton x ogdenii</i>	END	Yes – southern edge (Mazinaw-Lanark FMU)	Section 4.1 provide direction to address streams, beaver ponds and alkaline lakes. Planning teams can develop direction as per the FMPM if necessary.
Vascular Plants	Pink milkwort <i>Polygala incarnata</i>	END	No	No species-specific direction
Vascular Plants	Pumpkin ash <i>Fraxinus profunda</i>	END	No	No species-specific direction
Vascular Plants	Red mulberry <i>Morus rubra</i>	END	No	No species-specific direction
Vascular Plants	Scarlet ammannia <i>Ammannia robusta</i>	END	No	No species-specific direction
Vascular Plants	Skinner's agalinis <i>Agalinis skinneriana</i>	END	No	No species-specific direction
Vascular Plants	Slender bush-clover <i>Lespedeza virginica</i>	END	No	No species-specific direction
Vascular Plants	Small white lady's-slipper <i>Cypripedium candidum</i>	END	Yes	Wetland plants and insect direction in Section 4.3.1
Vascular Plants	Small whorled pogonia <i>Isotria medeoloides</i>	END	No	No species-specific direction
Vascular Plants	Stiff-leaved showy goldenrod <i>Solidago rigidiuscula</i>	END	No	No species-specific direction
Vascular Plants	Virginia's goat's-rue <i>Tephrosia virginiana</i>	END	No	No species-specific direction
Vascular Plants	Virginia mallow <i>Ripariosida hermaphrodita</i>	END	No	No species-specific direction
Vascular Plants	White prairie gentian <i>Gentiana alba</i>	END	No	No species-specific direction
Vascular Plants	Wood poppy <i>Stylophorum diphyllum</i>	END	No	No species-specific direction
Vascular Plants	American ginseng <i>Panax quinquefolius</i>	THR	Yes	Direction for large patch and small patch American ginseng in Section 4.3.1
Vascular Plants	American water-willow <i>Justicia americana</i>	THR	No	No species-specific direction
Vascular Plants	Blue ash <i>Fraxinus quadrangulata</i>	THR	No	No species-specific direction
Vascular Plants	Branched bartonia <i>Bartonia paniculata</i>	THR	Yes	Wetland plants and insect direction in Section 4.3.1
Vascular Plants	Deerberry <i>Vaccinium stamineum</i>	THR	No	No species-specific direction

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Vascular Plants	Dense blazing star <i>Liatris spicata</i>	THR	No	No species-specific direction
Vascular Plants	Dwarf hackberry <i>Celtis tenuifolia</i>	THR	No	No species-specific direction
Vascular Plants	Fern-leaved yellow false foxglove <i>Aureolaria pedicularia</i>	THR	No	No species-specific direction
Vascular Plants	Hairy valerian <i>Valeriana edulis</i> ssp. <i>ciliata</i>	THR	No	No species-specific direction
Vascular Plants	Hill's thistle <i>Cirsium hillii</i>	THR	No	No species-specific direction
Vascular Plants	Houghton's goldenrod <i>Solidago houghtonii</i>	THR	No	No species-specific direction
Vascular Plants	Kentucky coffee-tree <i>Gymnocladus dioicus</i>	THR	No	No species-specific direction
Vascular Plants	Pale showy goldenrod <i>Solidago pallida</i>	THR	Yes – single population in northwestern Ontario.	Grows in prairie grassland on shallow soils. Planning teams can develop direction as per the FMPM if necessary.
Vascular Plants	Pitcher's thistle <i>Cirsium pitcheri</i>	THR	Yes – 30 sites in Ontario, Canada: 3 on southern Lake Huron, 2 on Lake Superior and 25 in the Manitoulin region along Lake Huron.	Section 4.1 provide direction to address lake shorelines. Planning teams can develop direction as per the FMPM if necessary.
Vascular Plants	Purple twayblade <i>Liparis liliifolia</i>	THR	No	No species-specific direction
Vascular Plants	Round-leaved greenbrier <i>Smilax rotundifolia</i>	THR	No	No species-specific direction
Vascular Plants	Small-flowered lipocarpa <i>Cyperus subsquarrosus</i>	THR	Yes – isolated populations (Boundary Waters FMU)	Section 4.1 provide direction to address lake shorelines. Planning teams can develop direction as per the FMPM if necessary.
Vascular Plants	Smooth yellow false foxglove <i>Aureolaria flava</i>	THR	No	No species-specific direction
Vascular Plants	Spotted wintergreen <i>Chimaphila maculata</i>	THR	Yes – however, it is believed to have been extirpated from District of Muskoka	Planning teams can develop direction as per the FMPM if necessary.
Vascular Plants	Western silvery aster <i>Symphotrichum sericeum</i>	THR	Yes – grows in one area on south shore of Lake of the	Grows in open bur oak savannahs on shallow soils, found with other prairie species. Planning teams can develop

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			Woods and on 2 islands on lake.	direction as per the FMPM if necessary.
Vascular Plants	White wood aster <i>Eurybia divaricata</i>	THR	No	No species-specific direction
Vascular Plants	Wild hyacinth <i>Camassia scilloides</i>	THR	No	No species-specific direction
Vascular Plants	Willowleaf aster <i>Symphotrichum praealtum</i>	THR	No	No species-specific direction
Vascular Plants	American hart's tongue fern <i>Asplenium scolopendrium</i> var. <i>americanum</i>	SC	No	No species-specific direction
Vascular Plants	Broad beech fern <i>Phegopteris hexagonoptera</i>	SC	Yes – along southern edge (Mazinaw Lanark FMU)	Most documented occurrences are historical. Planning teams can develop direction as per the FMPM if necessary.
Vascular Plants	Climbing prairie rose <i>Rosa setigera</i>	SC	No	No species-specific direction
Vascular Plants	Common hoptree <i>Ptelea trifoliata</i>	SC	No	No species-specific direction
Vascular Plants	Crooked-stem Aster <i>Symphotrichum prenanthoides</i>	SC	No	No species-specific direction
Vascular Plants	Dwarf lake iris <i>Iris lacustris</i>	SC	No	No species-specific direction
Vascular Plants	Eastern false rue-anemone <i>Enemion biternatum</i>	SC	No	No species-specific direction
Vascular Plants	Goldenseal <i>Hydrastis canadensis</i>	SC	No	No species-specific direction
Vascular Plants	Green dragon <i>Arisaema dracontium</i>	SC	No	No species-specific direction
Vascular Plants	Hill's pondweed <i>Potamogeton hillii</i>	SC	No	No species-specific direction
Vascular Plants	Lakeside daisy <i>Tetrameuris herbacea</i>	SC	No	No species-specific direction
Vascular Plants	Riddell's goldenrod <i>Solidago riddellii</i>	SC	No	No species-specific direction
Vascular Plants	Shumard oak <i>Quercus shumardii</i>	SC	No	No species-specific direction
Vascular Plants	Swamp rose-mallow <i>Hibiscus moscheutos</i>	SC	No	No species-specific direction
Vascular Plants	Tuberous Indian-plantain <i>Arnoglossum plantagineum</i>	SC	No	No species-specific direction
Molluscs	Broad-banded forestsnail <i>Allogona profunda</i>	END	No	No species-specific direction
Molluscs	Eastern banded tigersnail	END	No	No species-specific direction

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	<i>Anguispira kochi kochi</i>			
Molluscs	Fawnsfoot <i>Truncilla donaciformis</i>	END	No	No species-specific direction
Molluscs	Hickorynut <i>Obovaria olivaria</i>	END	No	No species-specific direction
Molluscs	Kidneyshell <i>Ptychobranhus fasciolaris</i>	END	No	No species-specific direction
Molluscs	Northern riffleshell <i>Epioblasma torulosa rangiana</i>	END	No	No species-specific direction
Molluscs	Proud globelet <i>Patera pennsylvanica</i>	END	No	No species-specific direction
Molluscs	Rayed bean <i>Villosa fabalis</i>	END	No	No species-specific direction
Molluscs	Round hickorynut <i>Obovaria subrotunda</i>	END	No	No species-specific direction
Molluscs	Round pigtoe <i>Pleurobema sintoxia</i>	END	No	No species-specific direction
Molluscs	Salamander mussel <i>Simpsonaias ambigua</i>	END	No	No species-specific direction
Molluscs	Shagreen <i>Inflectarius inflectus</i>	END	No	No species-specific direction
Molluscs	Snuffbox <i>Epioblasma triquetra</i>	END	No	No species-specific direction
Molluscs	Striped whitelip <i>Webbhelix multilineata</i>	END	No	No species-specific direction
Molluscs	Toothed globe <i>Mesodon zaletus</i>	END	No	No species-specific direction
Molluscs	Carolina mantleslug <i>Philomycus carolinianus</i>	THR	No	No species-specific direction
Molluscs	Lilliput <i>Toxolasma parvum</i>	THR	No	No species-specific direction
Molluscs	Purple wartyback <i>Cyclonaias tuberculata</i>	THR	No	No species-specific direction
Molluscs	Threehorn wartyback <i>Obliquaria reflexa</i>	THR	No	No species-specific direction
Molluscs	Wavy-rayed lampmussel <i>Lampsilis fasciola</i>	THR	No	No species-specific direction
Molluscs	Eastern pondmussel <i>Ligumia nasuta</i>	SC	No	No species-specific direction
Molluscs	Mapleleaf <i>Quadrula quadrula</i>	SC	No	No species-specific direction
Molluscs	Rainbow <i>Villosa iris</i>	SC	Yes – Moira and Salmon Rivers (Mazinaw-Lanark FMU)	Section 4.1 provide direction to address aquatic ecosystems and shoreline forest.
Insects	Bogbean buckmoth <i>Hemileuca</i> sp.	END	Yes – Ottawa Valley FMU	Wetland plants and insect direction in Section 4.3.1
Insects	False-foxglove Sun Moth	END	No	No species-specific direction

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	<i>Pyrrhia aurantiago</i>			
Insects	Gypsy cuckoo bumble bee <i>Bombus bohemicus</i>	END	Yes	Has not been observed in Ontario in the last 20 years. Planning teams can develop direction as per the FMPM if necessary.
Insects	Hine's emerald <i>Somatochlora hineana</i>	END	No	No species-specific direction
Insects	Hoptree borer <i>Prays atomocella</i>	END	No	No species-specific direction
Insects	Hungerford's crawling water beetle <i>Brychius hungerfordi</i>	END	No	No species-specific direction
Insects	Laura's clubtail <i>Stylurus laurae</i>	END	No	No species-specific direction
Insects	Mottled duskywing <i>Erynnis martialis</i>	END	No	No species-specific direction
Insects	Nine-spotted lady beetle <i>Coccinella novemnotata</i>	END	Yes – no records of this species since the mid-1990's	Has not been observed in Ontario since the mid-1990's. Planning teams can develop direction as per the FMPM if necessary.
Insects	Northern barrens tiger beetle <i>Cicindela patruela</i>	END	No	No species-specific direction
Insects	Pygmy snaketail <i>Ophiogomphus howei</i>	END	Yes	There is only one record from Ontario in northwestern Ontario (Namakan River) 2007. Planning teams can develop direction as per the FMPM if necessary.
Insects	Riverine clubtail <i>Stylurus amnicola</i>	END	Yes	Planning teams can develop direction as per the FMPM if necessary.
Insects	Rusty-patched bumble bee <i>Bombus affinis</i>	END	Yes	Has not been observed in the managed forest in over 20 years. Planning teams can develop direction as per the FMPM if necessary.
Insects	Suckley's cuckoo bumble bee <i>Bombus suckleyi</i>	END	Yes	BMP for bumble bee species in Section 4.3.4
Insects	Transverse lady beetle <i>Coccinella transversoguttata</i>	END	No	No species-specific direction
Insects	Lake Huron grasshopper <i>Trimerotropis huroniana</i>	THR	Yes – occurs in 8 locations in Ontario including Pancake Bay on Lake Superior, island in Lake Huron, and Manitoulin	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest. Planning teams can develop direction as per the FMPM if necessary.

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			Island along Lake Huron shores.	
Insects	Northern oak hairstreak <i>Satyrrium favonius ontario</i>	THR	No	No species-specific direction
Insects	Rapids clubtail <i>Gomphus quadricolor</i>	THR	Yes – Mississippi River in eastern Ontario	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest. Planning teams can develop direction as per the FMPM if necessary.
Insects	Reversed haploa moth <i>Haploa reversa</i>	THR	No	No species-specific direction
Insects	Skillet clubtail <i>Gomphurus ventricosus</i>	THR	No	No species-specific direction
Insects	American bumble bee <i>Bombus pensylvanicus</i>	SC	Yes	BMP for bumble bee species in Section 4.3.4
Insects	Dukes' skipper <i>Euphyes dukesi</i>	SC	No	No species-specific direction
Insects	Monarch <i>Danaus plexippus</i>	SC	Yes – across the managed forest	BMP for bumble bee species and monarch in Section 4.3.4
Insects	Red-tailed leafhopper <i>Aflexia rubranura</i>	SC	No	No species-specific direction
Insects	West Virginia white <i>Pieris virginiensis</i>	SC	Yes – southern part of managed forest, Algoma to Ottawa Valley FMUs	Section 4.3.4 provides direction for West Virginia white.
Insects	Yellow-banded bumble bee <i>Bombus terricola</i>	SC	Yes	BMP for bumble bee species in Section 4.3.4
Fishes	American eel <i>Anguilla rostrata</i>	END	Yes – Bancroft-Minden, Mazinaw Lanark, and Ottawa Valley FMUs	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Fishes	Eastern sand darter (West Lake population) <i>Ammocrypta pellucida</i>	END	No	No species-specific direction
Fishes	Lake chubsucker <i>Erimyzon sucetta</i>	END	No	No species-specific direction
Fishes	Lake sturgeon (Great Lakes – Upper St. Lawrence populations) <i>Acipenser fulvescens</i>	END	Yes	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Fishes	Northern madtom <i>Noturus stigmosus</i>	END	No	No species-specific direction

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Fishes	Redside dace <i>Clinostomus elongatus</i>	END	Yes – 1 tributary of Lake Huron in Algoma FMU	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Fishes	River Darter (Great Lakes - Upper St. Lawrence populations) <i>Percina shumardi</i>	END	No	No species-specific direction
Fishes	Shortnose cisco <i>Coregonus reighardi</i>	END	Yes- may still exist in Lake Huron and Georgian Bay	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Fishes	Spotted gar <i>Lepisosteus oculatus</i>	END	No	No species-specific direction
Fishes	Warmouth <i>Lepomis gulosus</i>	END	No	No species-specific direction
Fishes	Lake sturgeon (Saskatchewan - Nelson River populations) <i>Acipenser fulvescens</i>	THR	No	No species-specific direction
Fishes	Lake whitefish (Opeongo Lake large-bodied populations) <i>Coregonus clupeaformis</i>	THR	Yes	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Fishes	Lake Whitefish (Opeongo Lake small-bodied populations) <i>Coregonus clupeaformis</i>	THR	Yes	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Fishes	Pugnose minnow <i>Opsopoeodus emiliae</i>	THR	No	No species-specific direction
Fishes	Pugnose shiner <i>Notropis anogenus</i>	THR	No	No species-specific direction
Fishes	Shortjaw cisco <i>Coregonus zenithicus</i>	THR	Yes Great Lakes, Lake of the Woods, Big Trout Lake, Lac Seul, Lake Nipigon, and 8 other lakes in northwestern Ontario or Algonquin Park.	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Fishes	Silver chub <i>Macrhybopsis storeriana</i>	THR	No	No species-specific direction
Fishes	Silver shiner <i>Notropis photogenis</i>	THR	No	No species-specific direction
Fishes	Blackstripe topminnow <i>Fundulus notatus</i>	SC	No	No species-specific direction
Fishes	Bridle shiner	SC	No	No species-specific direction

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	<i>Notropis bifrenatus</i>			
Fishes	Channel darter <i>Percina copelandi</i>	SC	Yes - southern edge of managed forest (Bancroft-Minden FMU).	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Fishes	Grass pickerel <i>Esox americanus vermiculatus</i>	SC	No	No species-specific direction
Fishes	Lake sturgeon (Southern Hudson Bay - James Bay populations) <i>Acipenser fulvescens</i>	SC	No	No species-specific direction
Fishes	Northern brook lamprey <i>Ichthyomyzon fossor</i>	SC	Yes – FMUs with streams flowing into Lake Superior, Lake Huron, and Georgian Bay.	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Fishes	Northern sunfish (Great Lakes - Upper St. Lawrence populations) <i>Lepomis peltastes</i>	SC	No	No species-specific direction
Fishes	River redhorse <i>Moxostoma carinatum</i>	SC	Yes – Ottawa River	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Fishes	Silver Lamprey (Great Lakes - Upper St. Lawrence River population) <i>Ichthyomyzon unicuspis</i>	SC	Yes – upper Mississippi River (Ottawa Valley FMU)	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Fishes	Spotted sucker <i>Minytrema melanops</i>	SC	No	No species-specific direction
Fishes	Upper Great Lakes kiyi <i>Coregonus kiyi kiyi</i>	SC	Yes – Lake Superior	Section 4.1 provides direction to address aquatic ecosystems and shoreline forest.
Amphibians	Alleghany mountain dusky salamander <i>Desmognathus ochrophaeus</i>	END	No	No species-specific direction
Amphibians	Fowler's toad <i>Bufo fowler</i>	END	No	No species-specific direction
Amphibians	Jefferson salamander <i>Ambystoma jeffersonianum</i>	END	No	No species-specific direction
Amphibians	Northern dusky salamander <i>Desmognathus fuscus</i>	END	No	No species-specific direction
Amphibians	Small-mouthed salamander	END	No	No species-specific direction

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	<i>Ambystoma texanum</i>			
Amphibians	Unisexual ambystoma (Jefferson Salamander dependent population) <i>Ambystoma laterale</i> – (2) <i>jeffersonianum</i>	END	No	No species-specific direction
Amphibians	Unisexual ambystoma (Small-mouthed Salamander dependent population) <i>Ambystoma laterale</i> – <i>texanum</i>	END	No	No species-specific direction
Reptiles	Blue racer <i>Coluber constrictor foxii</i>	END	No	No species-specific direction
Reptiles	Butler's gartersnake <i>Thamnophis butleri</i>	END	No	No species-specific direction
Reptiles	Common five-lined skink (Carolinian population) <i>Plestiodon fasciatus</i>	END	No	No species-specific direction
Reptiles	Gray ratsnake (Carolinian population) <i>Pantherophis spiloides</i>	END	No	No species-specific direction
Reptiles	Massasauga (Carolinian population) <i>Sistrurus catenatus</i>	END	No	No species-specific direction
Reptiles	Queen snake <i>Regina septemvittata</i>	END	No	No species-specific direction
Reptiles	Spiny softshell <i>Apalone spinifera</i>	END	Yes – Ottawa Valley FMU adjacent to Ottawa River.	Limited occurrences in the managed forest. Planning teams can develop direction as per the FMPM if necessary.
Reptiles	Spotted turtle <i>Clemmys guttata</i>	END	Yes	Section 4.3.6.2 provides direction for nesting sites and hibernation, foraging, thermoregulation, and movement habitat
Reptiles	Wood turtle <i>Glyptemys insculpta</i>	END	Yes	Section 4.3.6.2 provides direction for nesting sites and hibernation, foraging, thermoregulation, and movement habitat
Reptiles	Blanding's turtle <i>Emydoidea blandingii</i>	THR	Yes	Section 4.3.6.2 provides direction for nesting sites and hibernation, foraging, thermoregulation, and movement habitat
Reptiles	Eastern foxsnake (Carolinian population) <i>Pantherophis vulpinus</i>	THR	No	No species-specific direction
Reptiles	Eastern foxsnake (Great Lakes / St. Lawrence population) <i>Pantherophis vulpinus</i>	THR	Yes	Section 4.3.6.1 provides direction for nesting sites, gestation/oviposition sites, and

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				communal shedding or basking sites
Reptiles	Eastern hog-nosed snake <i>Heterodon platirhinos</i>	THR	Yes	Section 4.3.6.1 provides direction for hibernation sites and nesting sites, gestation/oviposition sites, and communal shedding or basking sites.
Reptiles	Gray ratsnake (Frontenac Axis population) <i>Pantherophis spiloides</i>	THR	Yes	Section 4.3.6.1 provides direction for hibernation sites and nesting sites, gestation/oviposition sites, and communal shedding or basking sites.
Reptiles	Massasauga (Great Lakes - St. Lawrence population) <i>Sistrurus catenatus</i>	THR	Yes	Section 4.3.6.1 provides direction for hibernation sites and nesting sites, gestation/oviposition sites, and communal shedding or basking sites.
Reptiles	Common five-lined skink (Southern Shield population)	SC	Yes	Section 4.3.6.3 provides direction for nesting sites.
Reptiles	Eastern musk turtle <i>Sternotherus odoratus</i>	SC	Yes	Section 4.3.6.2 provides direction for nesting sites and hibernation sites.
Reptiles	Eastern ribbonsnake <i>Thamnophis sauritus</i>	SC	Yes	Section 4.3.6.1 provides direction for hibernation sites.
Reptiles	Lake Erie water snake <i>Nerodia sipedon insularum</i>	SC	No	No species-specific direction
Reptiles	Northern map turtle <i>Graptemys geographica</i>	SC	Yes	Section 4.3.6.2 provides direction for nesting sites and hibernation sites.
Reptiles	Snapping turtle <i>Chelydra serpentina</i>	SC	Yes	Section 4.3.6.2 provides direction for nesting sites and hibernation sites.
Birds	Acadian flycatcher <i>Empidonax virescens</i>	END	No	No species-specific direction
Birds	Barn owl <i>Tyto alba</i>	END	No	No species-specific direction
Birds	Golden eagle <i>Aquila chrysaetos</i>	END	No (winter resident but no confirmed breeding in the managed forest)	No species-specific direction
Birds	Henslow's sparrow <i>Ammodramus henslowii</i>	END	No	No species-specific direction
Birds	King rail <i>Rallus elegans</i>	END	No	No species-specific direction
Birds	Kirtland's warbler <i>Setophaga kirtlandii</i>	END	Yes	Section 4.3.7 provides direction for breeding habitat.

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Birds	Loggerhead shrike <i>Lanius ludovicianus</i>	END	Yes – southern part of managed forest – Mazinaw-Lanark FMU	Species of pasture and grassland with scattered trees and shrubs. No species-specific direction. Planning teams can develop direction as per the FMPM if necessary.
Birds	Northern bobwhite <i>Colinus virginianus</i>	END	No	No species-specific direction
Birds	Piping plover <i>Charadrius melodus</i>	END	Yes – Lake of the Woods area.	Shorebird restricted to beaches. No species-specific direction.
Birds	Prothonotary warbler <i>Protonotaria citrea</i>	END	No	No species-specific direction
Birds	Red-headed woodpecker <i>Melanerpes erythrocephalus</i>	END	Yes	Section 4.3.7 provides direction for breeding habitat.
Birds	Red knot — <i>rufa</i> subspecies (Southeastern USA / Gulf of Mexico / Caribbean wintering population) <i>Calidris canutus rufa</i>	END	No	No species-specific direction
Birds	Red knot — <i>rufa</i> subspecies (Tierra del Fuego / Patagonia wintering population) <i>Calidris canutus rufa</i>	END	No	No species-specific direction
Birds	Yellow-breasted chat <i>Icteria virens</i>	END	No	No species-specific direction
Birds	American white pelican <i>Pelecanus erythrorhynchos</i>	THR	Yes - Rainy Lake, Lake of the Woods, Lake Nipigon, Lake Nipissing.	Nests on islands in large lakes. No species-specific direction.
Birds	Bank swallow <i>Riparia riparia</i>	THR	Yes	Section 4.3.7 provides direction for habitat containing burrows.
Birds	Bobolink <i>Dolichonyx oryzivorus</i>	THR	Yes	Nests on the ground in dense grasses, open meadows and hayfields. No species-specific direction. Planning teams can develop direction as per the FMPM if necessary.
Birds	Cerulean warbler <i>Setophaga cerulea</i>	THR	Yes	Section 4.3.7 provides direction for breeding habitat.
Birds	Chimney swift <i>Chaetura pelagica</i>	THR	Yes	Section 4.3.7 provides direction for nest/roost sites.
Birds	Eastern meadowlark <i>Sturnella magna</i>	THR	Yes	Breeds primarily in tall grasslands, such as pastures and hayfields, but also roadsides, shrubby overgrown fields or other open areas. No

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				species-specific direction. Planning teams can develop direction as per the FMPM if necessary.
Birds	Eastern whip-poor-will <i>Antrostomus vociferus</i>	THR	Yes	Section 4.3.7 provides direction for breeding habitat.
Birds	Hudsonian godwit <i>Limosa haemastica</i>	THR	No	No species-specific direction
Birds	Least bittern <i>Ixobrychus exilis</i>	THR	Yes	Section 4.3.7 provides direction for breeding habitat.
Birds	Lesser yellowlegs <i>Tringa flavipes</i>	THR	Yes	A shorebird breeding mainly in boreal wetlands. Section 4.1 provides direction for wetland ecosystems and shoreline forest. Planning teams can develop direction as per the FMPM if necessary.
Birds	Louisiana waterthrush <i>Parkesia motacilla</i>	THR	Yes	Section 4.3.7 provides direction for breeding habitat.
Birds	Short-eared owl <i>Asio flammeus</i>	THR	Yes	Section 4.2.2.7 provides direction for nest sites.
Birds	Barn swallow <i>Hirundo rustica</i>	SC	Yes	Section 4.3.7 provides direction for nest sites.
Birds	Black tern <i>Chlidonias niger</i>	SC	Yes	Section 4.2.2.3 provides direction for colonies.
Birds	Canada warbler <i>Cardellina canadensis</i>	SC	Yes	Breeding habitat generally addressed by coarse filter direction e.g., Section 3.2. Planning teams can develop direction as per the FMPM if necessary.
Birds	Common nighthawk <i>Chordeiles minor</i>	SC	Yes	Habitat consists of open areas with little to no ground vegetation. No species-specific direction. Planning teams can develop direction as per the FMPM if necessary.
Birds	Eastern wood-pewee <i>Contopus virens</i>	SC	Yes	Breeding habitat generally addressed by coarse filter direction e.g., Section 3.2. Planning teams can develop direction as per the FMPM if necessary.
Birds	Evening grosbeak <i>Coccothraustes vespertinus</i>	SC	Yes	Breeding habitat generally addressed by coarse filter direction e.g., Section 3.2. Planning teams can develop direction as per the FMPM if necessary.
Birds	Golden-winged warbler <i>Vermivora chrysoptera</i>	SC	Yes	Section 4.3.7 provides direction for breeding habitat.
Birds	Grasshopper sparrow <i>Ammodramus savannarum</i>	SC	No	No species-specific direction
Birds	Horned grebe	SC	No	No species-specific direction

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	<i>Podiceps auritus</i>			
Birds	Olive-sided flycatcher <i>Contopus cooperi</i>	SC	Yes	Most often found along forest edges and openings. Breeding habitat usually consists of coniferous or mixed forest adjacent to rivers or wetlands. Section 4.1 provides direction for wetland ecosystems and shoreline forest. No species-specific direction.
Birds	Peregrine falcon <i>Falco peregrinus</i>	SC	Yes	Section 4.2.2.1 provides direction for nest sites.
Birds	Red knot — <i>rufa</i> subspecies (Northeastern South America wintering population) <i>Calidris canutus rufa</i>	SC	No	No species-specific direction
Birds	Red-necked phalarope <i>Phalaropus lobatus</i>	SC	No	No species-specific direction
Birds	Rusty blackbird <i>Euphagus carolinus</i>	SC	Yes	Lives in habitats dominated by coniferous forest with wetlands nearby. Section 4.1 provides direction for wetland ecosystems and shoreline forest. No species-specific direction.
Birds	Wood thrush <i>Hylocichla mustelina</i>	SC	Yes	Lives in mature deciduous and mixed forests. They build their nests in living saplings, trees or shrubs. Section 3.0 provides direction that will provide suitable habitat conditions. No species-specific direction.
Birds	Yellow rail <i>Coturnicops noveboracensis</i>	SC	Yes	Section 4.3.7 provides direction for breeding habitat.
Mammals	American badger (Northwestern Ontario population) <i>Taxidea taxus taxus</i>	END	Yes	Found in habitats such as tall grass prairie, sand barrens and farmland. No species-specific direction. Planning teams can develop direction as per the FMPPM if necessary.
Mammals	American badger (Southwestern Ontario population) <i>Taxidea taxus jacksoni</i>	END	No	No species-specific direction
Mammals	Eastern small-footed myotis <i>Myotis leibii</i>	END	Yes	Section 4.3.8 provides specific direction for bat hibernation sites. Section 3.2 provides direction for wildlife trees that will provide maternity roost habitat for bat species.
Mammals	Little brown myotis <i>Myotis lucifugus</i>	END	Yes	Section 4.3.8 provides specific direction for bat hibernation

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				sites. Section 3.2 provides direction for wildlife trees that will provide maternity roost habitat for bat species.
Mammals	Northern myotis <i>Myotis septentrionalis</i>	END	Yes	Section 4.3.8 provides specific direction for bat hibernation sites. Section 3.2 provides direction for wildlife trees that will provide maternity roost habitat for bat species.
Mammals	Tri-colored bat <i>Perimyotis subflavus</i>	END	Yes	Section 4.3.8 provides specific direction for bat hibernation sites. Section 3.2 provides direction for wildlife trees that will provide maternity roost habitat for bat species.
Mammals	Eastern red bat <i>Lasiurus borealis</i>	END	Yes	Section 4.3.8 provides specific direction for bat hibernation sites. Section 3.2 provides direction for wildlife trees that will provide maternity roost habitat for bat species.
Mammals	Hoary bat <i>Lasiurus cinereus</i>	END	Yes	Section 4.3.8 provides specific direction for bat hibernation sites. Section 3.2 provides direction for wildlife trees that will provide maternity roost habitat for bat species.
Mammals	Silver-haired bat <i>Lasionycteris noctivagans</i>	END	Yes	Section 4.3.8 provides specific direction for bat hibernation sites. Section 3.2 provides direction for wildlife trees that will provide maternity roost habitat for bat species.
Mammals	Caribou (Boreal population) <i>Rangifer tarandus</i>	THR	Yes – FMUs across northern portion of the boreal forest from Cochrane to Red Lake.	Species-specific direction found in the Boreal Landscapes Guide.
Mammals	Eastern wolf <i>Canis sp. cf. lycaon</i>	THR	Yes	Section 4.3.8 provides direction for den sites and for traditional rendezvous sites.
Mammals	Gray fox <i>Urocyon cinereoargenteus</i>	THR	Yes	Section 4.3.8 provides direction for den sites.
Mammals	Polar bear <i>Ursus maritimus</i>	THR	No	No species-specific direction
Mammals	Wolverine <i>Gulo gulo</i>	THR	Yes	Section 4.3.8 provides direction for developing a den site and foraging area plan.
Mammals	Caribou (Eastern Migratory population)	SC	Yes	Species-specific direction found in the Boreal Landscapes Guide

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	<i>Rangifer tarandus</i>			
Mammals	Cougar <i>Puma concolor</i>	SC	Yes	Section 4.3.8 provides direction for den sites.
Mammals	Eastern mole <i>Scalopus aquaticus</i>	SC	No	No species-specific direction
Mammals	Woodland vole <i>Microtus pinetorum</i>	SC	No	No species-specific direction

(C&R) 4.3.1 Non-woody plants

Preamble/Direction

Revised guide status and rationale:

Content revised.

The revisions to the American ginseng direction address concerns raised about the size of delineated patches where plants within 40 m of each other were included in the same patch. Revisions are also based on a review of relevant literature regarding the distance to edge influence. The revised direction continues to maintain canopy cover, minimize disturbance to the forest floor and minimize access for collectors.

Direction for the following species has been removed from the revised guide:

- Small-flowered lipocarpa and lowland toothcup are a couple of listed species that occur along lake shorelines. Principal threats to small-flowered lipocarpa and lowland toothcup include shoreline development and alteration and recreational use of shorelines. Forest management practices likely have few negative effects on habitat suitability, except where road construction or movement of heavy equipment in shoreline areas might alter habitat (e.g., roads crossing beaver ponds). Other sections in this guide (e.g., Section 4.1) provide direction to minimize adverse effects on these plants.
- Direction for remnant patches of natural grasslands has been removed. Although they may also provide habitat for eastern prairie fringed-orchid and small white lady's-slipper orchid. The supply of natural grassland habitats is much reduced from the period prior to European settlement, and accounts for a very small percentage of the managed forest. Small remnant patches remain scattered across the southern portion of northwestern Ontario and in a few isolated locations along the edge of the managed forest in southern Ontario. The natural grassland areas are not generally impacted by forest management activities.
- Broad beech fern is an at risk plant that inhabits rich, moist areas in relatively undisturbed mature tolerant hardwood forest in the southern portions of the Great Lakes-St. Lawrence forest. Broad beech fern appears to be very sensitive to canopy opening and disturbance of the forest floor. This species has limited range within the

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managed forest and most documented occurrences are historical. There has been a lack of recent observations. This direction has been removed.

- Ogden's pondweed potentially occurs in slow-moving streams, beaver ponds, and alkaline lakes along the southern edge of the managed forest. Primary threats are habitat destruction (especially loss of beaver ponds) and competition from invasive plants. Forest management activities are unlikely to affect this species, except possibly where construction of roads or water crossings might alter the hydrological regime of occupied habitat. Other sections in this guide provide direction to minimize adverse effects on Ogden's pondweed.

i) American ginseng large patches

Description of value

Revised guide status and rationale:

Description revised.

The AOC is comprised of a patch of ≥ 30 American ginseng plants and the area within 100 m from the patch boundary. The delineated patch is a reserve and includes individual American ginseng plants separated by ≤ 10 m. The area within 0-10 m of the patch boundary is MMZ1, the area within 11-60 m of the patch boundary is MMZ2, and the area within 61-100 m of the patch boundary is MMZ3.

30 plants represent the extinction threshold (minimum number of plants needed to rebuild a population) for American ginseng in southern Quebec, as reported by Nantel et al (1996). Nantel et al (1996) and Nault et al (1998) found that the minimum viable population size for American ginseng in Quebec and Ontario is ~172 plants.

MMZ1 (0-10 m) captures any individual plants on the outer edge of the patch that may not have been detected during delineation (e.g., due to drought or delineation or marking outside the growing season), provides protection for those plants at the edge of the delineated patch, and considers GPS accuracy when delineating the patch.

MMZ2 (11-60 m) addresses the maximum distance of edge influence and maintains a suitable forest interior microhabitat for the existing patch and for the potential expansion of large patches. The 30 m closest to the patch boundary captures a large portion of the potential extent of long-distance seed dispersal. The spatial arrangement of American ginseng is typically clumped and suggests that most seeds are dispersed by gravity (McGraw et al 2013) and over short distances (Lewis and Zenger 1982). In a demography study in central Appalachia, Van der Voort (2005) found that 90% of seeds remained within 2 m of parent plants after gravity dispersal. However, long distance dispersal of seeds by mammals (e.g., deer, rodents) and birds (e.g., thrushes) has also been reported (McGraw et al 2013, Furedi and McGraw 2004). Thrushes are believed to be the primary disperser of ginseng seed while rodents and deer are most often seed

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predators (Furedi and McGraw 2004, Hruska 2014). However, rodents may cache seeds a short distance from parent plants without consuming them (Van der Voort 2005). Modeling of seed dispersal by thrushes indicates that most regurgitation of ginseng seed by thrushes will occur in a 15–37-minute time frame (Hruska et al 2014) and the area within 30 m of a patch included approximately 85% of -dispersed seeds (Elza et al 2016).

American ginseng is a shade-tolerant plant that typically inhabits forest interior (Nault et al 1998). Published studies on the distance of edge influence (DEI) on forest vegetation have been conducted in temperate deciduous forests in eastern North America. Burke and Nol (1998) and Wicklein et al (2012) have suggested that the mean distance of edge influence (DEI) is 20 m beyond which tree sizes, cover of alien species, plant composition and richness, and microclimate were similar to that found in the interior forest. Additionally, results from a compilation of 44 published studies on edge influence on forest structure and composition conducted by Harper et al (2005) indicate a mean and maximum DEI of ~25 m and ~40 m respectively for regenerating edges. In a similar, more recent global review of 446 studies, Franklin et al (2021) reported a mean and maximum DEI of ~42 m and ~180 m respectively for anthropogenic (e.g., forest harvest) induced edges in temperate forests. A filtering exercise to specifically investigate studies conducted in temperate deciduous forests in eastern North American indicated that mean DEI on vegetation was ~23 m with an upper 95% confidence interval of ~28 m. Thus, based on the science, 30 m will address the sensitivity to edge effects of American ginseng and the distance of edge influence in the habitat types for which it grows in Ontario. The 60 m distance serves to maintain the biophysical forest conditions necessary to support the complete life cycle of ginseng, including seed germination, juvenile and adult plant growth, reproduction (Chandler and McGraw 2015), seed dispersal (Hruska et al 2014, Elza et al 2016), and potential patch expansion.

MMZ3 (61-100 m) addresses the potential need to minimize access for collectors. There are no canopy closure retention requirements in MMZ3 (other than to meet the wildlife tree (Section 3.2.3.1) and residual (Section 3.2.2.1) requirements.) for any planned harvest operations.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within the delineated ginseng patch.
Trees will not be felled into the patch. Trees accidentally felled into the patch will be left where they fall.
Can reach into MMZ1 from outside and remove trees, felling them away from the patch with the following conditions: • No machine travel or cable skidding within MMZ1

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• Single tree selection only • Maintain 70% (dominant and co-dominant trees) uniform canopy cover within MMZ1.
Harvest, renewal, and tending operations within MMZ2 are subject to the following conditions: • Harvest, renewal and tending operations will be conducted in a manner that minimizes site disturbance. Operations within MMZ2 will not: ○ Exceed 2% coverage of ruts ○ Exceed 10% coverage of extraction trails ○ Leave ruts or a significant area of exposed mineral soil. Ruts and significant areas of exposed mineral soil will be promptly rehabilitated without adversely affecting ginseng plant habitat suitability ○ Mechanical site preparation is not permitted within MMZ2. • Only hand-based application of herbicides is permitted in MMZ2 following ginseng senescence.
Markings associated with the delineation of both large and small patches of American ginseng plants that might attract collectors will be removed or hidden upon completion of operations.
Harvest, renewal, and tending operations within MMZ2 are subject to the following conditions: • Harvest that retains a relatively uniform canopy cover of $\geq 70\%$ (dominant and co-dominant trees) is permitted within MMZ2. Harvest will normally be restricted to single tree selection. • Harvest operations will be conducted during the winter, unless with Ministry approval

Revised guide status and rationale:

Restriction of machine travel within MMZ1 provides protection for those plants at the edge of the delineated patch but does allow for controlled opening of the canopy that may benefit ginseng.

Forest harvesting within the AOC is limited to the winter season when the ground is adequately frozen during plant dormancy to eliminate direct crushing of the above-ground portions of plants that may be growing in MMZ2 and were undetected, and to minimize damage to plant roots.

Conditions on harvest, renewal, and tending in MMZ2 have not changed.

There are no conditions on harvest, renewal and tending in MMZ3.

Despite bans on harvest, possession, and export of wild American ginseng from Ontario, COSEWIC (Environment Canada 2018) suggests that more than 50% of surveyed populations in Ontario show signs of illegal harvest. Removal of any markings

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would reduce the chance that collectors may locate a patch and is intended to address the principal threat to the species which is illegal harvesting. Illegal harvesting is detrimental to the species through reduced abundance, reproductive potential, genetic diversity and viability (COSEWIC 2000).

New primary roads and associated landings are not permitted within MMZ1.
No new landings within MMZ2.
Forestry-related traffic and maintenance of existing roads are permitted within the AOC subject to the following conditions: The footprint of the road will not be increased
New primary roads are not permitted within MMZ2 or MMZ3, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process subject to the following condition: New primary roads are only permitted within MMZ2 or MMZ3 when constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 20 m to result in less impact on American ginseng or its habitat.
Forestry-related traffic and maintenance of existing [primary, branch, operational] roads are permitted within the AOC subject to the following condition: Road maintenance is restricted to surface grading or other low risk road maintenance operations necessary to maintain safe travel conditions.
When there are no practical or feasible alternatives, old landings [primary, branch, operational roads] in MMZ2 may be reused subject to the following conditions: - The footprint of the landing will not be increased - Gaps associated with landings will be included in the estimation of canopy closure.
Re-use of old landings is permitted in MMZ3.
In the absence of reusable landings [primary, branch, operational roads] in the AOC, wood may be piled and processed on the road right-of-way (if consistent with Ministry conditions on corridor width and worker and public safety considerations).
New branch and operational roads are permitted in MMZ2 or MMZ3 with Ministry approval subject to the following conditions: - Canopy gaps associated with new roads will be included in the estimation of the canopy closure in MMZ2 (see above) - Construct new roads on an existing roadbed (where the vegetation is predominantly <8 m tall) to result in less impact on ginseng or its habitat - Construct winter roads unless there is no practical or feasible alternative

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• Roads will be constructed to minimum standards to mitigate potential impact on ginseng habitat and potential illegal collection (e.g., right-of-way <10m, no grubbing, no disruption of hydrological flow, no ditching, locate road as far from ginseng patch as possible). • New roads will be promptly decommissioned upon completion of operations unless with Ministry approval
Construction of new landings and reuse of old landings are permitted within MMZ3.
New forestry aggregate pits and wood storage yards are not permitted within MMZ1 or MMZ2.
New forestry aggregate pits and wood storage yards are permitted within MMZ3, with Ministry approval and under the following condition: • Cannot be located within suitable habitat (normally includes mature or older deciduous or mixed forest with <50% of the overstory basal area comprised of tolerant or mid-tolerant hardwoods).
Existing forestry aggregate pits and wood storage yards within MMZ2 or MMZ3 may be reused as long as the footprint of the forestry aggregate pit or wood storage yard will not be increased.

Revised guide status and rationale:

Conditions on branch and operational roads and landings are more flexible in MMZ3.

One of the greatest threats to American ginseng in Ontario is the illegal harvesting of roots by collectors (Van der Voort and McGraw 2006, McGraw et al. 2010, Nault and Tanguay 2011, McGraw et al 2013). Forest access roads may facilitate improved access to ginseng patches by root collectors (Environment Canada 2018).

The use of existing roads for purposes of forestry is likely to have a negligible impact on the species in question if traffic levels are low and clean equipment protocols are followed. Road maintenance activity (gravel, grading, etc.) should have minimal impacts on ginseng.

It is assumed that older roadbeds and landings dominated by raspberries, other shrubs, and saplings < 8 m tall will normally not be providing suitable conditions (e.g., light, microclimate, and soil compaction) for establishment of ginseng, and that removal will have little influence on the amount of edge effect associated with the road or landing.

Additional roads, landings or forestry aggregate pits within MMZ2 could impact dormant plants or potential habitat for patch expansion. Soil compaction associated with roads and landings could also impact the hydrology of the site.

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Landings may create canopy openings that could result in edge creation/light penetration, within 60 m of a patch (Harper et al 2005, Franklin et al 2021). Although gaps associated with landings are included in the estimation of canopy closure, they may impact the amount of harvest that could occur while still meeting the minimum post-harvest canopy closure target of 70%. Use of existing landings for purposes of forestry are likely to have a negligible impact on the species as it would not result in increased canopy opening.

Restrictions on constructing roads to minimum standards within the AOC would minimize edge creation/light penetration that may negatively impact the patch (Harper et al 2005, Franklin et al 2021). Constructing winter roads minimizes the probability that the roads will provide improved access to ginseng patches or be used for illegal root harvest.

Aggregate pits may create canopy openings that could result in edge creation/light penetration, within 60 m of a patch (Harper et al. 2005, Franklin et al 2021). Construction and operation of a forestry aggregate pit could modify site drainage and hydrology. Continued operation of a forestry aggregate pit (and thus continued use and associated maintenance of the road to access the pit) in the vicinity of a ginseng patch may facilitate improved access to patches for illegal root harvest.

Best management practices: Retained, revised, or new

Follow the *Clean Equipment Protocol for Industry* (Halloran et al 2013) when moving equipment from areas where an invasive plant species is known to occur to minimize the risk of transporting and introducing the species to harvest areas adjacent to known American ginseng patches.

Revised guide status and rationale:

Following the clean equipment protocol will reduce the risk of introducing invasive species that may be detrimental to ginseng plants/patches by outcompeting them for growing space and resources.

ii) American ginseng small patches

Description of value

Revised guide status and rationale:

Description revised.

The AOC is comprised of a patch of <30 American ginseng plants and the area within 30 m from the patch boundary. The delineated patch is a reserve and includes individual American ginseng plants separated by ≤ 10 m. The area within 0-10 m of the patch boundary is MMZ1, the area within 11-30 m of the patch boundary is MMZ2.

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30 plants represent the extinction threshold (minimum number of plants needed to rebuild a population) for American ginseng in southern Quebec as reported by Nantel et al (1996). Nantel et al (1996) and Nault et al (1998) found that the minimum viable population size for American ginseng in Quebec and Ontario is ~172 plants. However, this does not imply that smaller populations are going to disappear, but instead indicates that smaller populations are likely too small to support any harvesting (Nantel et al 1996, Nault 1998). Furthermore, small and isolated populations contribute to the overall conservation of the species' genetic pool (Nault 1998). Providing protection to existing local seed sources (i.e., populations) is necessary for potential future reintroductions of the species to other areas.

Standards and guidelines: Retained, revised, or new

Trees will not be felled into the patch. Trees accidentally felled into the patch will be left where they fall.
Can reach into MMZ1 from outside and remove trees, felling them away from the patch with the following conditions: • No machine travel or cable skidding within MMZ1 • Single tree selection only • Maintain 70% (dominant and co-dominant trees) uniform canopy cover within MMZ1.
Harvest, renewal, and tending operations within MMZ2 are subject to the following conditions: • Harvest, renewal and tending operations will be conducted in a manner that minimizes site disturbance. Operations within MMZ2 will not: ○ Exceed 2% coverage of ruts ○ Exceed 10% coverage of extraction trails ○ Leave ruts or a significant area of exposed mineral soil. Ruts and significant areas of exposed mineral soil will be promptly rehabilitated without adversely affecting ginseng plant habitat suitability ○ Mechanical site preparation is not permitted. • Only hand-based application of herbicides is permitted following ginseng senescence.
Markings associated with the delineation of both large and small patches of American ginseng plants that might attract collectors will be removed or hidden upon completion of operations.
Harvest, renewal, and tending operations within MMZ2 are subject to the following conditions: • Harvest that retains a relatively uniform canopy cover of $\geq 70\%$ (dominant and co-dominant trees) is permitted within MMZ2. Harvest will normally be restricted to single tree selection • Harvest operations will be conducted during the winter, unless with Ministry approval

Revised guide status and rationale:

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Direction revised.

Small patches of American ginseng, <30 plants, are assumed to be less likely to persist and expand than are large patches (Nault et al 1998).

See rationale for large patches above for MMZ1 and MMZ2. Thirty metres addresses sensitivity to edge effects of American ginseng and the distance of edge influence in the habitat types for which it grows in Ontario.

Despite bans on harvest, possession, and export of wild American ginseng from Ontario, COSEWIC (Environment Canada 2018) suggests that more than 50% of surveyed populations in Ontario show signs of illegal harvest. Removal of any markings would reduce the chance that collectors may locate a patch and is intended to address the principal threat to the species which is illegal harvesting. Illegal harvesting is detrimental to the species through reduced abundance, reproductive potential, genetic diversity and viability (COSEWIC 2000).

New primary roads and associated landings are not permitted within the AOC.
Forestry-related traffic and maintenance of existing roads are permitted within the AOC subject to the following condition: • The footprint of the road will not be increased
Forestry-related traffic and maintenance of existing roads [primary, branch, operational] are permitted within the AOC subject to the following conditions: • Road maintenance is restricted to surface grading or other low risk road maintenance operations necessary to maintain safe travel conditions.
New branch and operational roads are not permitted within MMZ1.
No new landings within AOC.
New branch and operational roads are permitted in MMZ2 with Ministry approval subject to the following conditions: • Canopy gaps associated with new roads will be included in the estimation of the canopy closure • Construct new roads on existing roadbeds (where the vegetation is predominantly <8 m tall) to result in less impact on ginseng or its habitat • Construct winter roads unless there is no practical or feasible alternative • Roads will be constructed to minimum standards to mitigate potential impact on ginseng habitat and potential illegal collection (e.g., right-of-way <10m, no grubbing, no disruption of hydrological flow, no ditching, locate road as far from ginseng patch as possible) • New roads will be promptly decommissioned upon completion of operations unless with Ministry approval.
New forestry aggregate pits and wood storage yards are not permitted within the AOC.
No operations allowed in existing forestry aggregate pits and wood storage yards within the AOC.

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Revised guide status and rationale:

Direction revised.

One of the greatest threats to American ginseng in Ontario is the illegal harvesting of roots by collectors (Van der Voort and McGraw 2006, McGraw et al 2010, Nault and Tanguay 2011, McGraw et al 2013). Forest access roads may facilitate improved access to ginseng patches by root collectors (Environment Canada 2018).

Direction for roads and landings has changed to allow for roads in MMZ2 as long as they are built on existing roadbeds or are temporary winter roads.

The use of existing roads for purposes of forestry is likely to have a negligible impact on the species in question if traffic levels are low and clean equipment protocols are followed. Road maintenance activity (gravel, grading, etc.) should have minimal impacts on ginseng.

It is assumed that older roadbeds and landings dominated by raspberries, other shrubs, and saplings <8 m tall will normally not be providing suitable conditions (e.g., light, microclimate, and soil compaction) for establishment of ginseng, and that removal will have little influence on the amount of edge effect associated with the road or landing.

Additional roads, landings or forestry aggregate pits within MMZ2 could impact dormant plants or potential habitat for patch expansion. Soil compaction associated with roads and landings could also impact the hydrology of the site.

Restrictions on constructing roads to minimum standards within the AOC would minimize edge creation/light penetration that may negatively impact the patch (Harper et al 2005, Franklin et al 2021). Constructing winter roads minimizes the probability that the roads will provide improved access to ginseng patches or be used for illegal root harvest.

See rationale above for forestry aggregate pits in large patch ginseng AOC.

Best management practices: Retained, revised, or new

Follow the *Clean Equipment Protocol for Industry* (Halloran et al 2013) when moving equipment from areas where an invasive plant species is known to occur to minimize the risk of transporting and introducing the species to harvest areas adjacent to known American ginseng patches.

Revised guide status and rationale:

Following the clean equipment protocol will reduce the risk of introducing invasive species that may be detrimental to ginseng plants/patches by outcompeting them for growing space and resources.

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iii) Wetland plants and insects (branched bartonia, small white lady's slipper, eastern prairie fringed-orchid and bogbean buckmoth)

Formerly non-forested wetlands AOC description revised to address specified species. Bogbean buckmoth has been added to this AOC.

Description of value

Revised guide status and rationale:

The AOC is comprised of wetland vegetation communities (WVCs) known to have been occupied by branched bartonia, small white lady's slipper, or eastern prairie fringed-orchid, (i.e., occupied WVCs) within the past 20 years, or bogbean buckmoth (i.e., occupied WVCs) within the past 3 years, and an adjacent 120 m wide modified management zone (MMZ). Occupied WVCs to be delineated by the Ministry based on methodology for mapping vegetation communities described within the Ontario Wetland Evaluation System.

Operations within wetlands may directly (e.g., by crushing) or indirectly (e.g., by altering hydrological regime) adversely affect plant communities that are species at risk or support species at risk.

The area within the AOC would be important for the bogbean buckmoth due to the dependence of the early larval stage on bogbean, as well as the function and structure of the fen and the fen vegetation to support the moth and a key food source (Gradish and Tonge 2011).

Although the eastern prairie fringed-orchid may occupy only a small portion of suitable habitat at a site, the entire extent of contiguous suitable habitat surrounding currently known occurrences provides important habitat as the species is known to flower following periods of apparent absence (COSEWIC 2003), and the surrounding area supports moths required for pollination and seed inoculation and will provide areas for potential expansion (Bowles 1983, Crosson et al. 1999, Cuthrell et al. 1999).

The federal recovery strategy for branched bartonia (ECCC 2017) indicates that the wetland vegetation community, and the area within a radial distance of 120 m of the occupied wetland habitat, should be considered the species habitat as this area provides suitable habitat conditions to carry out essential life processes, and should

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allow for natural processes related to population dynamics and reproduction (e.g., dispersal and pollination) as well as prevent invasive species or pollution from impacting the species (ECCC 2017).

The 120 m AOC is also the area identified within the Ontario's Natural Heritage Reference Manual as the area where any development may adversely affect the ecological function of a wetland (OMNR 2010).

Standards and guidelines: Retained, revised, or new

Harvest, renewal and tending operations are not permitted within occupied WVCs
Harvest, renewal and tending operations are permitted within the MMZ if they retain residual forest and will not result in direct damage to vegetation or deposition of sediment within occupied WVCs. Operations are subject to the following conditions: • Machine travel is not permitted through upland habitats within 3 m of occupied WVCs or through wetland habitats within 15 m of occupied WVCs • Excessive removal or damage of sapling-sized trees (<10 cm dbh) and shrubs is not permitted in upland habitats within 3 m of occupied WVCs or in wetland habitats within 15 m of occupied WVCs • Felling of trees into occupied WVCs or into upland habitats within 3 m of occupied WVCs or into wetland habitats within 15 m of occupied WVCs is not permitted. Trees accidentally felled into WVCs will be left where they fall • Operations that leave ruts or significant areas of exposed mineral soil within 15 m of occupied WVCs is not permitted. Ruts or significant patches of exposed mineral soil will be promptly rehabilitated.
Contamination of occupied WVCs by foreign materials is not permitted. Specifically, • No equipment maintenance (e.g., washing or changing oil) is permitted within 30 m of occupied WVCs • Aerial application of herbicides is not permitted within the AOC. Machine-based ground application of herbicides (e.g., air-blast sprayers mounted on skidders) is not permitted within 60 m of occupied WVCs. Hand-based ground application of herbicides (e.g., back-pack sprayers) is not permitted within 3 m of occupied WVCs.
If there is a risk of introducing invasive species to AOCs occupied by plants listed as SAR (e.g., equipment is coming from an area known or suspected to contain invasive species), all equipment will be thoroughly inspected by operators and, as required, cleaned following the methods described in the <i>Clean Equipment Protocol for Industry</i> (Halloran et al 2013) before operating within these AOCs.

Revised guide status and rationale:

Direction revised.

Conditions on operations have changed to allow harvest, renewal and tending within the MMZ.

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Harvest, renewal, and tending operations outside the vegetation community but within the AOC that retain residual forest (e.g., selection or shelterwood harvest) and that follow careful operating practices as defined in Section 4.1.1 of the SSG (lakes and high potential sensitivity ponds), are unlikely to adversely affect the natural features or ecological functions which support the plants or insect. These practices include taking steps to prevent disruptions to the hydrologic function and to prevent the deposition of sediment of the vegetation community containing the plants or insect species.

As a wetland species, branched bartonia relies on open wet habitat, and changes to the hydrology in the wetland itself or its recharge (source) areas would degrade or destroy habitat.

Aerial spraying direction aligns with Ministry of Environment and Conservation and Parks direction and is supported by Payne and Thompson (1992).

Direction on ground application of herbicides is taken from Section 4.1 of the SSG. Site preparation/cleaning with herbicides poses a risk of exposure through spray drift.

Establishing spray drift buffer zones is one of the most important methods of mitigating negative impacts from herbicides (Thompson et al 2012).

Following the clean equipment protocol will reduce the risk of introducing invasive species that may be detrimental to ginseng plants/patches by outcompeting them for growing space and resources.

New all-weather roads and landings are not permitted within the AOC.
Winter roads are not permitted within the AOC except in extraordinary circumstances, as specifically identified and justified, including road location, through the FMP AOC planning process, the road is not permitted within occupied WVCs and must be >20 m from WVC. Appropriate mitigative measures will be taken to minimize the risk of disruption of hydrological flow (see Section 4.1.4).
New forestry aggregate pits are not permitted within the AOC.
Operations associated with existing forestry aggregate pits are permitted within the MMZ. However, aggregate extraction is not permitted below the water table.

Revised guide status and rationale:

Conditions on roads, landings, and forestry aggregate pits have not changed.

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(C&R) 4.3.2 Woody plants

Preamble/Direction

Revised guide status and rationale:

Content revised.

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Black ash is now listed as at risk. There is no direction for black ash because forestry conducted under the CFSA, and an approved FMP is exempt under the black ash regulation under the ESA. The exemption under the ESA allows forest industry to transport black ash to a process site and sell the materials.

i) Butternut

Revised guide status and rationale:

Direction for butternut has been revised from SGRs to an AOC. The revision addresses the critical rooting zone of healthy butternut trees and any saplings or seedlings present.

Butternut health assessors (BHA) are now butternut health experts (BHE).

Description of value

Revised guide status and rationale:

Description revised.

The direction applies to all recognizable living butternut trees of any size encountered during forest operations and their habitat. This direction does not apply to butternut trees that have been assessed by a *Butternut Health Expert* (BHE) as per *Butternut Assessment Guidelines* (MECP 2021) as Category 1. The area within the critical rooting zone (CRZ) comprises the AOC.

The CRZ is considered to extend the following distance from the stem of butternut trees:

- 5 m for butternut trees <10 cm dbh
- 10 m for butternut trees 10-24 cm dbh
- 15 m for butternut trees 25-35 cm dbh
- 20 m for butternut trees >36 cm dbh.

This area is intended to protect the CRZ of individual trees, immediate habitat conditions surrounding the tree that support the growth, and persistence of the tree over its lifetime. The critical root zone reflects the radius in which most tree roots occur and is calculated by multiplying a tree's dbh by a root radius factor that varies among species. Anderson (2011) recommended a root retention factor of 25-35 m per m of dbh for trees in Ontario.

Standards and guidelines: Retained, revised, or new

Herbicide application (other than hand-based ground application) is not permitted within the AOC. Herbicide application will avoid Category 2 or 3 trees (or unassessed) butternut trees.

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Harvest, renewal and tending operations within the AOC are subject to the following conditions:

- Harvest must retain shade on at least 2 sides of dominant, co-dominant, or intermediate Category 2 or 3 (or unassessed) butternut trees.
- Harvest, renewal, and tending operations will follow careful logging practices to ensure that the crown, stem, and roots of Category 2 or 3 (or unassessed) butternut trees are not damaged. Specifically,
 - Felling of trees that could damage Category 2 or 3 (or unassessed) butternut trees (e.g., trees leaning into butternut trees or into which butternut trees are leaning, trees whose crowns are interconnected with the crowns of butternut trees, etc.) is not permitted
 - No extraction trails within the dripline of the tree during the frost-free period unless approved by Ministry
 - No ruts within the dripline of the tree

Revised guide status and rationale:

Butternut is intolerant of shade and competition, requiring sunlight from above to survive but it can maintain itself as a minor component of forests in later successional stages (Environment Canada 2010).

In forested settings, trees must reach the overstory to thrive (Rink 1990 cited in Ostry and Pijut 2000). Trees having butternut canker exhibit higher growth and increased survival at sites with increased light, with 95% seedling survival achievable in full sun (Brosi 2010).

Disturbance of the soil profile within the critical rooting zone during harvest, renewal and tending operations (e.g., compaction, rutting) may impact roots or affect drainage conditions. Harvest, renewal and tending could pose a risk of incidental killing or harming of butternut seedlings and saplings as detectability is lower than with mature trees.

New roads or associated landings are not permitted within the CRZ of Category 2 or 3 (or unassessed) butternut trees, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process. The CRZ is considered to extend the following distance from the stem of butternut trees:

- 5 m for butternut trees <10 cm dbh
- 10 m for butternut trees 10-24 cm dbh
- 15 m for butternut trees 25-35 cm dbh
- 20 m for butternut trees >36 cm dbh.

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New forestry aggregate pits and wood storage yards are not permitted within the CRZ of Category 2 or 3 (or unassessed) butternut trees. The CRZ is considered to extend the following distance from the stem of butternut trees:

- 5 m for butternut trees <10 cm dbh
- 10 m for butternut trees 10-24 cm dbh
- 15 m for butternut trees 25-35 cm dbh
- 20 m for butternut trees >36 cm dbh.

Revised guide status and rationale:

Placement of roads, landings, forestry aggregate pits or wood yards outside the CRZ of Category 2 and 3 butternut trees will minimize the potential effects of compaction, root damage/destruction of the CRZ of these features on Category 2 or 3 trees. Construction and operation of an aggregate pit may alter hydrology, resulting in changes to drainage conditions, soil desiccation, or changes in soil properties.

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(C&R) 4.3.3 Lichens

Preamble/Direction

Revised guide status and rationale:

Content revised.

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New direction added for pale-bellied frost lichen and white-rimmed shingle lichen, both species of at risk.

Direction for the flooded jellyskin was removed. The flooded jellyskin was de-listed. It is a lichen found in woodland pools and rich hardwood swamps. Some forestry operations could potentially affect habitat suitability by alteration of seasonal hydrological regimes and removal of trees that are substrate for growth. Suitable habitat is maintained across the range by direction for woodland pools and rich hardwood swamps in Section 4.1.3.

i) Pale-bellied frost lichen

Description of value

Revised guide status and rationale:

New description – no current species-specific direction for pale-bellied frost lichen.

The direction focuses on maintaining the microclimate around the lichen, maintaining high canopy cover, and minimizing disturbance of the forest floor.

The AOC is comprised of the host tree (live, dead, or downed) known to have supported pale-bellied frost lichen and the area within 100 m. The area from 0-50 m is a reserve. The area from 51-100 m is an MMZ.

Pale-bellied frost lichen is sensitive to edge effects and changes in microsite conditions (Lewis 2011).

Protection of the reserve area within 50 m of the host tree would address negative edge effects and conserve the appropriate micro-climate conditions (Esseen and Renhorn 1998, Rheault et al 2003, Environment Canada 2016) and any forest management activities that may damage the host tree or lichen as well as protection of the root system of the host tree (Environment Canada 2016). The additional 50 m maintains hydrological integrity of the area surrounding the lichen and maintains features that create suitable microsite characteristics for growth of the lichen (Environment Canada 2007).

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within 50 m of known host trees.
Trees will not be felled into the reserve. Trees accidentally felled into the reserve will be left where they fell.

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Herbicide application (other than hand-based ground application) is not permitted within the AOC.

Revised guide status and rationale:

New direction.

Lichens are particularly sensitive to microclimate changes (Lewis 2011, Environment Canada 2016). Removal of trees has the potential to alter site conditions that may result in micro-climate conditions unsuitable for the species. Edge effects caused by forest disturbance have been shown to impact groups of common forest lichens up to a distance of 50 m (Esseen and Renhorn 1998, Rheault et al 2003). A 50 m radius AOC around the host trees of pale-bellied frost lichen addresses the potential negative edge effects on this species as well as any potential damage to the host tree or lichen from forestry operations.

McMullin et al. 2011 and 2013 reveal that triclopyr and glyphosate may be a potential threat as lichen are sensitive to these herbicides.

New [primary, branch, operational] roads or associated landings are not permitted within 50 m of known host trees.
Operations associated with [all existing roads, landings, forestry aggregate pits, wood storage yards] that increase their footprint are not permitted within the AOC.
New primary roads and associated landings are not permitted within the MMZ, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.
New branch and operational roads and/or associated landings are permitted in the MMZ subject to the following conditions: ○ New roads will be promptly decommissioned upon completion of operations unless with Ministry approval.
New forestry aggregate pits and wood storage yards are not permitted within 50 m of known host trees.
Aggregate extraction within the AOC is not permitted below the water table.
New forestry aggregate pits are not permitted within the MMZ, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.

Revised guide status and rationale:

New direction.

New roads or associated landings within 50 m of the host tree have the potential to impair or eliminate habitat. Opening forest canopies as a result of road construction may

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impact wind patterns, light levels, etc. – disturbances to which lichen are particularly sensitive (Lewis 2011).

Edge effects caused by forest disturbance have been shown to impact groups of common forest lichens up to a distance of 50 m (Esseen and Renhorn 1998, Rheault et al 2003).

Primary roads are built to higher standards and are a permanent feature on the landscape. Opening forest canopies as a result of road construction may impact wind patterns, light levels, etc. – disturbances to which lichen are particularly sensitive (Lewis 2011).

The use of existing roads for purposes of forestry is likely to have a negligible impact on the species and the hydrological regime. Road maintenance activity (gravel, grading, etc.) should have minimal impacts.

Increasing the footprint of existing roads could negatively impact potential host trees and the microclimate conditions required by the lichen.

Construction of forestry aggregate pits within the AOC could contribute to habitat loss and impact the microclimate conditions required by the host tree and/or potential host trees in the outer 50 m of the AOC.

Operations that increase the footprint of forestry aggregate pits within the AOC could contribute to habitat loss and impact the microclimate conditions required by the lichen or potential host trees in the outer 50 m of the AOC. Maintenance of hydrology-within 100 m of pale-bellied frost lichen would help maintain features that create suitable microsite characteristics for growth of the lichen (Environment Canada 2007).

Rehabilitation of aggregate pits in a manner creating favourable habitat for the host tree species can minimize the timeframe during which the habitat is unsuitable.

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Rheault, H., Drapeau, P., Bergeron, Y., and Esseen, P. 2003. Edge effects on epiphytic lichens in managed black forests of eastern North America. *Can. J. For. Res.* 33:23-32.

ii) White-rimmed shingle lichen

Revised guide status and rationale:

New direction, there is no current species-specific direction for white-rimmed shingle lichen.

Description of value

Revised guide status and rationale:

The direction focuses on maintaining the microclimate around the lichen, maintaining high canopy cover, and minimizing disturbance of the forest floor.

The AOC is comprised of host trees (live, dead, or downed) that support the white-rimmed shingle lichen, suitable habitat and potential host trees for possible colonization and the area within 100 m.

White-rimmed shingle lichen is sensitive to edge effects and changes in microsite conditions (Consiglio and Knight 2023).

Microclimate influences from clearcut forest edges have been shown to extend up to 240 m into mature forests (Chen et al 1993, Ghelhausen et al 2000). Although responses to harvesting activities may vary across cyanolichen species, current research shows that species richness and total abundance decrease as dimensions of the cut area increase (Bartemucci et al 2022). In addition to the importance of establishing buffer zones for protecting rare cyanolichens, Gauslaa et al (2019) found that increases in size of retained forest patches also exerted a strong positive influence on cyanolichen survival.

Protection of the area within 50 m of the host tree would address edge effects and conserve the appropriate micro-climate conditions (Esseen and Renhorn 1998, Rheault et al 2003, COSEWIC 2019, Consiglio and Knight 2019)) and any forest management activities that may damage the host tree or lichen. The additional 50-100 m maintains

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suitable habitat and potential host trees for possible colonization and thus expansion of the population by white-rimmed shingle lichen (Consiglio and Knight 2023, COSEWIC 2019).

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within 0-50 m of known host trees.
Herbicide application (other than hand-based ground application) is not permitted within the AOC.
Harvest, renewal, and tending operations are not permitted within 51-100 m of known host trees, unless with Ministry approval and subject to the following condition: • Harvest, renewal, and tending operations will be conducted in a manner that minimizes site disturbance and extraction trails will not exceed 10% coverage within the AOC.

Revised guide status and rationale:

New direction.

Lichens are particularly sensitive to microclimate changes (Consiglio and Knight 2023, COSEWIC 2019). Removal of trees within the AOC during harvest, renewal and tending operations has the potential to alter site conditions that may result in micro-climate conditions unsuitable for the species.

Edge effects caused by forest disturbance have been shown to impact groups of common forest lichens up to a distance of 50 m (Esseen and Renhorn 1998, Rheault et al 2003). A 50 m reserve around the host trees of white-rimmed shingle lichen addresses the potential edge effects on this species as well as any potential damage to the host tree or lichen from forestry operations.

Maintaining the area 51-100 m from the host tree maintains suitable habitat and potential host trees for colonization by white-rimmed shingle lichen and contribute to the integrity of the microclimate conditions.

McMullin et al. (2011 and 2013) show that triclopyr and glyphosate may be a potential threat as lichen are sensitive to these herbicides.

New [primary, branch, operational] roads and associated landings are not permitted within 50 m of known host trees.
New primary roads and associated landings are not permitted within 51-100 m of known host trees.
Operations associated with [all existing roads, landings, forestry aggregate pits, wood storage yards] that increase their footprint are not permitted within the AOC.

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New branch roads and associated landings are not permitted within 51-100 m of a known host tree except in extraordinary circumstances as justified through the AOC planning process. • Construct new roads on an existing roadbed (where the vegetation is predominantly <8 m tall) • Ensure appropriate mitigative measures are taken to minimize the risk of disruption of hydrological flow (see Section 4.1.4 and 5.1.1) • New roads will be promptly decommissioned upon completion of operations unless with Ministry approval.
New operational roads and associated landings are permitted within 51-100 m of a known host tree subject to the following conditions: • Ensure appropriate mitigative measures are taken to minimize the risk of disruption of hydrological flow (see Sections 4.1.4 and 5.1.1)
New operational roads will be promptly decommissioned upon completion of operations unless with Ministry approval.
New forestry aggregate pits and wood storage yards are not permitted within the AOC.
Aggregate extraction within the AOC is not permitted below the water table.

Revised guide status and rationale:

New direction.

New roads or associated landings within 50 m of the host tree have the potential to impair or eliminate habitat. Opening forest canopies as a result of road construction may impact wind patterns, light levels, etc. – disturbances to which lichen are particularly sensitive (COSEWIC 2019, Consiglio and Knight 2023).

Increasing the footprint of existing roads could negatively impact potential host trees and the microclimate conditions required by the lichen.

Edge effects caused by forest disturbance have been shown to impact groups of common forest lichens up to 50 m (Esseen and Renhorn 1998, Rheault et al 2003). A 50 m reserve around the host trees of white-rimmed shingle lichen addresses the potential edge effects on this species as well as any potential damage to the host tree or lichen from forestry operations.

The area 51-100 m from the host tree maintains suitable habitat and potential host trees for colonization by white-rimmed shingle lichen and contributes to the integrity of the microclimate conditions.

Primary roads are built to higher standards and are a more permanent features on the landscape.

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Opening forest canopies due to road construction may impact wind patterns, light levels, etc. – disturbances to which lichen are particularly sensitive.

Branch and operational roads typically exist for a shorter duration. Maintaining the area 51-100 m from the host tree maintains suitable habitat and potential host trees for colonization by white-rimmed shingle lichen and contributes to the integrity of the microclimate conditions.

It is assumed that older roadbeds and landings dominated by raspberries, other shrubs, and saplings <8 m tall will normally not be providing suitable conditions (e.g., light, microclimate, and soil compaction) that removal will have little influence on the amount of edge effect associated with the road or landing.

Construction of forestry aggregate pits within the AOC could contribute to habitat loss and impact the microclimate conditions and hydrological regime required by the host tree and/or potential host trees.

Operations that increase the footprint of forestry aggregate pits within the AOC could contribute to habitat loss and impact the microclimate conditions and the hydrological regime required by the lichen or potential host trees in the AOC. Maintenance of hydrology, as well as other naturally or semi-naturally vegetated areas within the AOC, would protect interior forest conditions and/or maintain features that create suitable microsite characteristics for growth of the lichen (Consiglio and Knight 2023).

Rehabilitation of aggregate pits in a manner creating favourable habitat for the host tree species can minimize the timeframe during which the habitat is unsuitable.

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(C&R) 4.3.4 Invertebrates

Preamble/Direction

Revised guide status and rationale:

To address the monarch, American bumble bee, Suckley's cuckoo bumble bee, and yellow-banded bumble bee a best management practice has been added.

Best management practices: Retained, revised, or new

The monarch, American bumble bee, Suckley's cuckoo bumble bee, and yellow-banded bumble bee may benefit from:

- Seeding of specific native plant species (e.g., milkweed, nectar producing plants) when rehabilitating forestry aggregate pits and landings
- Avoiding the use of *Bacillus thuringiensis* (Bt) and glyphosate near forest edges, clearings, and roads.

Revised guide status and rationale:

The American bumble bee and yellow-banded bumble bee are at risk due to a number of factors. The threats include pesticide use, mainly neonicotinoids, habitat loss, mainly to agricultural intensification and competition, as well as pathogen introduction from the eastern bumble bee which is used in greenhouses (COSEWIC 2015, COSEWIC 2018).

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The Suckley's cuckoo bumble bee is an obligate social parasite (cannot survive independent of the host species) and is threatened by the loss of its host, the yellow-banded bumble bee (COSEWIC 2019).

The monarch is at risk due to habitat loss in its wintering grounds (Mexico and California), herbicide use that negatively impacts milkweed (sole food source), and possible pesticide use, mainly neonicotinoids (COSEWIC 2016).

The habitat for these species is along the edges of forests, such as roadside or along the edges of forestry aggregate pit openings. Avoid the use of pesticide and herbicides along forest edges, clearing and roads where they are known to occur will be beneficial to these species. In addition, taking the steps during rehabilitation to seed aggregate pits and landings with milkweed and nectar producing plants will be beneficial to these species.

LITERATURE CITED

COSEWIC. 2015. COSEWIC assessment and status report on the yellow-banded bumble bee *Bombus terricola* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 60 pp.

COSEWIC. 2016. COSEWIC assessment and status report on the monarch *Danaus plexippus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 59 pp.

COSEWIC. 2018. COSEWIC assessment and status report on the American bumble bee *Bombus pensylvanicus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 52 pp.

COSEWIC. 2019. COSEWIC assessment and status report on the Suckley's cuckoo bumble bee *Bombus suckleyi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 70 pp.

i) Bogbean buckmoth

Preamble/Direction

Revised guide status and rationale:

Bogbean buckmoth direction has been included with the wetland plant direction in Section 4.3.1 (see 4.3.1 Non-woody plants (iii)).

The bogbean buckmoth is restricted to open, chalky, low shrub fens containing large amounts of bogbean, an emergent wetland flowering plant (Environment Canada 2015). In the few locations where it is found the wetland plant direction will address the needs of this insect, and the bogbean upon which it depends.

LITERATURE CITED

Environment Canada. 2015. Recovery Strategy for the Bogbean Buckmoth (*Hemileuca* sp.) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. 20 pp. + Annexes.

ii) West Virginia white

Description of value

Revised guide status and rationale:

The description was revised based on recent published studies in northeastern Ontario, providing a more detailed description of suitable habitat.

The AOC comprises suitable habitat occupied by the West Virginia white at least once in the past 10 years and either the area within a distance of 30 m above the high-water mark of permanent streams, or 10 m above the high-water mark of intermittent streams, as delineated through field survey.

The AOC is defined as suitable habitat known to be occupied by this species as delineated by field survey (see Coulson 1998). West Virginia white rely on the presence of broad-leaved toothwort (critical to larval development) and the presence of nectar producing plants. It is important to ensure these habitats are maintained for this species (Burke 2013).

Based on a study by Goertz and Hasnain (2018), which studied the distribution of two-leaved toothwort to better understand the localized distribution of larval habitat for the West Virginia white, they recommended applying a 30 m buffer around permanent streams and a 10 m buffer around intermittent streams in order to protect core larval habitat and some adjacent canopy cover and nectaring habitat.

Standards and guidelines: Retained, revised, or new

Revised guide status and rationale:

No changes to standards and guidelines.

Direction is still relevant. See existing Background and Rationale for Direction for rationale.

LITERATURE CITED

Burke, Peter S. 2013. Management plan for the west Virginia white (*Pieris virginiensis*) in Ontario. Ontario Management Plan Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. v + 44 pp.

Change and Rationale Document to Support the Review of the Draft Revised Stand and Site Guide

Coulson, D. 1998. Locating west Virginia white butterfly habitats. Pp. 191-200 *in* Selected wildlife and habitat features: inventory manual. OMNR, Queen's Printer for Ontario, Toronto, ON.

Goertz, D.E. and S. Hasnain. 2018. West Virginia white (*Pieris virginiensis*): Distribution and behavioural notes at the northern limit of its range in Ontario, Canada. *in* Ontario Lepidoptera 2018 (R. Cavasin and J.E. Linton, eds.). Toronto Entomologists' Association #50-2019, p 18-28.

(C&R) 4.3.5 Fish

Preamble/Direction

Revised guide status and rationale:

Lake Opeongo whitefish (large and small-bodied populations) and silver lamprey have been added to the SARO list.

Redside dace and shortnose cisco have been removed from the direction because they are not found in waterbodies within the managed forest. These species remain protected under the *Fisheries Act* and the *ESA*.

(C&R) 4.3.6 Amphibians and reptiles

Preamble

Revised guide status and rationale:

All direction imposing road use restrictions has been removed from snake and turtle AOCs and will be addressed by operator awareness direction for all herptiles.

Standards: Retained, revised, or new

Awareness and driver training are required for any individuals working in habitat potentially occupied by at risk snakes and turtles. This training must provide information about the species (i.e., identification, timing restrictions, habitat), including the distribution of educational materials (e.g., species identification cards) and the actions that operators are expected to take to minimize threats (e.g., reducing speed, speed control devices).

A local protocol will be developed that describes how at risk snakes and turtles will be protected from injury if encountered during operations (i.e., how they should be handled, temporarily held, and/or relocated). See the Ministry's *Ontario Species at Risk Handling Manual* for suggestions.

Revised guide status and rationale:

Restricting forest industry's use of roads that are open to the public, who are not restricted in their use, did not meet the intent of the direction. Restrictions on road use are being replaced by awareness direction. Awareness direction isn't new, it is in the current in the current guide. This direction is key to some of the flexibility and minimizing potential impacts. Targeted driver training, combined with measures to reduce speeds and increased awareness, can help to reduce the likelihood of traffic-related mortality. In a study of parameters that influence road mortality of several taxa in southwestern Ontario, posted road speed limit was the dominant positive predictor of roadkill (Farmer and Brooks 2012, OMNRF 2016).

LITERATURE CITED

Farmer, R.G. and R.J. Brooks. 2012. Integrated risk factors for vertebrate roadkill in southern Ontario. *The Journal of Wildlife Management* 76(6): 1215-1224.

(C&R) 4.3.6.1 Snakes

Preamble

Milksnake was de-listed from the SARO list and has been removed from the hibernation site and the nesting sites, gestation sites, and communal shedding and basking sites direction.

Eastern foxsnake has been removed from the hibernation site direction. Generally, this species does not hibernate within forested habitats.

Eastern ratsnake is now referred to as gray ratsnake.

Direction

Revised guide status and rationale:

Content revised.

i) Eastern hog-nosed snake or eastern ribbonsnake hibernation sites

Description of value

Revised guide status and rationale:

Description revised.

The milksnake was de-listed from the SARO list in 2016. Otherwise, the description for eastern hog-nosed snake and eastern ribbonsnake hibernation sites has not changed.

Standards and guidelines: Retained, revised, or new

Harvest, renewal and tending operations are not permitted during the entrance and emergence periods unless with Ministry approval.

Revised guide status and rationale:

This is a change from current direction which permits no harvest, renewal, or tending within the AOC.

The eastern hog-nosed snake and eastern ribbonsnake generally prefer non-forested habitats (e.g., wetlands), forest openings, or forest edges.

Permitting harvest, renewal, and tending activities within the AOC outside of the entrance and emergence periods minimize the risk of killing or injuring snakes when they are staging. Including 'with Ministry approval' provides the flexibility to address local situations. Eastern hog-nosed snake hibernates in excavations in sandy soil or animal burrows (COSEWIC 2021). Eastern ribbonsnake hibernate in animal burrows or rock crevices (COSEWIC 2012).

The potential risks to snakes from forest operations is especially high during the spring and fall emergence and entrance periods since snakes congregate at these features, at least a week prior to and after hibernation (Lawson 2005, Robson 2011, Prior and Weatherhead 1996, Marshall et al. 2006).

In central Ontario, eastern hog-nosed snakes and eastern ribbonsnakes typically emerge from hibernation between mid to late April and they enter hibernation sites in early to mid- October (COSEWIC 2002, COSEWIC 2021).

New roads and landings are not permitted within the AOC.

Operations associated with existing roads and landings during the entrance and emergence periods will include the following conditions:

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|--|
| <ul style="list-style-type: none">• During road maintenance operations, roads within the AOC will be clearly identified using flagging tape, signs, or other visual markers.• Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading, etc.) and measures to increase awareness (e.g., training, signage). |
|--|

New forestry aggregate pits and wood storage yards are not permitted within the AOC.

Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the AOC during the entrance and emergence period .

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Revised guide status and rationale:

Conditions on roads, landings and forestry aggregate pits has not changed.

Enhanced direction to improve awareness of snakes and specific habitat features has been added.

Marking hibernation sites so that they can be avoided during road maintenance operations will reduce the overall risk of potential damage to the habitat feature and potential injury or mortality to snakes.

Targeted driver training combined with measures to reduce speeds and increase awareness can help to reduce the likelihood of traffic-related mortality. In a study of parameters that influence road mortality of several taxa in southwestern Ontario, posted road speed limit was the dominant positive predictor of roadkill (Farmer and Brooks 2012. OMNRF 2016).

LITERATURE CITED

COSEWIC 2002. COSEWIC assessment and status report on the eastern ribbonsnake *Thamnophis sauritus*. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 24.

COSEWIC. 2012. COSEWIC assessment and status report on the eastern ribbonsnake *Thamnophis sauritus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 39 pp.

COSEWIC. 2021. COSEWIC assessment and status report on the eastern hog-nosed snake *Heterodon platirhinos* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 45 pp.

Farmer, R.G. and R.J. Brooks. 2012. Integrated risk factors for vertebrate roadkill in southern Ontario. J. Wildl. Manage. 76:1215-1224.

Lawson, A. 2005. Potential for gene flow among Foxsnake (*Elaphe Gloydi*) of Georgian Bay, Canada. M.Sc. Thesis, University of Guelph, Guelph, ON.

Marshall, J.C., J.V. Manning, and B.A. Kingsbury. 2006. Movement and macrohabitat selection of the eastern massasauga in a fen habitat. Herpetologica 62:141-150.

OMNRF. 2016. Best Management Practices for Mitigating the Effects of Roads on Amphibians and Reptile Species at Risk in Ontario. Queen's Printer for Ontario. 112 pp.

Prior K.A. and P.J. Weatherhead. 1996. Habitat features of black rat snake hibernacula in Ontario. J. Herpetol. 1:211-8.

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Robson, L.E. 2011. The spatial ecology of eastern hognose snakes (*Heterodon platirhinos*): habitat selection, home range size, and the effect of roads on movement patterns. M.Sc. thesis, University of Ottawa.

ii) Gray ratsnake hibernation sites

Description of value

Revised guide status and rationale:

Description revised.

The AOC for gray ratsnake hibernation sites has been separated from a previously grouped AOC which included eastern foxsnake and massasauga.

The dimensions of the hibernation site AOC for gray ratsnake have changed. It has increased from 100-150 m.

The AOC comprises the hibernation site and the area within a radius of 150 m. The area within 0-50 m of a hibernation site is a reserve and the area within 51-150 m of a hibernation site comprises the MMZ.

Gray ratsnake use basking trees found near the hibernation site, that tended to be relatively large and decayed or dying with numerous cavities, that would be used at emergence and entrance times (Prior and Weatherhead 1996, ECCC 2017). A distance of 150 m around a hibernaculum is considered necessary to maintain the physical and biological composition, structure and function of the surrounding subterranean environment, and to protect staging areas in the vicinity of the hibernacula used in the spring and fall (Blouin-Demers and Weatherhead 2002 as cited in ECCC 2017).

An area with a radius of 100 to 150 m around the hibernation site entrance will encompass the habitat being used for hibernation, the area necessary to maintain the microhabitat conditions of the site, and the associated staging areas used by snakes prior to entering the hibernation site and after emergence in the spring (EFSRT 2010). This also helps to avoid potential risks to the species and their habitat from forest management activities.

The 150 m AOC is consistent with critical habitat for gray ratsnake (ECCC 2017).

Standards and guidelines: Retained, revised, or new

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Harvest, renewal, and tending operations are permitted within the MMZ subject to timing restrictions and the following conditions:

- Harvest, renewal and tending operations involving heavy equipment (e.g., skidders, mechanical harvesters) are not permitted in the MMZ during the **entrance and emergence periods** unless with Ministry approval (see Appendix 1b).
- Harvest will retain forest that meets the definition of residual and retains wildlife trees and downed woody material as per Section 3.2.3.2, and ≥50% canopy closure.
- Renewal and tending operations will leave a residual stand structure that meets the minimum described above; all other renewal and tending operations are permitted within the MMZ.

Revised guide status and rationale:

The conditions on harvest, renewal and tending haven't changed only the size of the MMZ has increased by 50 m.

The entrance and emergence periods have been adjusted, the entrance and emergence periods were both shortened by 2 weeks to address recent literature and to recognize that the gray ratsnake is at the northern edge of its range (Blouin-Demers et al 2000, Blouin-Demers and Weatherhead 2001, Kraus et al 2010, COSEWIC 2018).

New primary roads, branch roads, and associated landings are not permitted within the AOC.

Operations associated with existing [primary, branch, operational] roads and landings during the entrance and emergence periods will include the following conditions:

- During road maintenance operations, roads and landings within the AOC will be clearly identified using flagging tape, signs, or other visual markers
- Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage)

New operational roads and landings are not permitted within 0-50 m of the hibernation site.

New operational winter roads and new all-weather operational roads, including those build on existing roadbeds (where the vegetation is predominantly <8 m tall), will be built to minimum standards (e.g., maximum right-of-way width 15 m).

No new landings permitted within the MMZ.

New all-weather operational roads are not permitted within the MMZ, unless with Ministry approval. If there is no practical or feasible alternative, construct winter roads, as approved by the Ministry.

Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the MMZ during the entrance and emergence periods.

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New forestry aggregate pits and wood storage yards are not permitted within the MMZ unless approved by the Ministry.

Revised guide status and rationale:

See rationale for eastern hog-nosed and eastern ribbonsnake hibernation site above.

Use of existing roadbeds acknowledges the existing footprint and in the GLSL forest region that stands will be re-entered every 20-30 years.

When roads must be constructed within the AOC, use of temporary roads or shorter-term roads is preferred to limit future access and risk of traffic related mortality.

Including 'with Ministry approval' provides the flexibility to address local situations.

LITERATURE CITED

Blouin-Demers, G., K.A. Prior, and P.J. Weatherhead. 2000. Patterns of variation in spring emergence by black rat snakes (*Elaphe obsoleta obsoleta*). *Herpetologica* 56:175-188.

Blouin-Demers, G. and P.J. Weatherhead. 2001. Thermal ecology of gray ratsnakes (*Elaphe obsoleta*) in a thermally challenging environment. *Ecology* 82:3025-3043.

Blouin-Demers, G. and P.J. Weatherhead. 2002. Implications of movement patterns for gene flow in gray ratsnakes (*Elaphe obsoleta*). *C. J. Zool.* 80:1162-1172.

Burke, D.M. and E. Nol. 1998. Edge and fragment size effects on the vegetation of deciduous forests in Ontario, Canada. *Nat. Areas J.* 18:45-53.

COSEWIC. 2018. COSEWIC assessment and status report on the gray ratsnake *Pantherophis spiloides*, Great Lakes / St. Lawrence population and Carolinian population in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xvi + 44 pp.

Eastern foxsnake Recovery Team (EFSRT). 2010. Recovery strategy for the eastern foxsnake (*Pantherophis gloydi*) – Carolinian and Georgian Bay populations in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 39 pp.

Environment and Climate Change Canada (ECCC). 2017b. Recovery Strategy for the gray ratsnake (*Pantherophis spiloides*), Carolinian and Great Lakes/St. Lawrence populations, in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. 3 parts, 39 pp. + vi + 23 pp. + 5 pp.

Fraver, S. 1994. Vegetation responses along edge-to-interior gradients in the mixed hardwood forests of the Roanoke River Basin, North Carolina. *Cons. Biol.* 8:822–832.

Change and Rationale Document to Support the Review of the Draft Revised Stand and Site Guide

Kraus, T., B. Hutchinson, S. Thompson, and K. Prior. 2010. Recovery Strategy for the gray ratsnake (*Pantherophis spiloides*) – Carolinian and Frontenac Axis populations in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 23 pp.

Matlack, G.R. 1993. Microenvironment variation within and among forest edge sites in the eastern United States. Biol. Conserv. 66:185-194.

Prior K.A., and P.J. Weatherhead. 1996. Habitat features of black rat snake hibernacula in Ontario. J. Herpetol. 1:211-8.

iii) Massasauga hibernation sites

Description of value

Revised guide status and rationale:

Description revised.

The AOC for massasauga hibernation sites has been separated from a previously grouped AOC which included eastern foxsnake and gray ratsnake (formerly eastern ratsnake).

The dimensions of the reserve area within the AOC for massasauga have changed. It has been decreased from 50 m to 30 m. The MMZ has increased from 51-100 m to >30 to 100 m. The dimension of the AOC remains 100 m.

The AOC comprises the hibernation site and the area within a radius of 100 m. The area within 0-30 m of a hibernation site is a reserve and the area within 31-100 m of a hibernation site comprises the MMZ.

After emergence from hibernation, massasaugas moved to basking areas within a few meters of their hibernacula and remained there within 10–30m for approximately a week (Marshall et al 2006). When they return for entrance to the hibernation site, they tend to move to areas within 50 m of their hibernation site (Marshall et al. 2006). Massasaugas hibernate within 100m of previously used hibernation site (Weatherhead and Prior 1992, Harvey and Weatherhead 2006 as cited in COSEWIC 2012).

Massasauga are long-lived and demonstrate high fidelity to important hibernation site features, which are used throughout the individuals' life and over multiple generations (Harvey and Weatherhead 2006, COSEWIC 2012). Thus, habitats that are occupied by these species are often depended on by the same individuals for decades, as well as by future generations as long as the habitat remains suitable. Based on the extended use of these sites, over generations, a 20 year time period is recommended.

Standards and guidelines: Retained, revised, or new

Harvest, renewal and tending operations are not permitted in the MMZ during the entrance and emergence periods unless with Ministry approval.

Revised guide status and rationale:

Habitat alteration is prohibited within the inner 30 m of the AOC, where the likelihood of killing or injuring snakes is highest.

To minimize the risk of killing or injuring snakes, harvest, renewal, and tending operations are prohibited within the AOC during the entrance and emergence periods.

Including 'with Ministry approval' provides the flexibility to address local situations.

New primary roads, branch roads, operational roads, and landings are not permitted within the AOC.

Operations associated with existing [primary, branch, operational] roads and landings during the entrance and emergence periods will include the following conditions:

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| <ul style="list-style-type: none">• During road maintenance operations, roads within the AOC will be clearly identified using flagging tape, signs, or other visual markers.• Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage). |
|--|

New operational roads and landings are not permitted within 0-50 m of the hibernation site.

New operational winter roads and new all-weather operational roads, including those build on existing roadbeds (where the vegetation is predominantly <8 m tall), will be built to minimum standards (e.g., maximum right-of-way width 15 m).

No new landings permitted within the MMZ.

New all-weather operational roads are not permitted within the MMZ without Ministry approval. If there is no practical or feasible alternative construct winter roads, as approved by the Ministry.

Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the MMZ during the entrance and emergence periods.

New forestry aggregate pits and wood storage yards are not permitted within the MMZ unless approved by the Ministry.

Best Management Practices: Retained, revised, or new

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Where possible, new operational winter roads and all-weather operational roads will be built on existing roadbeds.

Revised guide status and rationale:

See rationale for Eastern hog-nosed and eastern ribbonsnake hibernation site above.

When roads must be constructed within the AOC, use of temporary roads or shorter-term roads is preferred to limit future access and risk of traffic related mortality.

Use of existing roadbeds acknowledges the existing footprint and in the GLSL forest region that stands will be re-entered every 20-30 years.

LITERATURE CITED

COSEWIC. 2012. COSEWIC assessment and status report on the massasauga *Sistrurus catenatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 84 pp.

Harvey, D.S. and P. J. Weatherhead. 2006. A test of the hierarchical model of habitat selection using eastern massasauga rattlesnakes (*Sistrurus c. catenatus*). Biol. Conserv. 130:206-216

Marshall, J.C., J.V. Manning, and B.A. Kingsbury. 2006. Movement and macrohabitat selection of the eastern massasauga in a fen habitat. Herpetologica 62:141-150.

Weatherhead, P.J. and K.A. Prior. 1992. Preliminary observations of habitat use and movements of the eastern massasauga rattlesnake (*Sistrurus c. catenatus*). J. Herpetol. 26:447-452.

iv) Eastern foxsnake, eastern hog-nosed snake, gray ratsnake, or massasauga nesting sites, gestation/oviposition sites, and communal shedding or basking sites

Description of value

Revised guide status and rationale:

There is no change to the description of eastern foxsnake, eastern hog-nosed snake, gray ratsnake, or massasauga nesting sites, gestation/oviposition sites, and communal shedding or basking sites.

Standards and guidelines: Retained, revised, or new

Revised guide status and rationale:

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There is no change to the direction for snake nesting sites, gestation/oviposition sites, and communal shedding or basking sites.

The recent literature continues to support the existing background and rationale.

(C&R) 4.3.6.2 Turtles

Preamble/Direction

Direction for turtle nesting sites has been divided into natural nesting sites and anthropogenic nesting sites to address the differences of nesting site locations.

Revisions have been made to the Blanding's turtle and spotted turtle direction. The revisions provide more detail for the description of the value and provide more flexibility to address local conditions.

Wood turtle direction has been added to nesting sites and species-specific direction addressing foraging, thermoregulation, hibernation, and movement habitat has been added to this guide.

The snapping turtle was added to the SARO list in 2009, and has been added to the direction for natural turtle nesting sites, anthropogenic turtle nesting sites, and turtle hibernation sites.

Spiny softshell turtle direction has been removed. Generally, this species habitat does not overlap with forested habitat in the managed forest.

i) Turtle natural nesting sites

Description of value

Revised guide status and rationale:

Spotted turtle, wood turtle, and snapping turtle have been added to the direction for natural nesting sites. Turtle nesting sites have been divided into natural and anthropogenic nesting sites (see below).

Natural nesting sites known to have been used by spotted turtle, wood turtle or snapping turtle within the past 40 years and eastern musk turtle or northern map turtle within the past 10 years and the area within a radius of 30 m and nesting sites known to have been used by Blanding's turtle during the current year and the area within a radius of 10 m comprises the AOC.

Standards and guidelines: Retained, revised, or new

Revised guide status and rationale:

The only change to the direction is adding spotted turtle, wood turtle and snapping turtle.

Spotted turtles show a high fidelity to core habitat areas and breeding sites (ECCC 2018). Spotted turtle has an extended generation time that is estimated to be 40.6 years (ECCC 2018).

Wood turtles have been known to exhibit high nest-site fidelity and the 40-year period represents the approximate generation time for a wood turtle (ECCC 2020b).

Female snapping turtles exhibit strong nesting site fidelity returning to the same site year after year (ECCC 2020a). Snapping turtles can often reach ages of greater than 50 years (ECCC 2020a).

LITERATURE CITED

Environment and Climate Change Canada. 2018. Recovery strategy for the spotted turtle (*Clemmys guttata*) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. ix + 61 pp.

Environment and Climate Change Canada. 2020a. Management plan for the snapping turtle (*Chelydra serpentina*) in Canada. Species at Risk Act Management Plan Series. Environment and Climate Change Canada, Ottawa, iv + 40 p.

Environment and Climate Change Canada. 2020b. Recovery strategy for the wood turtle (*Glyptemys insculpta*) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. vi + 52 pp.

ii) Turtle anthropogenic nesting sites

Description of value

Revised guide status and rationale:

New description – no current direction for turtle anthropogenic nesting sites.

Direction for turtle nesting sites on anthropogenic sites was included to provide more flexibility regarding the use of roads than the direction for natural turtle nesting sites affords.

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Construction of roads, landings or forestry aggregate pits or associated maintenance activities within these AOCs poses a risk to damage or destroy those sensitive habitat features and the eggs and hatchlings.

The AOC comprises nesting sites along roads and the road surface within 50 m either side, in forestry aggregate pits or wood storage yards (as delineated by the Ministry), and on landings comprise the entire landing, used by Blanding's turtle, spotted turtle, wood turtle, eastern musk turtle, northern map turtle, or snapping turtle.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within the AOC.

Revised guide status and rationale:

Nesting sites are key features on the landscape, required to support key life processes for turtles.

Avoiding harvest, renewal and tending operations within the AOC avoids potential damage or destruction of these habitat features and the risk of killing or injuring turtles.

Maintenance operations that disturb the roadbed (except those required for safety or environmental protection and accompanied mitigation) associated with existing roads or operations associated with existing landings are not permitted within the AOC during the nesting, incubation, and juvenile dispersal period unless with Ministry approval, including the following conditions:

- During road maintenance operations, roads within the AOC will be clearly identified using flagging tape, signs, or other visual markers
- Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits) and measures to increase awareness (e.g., training, signage).

Operations associated with existing forestry aggregate pits are not permitted within the AOC during the nesting, incubation, and juvenile dispersal period unless with Ministry approval (see Appendix 1b), including the following condition:

- During aggregate extraction, the AOC will be clearly identified using flagging tape, signs, or other visual markers.

Revised guide status and rationale:

Restricting maintenance operations on roads and landings in the AOC and restricting operations associated with existing aggregate pits will reduce the overall risk of potential damage to key habitat features and potential injury or mortality to turtles, during critical reproductive periods and during times of year when these species are most vulnerable or mobile.

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Marking nesting sites so that they can be avoided during road maintenance operations will reduce the overall risk of potential damage to the habitat feature and potential injury or mortality to turtles.

Targeted driver training combined with measures to reduce speeds and increase awareness, can help to reduce the likelihood of traffic-related mortality. In a study of parameters that influence road mortality of several taxa in southwestern Ontario, posted road speed limit was the dominant positive predictor of roadkill (Farmer and Brooks 2012, OMNRF 2016).

LITERATURE CITED

Farmer, R.G. and R.J. Brooks. 2012. Integrated risk factors for vertebrate roadkill in southern Ontario. *J. Wildl. Manage.* 76:1215-1224.

OMNRF. 2016. Best management practices for mitigating the effects of roads on amphibians and reptile species at risk in Ontario. Queen's Printer for Ontario. 112 pp.

iii) Turtle hibernation sites

Description of value

Revised guide status and rationale:

Snapping turtle has been added to turtle hibernation sites, otherwise the direction remains unchanged.

Suitable hibernation sites and associated aquatic features known to have been used by the eastern musk turtle, northern map turtle or snapping turtle at least once within the past 10 years.

Standards and guidelines: Retained, revised, or new

Revised guide status and rationale:

The only change to the direction is adding snapping turtle.

iv) Blanding's turtle foraging, thermoregulation, hibernation, and movement habitat

The Blanding's turtle habitat direction was simplified by rolling the hibernation site direction into the same AOC. The direction was also revised to be more specific and

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identify key aquatic areas in the value description and also to provide more flexibility to address local conditions and circumstances.

Description of value

Revised guide status and rationale:

The description for Blanding's turtle habitat is revised to identify some key small aquatic areas used for staging and in some cases hibernation.

The AOC is comprised of identified large aquatic habitats and the area within a distance of 200m that are within 2 km of reliable observations and identified small aquatic habitats and the area within 30 m that are within 2 km of reliable observations within the past 40 years.

Aquatic habitats include aquatic features that have a high potential to be used by Blanding' turtle during the **active season** and **hibernation period**. Large aquatic habitats, ≥ 0.5 ha known to be used during the **active season**, or isolated small aquatic habitats, < 0.5 ha, known to be used during the **active season** and the **staging period**.

Large Aquatic Habitats:

- The area within 0-30 m of large aquatic habitats comprises MMZ1.
- The area within 31-100 m of large aquatic habitats comprises MMZ2.
- The area within 101-200 m of large aquatic habitats comprises MMZ3.

Small Aquatic Habitats:

- The area within 0-15 m of small aquatic habitats is a reserve.
- The area within 16-50 m of small aquatic habitats comprises MMZ4.

The mean generation time for Canadian Blanding's turtles is estimated to be 40 years (range 37-42 years), based on an age of maturity at 20-25 years (COSEWIC 2016).

Blanding's turtles are shown to exhibit high fidelity to their nesting sites and overwintering sites and, to a lesser extent, to their home range (ECCC 2018).

Suitable aquatic habitat, plus 200 m within 2 km of a reliable observation, is intended to capture the range of life cycle activities of Blanding's turtles. These activities include mating, thermoregulation, foraging, summer inactivity, overwintering and movement (ECCC 2018).

Females can make movements up to 2 km or more through upland habitat to access nesting sites, but generally travel no more than 0.5 km between wetlands (Edge 2008, Edge et al. 2010, Congdon et al. 2008, Joyal et al. 2001). In the Joyal et al. (2001) study in Maine, the maximum distances that Blanding's travelled to nest was 1620 m (mean 633 m +/- 587) and travel between wetlands was 2050 m (mean 680 m +/- 550).

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An area of 1800 m (one half the largest observed inter-wetland movement) would incorporate 93% of all inter-wetland movements and protect all known nesting and overwintering locations (Edge 2008).

Blanding's turtles shift their habitat use throughout the active season (Beaudry et al. 2009), and they make regular over-land movements between wetlands or other aquatic areas throughout the active season in order to access mates, overwintering sites, nesting sites, other seasonally required resources and thermoregulation sites (Rowe and Moll 1991, Joyal et al 2001, Beaudry et al 2009, Congdon et al 2008, Edge et al 2010). Blanding's turtles' nest within close proximity of suitable aquatic habitat, with average reported distances between nests and the nearest wetland ranging from 100 to 242 m, with maximum distance of up to 400 m (Joyal et al 2001, Beaudry et al 2010, Congdon et al. 2011, Paterson et al 2012, Refsnider and Linck 2012). Average inter-wetland movement distances for an Ontario population were 231 m for males and 497 m for females (Edge et al 2010). Thus, even during long nesting migrations, Blanding's turtles are most often within 250 m of suitable aquatic habitat.

In general Blanding's turtles occupy a variety of eutrophic wetlands and slow flowing streams (Rowe and Moll 1991, Congdon et al 2008). They prefer marshes, swamps, ponds, fens and bogs interspersed with shallow open water (Hartwig 2004, Edge 2008, Edge et al 2010). Wetlands are preferred over lotic and upland habitats (Edge et al 2010). Blanding's turtles are associated with shallow water depths (mean 30 cm, up to 2.5 m), deep muck substrates and areas of abundant floating, submerged and emergent vegetation that provides food, thermoregulation and cover from predators (Kofron and Schreiber 1985, Hartwig 2004, Hartwig and Kiviat 2007). Blanding's will use wetlands ranging in size from <1 ha to >100 ha, but most occupied wetlands reported in the literature are >0.5 ha in size (see review in Hartwig 2004).

Local experts in central Ontario identified the importance of small aquatic areas <0.5 ha for staging, and in some cases hibernation, for Blanding's turtles. Modified management zones around large aquatic areas have been decreased based on recent local studies in central Ontario and expert opinion.

Standards and guidelines: Retained, revised, or new

In aquatic habitats, operations involving heavy equipment (e.g., mechanical harvesters, skidders, bulldozers) or otherwise representing a potential injury risk to turtles are not permitted:

- In MMZ1 during the active season
- In MMZ2 during the terrestrial period
- In MMZ3 during the nesting period
- In MMZ4 during the terrestrial period and staging period.

Notes

The active season is April 15 to October 15. The terrestrial period is April 15-July 7. The nesting period is June 1-July 7. The staging period is August 21-October 15. Local knowledge may be used to adjust these dates.

Revised guide status and rationale:

Harvest, renewal and tending operations at the scale that it occurs within Blanding's turtle habitat is generally not expected to negatively affect Blanding's turtle upland habitat (ECCC 2018).

It is now understood that harvesting adjacent to aquatic and wetland ecosystems may be beneficial to beavers among other species that use early-mid successional forest species and to the multitude of species that depend on wetlands created by beavers (Section 4.1.3 SSG). Thus, harvest is permitted within the area immediately adjacent to within 30 m of large aquatic habitats and within 15 m of small aquatic habitats, subject to specific conditions that are likely to avoid damage or destruction of Blanding's turtle habitat. These conditions will help maintain the hydrological function and integrity of the aquatic habitat, minimize the risk of transporting sediment into water features, and maintain cover and microhabitats necessary for basking adjacent to these habitats.

Blanding's turtles are dependent on the area within 30 m of large aquatic habitats as basking habitat throughout the active season (Joyal et al 2001). For Blanding's turtles, basking can take place within aquatic habitat, as well as on open shoreline in areas with partial to full sunlight and mainly occurs within of 30 m of wetlands (Joyal et al 2001). A 30 m radius (average tree height) buffer is also important to maintain the microclimate conditions (e.g., thermal, vegetative and lighting features).

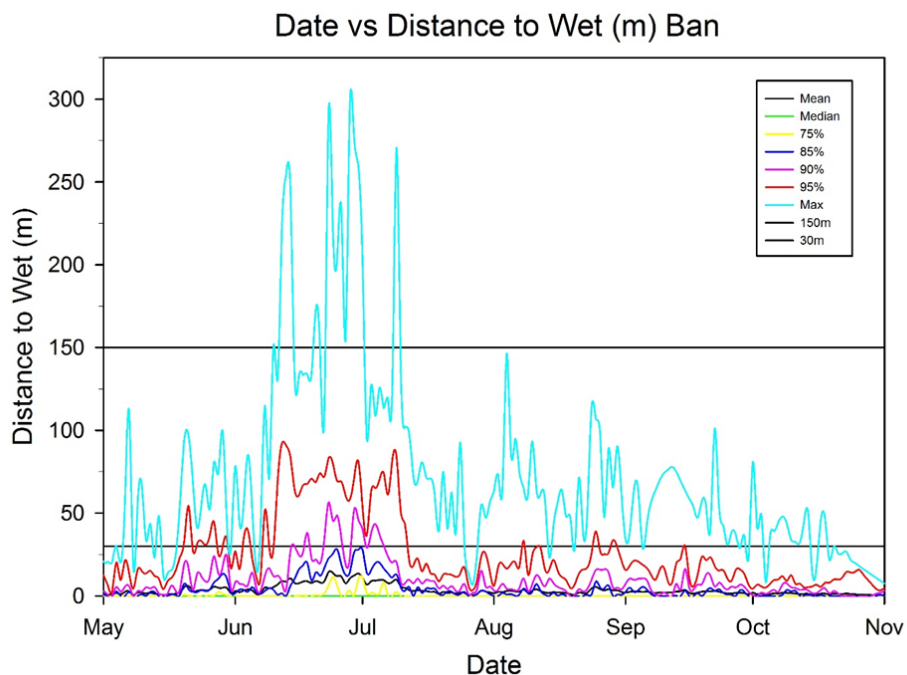
The operation of heavy equipment within Blanding's turtle habitat during the active season has the potential to result in injury or mortality of Blanding's turtles. Conducting forestry operations when Blanding's turtles are least likely to be in upland habitats, outside the active season, will reduce the risk of encounters with heavy equipment.

Blanding's turtles are generally active from April to October (COWEWIC 2016, ECCC 2018). However, at more northern latitudes, such as in the managed forest, it is likely that the active season does not begin until mid April and ends mid October (Edge et al 2009).

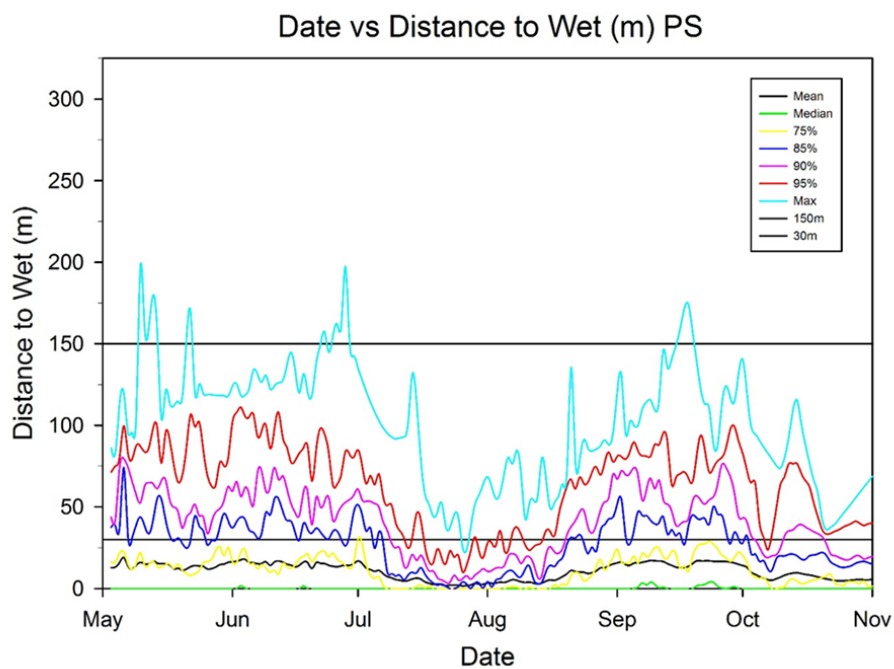
Blanding's turtle nest from late May until early July (Edge et al 2010, Millar and Blouin-Demers 2011, Markle and Chow Fraser 2014, ECCC 2018).

Based on local studies in Parry Sound, Bancroft, and Algonquin Park areas, and expert opinion, modified management zones around large aquatic areas have been decreased and timing periods have been adjusted, identifying periods when turtles are less active in order to provide more flexibility for operations to occur without the likelihood of harming turtles and their habitat.

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Telemetry data showing distance of tracked Blanding's turtles in Bancroft (Ban) to aquatic habitat throughout the active season. Cameron, G., J. Rouse. Unpublished data



Telemetry data showing distance of tracked Blanding's turtles in Parry Sound (PS) to aquatic habitat throughout the active season. Cameron, G., J. Rouse. Unpublished data

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Data showing distance of tracked Blanding's turtles in Algonquin Park to aquatic habitat throughout the active season. Data from Algonquin Park (C. Edge 2010)

April – May

- 162 observations
- 95% observed <100 m from wet area

June – July 7

- 186 observations
- 98% observed <200 m from wet area

July 8 – October

- 301 observations
- 99.7% observed <30 m from wet area

Aug. 21 – October

- 61 observations
- 100% observed <30 m from wet area

Only operations associated with low risk road maintenance necessary to maintain safe travel conditions on primary roads within MMZ1 are allowed during the active season (see also turtle nesting site direction).
Materials accumulated through [primary, branch, operational] road maintenance (e.g., brush, gravel) will not be deposited into small aquatic habitats (e.g., borrow pits, roadside ditches, vernal pools).
New primary (including winter roads) and associated landings are not permitted within MMZ1 or MMZ4 except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process.
New all-weather primary roads and associated landings within MMZ2 and MMZ3 will be constructed with Ministry approval to ensure roads are built in areas with the least potential impact on turtles and their habitat.
Operations associated with existing [primary roads] landings are not permitted within MMZ1 during the active season, unless with Ministry approval.
Forestry-related traffic and operations on primary roads within MMZ1 during the active season or within MMZ2 and MMZ3 during the nesting period will be accompanied by measures to reduce traffic speed (e.g., reduced speed limits, minimal grading, etc.) and measures to increase awareness (e.g., training, signage).
Temporary water drawdowns that negatively impact hibernation habitat are not permitted but may be allowed subject to timing restriction and with Ministry approval.
Road maintenance activities [primary, branch, operational roads] that will result in permanent changes to water levels within large aquatic habitats are not permitted except where beaver activity has affected a water crossing and the resulting water levels are likely to create a safety or environmental concern and the activity will not lower water levels below what was present before the beaver activity.

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Construction of new branch roads, operational roads and associated landings is not permitted: • In MMZ1 during the active period • In MMZ4 during the terrestrial period or the staging period.
Construction of new roads or associated landings are not permitted: • In MMZ2 during the terrestrial period • In MMZ3 during the nesting period.
Only operations associated with low risk road maintenance necessary to maintain safe travel conditions on existing branch roads and operational roads within MMZ1 are allowed during the active season (see also turtle nesting site direction).
New branch roads, operational roads, and associated landings are not permitted within MMZ1 or within MMZ4, unless approved by the Ministry.
New branch roads, operational roads, and associated landings within MMZ2 and MMZ3 will be constructed with Ministry approval to ensure roads are built in areas with the least potential impact on turtles and their habitat.
Operations associated with existing landings are not permitted within MMZ1 during the active season , unless with Ministry approval.
Forestry-related traffic and operations on branch roads and operational roads within MMZ1 and MMZ4 during the active season or within MMZ2 and MMZ3 during the nesting period will be accompanied by measures to reduce traffic speed (e.g., reduced speed limits, minimal grading), and measures to increase awareness (e.g., training, signage).
New forestry aggregate pits and wood storage yards are not permitted within MMZ1.
New forestry aggregate pits and wood storage yards within MMZ2, MMZ3 and MMZ4 will be constructed with Ministry approval.

Best management practices: Retained, revised, or new

Construct new roads on existing roadbeds (where the vegetation is predominantly <8 m tall) whenever practical.
Reuse old landings whenever practical.
During operations associated with existing aggregate pits operators should walk the aggregate pit immediately (i.e., less than one hour) before operations within MMZ1 during the active season or within MMZ2 and MMZ3 during the nesting period .

Revised guide status and rationale:

Traffic-related mortality is one of the most significant threats to Blanding's turtle in Ontario, and forestry roads have the potential to result in Blanding's turtle mortality. Primary roads pose a higher risk to Blanding's turtles, while branch and operational roads present a lower risk based on probable traffic volumes. Blanding's turtle activity

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and habitat use are concentrated within 30 m of aquatic habitat (Joyal et al 2001). As such, the risk of traffic-related mortality is greatest for Blanding's turtles within 30 m of aquatic habitat, while the risk of traffic-related mortality in areas that are greater than 30 m from aquatic habitat decreases.

Due to the small size of the small aquatic habitats and their importance to the life processes of Blanding's turtle MMZ4 extends to 50 m. Turtles are most vulnerable when they are staging and hibernating.

Although Blanding's turtle activity is concentrated in and around aquatic habitat, Blanding's turtles will make long overland movements, particularly during the nesting season. The creation of new roads within the AOC has the potential to result in harm to turtles. When new roads are required, they will be constructed with Ministry approval to minimize potential impacts to Blanding's turtle and their habitat.

Conducting road operations when Blanding's turtles are least likely to be in upland habitats will significantly reduce the risk to Blanding's turtles, including during the nesting period.

Blanding's turtles are highly dependent on the area within 30 m of aquatic habitat throughout the active season. Restrictions on the use of existing landings within 30 m of aquatic habitat during the active season reduces the potential to injure a turtle to a low risk.

When operational roads must be constructed within the AOC, it will be done with Ministry approval to ensure potential effects of increased access are mitigated. Most of the roads constructed in Blanding's turtle range within the managed forest are operational roads.

The operation of heavy equipment within Blanding's turtle habitat during the active season has the potential to result in injury or mortality of Blanding's turtles. Conducting road maintenance outside the active season, when Blanding's turtles are least likely to be in upland habitats, will significantly reduce the risk of encounters with heavy equipment.

Restrictions on the use of existing landings within at 30 m of large aquatic habitat of aquatic habitat during the active season reduces the potential to injure a turtle to a low risk.

Water drawdowns may adversely affect aquatic habitat suitability.

Blanding's turtles may use aggregate pits as nesting sites or use them as basking sites. Walking the forestry aggregate pit prior to proceeding with operations will lower the risk of harm to turtles.

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v) Spotted turtle foraging, thermoregulation, hibernation, and movement habitat

Description of value

Revised guide status and rationale:

The description for spotted turtle habitat was revised to provide more detail about the suitable aquatic habitat (SAH) for spotted turtle and reflects information from recent studies which will provide more consistency in the delineation of SAH. The AOC size was increased from all SAH within 500 m to 1 km. The inclusion of terrestrial habitats

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adjacent to SAH was decreased from 300 m to 130 m. The description was simplified and removes the use of suitable summer habitat, suitable winter habitat and aestivation sites which will be captured under SAH and the terrestrial area within 130 m.

The AOC comprises permanent mapped aquatic features of SAH and the area within a distance of 130 m from the boundary of SAH that are within 1 km of reliable observations of spotted turtles reported within the past 40 years.

SAH includes a variety of permanent mapped aquatic features such as marshes, bogs, fens, swamps, deep ponds and small lakes within bog areas. SAH should have soft substrate with abundant aquatic and floating vegetation, with shallow areas (≤ 2 m in depth). These features provide habitat for foraging, cover, and thermoregulation.

The AOC encompasses SAH within 1 km of observations which represents the maximum individual home range length for spotted turtle. (Haxton 1998, Lewis and Ritzenthaler 1997, Joyal et al 2001, Beaudry et al 2010).

The species requires passable habitat between SAH and suitable sites for nesting, thermoregulation, summer activity periods and for hatchlings to access suitable habitat. Spotted turtle travel frequently overland (Beaudry et al 2009). Based on an analysis of spotted turtle movements, a 130 m terrestrial distance captures 95% of terrestrial observations of the species, including nesting locations and the movement of hatchlings (Steen et al 2012).

The generation time of spotted turtle is estimated to be 40.6 years (COSEWIC 2014). Application of a forty-year timeframe allows for the inclusion of local populations that likely persist but for which spotted turtle individuals may not have been detected in recent years (ECCC 2018).

The spotted turtle has distinct seasonal movement patterns (Joyal et al 2001; Beaudry et al 2009) as the species moves among aquatic and terrestrial habitats to meet different biological or behavioural needs (ECCC 2018). Habitat used by spotted turtles varies greatly throughout the species' geographical range and amongst different populations (Haxton and Berrill 1999, Rasmussen and Litzgus 2010, ECCC 2018). In general, spotted turtles within the managed forest prefer marshes and bogs, hibernating exclusively in bogs, and deep ponds and small lakes within bog areas (≤ 2 m in depth) (Litzgus 1996, Haxton and Berrill 1999). They also use fens and swamps (COSEWIC 2014, ECCC 2018). SAH is associated with soft substrates and aquatic and emergent vegetation that provides food, thermoregulation, and cover from predators (ECCC 2018).

Woodland pools and drainage ditches (of suitable depth) (ECCC 2018) can provide habitat, but the described SAH is preferred.

Standards and guidelines: Retained, revised, or new

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Harvest, renewal, and tending operations are permitted within the AOC subject to the following conditions:

- Harvest, renewal, and tending operations (including extraction trails) are not permitted within known or suspected hibernation sites or in SAH
- Harvest, renewal and tending operations are not permitted within 30 m of SAH during the active season.

Revised guide status and rationale:

All operations are subject to the standard conditions placed on operations adjacent to standing and flowing waters outlined in the SSG section 4.1.

Habitat alteration caused by forest harvesting is not likely to affect spotted turtles; early successional habitats (including clearcuts) may actually represent important nesting (e.g., Litzgus and Mousseau 2004) or summer inactivity habitat (COSEWIC 2014). Avoiding harvest, renewal, and tending operations within overwintering sites and suitable aquatic habitat avoids damage or destruction of habitat and prevents killing, harming, or harassing of turtles that may be present within these areas. Some spotted turtles may show strong fidelity to individual hibernacula, in some cases with multiple turtles occupying one hibernaculum (Litzgus et al 1999, Haxton and Berrill 1999, Rasmussen and Litzgus 2010).

Mortality or injury associated with encounters with heavy equipment is a potential risk. Thus, restrictions are placed on harvest, renewal, and tending operations within the AOC during the active season.

In some parts of Ontario (and other parts of their range) they are rarely found more than a few metres from water throughout the summer (Haxton and Berrill 1999). Restricting activities involving use of heavy equipment within 30 m of SAH during the active season will reduce the likelihood of injury or mortality of turtles undertaking aestivation/summer inactivity and nesting movements.

Only operations associated with low risk road maintenance [primary, branch, and operational roads] necessary to maintain safe travel conditions on existing primary and branch roads within 30 m of SAH are allowed during the active season.

New primary and branch roads are permitted within the AOC subject to the following conditions:

- New primary and branch roads are not permitted within 30 m of SAH, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process
- New primary and branch roads are not permitted within 130 m of communal hibernation sites, as defined by the Ministry
- New all-weather primary and branch roads or associated landings within 31-130 m of SAH will be constructed with Ministry approval to ensure roads are built in areas with the least potential impact on turtles and their habitat.

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Forestry-related traffic and operations on [primary, branch, operational] roads within 30 m of SAH during the active season, within 130 m of SAH during the nesting period will be accompanied by measures to reduce speeds (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training and signage).
New operational roads are permitted within the AOC subject to the following conditions: • New operational roads are not permitted within 30 m of SAH, unless approved by the Ministry • New operational roads are not permitted within 130 m of significant communal hibernation sites, as defined by the Ministry • New all-weather operational roads or associated landings within 31-130 m of SAH will be constructed with Ministry approval to ensure roads are built in areas with the least potential impact on turtles and their habitat.
New operational roads will be promptly decommissioned when operations are done unless with Ministry approval.
New forestry aggregate pits and wood storage yards are not permitted within 30 m of SAH.
New forestry aggregate pits and wood storage yards are not permitted within 130 m of significant communal hibernation sites, as defined by the Ministry.
New forestry aggregate pits and wood storage yards within 31-130 m of SAH will be constructed with Ministry approval.

Revised guide status and rationale:

Roads are not permitted within SAH as they may affect the suitability of habitat by altering hydrological regime or increasing frost penetration, resulting in damage or destruction of habitat.

Overwintering habitat may be particularly susceptible to damage as changes in hydrology or frost penetration may result in the habitat no longer being suitable. As spotted turtles may overwinter communally, this may result in a risk to population viability if there is not alternate suitable habitat in close proximity.

Combined with mitigation risk associated with new roads within 30 m of SAH, decommissioning existing roads that are also located within 30 m of SAH (or within other priority areas where decommissioning is not possible within 30 m) will reduce the risk of road mortality and injury.

Operational roads are expected to result in lower risk of injury or mortality compared to primary or branch roads. Operational roads have lower traffic volume (including use by the public) and thus create a lower risk of injury or mortality (Len Hunt, unpublished data 2016).

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When operational roads must be constructed within the AOC, reasonable efforts will be made to mitigate potential effects of increased access. Most of the roads constructed in spotted turtle range within the managed forest are operational roads.

Yagi and Litzgus (2012) found that 90-99% of spotted turtle activity occurred within aquatic habitat and Haxton and Berrill (2001) observed that turtles were found submerged throughout all the active season (April 15-October 15). The area within 30 m SAH is likely used more often by spotted turtles.

Some spotted turtles show strong fidelity to individual hibernacula, in some cases with multiple turtles occupying one hibernaculum (Litzgus et al 1999, Haxton and Berrill 1999, Rasmussen and Litzgus 2010).

Communal overwintering sites may contain large portions of a local population, and thus roads within 130 m would place the population at a disproportionately high risk of road mortality or injury.

Most terrestrial activity occurs during the nesting period which occurs shortly after they emerge from hibernacula (Haxton and Berrill 1999, Beaudry et al. 2009, COSEWIC 2014). For example, in Pennsylvania female spotted turtles moved up to 50 m from water for nesting and males could be found up to 250 m from water. Two studies in Maine found spotted turtles a maximum of 120 m from wetlands with a mean ranging from 21.5 m to 50 m (Joyal et al 2001, Beaudry et al 2010). Steen et al (2012) reviewed studies on terrestrial habitat requirements of nesting turtles, and for studies on spotted turtles from Massachusetts and Ontario, found that 95% of turtle nests or gravid females are found within 127 m of wetlands. Upland dormancy (summer inactivity) sites were found within 80 m of wetlands (Joyal et al 2001). Thus, direction is more restrictive within 130 m of hibernacula.

Avoiding key habitat features (e.g., nesting sites, hibernacula) and concentrations of turtles reduces the risk of traffic and heavy equipment related mortality as turtles are likely to travel over land to reach these areas and travel between them to meet life process requirements (Beaudry et al 2009, ECCC 2018).

The operation of heavy equipment, within 30 m SAH during the active season and 130 m of SAH during the nesting period, has the potential to result in injury or mortality of spotted turtles (see above under potential effects of forest management, roads). Inter-wetland movements peaked during the nesting period (Beaudry et al 2009). Conducting low risk road maintenance, only when necessary for safety, in combination with reduced speed measures and awareness, will greatly reduces the risk to turtles.

Targeted driver training combined with measures to reduce speeds and increase awareness can help to reduce the likelihood of traffic-related mortality. In a study of parameters that influence road mortality of several taxa in southwestern Ontario, posted road speed limit was the dominant positive predictor of roadkill (Farmer and Brooks 2012, OMNRF 2016).

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Spotted turtles may use a variety of sites for nesting which could include aggregate pits. Inter-wetland movements peaked during the nesting season (Beaudry et al 2009). Walking the forestry aggregate pit prior to proceeding with operations will lower the risk of harm to turtles.

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vi) Wood turtle foraging, thermoregulation, hibernation, and movement habitat

The wood turtle AOC is new direction and focuses on minimizing the risk of direct mortality from traffic and forest management equipment, maintaining, and protecting suitable habitat and minimizing access to populations by collectors. The AOC combines direction for nesting sites for wood turtle along with other key elements of habitat.

Description of value

Revised guide status and rationale:

New description – no current species-specific direction for wood turtle.

The AOC comprises suitable aquatic habitat (SAH) within 2 km of reliable observations of wood turtles reported within the past 40 years, and the area within a distance of 200 m from the boundary of SAH.

SAH to be identified by the Ministry will normally include rivers and/or streams with moderate current, sand or gravel substrates, deep pools (generally >1 m deep in the winter), and nearby nesting sites (e.g., sand and gravel bars). SAH may also have

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undercut banks, log jams and beaver dams. SAH includes the aquatic feature up to the high-water mark. Local knowledge may be used to refine the definition of SAH.

The AOC is divided into two zones:

- **Zone A** consists of SAH within 2 km of reliable observations of wood turtles within the past 40 years and the area ≤ 30 m.
- **Zone B** consists of the area within 31-200 m of SAH described in **Zone A**.

The AOC is divided into two zones. Both zones A, and B are within 2 km up and down stream of reliable observations of wood turtles.

This distinction reflects the assumption that the likelihood of encountering turtles (especially in terrestrial habitats) >2 km from a reliable observation is very low since the average home range length (along a watercourse), from studies in Ontario and Quebec, is approximately 2 km (OMNR unpubl. data 2006, Greaves 2007, ECCC 2020).

The two zones are based on the distance female turtles travel from SAH during the active season and thus the likelihood of encountering turtles during forest management operations:

- Approximately 55% of locations of 33 radio-tagged turtles studied in 3 populations in Ontario (Bill Greaves unpubl. data 2005, OMNR 2005, OMNR unpubl. data 2006) were within 30 m of SAH.
- Approximately 90% of locations were within 200 m of SAH.

The risk of wood turtle mortality or injury resulting from road traffic or encounters with heavy equipment is likely highest close to SAH (e.g., within 30 m of SAH), where wood turtle activity and habitat use is concentrated for much of the season. Risk is likely much lower in upland terrestrial habitat that is further than 200 m from SAH, since wood turtles spend little of their time in these areas.

Similarly, risk is likely highest within the core area of the population (e.g., within 2 km of an occurrence) and lower at the extremities where wood turtles spend less time.

The wood turtle is a long-lived species that has a long-term reproductive success strategy based on delayed sexual maturity (11 – 22 years) (ECCC 2020). The 40-year period represents the approximate generation time for a wood turtle (ECCC 2020, COSEWIC 2007). Wood turtles show fidelity to their home ranges and to nest areas (Walde et al 2007, ECCC 2020). The large timing window allows for inclusion of local populations that likely persist but for which wood turtle individuals may not have been detected in recent years. It also increases the confidence that a site will likely contribute to the maintenance of a local wood turtle population (ECCC 2020).

Wood turtles are associated with rivers and streams with sandy or gravely sandy bottoms, and prefer clear, meandering streams with moderate current and frequent oxbows (Wesley 2006, COSEWIC 2007 and 2018). Other habitats used less often by wood turtles include bogs, marshy pastures, beaver ponds, oxbows, riparian, and shrub

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areas (COSEWIC 2007 and 2018). Repeatedly used habitat elements included specific riverine sandbars and undercut riverbanks (Thompson et al 2018).

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within Zone A .
Harvest, renewal, and tending operations are permitted within Zone B subject to timing restrictions (see notes below) and the following condition: • Within Zone B, ensure $\geq 30\%$ of mature forest is retained.
Operations involving heavy equipment or otherwise representing a significant risk to turtles are not permitted in Zone B during terrestrial period .

Notes

The active season is April 1-October 31. Terrestrial period is May 1-September 30. Local knowledge may be used to adjust these dates.

Revised guide status and rationale:

Selection of watercourses by wood turtles appears to be influenced by characteristics of habitat within 30 m of the water's edge (Wesley 2006). Moreover, wood turtles are highly dependent on these areas throughout the year, and $\geq 50\%$ of radio-telemetry locations have been reported within 30 m of the water's edge (Wesley 2006, Sweeten 2008, Tingley et al 2009). Thus, the risks to the species and protection of aquatic habitat are likely highest within this area.

The literature suggests that suitable wood turtle habitat is a mosaic of open, shrubby, and forested habitats (Compton et al 2002, Wesley 2006, Dubois et al 2009). For example, in Algoma District, habitat characterized as available to wood turtles was roughly 20% open, herbaceous-dominated, or short (<2 m tall) shrub-dominated habitat, 30% tall (2-5 m tall) shrub-dominated habitat, and 30% forested habitat (>5 m tall) (Thompson et al 2018, Wesley 2006: Appendix 6). In Maine, Compton et al (2002) found a similar amount (10-50%) of forested habitat (age not defined) where the probability of wood turtle occurrence was high (no data presented for open or tall shrub habitats). In Quebec, Dubois et al (2009) found that the area used by wood turtles was about 40% 'closed' habitat (alder thickets and forested habitat) and about 50% 'open' habitat (e.g., hay fields, wetlands, habitat dominated by shrubs <2 m tall or herbaceous vegetation). Compton et al (2002) suggests that wood turtles select forest edges to balance thermoregulatory and feeding needs. This was confirmed in Dubois et al. (2009).

Thus, an appropriate mix of habitat types appears to be roughly 10-30% open habitat, 20-40% shrubby habitat, and 20-40% forested habitat. Harvesting may help create this mosaic as long as sufficient forested habitat (approximately 30%) is retained.

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Habitat within 200 m of SAH generally receives the greatest use by foraging female turtles, retention of at least 30% of Zone B as mature forest is required.

Mortality or injury associated with encounters with heavy equipment is a potential risk. Thus, operations involving heavy equipment (e.g., mechanical harvesters, skidders, bulldozers) or otherwise representing a potential injury risk to turtles are not permitted during specific time periods and within specific portions of the AOC when/where there is a reasonable likelihood of wood turtle presence.

During April and October, >99% of observations are within 30 m of SAH. Since, harvest, renewal, and tending operations are not permitted within Zone A at any time of year (see above), no further seasonal restrictions are prescribed during these months.

Wood turtles move further inland from May through September. Female wood turtle use of terrestrial habitat occurs within 200 m of SAH, and >80% of observations occur within 120 m of SAH (Bill Greaves unpubl. data 2005, OMNR 2005, OMNR unpubl. data 2006), aligning restrictions on broadcast application of herbicides (aerial and machine-based ground application) with the recommendations in the *Ontario Ministry of Environment/Ontario Ministry of Natural Resources Buffer Zone Guidelines for Aerial Application of Pesticides in Crown Forests of Ontario* (1992) for sensitive features (i.e., 120 m from SAH) presents a low risk.

Construction of new primary roads and associated landings are not permitted in Zone A during the active season and in Zone B during terrestrial period.
Only operations associated with low risk [primary, branch, operational] road maintenance necessary to maintain safe travel conditions on existing roads within Zone A and Zone B are allowed during the active season.
New primary roads are not permitted in Zone A or Zone B, except in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process.
Temporary water drawdowns that negatively impact hibernation habitat are not permitted but may be allowed subject to timing restriction and with Ministry approval.
Road [primary, branch, operational] maintenance activities that will result in permanent changes to water levels within large aquatic habitats are not permitted except where beaver activity has affected a water crossing and the resulting water levels are likely to create a safety or environmental concern, and the activity will not lower water levels below what was present before the beaver activity.
Operations within existing [primary, branch, operational roads] landings are not permitted in Zone A and Zone B during the terrestrial period unless with Ministry approval.

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Forestry-related traffic on [primary, branch, operational] roads in Zone A and in Zone B during the active season will be accompanied by measures to reduce traffic speed (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).
New branch and operational roads and associated landings are permitted within the AOC subject to the following conditions: • Construction of new branch roads, operational roads, and associated landings is not permitted in Zone A during the active season and in Zone B during the terrestrial period.
New branch and operational roads and associated landings are permitted within the AOC subject to the following conditions: • New branch roads, operational roads and associated landings will be constructed with Ministry approval to ensure roads are built with the least potential impact on turtles and their habitat • New branch roads and operational roads will be constructed to conditions that restrict traffic flow and road longevity (e.g., maximum 10 m wide cleared corridor, roads built to minimum standards), unless with Ministry approval.
New branch and operational roads will be promptly decommissioned when operations are done unless with Ministry approval.
New forestry aggregate pits and wood storage yards are permitted within the AOC subject to the following conditions: • New forestry aggregate pits and wood storage yards are not permitted within Zone A.
New forestry aggregate pits and wood storage yards are permitted within the AOC subject to the following condition: • New forestry aggregate pits and wood storage yards within Zone B will be constructed with Ministry approval.

Revised guide status and rationale:

The creation of forestry access roads within the AOC may result in traffic-related mortality and illegal collection and. However, risk is likely greatest within zones A and B (approximately 90% of female turtle observations) and on primary roads where traffic volumes are likely higher. New primary and branch roads are not permitted within zones A and B except in extraordinary circumstances. Traffic volumes on branch and operational roads are low and pose a lesser likelihood of risk to turtles. Wood turtles are highly dependent on the watercourse and the area within 30 m of the water's edge throughout the year (≥50% of radio-telemetry locations have been reported within 30 m of the water's edge; Wesley 2006, Sweeten 2008, Tingley et al 2009), and the risks associated with roads are highest within this zone.

Traffic related mortality is one of the most significant threats to wood turtle in Ontario and use of forestry roads have the potential to result in mortality.

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The creation of forest access roads within the AOC may result in traffic-related mortality and illegal collection.

The use of heavy equipment has the potential to harm wood turtles during the active season. Allowing low risk road maintenance within zone A and B, only when necessary for safety purposes, poses a low risk for wood turtles.

Water drawdowns may adversely affect aquatic habitat suitability and are thus not permitted in SAH.

Restrictions on the use of existing landings in zones A and B during time periods when they are more likely to be present reduces the potential risk of injury to wood turtles.

Targeted driver training combined with measures to reduce speeds and increase awareness can help to reduce the likelihood of traffic-related mortality. In a study of parameters that influence road mortality of several taxa in southwestern Ontario, posted road speed limit was the dominant positive predictor of roadkill (Farmer and Brooks 2012, OMNRF 2016).

Use of existing roadbeds minimizes an increased footprint on the landscape and requires less aggregate material to restore the roadbed to useable condition.

Wood turtles may use aggregate pits as nesting sites. Walking the forestry aggregate pit or storage yard prior to proceeding with operations will lower the risk of harm to turtles.

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(C&R) 4.3.6.3 Lizards

Preamble

Revised guide status and rationale:

Ontario's only lizard, the five-lined skink, is listed as a species at risk and is found along the southern edge of the managed forest. The primary threats to the survival and

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recovery of five-lined skink include habitat fragmentation and loss (e.g., development), predation, and road mortality (COSEWIC 2021, Seburn 2010).

i) Five-lined skink nesting sites

Description of value

Revised guide status and rationale:

New description – no current species-specific direction for five-lined skink.

The AOC comprises nesting sites known to have been used by common five-lined skink within the past 5 years and the area within a radius of 30 m.

The five-lined skink will communally nest, which allows for more continuous guarding of the eggs by females, as females will guard the eggs of other females (COSEWIC 2021, Seburn 2010). The females exhibit a high level of brooding behaviour and rarely leave the eggs unattended, rotating eggs for air exposure and defending the nest from predators (COSEWIC 2021, Seburn 2010).

The average life span of this lizard does not generally extend beyond 5 to 6 years (COSEWIC 2013).

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within the AOC.

Revised guide status and rationale:

The habitat for the five-lined skink is generally in open areas, rocky outcrops, and rock barren. Keeping heavy machinery away from these areas helps to protect the integrity of the nest site and protect the females while they are laying and guarding the nest, as well as the hatchlings as they disperse.

New roads and landings are not permitted within the AOC.

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Operations associated with existing roads and landings are not permitted within the AOC during the active season unless with Ministry approval, including the following conditions:

- During road maintenance operations, roads within the AOC will be clearly identified using flagging tape, signs, or other visual markers
- Forestry-related traffic and operations will be accompanied by steps to reduce speed within the AOC (e.g., reduced speed limits, minimal grading) and measures to increase awareness (e.g., training, signage).

New forestry aggregate pits and wood storage yards are not permitted within the AOC.

Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the AOC during the active season, unless with Ministry approval.

Notes

Active season is April 15-October 15. Local knowledge may be used to adjust these dates.

Revised guide status and rationale:

In Ontario, the active season of common five-lined skink is usually from mid-April to early October (COSEWIC 2021). Females typically lay eggs from early to mid July on the shield. They brood their eggs for 4-6 weeks and hatching typically occurs in Ontario from late early to mid-August (COSEWIC 2021). Forestry operations would most likely impact five-lined skink nesting sites, through forestry operations occurring during the nesting, incubation, and juvenile dispersal period (e.g., road building, aggregate pits construction, operations involving heavy machinery).

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(C&R) 4.3.7 Birds

Preamble/Direction

Revised guide status and rationale:

New species-specific direction for barn swallow, eastern whip-poor-will, and peregrine falcon (see Section 4.2.2) have been added to this guide.

i) Bank swallow

Description of value

Revised guide status and rationale:

The AOC has been revised to apply to every bank swallow burrow, a change from only applying to colonies of ≥ 100 pairs.

The AOC comprises natural or artificial bank/pit faces containing burrows, that are **known** or **suspected** to have been occupied by breeding bank swallows within the past 10 years for natural sites or 3 years for artificial sites and the area within 50 m. Bank/pit faces containing burrows, or structurally supporting burrows are considered linear features.

The bank swallow nests in burrows excavated in riverbanks, lakeshore bluffs, road cuts and aggregate pits. The revised AOC addresses the nest sites within artificial banks/pit faces by providing additional flexibility regarding forest management operations.

The timeframe for occupancy of burrows in artificial sites has been decreased from 3 to 5 years. As freshly exposed vertical faces are required for burrow excavation, abandoned pits may quickly cease to provide suitable habitat (Freer 1979). After 3 years with no maintenance, nest sites created specifically for bank swallows have been found to become unsuitable for nesting due to slumping of vertical faces, vegetation overgrowth, and/or the soils too hard to excavate (Garrison 1991 cited in Garrison 1998).

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within the following distance of occupied burrows during the **critical breeding period** based on potential impact of the operation (see Appendix 4.2), unless with Ministry approval (see Appendix 1b):

- 50 m for high potential impact operations
- 25 m for moderate impact operations
- 10 m for low potential impact operations.

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Revised guide status and rationale:

The removal of forest cover within the AOC is unlikely to adversely affect the suitability of a nest site since use of sites may be inversely related to the amount of vegetative cover (especially woody cover) present (Garcia 2009, Silver and Griffin 2009). Bank swallows need an unobstructed area in front of the nesting face for entry and exit of the burrows (Hjertass 1984). Removing trees from the area in front of a bank face that supports a colony could potentially increase flying space, and thus is unlikely to have a negative effect on bank swallow foraging.

Harvest, renewal and tending operations above the face of an aggregate pit are unlikely to come close enough to damage burrows or affect the stability of a bank face, both for operator safety reasons and due to operational standards, that require prior removal of trees from near the pit face.

There has been a change where harvest, renewal and tending may be allowed to occur during the critical breeding period with Ministry approval, which is a change from 'except in extraordinary circumstances'.

New primary roads and associated landings are not permitted within the AOC associated with riverine nest sites.
New branch roads and operational roads and associated landings are not permitted within the AOC associated with riverine nest sites.
New branch roads and operational roads are permitted within the AOC associated with riverine nest sites if constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 15 m, outside the critical breeding period.
Operations associated with existing [primary, branch, and operational roads, forestry aggregate pits and wood storage yards] are not permitted within 10 m (low impact operations), 25 m (moderate impact operations), or 50 m (high impact operations) (see Appendix 4.2) of occupied burrows during the critical breeding period unless with Ministry approval.
Follow forestry aggregate pit and wood storage yard direction, as per FMPM (Appendix III and IV), outside the critical breeding period.

Revised guide status and rationale:

The construction of new primary roads, landings, and water crossings in riparian areas supporting riverine colonies might remove existing burrows or alter the suitability of banks. Given the rarity of natural colonies within the managed forest, the longevity of riverine colonies and bank swallow site fidelity, these activities are not permitted at any time within the AOC for natural sites.

Use of an existing roadbed for a branch or operational road, which has less traffic than a primary road, would have less impact and would assume stability of the site upon which they are planned.

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The continued use of artificial nesting sites appears to depend on the regular creation of freshly exposed vertical bank faces (Freer 1979, Ghent 2001a, Ghent 2001b). Nest sites created specifically for bank swallows have been found to become unsuitable for nesting after 3 years with no maintenance (Garrison 1991 cited in Garrison 1998). Extraction operations can create nesting habitat through the formation and maintenance of vertical bank faces (Freer 1979, Hjertaas 1984, Garrison 1999, Ghent 2001b). Timing restrictions prohibiting operations within the AOC during the critical breeding season prevent negative effects on nesting birds and their young.

There are changes to provide flexibility regarding roads by allowing a new road if it is built on an existing roadbed and operations in a forestry aggregate pit or wood storage yard, but only with Ministry approval.

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ii) Barn swallow

Description of value

Revised guide status and rationale:

New direction – no current species-specific direction for barn swallow.

The AOC comprises nests **known** or **suspected** to be or have been occupied by barn swallows and the area within a radius of 20 m.

Møller (2014) measured flight initiation distance (FID) of nesting swallows in response to approaches by a pedestrian. Most species are more sensitive to human intruders than to motorized vehicles etc., so FID is generally thought to be a good variable to consider when defining setback distances. Mean FID is generally multiplied by a constant to define setback distance. Recent work by the US F&W Service used a multiplier of 1.5 to define setback distances for SAR birds (Livezey et al 2016).

Mean FID in Møller (2014) was 12.3 m (SE=0.15), range 1-36 m, N = 2196. Thus, a setback distance of 20 m is used for the AOC.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within the AOC.

Revised guide status and rationale:

This direction ensures that operations will not adversely affect nest sites. Given the fact that the species typically nests on anthropogenic features, it is unlikely the direction will impact operations.

If operations that will remove, damage, or destroy nests or adversely alter the supporting structure are planned to take place during the critical breeding period, the following condition applies:

- Measures must be in place before the critical breeding period to prevent barn swallows from accessing existing nests and/or any part of the supporting structure that is being altered by the planned operations.

Any moderate or high impact operations associated with existing roads are not permitted during the critical breeding period if nests are occupied, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process. However, there is no timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading).

Revised guide status and rationale:

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Barn swallows routinely nest near humans and can habituate to activities taking place around the nest. To minimize potential impacts to the nest and young, only low potential impact road operations are allowed during the critical breeding period.

Timing restrictions (i.e., during critical breeding period) prohibiting operations that have a high potential to impact the species, such as water crossing maintenance and decommissioning, supports the protection of the AOC and the species. Barn swallows depend on these areas for egg laying, incubation, feeding, resting, and rearing of their young (COSEWIC 2021, Heagy et al 2014).

Notes

The critical breeding period is defined as May 1-August 31. Local knowledge of breeding chronology may be used to adjust these dates.

Revised guide status and rationale:

The critical breeding period for this species refers to the time when barn swallows arrive in Ontario in the spring and leave in the fall. The breeding season begins in mid-May and ends in late August (COSEWIC 2011). Bird Studies Canada provides information on nesting dates through their Nesting Calendar Query Tool and the federal Canadian Wildlife Service also has nesting calendars with additional information.

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iii) Cerulean warbler

Description of value

Revised guide status and rationale:

Forest management operations may alter suitability of occupied habitat or disturb nesting birds. Thus, direction identifies suitable habitat within 250 m of reliable observations as the AOC and focuses on:

- maintaining suitability of occupied breeding habitat, and
- avoiding disturbance of nesting birds during the **critical breeding period**.

A review of the literature and the sensitivity of the species to forest fragmentation the size of the AOC has been increased from a 10 ha patch (180 m radius) to a 20 ha patch (250 m radius) and a more detailed description of suitable habitat. The critical breeding period has not changed.

The AOC is comprised of suitable habitat within a radius of 250 m of reliable observations of cerulean warbler breeding evidence reported within the past 30 years comprises the AOC. The area from 0 – 125 m comprises a reserve. The area from 126-250 m comprises an MMZ.

Suitable habitat to be delineated by the Ministry typically includes dense (i.e., ≥ 20 m²/ha basal area and/or $\geq 70\%$ canopy closure) mature or older tolerant hardwood forest with occasional large canopy gaps.

The AOC includes suitable habitat within 250 m of observations of breeding activity within the past 30 years.

The cerulean warbler is considered to be an area sensitive species that is adversely affected by forest fragmentation (Thogmartin et al 2004, Wood et al 2006, Thompson et al 2012). Minimum forest patch size occupied by this species is reported to range from as little as 10 - >1000 ha (COSEWIC 2010); this variation may reflect landscape context and the risk of nest-parasitism or predation (Hamel 2000).

A 250 m radius AOC captures about 20 ha of suitable habitat; minimum patch size requirements in the northeastern part of the species' distribution range from about 10-30 ha (Hamel 2000, Thogmartin et al. 2004, Beaudry et al. 2010).

Observations within the past 30 years are included (longer time frame than used for other bird species) since habitat occupied tends to be relatively stable and adults show high site fidelity (Barg et al 2005, 2006).

The description of suitable habitat is based largely on characteristics of habitat occupied by the cerulean warbler in southeastern Ontario (e.g., basal area that constitutes suitable habitat) (Falconer et al 2015).

Standards and guidelines: Retained, revised, or new

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Harvest, renewal, and tending operations are not permitted within the inner 125 m of the AOC.
Harvest, renewal, and tending operations are permitted within the MMZ subject to timing restrictions and the following condition: Harvest operations are limited to selection harvest that follows residual stand structure targets for old growth hardwood forest (see <i>Ontario Tree Marking Guide</i>).
Harvest, renewal, and tending operations are not permitted within the AOC during the critical breeding period unless with Ministry approval.

Revised guide status and rationale:

The conditions on harvest, renewal and tending are unchanged, but have been adjusted to apply to the inner 125 m reserve area and the outer 125 m MMZ.

Individual nest sites are unlikely to be identified. Prohibiting operations in the inner 125 m during the critical breeding period protects occupied nests from being disturbed or destroyed.

Evidence suggests that the cerulean warbler may respond negatively to forest edges associated with large open areas (Wood et al. 2013). Forest edge may increase predation and brood parasitism (Buehler et al 2008, ECCC 2021). In contrast, the cerulean warbler may respond positively to edges associated with small open areas.

Allowing harvest, renewal, and tending outside of the critical breeding period in the outer 125 m of the AOC, while maintaining appropriate conditions for suitable habitat, minimizes forest fragmentation for the cerulean warbler. Residual stand structure targets for old growth hardwood forest in the Ontario Tree Marking Guide (2004) are prescribed to maintain the density of large diameter trees, considered to be preferred by this species (Weakland and Wood 2005).

New primary roads or associated landings are not permitted within the AOC.
Operations associated with new or existing [primary, branch, operational] roads and associated landings are not permitted within the AOC during the critical breeding period.
There is no timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading).
New branch roads and operational roads are not permitted within the inner 125 m of the AOC.
New landings [branch and operational roads] are not permitted within the AOC.
New branch roads and operational roads are permitted within the MMZ if constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 15 m, outside the critical breeding period.

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New forestry aggregate pits are not permitted within the AOC.

Operations associated with existing forestry aggregate pits are not permitted within the AOC during the critical breeding period unless with Ministry approval.

Revised guide status and rationale:

Road direction was clarified and flexibility re. road construction was added to address the increased size of the AOC.

Roads may provide edges associated with small openings that increase habitat suitability. However, road corridors also remove forest cover, potentially reducing habitat suitability and increasing the risk of predation and/or nest parasitism.

Thus, roads are only permitted in the outer 125 m of the AOC, and if built on existing roadbeds (i.e., they do not create new gaps in the canopy).

Existing or old roadbeds refers to roads that are not yet dominated by trees contributing to canopy structure. Constructing roads on these roadbeds will not alter canopy cover and habitat suitability.

There is no restriction on forestry-related traffic or low potential impact road maintenance operations. Birds that occupy habitat adjacent to existing roads are assumed to be tolerant of such traffic and low potential impact maintenance operations.

There is no change to the conditions on forestry aggregate pits.

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iv) Chimney swift

The AOC reflects the need to retain suitable chimney trees on the landscape for nesting and/or roosting chimney swift. Few alternatives for nesting and roosting habitat, including roosting sites during seasonal migrations, exist when suitable chimneys, structures, or natural tree cavities are unavailable for swifts (COSEWIC 2018).

Roosts are used primarily during migration. Some non-breeding individuals and failed breeders continue to congregate in roosts at night throughout the breeding season. All

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along the migration route, the birds spend their nights in such roosting sites (Steeves et al 2014 as cited in ECCC 2023).

Description of value

Revised guide status and rationale:

The AOC size was reduced from 50 m to a 30 m radius, it reflects a tree length AOC.

The AOC is comprised of trees with suitable nest/roost cavities known or suspected to be or have been occupied by nesting or roosting swifts and the area within a radius of 30 m.

Given the rarity of suitable nest/roost trees and the high fidelity shown by chimney swifts to these features, nest/roost trees known or suspected to have been occupied are considered to be values until they are no longer suitable (Dexter 1992).

The 30 m AOC also captures the 25 m that represents the average height of dominant sugar maple trees within the Bancroft Minden and Mazinaw-Lanark Forests (from the provincial growth and yield database) (Plonski 1974, Scott McPherson, pers. comm. 2015). In the boreal forest the estimated height of a 100 year old white spruce (site class 1) is 26.6 m, the estimated height of a 100 year old trembling aspen (site class 1) is 31.0 m (Maurer 1993)/29.7 m (Plonski 1974) and the estimated height of a 100 year old white pine (site class 1) is 26.4 m (Maurer 1993)/28.8 m (Plonski 1974).

30 m protects the roost/nest tree from damage by other trees harvested or falling. The 30 m AOC also reduces the risk of damage by felled trees. The premise is that if a tree is accidentally felled towards a nest/roost tree, the 30 m reserve would prevent damage to the nest/roost tree and protect the roots from compaction of the surrounding soil.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to the following conditions:

- The nest/roost tree(s) will be retained

Harvest, renewal, and tending operations are permitted within the AOC subject to the following conditions:

- Harvest, renewal, and tending operations are not permitted within the AOC when there are occupied nests/roosts during the critical breeding/roosting period, except in extraordinary circumstances, as specifically identified and justified through the FMP planning process
- Operations involving heavy equipment or that might otherwise adversely affect nest/roost trees or the amount of vertical or lateral cover are not permitted within 20 m of natural nest or roost sites.

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Revised guide status and rationale:

Forest management operations in the vicinity of nest/roost trees that remove surrounding forest cover could potentially alter site suitability and impact the root structure supporting the nest/roost tree, affecting the tree's function and stability.

This direction ensures some concealment for nest/roost trees, protects trees from potential felling or root damage, and ensures dead trees can be retained without creating a potential risk to the safety of workers.

New primary roads and associated landings are not permitted within the AOC.
Operations associated with existing [primary, branch, operational] roads and landings are not permitted during the critical breeding/roosting period when nest/roost trees are occupied, unless with Ministry approval. However, there is no timing restriction on forestry-related traffic or low potential impact road maintenance operations (e.g., grading) if the road predates the nest/roost site.
New landings [branch and operational roads] are not permitted within the AOC.
New branch roads and operational roads are permitted in the AOC if constructed on an existing roadbed (where the vegetation is predominantly <8 m tall) provided the cleared right-of-way width is as narrow as practical and feasible and does not exceed 15 m, outside the critical breeding period.
New forestry aggregate pits and wood storage yards are not permitted within the AOC.
Operations associated with existing forestry aggregate pits and wood storage yards are not permitted within the AOC during the critical breeding/roosting period when nest/roost trees are occupied, unless with Ministry approval.

Revised guide status and rationale:

There has been a change that removes the potential to construct roads, landings, and aggregate pits within 20-50 m (reasonable efforts), and replaces it with the potential to build new operational roads on existing roadbeds within the AOC.

Construction of roads, landings, forestry aggregate pits or wood storage yards within the AOC removes surrounding forest cover that could potentially alter site suitability and could impact the root structure, potentially affecting the nest/roost tree's function and stability.

It is assumed that branch or operational roads constructed on existing roadbeds would not significantly impact the surrounding forest cover and thus maintain the site suitability. The potential impact on the root structure supporting the nest/roost tree, would likely be minimal, thus maintaining the nest/roost tree's function and stability.

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v) Eastern whip-poor-will

Whip-poor-will are insectivores and they forage in open areas and use forested areas for roosting (resting and sleeping) and nesting (Spiller et al 2022). Suitable habitat for whip-poor-will includes a mosaic of habitats for nesting, roosting and foraging. Suitable breeding habitats generally include open, partially and fully treed areas and often exhibit a scattered distribution of treed and open space.

Forestry may have beneficial impacts to whip-poor-will habitat by emulating natural disturbance and maintaining a mosaic of open and closed canopies (ECCC 2018).

Description of value

Revised guide status and rationale:

New direction – no current species-specific direction for eastern whip-poor-will.

The AOC comprises a 12.5 ha patch of suitable habitat OR suitable habitat within a 200 m radius of reliable observations of eastern whip-poor-will breeding evidence reported within the past 10 years, unless documented as unoccupied for four consecutive years.

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The Ministry will situate the AOC to encompass a mosaic of habitats suitable for nesting, roosting, and foraging. The AOC shall encompass all known or suspected whip-poor-will nesting, roosting sites, and foraging area within a single breeding territory.

Suitable habitat typically includes forest with sparse (<25%) to moderate tree cover (25-75%) and open habitat. Whip-poor-will have an affinity for rocky barren areas and open wetlands for foraging habitat. For roosting and nesting habitat, they prefer patches of forest cover such as closed canopy with open understory.

Breeding can occur in the first year following hatching, the longevity record for a whip-poor-will is 15 years, and the survival rate for adults might be as high as 77%. These figures suggest that the average age of breeding adults in the population is four years (COSEWIC 2009). Thus, breeding evidence within the past 10 years is used to delineate the AOC.

Whip-poor-will continuously return to the same breeding/nesting grounds (Farrell et al 2019).

Whip-poor-wills do not construct a traditional nest as eggs are laid directly on leaf litter (Peck and James 1983). Nests require tree cover, shade, sparse ground cover, and proximity to open areas for foraging on flying insects (Eastman 1991, Reese 1996, Wilson and Watts 2008). These features are important to nesting site suitability. Nesting habitats include most types of forest at early stages of succession (or edges of forests), rock or sand barrens with scattered trees, savannahs, old burns as well as sparse conifer plantations (Wilson 1985; Bushman and Therres 1988; Cink, 2002; Mills 2007; Wilson and Watts 2008; Tozer et al 2014) as reported in ECCC (2018). All these habitats exhibit characteristics such as well-drained soils, moderate tree cover and moderate to sparse shrub and herbaceous cover (ECCC 2018).

Farrell et al. 2019 noted in their study that eastern whip-poor-will typically nested in clear-cut areas that are less than 10 years old, though there were exceptions.

Both male and female whip-poor-will incubate their eggs, however it is only the male birds who sing (Spiller et al. 2022).

It is important to note that whip-poor-will nests are rarely identified due to their cryptic nature. It is inadvisable to search for whip-poor-will nests as this may inadvertently jeopardize the nesting site and/or offspring.

Whip-poor-will forage distances of approximately 0.13-0.31 km (Cink 2002 and Rand 2014 as reported in Farrell et al. 2019). Defended territories have been found to range between 3-11 ha (Cink 2002, Hunt 2009, English et al 2017). This area is depended upon for nesting, rearing young, feeding, and resting. This area can also support additional nesting opportunities (Cink 2002).

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following conditions: • Retain a minimum of 20% residual forest that will provide nesting and roosting habitat. Harvest that retains residual forest is generally restricted to commercial thinning, shelterwood preparation and regeneration cuts, and single tree selection harvest. No harvest is permitted if initial canopy closure is <50% • In clearcuts and final shelterwood cuts, retain a minimum of 20% residual forest in patches ≥ 30 m in radius that will provide nesting and roosting habitat • Wildlife trees and downed woody material will be retained as per direction in Section 3.2.3.1 and 3.2.3.2, respectively • Nests encountered during operations will be retained in an unharvested residual patch >50 m in radius • Non-mechanical renewal operations are permitted during the critical breeding period (e.g., hand planting).
Harvest, renewal, and tending operations are permitted within the AOC subject to timing restrictions (see below) and the following condition: • Mechanical renewal and tending operations are only permitted outside of the critical breeding period, except in extraordinary circumstances, as specifically identified and justified through the FMP AOC planning process
Harvest operations are not permitted during the critical breeding period, except in extraordinary circumstances as specifically identified and justified through the FMP approval process.

Revised guide status and rationale:

Nests require tree cover, shade, sparse ground cover, and proximity to open areas for foraging on flying insects (Eastman 1991, Reese 1996, Wilson and Watts 2008) and residual patches of this size will provide such cover (Cink 2002). Tree cover is also required for roosting during the daylight hours. Tree cover rationale is consistent with Rand (2014).

Rand (2014) found that the amount of forest within core ranges varied from about 20 – 90%. Similarly, Purves (unpublished data) suggests that the amount of closed forest within 1140 m of survey points at which whip-poor-will were heard ranged from about 10-80%. In New Hampshire, whip-poor-will territories were only about one-third mature forest. They appeared to select thinned and young forest and shrubby habitats, and avoided mature forest (Hunt 2009). In Ontario, decreases in whip-poor-will occurrence were related to loss of early succession forest and fields, not loss of forest cover (Purves 2015, English et al 2017). Given the wide range in amount of forest within home ranges (or associated with detections) and the lack of clear selection for forests by whip-poor-will, these findings do not suggest that the current average of residual retention (20%) would be insufficient if distributed in patches large enough to facilitate

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nesting and spaced to optimize use of recently harvested areas. At the local scale (50 km²), the area of open habitats containing scattered trees, and mostly rocky ridges dominated by juniper shrubs and sparsely distributed oak trees, had the strongest positive correlation with abundance. Finer-scale assessments of forest cover support the observation that whip-poor-wills prefer habitats with open spaces and reduced forest canopy closure (English et al 2017).

Minimum forest patch size requirements are unknown (Tirpak et al 2009). In Massachusetts, whip-poor-will were generally associated with patches with complex shape and high edge contrast and tended to be inversely related to patch area (see fig. 3 Grand and Cushman 2003). Patch sizes of a minimum of 30 m radius address windthrow.

Furthermore, whip-poor-will nests in closed forest are generally within 30-50 m of open habitat (Akresh and King 2016, ECCC 2018) so patches used for nesting may not need to be large. Residual patches at least 50 m in radius (close to 1 ha) would maximize the number of residual patches likely to be used for nesting.

Forest management guide direction requires retention of residual forest as strips, patches, and scattered trees, creating an interspersion of nesting and foraging habitat. Ensuring a mosaic of open, partially and fully treed forest to provide habitat for whip-poor-will be combined with the coarse and fine filter approach outlined in the Boreal and GLSL Landscape Guides and the Stand and Site Guide will provide habitat for whip-poor-will through forest management.

Notes

The critical breeding period is May 15 - July 31. Local knowledge of breeding chronology may be used to adjust these dates.

Revised guide status and rationale:

The general nesting period for eastern whip-poor-will in Canada is estimated to extend from mid-May to the end of July (Rousseau and Drolet 2015, unpublished data) (ECCC 2018). The Rousseau and Drolet data is published in *The nesting phenology of birds in Canada Bird Study Canada's* by the Canadian Wildlife Service (Rousseau and Drolet 2017). Bird Study Canada's *Bird Nesting Calendar Query Tool* also predicts and the bulk of the nesting period for eastern whip-poor-will (date when 10% of eggs have been laid to the date when 90% of young have fledged) to be from May 15 - July 31 within the Crown lands in Ontario within management units designated under the CFSA with minor regional variation (Rousseau and Drolet 2017). Local knowledge of breeding chronology may be used to adjust the specified dates.

Operations associated with existing [primary, branch, operational] roads or landings that result in the removal of vegetation are not permitted during the critical breeding period.

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New [primary, branch, operational] roads and associated landings are not permitted within the AOC unless with Ministry approval, subject to the following condition: • New roads and landings will be constructed outside the critical breeding period.
Operations associated with existing forestry aggregate pits that result in the removal of vegetation or increasing the footprint is not permitted during the critical breeding period .
New forestry aggregate pits and wood storage yards are not permitted within the AOC, unless with Ministry approval, subject to the following condition: • New forestry aggregate pits will be constructed outside the critical breeding period.

Best management practices: Retained, revised, or new

To the extent practical and feasible, operations associated with existing roads or landings will be conducted during daylight during the critical breeding period . Check local sunrise and sunset times.
To the extent practical and feasible, operations associated with existing forestry aggregate pits and wood storage yards will be conducted during daylight during the critical breeding period . Check local sunrise and sunset times.

Revised guide status and rationale:

Due to the size of the AOC new forestry roads are not permitted, except with Ministry approval.

Restrictions on removal of vegetation during the critical breeding period ensures occupied nests will not be disturbed or destroyed.

Operations during the daylight may avoid whip-poor-will who typically forage only at dawn or dusk and can forage all night during moonlit nights.

Due to the size of the AOC, forestry aggregate pits are not permitted except in extraordinary circumstances. Restrictions on construction of forestry aggregate pits or removal of vegetation during the critical breeding period ensures occupied nests will not be disturbed or destroyed.

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vi) Golden-winged warbler and yellow rail

Description of value

Revised guide status and rationale:

The description for golden-winged warbler and yellow rail breeding habitat remains unchanged.

Standards and guidelines: Retained, revised, or new

Revised guide status and rationale:

Direction is still relevant. The recent literature continues to support the existing background and rationale for this direction.

vii) Kirtland's warbler

Description of value

Revised guide status and rationale:

The AOC has been revised to reflect that Kirtland's warbler is area sensitive and the size of stands that are considered to be optimal breeding habitats is at least 80 ha (500 m radius). This is an increase from the current direction (30 ha) which represents the smallest patch of suitable habitat likely to be occupied. Also, more detail as to what comprises suitable habitat has been added.

The AOC is comprised of suitable habitat within a radius of 500 m of reliable observations of Kirtland's warbler breeding evidence reported within the past 20 years.

Suitable habitat to be delineated by the Ministry typically includes young stands of jack pine or red pine, 1.5-5 m tall, with $\geq 3,000$ pine stems/ha, and an understory containing low sweet blueberry, bearberry, sweet fern, bracken fern, Canada mayflower, and various grasses.

Kirtland's warbler is considered to be area sensitive (Mayfield 1992). Large blocks provide the best habitat for Kirtland's warbler because they offer the best chance for colonization, are occupied for longer periods, support denser colonies, and more closely simulate wildfire conditions (Mayfield 1992). However, in many areas the landscape structure, social perception does not permit large contiguous blocks.

Optimal breeding habitats are associated with stands >80 ha (equivalent to a radius of 500 m), which is typically the species' preferred stand size (Mayfield 1992). Anderson and Storer (1976) found that 90% of nests that fledged Kirtland's warbler were located in stands >80 ha.

Kirtland's warbler are habitat specialists that require dense, early successional stands of jack pine (Mayfield 1992) but will also nest in red pine (Anich et al. 2011). The species can nest in stands with densities of $<3,000$ trees/ha, but higher densities are optimal (Probst 1988). Kirtland's warbler typically begin using stands when the trees are approximately 1.5-2.0 m tall as the low branches conceal their nests; this species will continue to use the stands until the trees reach 3.0-5.0 m in height, which is about 15 to 20 years (Walkinshaw 1983, Probst 1988, Probst and Weinrich 1993). Mature pine trees that no longer have branches near the ground do not provide sufficient cover.

Understory vegetation is also important for nest concealment as mentioned above.

Investigators have also reported Kirtland's warbler in jack pine stands between 5 and 23 years old, as well as red pine dominated stands 11-13 years old and at least 2000 stems/ha (Probst 1988, Probst and Weinrich 1993, Bocetti 1994).

Standards and guidelines: Retained, revised, or new

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Harvest, renewal and tending operations are not permitted within the AOC unless compatible with enhancing or maintaining habitat as specifically identified and justified within the FMP AOC planning process, conducted outside the critical breeding period.
New landings are not permitted within the AOC.
New roads are not permitted within the AOC except in extraordinary circumstances as specifically identified and justified through FMP AOC planning process and the following condition: • The patch of suitable habitat associated with the AOC is >80 ha in size, the road, including specific location.
Road construction is not permitted within the AOC during the critical breeding period except in extraordinary circumstances, as specifically identified and justified through FMP AOC planning process. There are no restrictions on operations associated with existing roads and landings within the AOC.
New forestry aggregate pits and wood storage yards are not permitted within the AOC; there are no restrictions on operations associated with existing forestry aggregate pits.

Notes

The **critical breeding period** is defined as May 1 - August 15. Local knowledge of breeding chronology may be used to adjust these dates.

Revised guide status and rationale:

The timeframe of the critical breeding period has increased by two weeks. It was formerly May 1 – July 31.

Kirtland's warblers begin to arrive on their breeding grounds about May 1 (Mayfield 1992). Breeding males and females have been found on the breeding grounds until August 15th (Richard 2013 a and b).

The direction for roads, landings and forestry aggregate pits has not essentially changed. Direction is still relevant. See existing Background and Rationale for Direction for rationale.

LITERATURE CITED

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Richard, T. 2013a. MSc Thesis. Characterization of Kirtland's warbler habitat on a Canadian military installation. Royal Military College of Canada. 116 pp.

Richard, T. 2013b. Seven years later – Kirtland's warbler at Garrison Petawawa: 2006-2013. *Ontario Birds* 31:148-159.

Walkinshaw, L.H. 1983. Kirtland's warbler, the natural history of an endangered species. Cranbrook Institute of Science, Bloomfield Hills, Michigan. 207 pp.

viii) Least bittern

Description of value

Revised guide status and rationale:

The AOC has been revised to reflect the mean home range of the least bittern. They are found in a variety of wetland habitats with tall and robust emergent herbaceous or woody vegetation interspersed with open water (hemi-marsh conditions) (Environment Canada 2014). This is an increase from the current direction (5 ha) which represents the smallest patch of suitable habitat likely to be occupied. There is also more detail of what comprises suitable habitat in the description.

The AOC is comprised of suitable habitat within a radius of 400 m of reliable observations of least bittern breeding evidence reported within the past 20 years.

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Suitable habitat to be delineated by the Ministry typically includes marshes and shrub swamps with tall and robust emergent herbaceous and/or woody vegetation interspersed with open water (hemi-marsh conditions).

Least bitterns are elusive in nature and inhabits wetland marsh habitat that can be inaccessible. Territory and home range size for the species are highly variable (COSEWIC 2009). The federal recovery strategy (Environment Canada 2014) references two studies that focus on least bittern movements: one in western New York (closest geographically to Ontario) found mean home range length was ~400 m (Bogner and Baldassarre 2002), and the other a study in Missouri found average maximum movements of >2000 m (Griffin et al 2009). Wetlands in Ontario are more similar to those in New York state than Missouri where wetlands are broad, flat, and large. Resources (e.g., food) used by least bittern may be irregularly distributed in Missouri wetlands requiring them to travel further. The 400 m is based on the greater ecological similarity between wetlands in New York and those in Ontario.

The federal recovery strategy requires probable and confirmed breeding evidence (Environment Canada 2014). Given the secretive nature of least bittern and the fact that it is difficult to observe and confirm breeding (Tozer et al 2007), observations associated with confirmed, probable and possible breeding will be used to determine the AOC.

Standards and guidelines: Retained, revised, or new

Harvest, renewal, and tending operations are not permitted within the AOC.
New landings are not permitted within the AOC.
Operations associated with existing roads and landings are permitted within the AOC subject to the following condition: • Road maintenance is restricted to surface grading or other maintenance operations identified in the approved FMP.
Water drawdowns or other operations that significantly alter hydrological regime are not permitted within the AOC.
New all-weather roads are not permitted within the AOC. However, water crossings and associated approaches (branch and operational roads only) may be permitted in extraordinary circumstances as specifically identified and justified through the FMP AOC planning process. In all cases, water crossings and associated approaches will be decommissioned or otherwise subject to access control measures following operations.
New winter roads are permitted within the AOC with Ministry approval.

Revised guide status and rationale:

The direction for roads, landings and forestry aggregate pits has not essentially changed. Direction is still relevant. See existing Background and Rationale for Direction

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for rationale. There is added flexibility for the possibility of temporary crossings in extraordinary circumstances.

LITERATURE CITED

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COSEWIC. 2009. COSEWIC assessment and update status report on the least bittern *Ixobrychus exilis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 36 pp.

Environment Canada. 2014. Recovery strategy for the least bittern (*Ixobrychus exilis*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada. Ottawa. vi + 41 pp.

Griffin, A.D., F.E. Durbian, D.A. Easterla, and R.L. Bell. 2009. Spatial ecology of breeding least bitterns in northwest Missouri. *Wilson J. Ornithol.* 121:521-527.

Tozer, D.C., K.F. Abraham, and E. Nol. 2007. Short call-broadcasts fail to detect nesting least bitterns (*Ixobrychus exilis*). *Northeast. Nat.* 14:637-642.

ix) Louisiana waterthrush

Description of value

Revised guide status and rationale:

The description for Louisiana waterthrush breeding habitat remains unchanged.

Standards and guidelines: Retained, revised, or new

Revised guide status and rationale:

Direction is largely unchanged and is still relevant. The recent literature continues to support the existing background and rationale for this direction.

x) Red-headed woodpecker

Description of value

Revised guide status and rationale:

The description for red-headed woodpecker breeding habitat remains unchanged.

Standards, guidelines, and best management practices: Retained, revised, or new

Revised guide status and rationale:

Direction is largely unchanged and still relevant. The recent literature continues to support the existing background and rationale for this direction.

(C&R) 4.3.8 Mammals

Preamble/Direction

Revised guide status and rationale:

Seven of eight bat species found in Ontario have been listed. The bat hibernation direction has not changed, it addresses 4 listed species (eastern small-footed myotis, little brown myotis, northern myotis and tri-colored bat) and the one species not listed (big brown myotis).

i) Bat hibernation sites

Description of value

Revised guide status and rationale:

The description for bat hibernation sites remains unchanged.

Standards and guidelines: Retained, revised, or new

Revised guide status and rationale:

Direction is largely unchanged and still relevant. The recent literature continues to support the existing background and rationale for this direction.

ii) Eastern wolf and grey wolf

Description of value

Revised guide status and rationale:

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The description for eastern wolf and grey wolf den sites, and eastern wolf rendezvous sites remains unchanged.

Standards and guidelines: Retained, revised, or new

Revised guide status and rationale:

Direction is largely unchanged and still relevant. The recent literature continues to support the existing background and rationale for this direction.

iii) Gray fox den sites

Description of value

Revised guide status and rationale:

The description for gray fox den sites remains unchanged.

Standards and guidelines: Retained, revised, or new

Revised guide status and rationale:

Direction is largely unchanged and still relevant. The recent literature continues to support the existing background and rationale for this direction.

iv) Cougar den sites

Description of value

Revised guide status and rationale:

The description for cougar den sites remains unchanged.

Standards and guidelines: Retained, revised, or new

Revised guide status and rationale:

Direction is largely unchanged and still relevant. The recent literature continues to support the existing background and rationale for this direction.

v) Wolverine den site(s) and foraging area

Preamble

Revised guide status and rationale:

The name of the AOC has been revised to explicitly reflect that it is intended to address the known den sites of a wolverine and the foraging area she requires to raise the kits.

The AOC has been revised to reflect recent local studies (number of years den area documented as unoccupied), implementation of the direction to address “double-bubble” and including a denning period to address situations where there are existing roads.

Description of value

Revised guide status and rationale:

The AOC remains in place unless documented as unoccupied for ≥ 4 consecutive years because of the likelihood of reuse of the area by reproductive females and those females don't necessarily breed every year, which would provide the female at least two opportunities for parturition in the area and demonstrate re-use of the area for denning (COSEWIC 2014). The time which the AOC is relevant “known to have been occupied by wolverines within the past eight years...” has been decreased from 10 years to reflect that the generation time for wolverines is likely 7.5 years (COSEWIC 2014).

The value description has been revised to address how the AOC is implemented. When there is more than one den site used in a year by the same female the delineation of the AOC will be centred on the minimum convex polygon within a radius of 4 km. This is a change from a 4 km radius being delineated around each individual den site of a single female (“double-bubble”).

Standards and guidelines: Retained, revised, or new

In consultation with Ministry staff with expertise in species at risk, a den site(s) and foraging area management plan will be developed that outlines the extent and timing of harvest, renewal, and tending operations acceptable within the AOC, as well as conditions on roads, landings, forestry aggregate pits, and wood storage yards. NOTE: a den site(s) and foraging area management plans are required if the denning area overlaps planned operations.

Reasonable efforts will be made to incorporate the AOC into a large block of unharvested and unroaded forest (e.g., incorporate the AOC into a dynamic caribou habitat schedule block that is not scheduled to be harvested in the near future).

The den site(s) and foraging area management plan will:

- Normally prohibit forest management operations during the **denning period**.
- Any harvest, renewal, and tending operations, road and wood storage yard construction, and aggregate extraction permitted within the AOC will maintain the suitability of denning and foraging habitat. It is recognized that some

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operations may be permitted to meet ecological, social, or economic objectives.

- Considerations in the development of the den site(s) and foraging area management plan should include: the strategic landscape map, planned operations, existing operations, existing disturbances, landscape features and balancing objectives (including socio-economic). If operations are considered, a modified management zone will be defined in the den site(s) and foraging area management plan.
- Include Use Management Strategies for existing roads that will provide locally appropriate measures to minimize road-associated impacts on wolverines. This may include access controls while roads are in use and a decommissioning plan for roads following use.

Revised guide status and rationale:

The elements to consider in developing a den site(s) and foraging area management plan have been expanded upon to be more explicit, based on den site management plans that have been developed.

In the case where local circumstance where harvesting might be considered (e.g., existing roads, a denning period was added).

Notes

The denning period is January 15-June 1. Local knowledge of denning chronology may be used to adjust these dates.

Revised guide status and rationale:

Natal dens are used between-January and April, at which point the kits are moved to several maternal dens until weaning (9-10 weeks), generally from mid-April to the end of May (COSEWIC 2014, Heeres 2020, Inman et al 2012, Ontario Wolverine Recovery Team 2013).

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COSEWIC. 2014. COSEWIC assessment and status report on the wolverine *Gulo gulo* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 76 pp.

Heeres, Rick, 2020. Den shifting behaviour of female wolverines (*Gulo gulo*) in Northern Sweden. MSc thesis. Swedish University of Agricultural Sciences, Dept. of Ecology, Grimsö, Sweden.

Inman, R.M., A.J. Magoun, J. Persson and J. Mattisson. 2012. The wolverine's niche: linking reproductive chronology, caching, competition, and climate. J. Mammal. 93:634-644.

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Ontario Wolverine Recovery Team. 2013. Recovery strategy for the wolverine (*Gulo gulo*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 66 pp.

(C&R) 5.0 OPERATIONAL CONSIDERATIONS

Preamble

Revised guide status and rationale:

Existing preamble to Section 5.0 remains largely unchanged.

(C&R) 5.1 Roads and water crossings

Preamble

Revised guide status and rationale:

Existing preamble to Section 5.1 remains largely unchanged.

(C&R) 5.1.1 Roads

Preamble/Direction

Revised guide status and rationale:

Added preamble to Section 5.1.1 to specify that:

- Direction in Section 5.1.1 applies to all roads, regardless of whether they are located within an AOC
- Any additional direction for roads within an AOC or addressed by conditions on roads, landings, forestry aggregate pits or wood storage yards can be found in the respected subsection of Section 4 (e.g., water features, wetlands, nests, dens, species at risk).

Added a direction description to be consistent with other sections.

Removed current Section 5.1.1.2 (roads within areas of concern). Moved some direction to appropriate subsections in Section 4.1 and some direction to Section 5.1.1 that applies to all roads (both inside and outside AOCs) and 5.1.2 (water crossings). Also, some of the direction (e.g., narrower right-of-way widths in AOCs) is already covered in section 4 and elsewhere (e.g., *Ministry of Natural Resources and Forestry/Fisheries and Oceans Canada Protocol for the Review and Approval of Forestry Water Crossings* (the Protocol)).

Direction provided in current Table 5.1a should also apply to roads within AOCs and BMPs in current Table 5.1b should also apply to roads outside AOCs. The resulting merged section provides direction for “all roads” under the auspices of the FMPP on Crown land in the managed forest. Direction in current Table 5.1b is really “additional” direction for road planning, construction and maintenance within more sensitive AOC areas and has been moved to the respective subsections of Section 4 (e.g., standing and flowing waters, wetlands).

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Created following subsections with label terminology consistent with water crossing section:

- i. Design and location;
- ii. Construction and maintenance; and
- iii. Decommissioning.

Grouping of direction into subsections improves organization which was a recommendation from practitioners in the five-year review of the guide. Applying terminology used in section 5.1.2 (water crossings) in the roads section improves consistency within the guide and with the Protocol. Current direction is scattered in standards, guidelines, and BMPs with little organization/grouping.

As there is no longer a separate subsection (5.1.1.3) for decommissioning of roads, move decommissioning preamble to this section.

The five-year review recommended that the definition of decommissioning and the desired outcomes of this practice be revisited. The current definition for decommissioning is found in the glossary of the FMPM. Additionally, a section has been added to the FMPM under use management strategies (Part A, 1.2.10.7) that discusses the requirements for road decommissioning in greater detail. The revised text expands upon the potential objectives decommissioning.

i) Design and location

Guidelines: Retained, revised, or new

To minimize the potential adverse effects of roads on terrestrial and aquatic ecosystems, road planning (location, layout and design) will:

- Make use of existing roads where practical for long-term access
- Ensure temporary roads are designed to the minimal standard necessary, reflecting their future management intent (e.g., anticipated traffic volume and service life, potential decommissioning)
- Minimize the number of water crossings
- Avoid unsuitable terrain including long, steep (>10%) grades, deep swamps, bedrock, and shallow soils
- Avoid locating landings and turn-arounds in low, wet areas where they may disrupt hydrological function or cause rutting.

Revised guide status and rationale:

New direction.

Decisions made at the planning stage may have long-term effects on the surrounding terrestrial and aquatic ecosystems as well as road construction and maintenance costs. Roads should be located to minimize potential environmental impacts while still meeting operational, economic and safety requirements.

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When the location of the road and landings within the approved corridor or operational road boundary are being finalized, avoid recognizable hydrological connections that channel ephemeral surface flow and/or shallow groundwater flow to lakes, ponds, rivers, or streams.

Revised guide status and rationale:

Direction (currently a guideline) remains largely unchanged.

Text revised to reflect new terminology for hydrological connections.

Guidelines: Removed

The planning, construction, and maintenance of primary and branch road corridors and road network locations, and their applicable use management strategies, will consider:

- i. the strategic direction associated with other resource plans, policies and directives (e.g., Crown Land Use Policy Atlas);
- ii. the strategic direction being addressed through the use of LLPs resulting from the application of the Landscape Guide;
- iii. the management objectives, and emphasis for specific areas (e.g., direction provided by the Crown Land Use Policy Atlas; LLPs as described in Section 3.3 of this guide); and
- iv. the potential impact (including benefits) to other natural resource features, land uses, and values (e.g., lakes and streams, cottage sites, boat caches).

Revised guide status and rationale:

Current guideline removed.

Requirement to consider other planning initiatives during selection of alternative corridors for primary and branch roads identified in FMPM. Requirement to consider LLPs already described in section 3.3 and the Landscape Guide.

Ensure engineering safety considerations are incorporated into road planning.

Revised guide status and rationale:

Current guideline removed.

The FMPM requires that engineering and safety factors be considered when planning and locating primary and branch road corridors. The *Occupational Health and Safety Act, 1990*, Reg. 851, s. 117 also identifies safety requirements for haul roads.

Best management practices: Retained, revised, or new

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To minimize the risk of disrupting hydrological function within hydrological connections when avoidance is not practical or feasible, roads should cross:

- At the narrowest point possible
- At right angles to the direction of hydrological flow
- As far from the connected aquatic features as possible
- At locations with the highest soil bearing capacity possible (look for indicators of drier soil conditions).

Revised guide status and rationale:

New BMP.

BMP (based on subject expert advice and current literature) added to provide more direction to help operators avoid disrupting water movement.

Where possible, locate roads and landings so skidding and forwarding does not have to cross natural drainage patterns.

Revised guide status and rationale:

BMP moved from Section 5.2.5 (Hydrological impacts) to 5.1.1 (Roads) under design and location because it speaks to locating roads and landings to minimize adverse impacts on site hydrology. BMP still relevant.

Avoid creating permanent, all-season loop roads where they may result in unsustainable hunting and/or angling pressure and/or impede enforcement to pursue unauthorized hunting and angling activities.

Revised guide status and rationale:

Loop roads may reduce wood delivery costs and improve safety (e.g., directional hauling), however, they may also negatively impact local wildlife and fish populations. They may increase hunting pressure by reducing hunter/angler effort and increasing hunter/angler efficiency. When one road can be used to access an area and another to leave the area, it may make it more difficult for enforcement to pursue offenders for unauthorized hunting and angling activities.

ii) Construction and maintenance

Standards and guidelines: Retained, revised, or new

Materials moved during construction, such as grubbed soil and organic material, will not be piled where they block drainage courses.

Revised guide status and rationale:

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No changes made to direction.

Placing materials moved during construction into drainage courses makes them susceptible to erosion and could result in deposition of sediment in associated water features.

The Ministry will ensure that signs used to identify the use management strategies for roads (e.g., travel restrictions) are maintained.

Revised guide status and rationale:

No changes made to direction.

When grading roads, do not create false ditches (accumulated berms of gravel along road edges) that channel sediment-bearing water down the road directly into a water feature.

Ensure road grading operations do not result in the blockage of off-take ditches.

When grading a road adjacent to a bridge, do not pull road surface material onto bridge deck.

Revised guide status and rationale:

New direction.

The five-year review of the guide identified that there is no direction provided for road surface maintenance practices (i.e., grading). Past direction for forest roads in the *Environmental Guidelines for Access Roads and Water Crossings* (MNR 1990) including a best management practice to bring back loose material toward the centre of the road to prevent the creation of berms that could channel run-off down the road and erode the fill slopes. Road construction and maintenance policy in New Brunswick and British Columbia also provide direction for the maintenance of road surfaces.

The creation of false ditches, as a result of improper grading practices, has been recently reported in recommendations/findings of three Independent Forest Audits conducted across the province in 2016 and 2017. Audit teams observed the occurrences as part of their assessments to determine whether roads have been constructed, maintained, and decommissioned to minimize environmental impacts and provide for public and operator safety. The auditors recommended that road monitoring and grader operator training be improved to avoid the occurrence of false ditches.

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Minimize the clearing width of the road right-of-way to that required for construction and safety (i.e., line of sight) purposes and specify maximum clearing widths (for roads outside AOCs that specify maximum right-of-way widths) in the FMP.

Revised guide status and rationale:

Replaces current guideline in Table 5.1b (roads in AOCs).

The existing guideline applies to roads within areas of concern only. There are requirements to narrow clearing right-of-way widths in some AOCs (e.g., 20 m for standing and flowing water) in section 4. However, as per past direction in the *Environmental Guidelines for Access Roads and Water Crossings* (1990), maximum clearing widths should be specified in the FMP to minimize the areal extent of disturbance caused by road construction.

When recognizable hydrological connections (linear features that channel ephemeral surface flow and/or shallow groundwater flows to lakes, ponds, rivers, or streams must be crossed), road construction will not disrupt hydrological function. Maintain hydrological function through adequate cross drainage. Hydrological function will be considered to be disrupted if a road impedes water movement by restricting flow and creating pools of standing water that exist for >1 year that may or may not cause the flooding and subsequent mortality of adjacent trees. These locations may best be identified in the spring when ponding may be more frequent along a new road.

Revised guide status and rationale:

Direction (currently a guideline) revised.

Text revised to reflect new terminology for hydrological connections and examples added to illustrate when water movement has been disrupted to assist in compliance.

When ongoing monitoring reveals the need for road maintenance, remedial action will be undertaken as soon as possible based on the potential for environmental damage and/or risk to public safety.

Revised guide status and rationale:

Direction revised. Replaces current guideline to have a monitoring program for roads or road networks.

The requirement to have a monitoring program for roads is covered in Part B, section 4.7.4 of the FMPM. However, the FMPM does not specify how the results of monitoring efforts are to be incorporated into a risk-based maintenance strategy.

Standards and guidelines: Removed

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Fill material required to build the road at the site of the crossing, below the high-water level and within the floodplain of the water feature, will be erosion resistant and/or protected from erosion.

Revised guide status and rationale:

Current standard removed.

The Protocol includes a general standard that states fill material placed below the normal high-water mark will be erosion-resistant and/or protected from erosion.

Any exposed mineral soil between the height of land and a water crossing, or within 100 m of a water crossing, whichever is less, will be trimmed to a stable angle and be protected from erosion so sediment will not enter the water after construction.

Revised guide status and rationale:

Current standard removed.

The Protocol includes a general standard that states that cut and fill slopes are to be stabilized at a 2:1 slope or stable angle of repose to prevent sediment from entering the watercourse during and after construction and decommissioning.

When all-weather roads must cross wetlands, provide frequent cross drainage culverts to ensure that surface water is equalized on both sides of the road and impacts to hydrologic flow and wetland function are minimized (see also Sections 4.1.3, 4.3.1, 4.3.5.3 and 4.3.6).

Revised guide status and rationale:

Current guideline removed from Section 5.1.1. Moved direction to Section 4.1.3 (wetlands) for a better fit.

Identify natural drainage features (e.g., gully) and areas of concentrated surface water flow and maintain drainage patterns through appropriate use (sizing and spacing) of cross drainage culverts. These locations may best be determined the following spring when ponding is evident at unpredicted locations along a new road.

Revised guide status and rationale:

Current guideline removed.

Direction incorporated into other direction for road construction and maintenance.

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Where ditches leading downhill from rock cuts pass over earth material, use techniques to protect the earth/rock interface from erosion.

Revised guide status and rationale:

Current guideline removed.

Direction is vague and unnecessary.

Grubbing of low vegetative cover between the height of land (e.g., the high point on a ditch line) and a water crossing, or within 100 m of a water crossing, whichever is less, will be limited to that required to address engineering issues and safety concerns, such as the removal of hazards.

Revised guide status and rationale:

Current guideline removed.

This direction applies more to water crossings than it does to roads. Additionally, the Protocol includes general design and location standards that state that loss or disturbance to riparian vegetation will be minimized and restricted to the disturbance footprint required to construct, maintain, and decommission a water crossing.

Have a plan to ensure rock or earth remains within the right-of-way when explosives and blasting are required.

Revised guide status and rationale:

Current guideline removed.

This is already a requirement in the Blasting Safety Regulations of the OHSA.

When constructing roads during the bird nesting season, and occupied nests are encountered, follow direction in Section 4.2.2.

When planning primary and branch road corridors, avoid high value wildlife habitats such as ungulate wintering areas (see Sections 3.3.3 and 3.3.4 and the Landscape Guide for further information).

Revised guide status and rationale:

Current guidelines removed.

Reference to direction in other sections of this and other guides in a guideline is redundant and not necessary.

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Do not place windrows or grubbing materials across known migration paths of wildlife in a manner that could impede their travel.

Revised guide status and rationale:

Current guideline removed.

Unlikely to know or have the inventory data to determine the location of wildlife migration paths at this scale which makes the direction irrelevant.

Reasonable efforts (e.g., clearing of logging debris, avoid steep ditching) will be made to ensure that recreational portage routes and trails used for accessing and working traplines are passable following forest management operations.

Revised guide status and rationale:

Current guideline removed.

Portages, trails, and traplines represent social values (e.g., recreation, cultural heritage, tourism), not forest biodiversity values that may be affected by forest management activities. Appropriate mitigative measures for these types of features or values are provided by other forest management guides (e.g., *Forest Management Guide for Cultural Heritage Values, Management Guidelines for Forestry and Resource-based Tourism*), other pieces of direction (e.g., legislation, policies), or are developed by planning teams as per the FMPM.

Best management practices: Retained, revised, or new

Grubbed material should be piled and stored so that it can be used to assist in road decommissioning.

Revised guide status and rationale:

No change to BMP.

The pull back of post-harvest slash and grubbed organic matter onto the road surface as a decommissioning treatment improves microsite conditions for revegetation of the road and acts as a barrier to vehicles (Hall et al. 2016).

Construct offtake ditches on long sustained grades to reduce the flow velocity and volume of water being carried down roadside ditches.

Revised guide status and rationale:

BMP reworded to improve clarity.

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Ensure winter roads are constructed with water crossings able to accommodate flows from early and mid-winter thaws or from rain-on-snow precipitation events.

Consider the following practices to mitigate the potential impacts of short duration, high intensity rainfall events:

- Increase the number (spacing frequency) and size of cross drainage culverts to accommodate higher flows and more debris which will reduce the likelihood of washouts
- Construct and maintain (through grading) road crowns to 3-5% to facilitate rapid removal of water off the road surface
- Construct a shallow, armoured depression beside culverts (see Figure 5.1a) on low-volume roads to provide peak flow water passage over top of the road surface and divert flow back toward the natural channel with minimum damage.

Provide breaks in high snowbanks along the sides of a road to allow meltwater trapped on the road surface to flow away from the road.

Revised guide status and rationale:

New BMPs.

The five-year review of the guide recommended that the guide provide sufficient flexibility to enable practitioners to adapt practices to unanticipated outcomes of climate change. To address this recommendation, propose adding the above new best management practices associated with adaptation of forest access roads to climate change.

Potential increased occurrences of freeze/thaw cycles, mid-winter thaws and warmer winters may increase the need for forest operations managers to implement water management practices during winter operations to maintain road functional and environmental performance. In a recent FPInnovations publication, Gillies and Belyea (2017) present options and practices for water management during unfrozen periods along winter roads. They suggest physically breaching snow berms that have built up over the winter from plowing operations to allow meltwater trapped on the road surface to drain into the adjacent ditches. They recommend that snow berms be breached in locations where a sufficient gradient exists between the road surface and the other side of the berm to promote the flow of water away from the road and right-of-way.

Partington and others (2017) suggest adaptation practices to mitigate the potential risks of climate change on new and existing resource roads and infrastructure. Changes in local and regional precipitation patterns and temperature regimes may impact the water passage requirements of crossing structures. They argue that weather events such as heavy precipitation are not new concerns for forest operations managers, however, it is the increased intensity and duration that may pose challenges. These events will alter runoff and peak stream flows. They recommend increasing cross drainage and road

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crowning and the use of additional water passage structures (e.g., armoured dips) to help to ensure forest access roads will be more resilient to climatic impacts.

Establish a minimum size for cross drainage culverts based on local conditions.

Revised guide status and rationale:

No change to BMP.

Consider following the signage requirements (regulatory, warning, temporary conditions, information and Ministry-specific signs) identified in the Ministry's *Roads and Crossings Sign Manual* (2018) for roads on Crown land that are administered under the CFSA. Users of the guide may refer to the manual for further direction on sign design, placement and maintenance.

Revised guide status and rationale:

New BMP.

The *Roads and Crossings Sign Manual* (OMNRF 2018) provides guidance on the signage requirements (regulatory, warning, temporary conditions, information and Ministry specific signs) for roads and crossings on Crown land that are administered under the PLA, CFSA, and PPCRA based on the requirements of the *Highway Traffic Act* and the *Occupational Health and Safety Act*, Reg. 851, s. 117. Users of the guide are referred to the manual for further direction on sign design, placement and maintenance.

Have a maintenance schedule to keep cross drainage culverts clear of obstructions to help avoid potential problems such as roadside water ponding and washouts.

Revised guide status and rationale:

No change to BMP.

Best management practices: Removed

Log landings, loading areas, and turn-around areas should be located on high ground to avoid rutting and blocking of drainage paths.

Revised guide status and rationale:

Current BMP removed. Incorporated in first guideline for road design and location.

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Any wetland or peatland (e.g., bogs, fens) with organic layers over 2 m deep, without a good root mat, should be avoided because they are less likely to support the road weight, resulting in excessive settlement or displacement and impacts to hydrologic flow and wetland function.

If wetlands (e.g., bogs) must be crossed to conduct forest operations, consider using temporary, winter crossings when the soil is frozen.

Revised guide status and rationale:

Current BMPs removed – now addressed in Section 4.1.3 (wetlands).

If long windrows (e.g., of slash or rock) are created, breaks should be provided to allow animals, other forest users and operations unobstructed access routes across the right-of-way. A 10 m break every 100 m of windrow is a good target.

Revised guide status and rationale:

Removed BMP from Section 5.1.1 – moved to Section 5.2.4 (Loss of productive forest area).

It is highly unlikely road construction alone would create excessive windrows of slash/rock for this to be an issue. Moved to Section 5.2.4 as piles of merchantable tops from full-tree harvesting operations at roadside may exceed 100 m in length.

If areas where animal migrations occur (e.g., deer, woodland caribou) are known, wing back snow banks following heavy snowfalls and maintain low snow banks over the course of the winter.

Revised guide status and rationale:

Removed BMP - unlikely to know or have the inventory data to determine the location of wildlife migration paths at this scale.

Construction of loop roads in high value wildlife habitats should be avoided.

Revised guide status and rationale:

Current BMP removed. Incorporated in one of the BMPs for road design and location.

iii) Decommissioning

Guidelines: Retained, revised, or new

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For each road or road network scheduled to be decommissioned, stabilize slopes susceptible to washouts (e.g., slope grading, surface roughening, applying logging debris, seeding) to prevent erosion and protect public safety.

Revised guide status and rationale:

Minor revisions - include examples of possible procedures to stabilize slopes.

When a road or road network is to be decommissioned, all associated water crossings that have been assessed to pose a potential threat to public safety, water quality or fish habitat, as per the criteria for water crossing structure removal in Section 5.1.2, will be removed in conjunction with the scheduling of any associated road treatments. Decommissioning of a road or road network may not require removal of all water crossings where agreed upon by the Ministry.

Revised guide status and rationale:

Current guideline revised.

The five-year review of the guide recommended that road decommissioning direction be more objective. The direction is more clear; remove high risk water crossings as part of the road decommissioning work.

See original Background and Rationale for Direction, FMPM (Part A, 1.2.7.10 and Part D, 3.2.3.3) for reasoning/criteria for why water crossing may not be removed as part of road decommissioning.

Standards and guidelines: Removed

Where decommissioning is planned, it will be incorporated into the approved use management strategy for roads and road networks as per FMPM requirements.

Revised guide status and rationale:

Current standard removed.

This is a requirement of the FMPM to include any planned decommissioning activities in the management intent of a road use management strategy.

Specific road and road network decommissioning direction is provided in Section 3.3, as well as in the Landscape Guide. Where applicable, this direction will contribute to the use management strategy for the road or road network.

Revised guide status and rationale:

Current guideline removed.

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Any value or habitat specific decommissioning and road use management strategy requirements are covered in the appropriate guides/sections.

For decommissioned roads or road networks, MNR will have an appropriate monitoring program to address environmental and/or safety concerns.

Revised guide status and rationale:

Current guideline removed.

The requirement for a monitoring program is already identified in the FMPM.

Best management practices: Retained, revised, or new

Materials which had been moved and piled during construction, such as grubbed soil and organic materials, and post-harvest slash should be pulled back onto the roadbed. This material will help to deter vehicles and improve microsite conditions for regeneration.

Revised guide status and rationale:

Minor revisions to BMP.

Plan and construct roads to the minimum standard required to reduce efforts and costs associated with decommissioning (e.g., construct winter roads and crossings where operationally feasible, use temporary bridges).

Revised guide status and rationale:

BMP revised - Combined two decommissioning BMPs related to initial road construction into one.

If the use management strategy includes access control, consider options such as:

- Signage (under the *Public Lands Act*)
- Physical barriers such as large rocks, slash, or berms
- A gate
- Seasonal closure
- Any other option the planning team deems appropriate/effective for the area.

Revised guide status and rationale:

Minor revisions/additions to BMP.

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Seasonal closure added as an access control option. Hunt and Hupf (2014) and Hunt and Hosegood (2008) found that seasonal closures were more effective at reducing vehicle traffic than year-round closures on forest access roads during the hunting season in northern Ontario. They estimated seasonal closures removed upwards of 92% of expected traffic.

Remove cross drainage culverts and slope the roadbed where culverts have been removed to prevent erosion and for public safety concerns, while allowing water to flow freely over it.

Revised guide status and rationale:

No changes made to BMP.

If the objective of the road decommissioning includes returning the roadbed to a forested condition, establish access control(s) to prevent vehicular access to recently re-forested roadbeds to improve regeneration survival and growth.

Consider establishing multiple access controls (e.g., multiple berms) on a road to improve the effectiveness of the treatment for reducing traffic. The number and type of access controls to be installed should reflect the sensitivity of the value being protected and the anticipated non-compliance efforts.

Where it is operationally and environmentally feasible to do so, take advantage of natural barriers to traffic when decommissioning roads. Strategically located water crossing removals or roadbed removal where it crosses a wetland may reduce unwanted fording or circumvention of the decommissioning treatment.

Revised guide status and rationale:

New BMPs.

In case studies investigating the effectiveness of various road decommissioning and reclamation treatments throughout northwestern Ontario, Hall et al. (2016) identified some of the critical factors affecting treatment success including degree of road surface compaction, historic use, and access management. Based on their survey results, they recommended the above best practices for decommissioning and/or reclaiming roads.

Best management practices: Removed

Where the use management strategy suggests the road will not be used in the long-term (e.g., direction in Section 3.3), consider returning the roadbed to the productive forest landbase. Roadbeds, log landings, loading areas, and turn-around areas can be treated and planted with trees or other plants appropriate for the site and consistent with other management objectives of the area.

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Revised guide status and rationale:

BMP removed from Section 5.1.1 and moved to Section 5.2.4 (loss of productive forest area).

As a safety precaution, ensure the roadbed where any cross-drainage culverts were removed has a gentle slope (i.e., no sudden drops) and is erosion resistant.

Revised guide status and rationale:

Removed BMP – incorporated into a related BMP that has been retained.

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(C&R) 5.1.2 Water crossings

Preamble/Direction

Revised guide status and rationale:

Minor changes to content – added introduction paragraph.

Reduced/reorganized section by combining current Tables 5.1d, 5.1e and 5.1g into one set of standards, guidelines, and BMPs for general standards, design and location. Sub-sections (general, design and location, construction and maintenance, removal) are consistent with those found in the *Ministry of Natural Resources and Forestry/Fisheries and Oceans Canada Protocol for the Review and Approval of Forestry Water Crossings* (the Protocol), Section 8 - Approved Water Crossing Standards.

Ensures current mitigation measures in the water crossing standards documented in the FMP are applied in the replacement/repair of any existing water crossings to avoid the death of fish or harmful alteration, disruption, or destruction of fish habitat as per the Protocol. Represents generalized direction so moved to preamble from current installation and maintenance direction.

i) General

Standards: Retained, revised, or new

The submission, review and approval of water crossings built under authority of the CFSA will comply with the requirements of the FMPM, *Ministry of Natural Resources and Forestry/Fisheries and Oceans Canada Protocol for the Review and Approval of Forestry Water Crossings*, *Crown Land Bridge Management Guidelines*, and all other applicable legislation. Further information about the approval process for water crossings (e.g., Ministry engineering approvals) can be obtained from the local Ministry office and/or Conservation Authority.

Revised guide status and rationale:

Revised current standard.

The FMPM requires application of the Protocol in the submission, review and approval of water crossings. The Protocol includes a risk-informed Proponent self-screening approach for lower-risk water crossings that utilizes pre-determined and mandatory technical water crossing standards to direct routine water crossing construction and decommissioning activities in a manner that avoids the death of fish and harmful alteration, disruption or destruction to fish habitat. The Protocol also requires that the DFO's direction in *Measures to Protect Fish and Fish Habitat* and *Standards and Codes of Practice* be followed.

Recategorized as "general" because the requirements of the FMPM and other applicable legislation apply to more than just design and location.

For the approval of construction or removal of single, closed-bottom round culverts >1,200 mm in diameter and/or multiple culverts, the Ministry will ensure that at a minimum, the general water crossing standards and water crossing standards for the construction and removal of single, small ($\leq 1,200$ mm) closed-bottom round culverts are applied.

Revised guide status and rationale:

New direction.

The water crossing standards for the construction of single, small closed-bottom round culverts in the Protocol do not cover culverts >1,200 mm in diameter. Thus, this direction ensures standards in the Protocol are adhered to for larger culverts.

ii) Design and location

Guidelines: Retained, revised, or new

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Selection of the type of water crossing structure, its location, and its capacity to pass water and allow for the movement of fish, will consider:

- i. possible negative effects on the form and function of the undisturbed natural channel and its floodplain;
- ii. the fish species present and the impact of the crossing structure on them, as required by the *Fisheries Act*; and
- iii. whether the water crossing is over navigable waters.

Revised guide status and rationale:

No changes made to direction.

The Protocol does not directly speak to the factor that are taken into consideration when selecting the type of water crossing structure to install at a given location.

Guidelines: Removed

Avoid crossing in areas which affect known critical fish habitat, such as fish spawning, feeding, over-wintering, or nursery areas.

Avoid steep high banks or sites where actively slumping banks are evident.

Revised guide status and rationale:

Direction removed – equivalent direction found in the Protocol.

Best management practices: Retained, revised, or new

If past or present beaver activity is identified at a crossing location, change the crossing location (preferably upstream of the area with beaver activity) or include mitigative techniques to address the probability beavers will return to the site.

Revised guide status and rationale:

No change to BMP.

The Protocol speaks to the management of beaver activity only briefly through two BMPs (installing beaver deterrents and increased frequency of culvert inspections). This BMP reminds proponents to be aware of beaver activity in the area and make decisions on location based on the activity.

On large streams (i.e., streams >2 m wide), consider crossing with a bridge or arch (open-bottom) culvert. Bridges and arches have a higher initial cost but are less prone to washouts and beaver problems than closed-bottom round culverts.

Revised guide status and rationale:

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No change to BMP – still applies.

Best management practices: Removed

Choose a site where the road approaches are favorable and earth cuts are not required within 100 m of the water's edge.

Revised guide status and rationale:

BMP removed – equivalent BMP exists in the Protocol.

iii) Construction and maintenance

Standards and guidelines: Retained, revised, or new

To facilitate fish passage, install culverts with at least 10% of the diameter of the culvert below the natural stream bed (excludes culverts installed for temporary winter access).

Revised guide status and rationale:

Direction revised/reategorized. Moved from a BMP to a standard.

The upgrade from a BMP to a standard was a recommendation from practitioners from the five-year guide review as it is already treated and assessed like a standard on the ground. However, it is only categorized as a BMP in the Protocol (2020). A general standard in the Protocol states that all projects must be compliant with applicable water crossing standards in the Stand and Site Guide.

Construct and use fords during the driest time of the year but not during the restricted time of high risk to fish (see Table 5.1a); ensure the ford does not restrict fish passage.

Revised guide status and rationale:

No changes made to direction.

The Protocol only provides a standard for one-time fording. Direction retained for long-term fords to ensure that use must adhere to the appropriate in-water timing windows and must occur during low-flow conditions.

Construction operations that may enter a water feature (i.e., in-water work) or that may potentially cause sediment to enter a water feature, are not to occur during periods of fish spawning, incubation, or fry emergence, unless approved by the

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Ministry. Timing restrictions vary across the province; generic timing restrictions, by species for each Ministry region, are provided in Table 5.1a.

Revised guide status and rationale:

Direction retained and revised.

The Protocol directly references the forest management guides (and the approved FMP) as the source of the fisheries in-water timing windows, therefore this standard and associated timing restrictions table will remain in the guide.

The timing restriction windows in Table 5.1a have been revised to be consistent with the in-water work timing window guidelines released by the Ministry's Policy Division Fisheries Section in 2013.

Minor rewording to be consistent with wording used for bird critical breeding periods in Section 4.2.2.

When existing water crossings are identified for replacement, maintenance, or unplugging (e.g., from beaver activity) in the monitoring program for road and water crossings approved in the FMP, prioritize required remedial work based on risk assessment (e.g., higher priority will be given to crossings that pose the greatest risk to public safety and fish passage and migration).

Revised guide status and rationale:

Revised direction - simplified to identify problem crossings through monitoring program and prioritize remedial action based on risk.

The requirement for a monitoring program for roads and water crossings is identified in the FMPM. However, the FMPM does not specify how the results of monitoring efforts are to be incorporated into a maintenance strategy. Additionally, the Protocol is primarily concerned with the potential impacts of water crossings on fish/fish habitat, not on public safety, and does not speak directly to the replacement or repair of existing water crossing infrastructure.

When clearing water crossings that have been affected by beaver activity or other debris remove material gradually beginning with a small breach, working in stages to control flows and prevent sediment from being released, downstream erosion, and fish stranding.

Revised guide status and rationale:

New guideline – added to ensure fish are not stranded due to a rapid change in water levels.

Best management practices: Retained, revised, or new

Nuisance beaver activity should be managed to keep culverts clear and provide for the passage of water and fish. Suggested methods are provided in the Ministry's *The Beaver Handbook* (1995) or in [Fisheries and Ocean's Canada \(DFO\)'s Code of practice: Beaver dam breaching and removal](#).

Revised guide status and rationale:

No changes made to BMP.

The Protocol speaks to the management of beaver activity only briefly. This BMP reminds proponents of the importance of monitoring and maintaining culverts to avoid issues caused by beaver activity and these two existing helpful resources.

Standards and guidelines: Removed

Those responsible for installation and maintenance will monitor operations and select operating practices, materials, and mitigation techniques at each water crossing to prevent the harmful alteration, disruption or destruction of fish habitat or the impairment of water quality. Harmful alteration, disruption, or destruction of fish habitat is not permitted without DFO approval.

The installation of a water crossing will not result in the impediment of fish passage; mitigative techniques will be applied if the structure has the potential to impede or block fish migration or passage.

At any time of year, the free movement of water and fish will not be blocked or otherwise impeded, except for brief periods during construction and as approved by MNR.

The removal of stream boulders is generally not acceptable, except where necessary for installation of a crossing structure which retains a natural streambed (e.g., a bridge).

Fill material required to build the road at the site of the crossing, below the high water level and within the floodplain of the water feature, will be erosion resistant and/or protected from erosion.

Any exposed mineral soil between the height of land and the water crossing, or within 100 m of the water crossing, whichever is less, will be trimmed to a stable angle and be protected from erosion so sediment will not enter water.

During construction and maintenance of a water crossing, contamination of a water feature by foreign materials such as lumber, nails, fuel, oil, or herbicides is not permitted (the crossing structure itself, including temporary crossings, can be in the water, if the approved design allows for this).

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Prevent sediment from entering the water features by using erosion and sediment control techniques.
Blasting in or near water produces shock waves that can kill fish and will normally be avoided. Blasting with a potential impact on fish or fish habitat will only be done following approval from DFO.
Upon completion of a water crossing, any temporary fill, culverts, refuse, etc. will be removed from the construction area and properly disposed of in a satisfactory manner.
After construction, on-site inspections will be made by the proponent to confirm these standards are being met.
If using temporary winter-only crossings, materials other than ice and snow will be removed from the stream prior to spring break-up.
Upon installation, each new water crossing will be incorporated into the approved program for monitoring roads and water crossings.
Use techniques and materials appropriate for the conditions encountered at each water crossing, to minimize disturbance of a water feature and significantly reduce the potential for erosion and sedimentation.
Ensure logs and brush which may need to be removed or trimmed at the crossing site do not enter the water feature.
Grubbing of low vegetative cover between the height of land and a water crossing, or within 100 m of a water crossing, whichever is less, will be limited to that required to address engineering issues and safety concerns, such as the removal of hazards.
Apply mitigative techniques to provide for fish passage if there is potential to impede or block fish migration during installation of the crossing.
Begin site stabilization and clean-up as soon as possible after the water crossing has been installed, including the removal of all diversions.
Trim fill slopes to a stable angle or use other mitigative stabilization techniques. A person should be able to walk up the slope without causing slumping and sliding of soil particles. When a temporary channel is no longer required, it should be stabilized to avoid long-term erosion.
Material used within the stream and on the banks to improve the crossing will be clean, non-erodible, material non-toxic to aquatic life.

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Install culverts on a straight section of stream. When installation of a culvert on a straight section of stream is not possible, minimize the change in stream morphology and impacts on fish habitat (Figure 5.1b).

Revised guide status and rationale:

Direction removed – equivalent direction found in the Protocol and/or FMPM.

These standards are applicable to previously installed water crossings when they are replaced or upgraded due to sub-standard safety, environmental, or operational reasons.

Revised guide status and rationale:

Current standard removed – moved to direction description for Section 5.1.2.

When diverting and/or removing water for dry installations, chase away or trap and relocate live fish before completely dewatering the area (note: permits may be required; consult the local MNR district office for further information).

Revised guide status and rationale:

Current guideline removed.

This is a requirement specified in the DFO Code of Practice for temporary cofferdams and diversion channels. The requirement to follow the DFO Codes of Practice is a general standard in Section 8 of the Protocol.

Best management practices: Removed

Use instream sediment control techniques to isolate working equipment from shallow open water. A good reference source is MNR's *Instream Sediment Control Techniques - Field Implementation Manual* (1996).

Establish a maintenance schedule to keep culverts clear of obstruction to help avoid potential problems, particularly washouts and obstruction of fish passage.

Maintain vegetation on the approaches and fill slopes by re-seeding of gaps or by placing sediment and erosion controls on road cuts and fills where problems occur.

Normally, culverts are not recommended for use as temporary, winter-only, water crossings. Structures and techniques such as temporary bridges, ice bridges, and snowfills are normally more appropriate (Figure 5.1d).

Revised guide status and rationale:

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BMPs removed – equivalent BMPs found in the Protocol or the DFO's *Standards and Codes of Practice*.

iv) Removal

Standards and guidelines: Retained, revised, or new

When decommissioning of a road or road network is planned, all water crossings on that road or road system will be assessed for potential removal.

Revised guide status and rationale:

Direction revised.

Removed sentence describing “environmentally sound” removal as it is vague and already covered in the Protocol. Last sentence moved to road decommissioning section (5.1.1).

Water crossing removal operations that may enter a water feature (i.e., in-water work) or that may potentially cause sediment to enter a water feature, are not to occur during periods of fish spawning, incubation, or fry emergence, unless approved by the Ministry. Timing restrictions vary across the province; generic timing restrictions, by species for each Ministry region, are provided in Table 5.1a.

Revised guide status and rationale:

Direction revised.

The Protocol directly references the forest management guides (and the approved FMP) as the source of the fisheries in-water timing windows, therefore this guideline and associated timing restrictions table will remain in the guide.

Whether and how a water crossing structure is to be removed will be agreed upon by the Ministry and will be based on an analysis of the following criteria as a minimum: Biological (5 bullets), Water quality (1 bullet), Engineering (6 bullets), Safety (1 bullet), Anticipated road use (2 bullets).

Revised guide status and rationale:

No changes to existing direction and retained. Added criteria (2 bullets that are currently guidelines in the current guide) that need to be considered related to future anticipated road use.

As per the FMPM, Part A, section 1.2.10.7, whether a water crossing is removed needs to be agreed upon by the Ministry.

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This direction needs to be retained in the SSG as these criteria are directly referenced in the FMPM, Part D, section 3.2.3.3.

Standards and guidelines: Removed

During decommissioning, workers will prevent contamination of a water feature by foreign materials such as lumber, nails, fuel and oil.
The proponent for decommissioning of water crossings will monitor operations and mitigation techniques to prevent the harmful alteration, disruption, or destruction of fish habitat, the impairment of water quality, and problems related to fish passage.
Fill material placed below the high-water level within the floodplain of a water feature will be erosion resistant and/or protected from erosion.
Any exposed mineral soil between the height of land and the water crossing, or within 100 m of the water crossing, whichever is less, will be trimmed to a stable angle and be protected from erosion so sediment will not enter the water.
Upon completion of decommissioning, any temporary fill, culverts, refuse, etc. will be removed from the construction area and disposed of in a satisfactory manner.
Following decommissioning, on-site inspections will be made by the proponent to confirm the standards are being met. Problems are to be reported to MNR immediately.
For decommissioned water crossings that have not been removed, have a monitoring program to identify and mitigate safety and environmental issues.
Use techniques appropriate for the conditions encountered at each crossing to minimize disturbance of the water feature and the potential for erosion and sedimentation during and after decommissioning.

Revised guide status and rationale:

Direction removed – equivalent direction found in the Protocol and/or FMPM.

Decommissioning of water crossings is related to decommissioning of roads. Ensure the schedules for water crossing and road or road network decommissioning (Section 5.1.1.3) are coordinated.

Revised guide status and rationale:

Current guideline removed.

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Direction deemed not necessary. To avoid significant operational inefficiencies and costs, one could reasonably expect that forest managers would ensure schedules for road decommissioning and any associated water crossing removals would be coordinated.

Best management practices: Retained, revised, or new

Where a road or road network is being decommissioned and culverts are not being removed, incorporating a shallow depression in the approach will allow floodwater to flow over the road in the event of a culvert blockage or capacity exceedance (Figure 5.1c). This may require placing erosion-resistant materials in the depression and on the downstream side of the road fill.

Revised guide status and rationale:

No changes made to BMP.

When water crossing removal results in conditions unsuitable for vehicular passage, consider installing physical barriers (e.g., a large rock berm) for public safety.

Revised guide status and rationale:

BMP reworded and retained.

This is already standard practice associated with the removal of a bridge or culvert to address any liability issues for the SFL manager that may arise.

(C&R) 5.2 Soil and productive forest area conservation

Preamble

Revised guide status and rationale:

Content revised and reorganized.

Minor rewording to reflect discontinued use of standards and guidelines in direction characterization.

For improved organization, moved direction for hydrological impacts (Section 5.2.5) to water section (4.1) and renamed it Section 4.1.4 (Hydrological connections). Hydrological connections are often headwater features that are connected to and have impact on aquatic features and fish habitat downstream (e.g., streams, wetlands, ponds, and lakes). Section 5.2 will continue to address potential impacts of forest operations on water movement through soil as a component of soil (both mineral and organic) conservation.

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Definitions for rut, extraction trails, and significant mineral soil exposure remain unchanged. Definition for disruption of hydrologic function moved to Section 4.1.4.

The five-year review of the guide recommended revisiting the definition of a rut with a focus on the current minimum depth and length and whether the current approach to measuring depth of ruts is adequate.

Yanai et al (2006) reported that most feeder roots in northern hardwood stands, which are critical for water and nutrient uptake, occur within the upper 20 cm of soil. As the guide currently defines a rut as being ≥ 30 cm deep, depressions 20-30 cm deep would not be considered a rut but could result in significant root damage. However, for ease and consistency of measurement in the field, the guide uses the level of displaced material (soil and organic matter) as the starting point for measuring rut depth. If we reasonably assumed that the depth of displaced material averaged around 10 cm, then measuring to depth of 30 cm from the top of displaced material would be roughly equivalent to measuring to a depth of 20 cm from the top of mineral soil. Thus, the current minimum rut depth is believed to adequately address tree feeder rooting depth.

Kwiaton et al (2019) analyzed data from the 20-25 year re-measurement of two site disturbance plot networks in northwestern Ontario established in clearcut harvested lowland black spruce sites with varying levels of rutting. They reported that planted black spruce seedling survival after 20+ years increased in rutted plots as a function of rutting depth up to a threshold average rutting depth of 30-35 cm, which supports the current threshold depth in the guide.

It is also worthy to note that ruts may decompact fully or partially over time through natural processes including freeze-thaw cycles and root and soil fauna activity (Arnup 1999). Kwiaton and Morris (in prep) investigated the temporal changes in rut physical characteristics. Over the 23-year post-harvest period, rut depth decreased by 40% and 26% in moderately and severely rutted plots, respectively.

The five-year review of the guide did not include any recommendations to revisit the definitions for extraction trails or significant mineral soil exposure.

Direction

Revised guide status and rationale:

Added a direction description for Section 5.2 to be consistent with other sections. Moved the current two standards and guidelines in Table 5.2a (pg 146) to direction description.

(C&R) 5.2.1 Rutting and compaction

Preamble

Revised guide status and rationale:

No changes made to content.

i) All silviculture systems

Standards and guidelines: Retained, revised, or new

No more than 40% of any 0.1 ha circle is permitted in ruts.

Revised guide status and rationale:

Direction revised.

The five-year review of the guide included the following recommendations:

- Need to review the standards and guidelines (i.e., thresholds) for rutting and compaction. This should include looking at any new data or information available and the evolving expert opinion on acceptable thresholds levels.
- Need to actively pursue effectiveness monitoring projects that address site disturbance. While there are some on-going projects on file, a stronger commitment is needed to reduce the uncertainty with the direction in this section.
- The guides unit should explore ways to take advantage of the existing site disturbance plot network. This could include remeasuring plots and using that data to better understand impacts/recovery over time.

Since the development of the current Stand and Site Guide, new empirical information exists to address a key effectiveness monitoring priority of the guide related to site disturbance (Section 7.0, pg 168, Q10).

Morris et al (2009) surveyed regeneration survival and growth 11 years post-harvest in severely rutted, moderately rutted, and non-rutted harvested lowland black spruce blocks in the Black Spruce Forest. They found that severe rutting (42% areal coverage of ruts) resulted in a reduction in seedling survival and number of plantable microsites compared to no rutting (9% areal coverage of ruts). The reduction in seedling survival in severely rutted blocks was believed to be attributed to the altered hydrologic function of the site, as >60 % of the plantable microsites were wet or submerged in standing water. However, severely rutted sites did not appear to impact seedling growth. Moderately rutted sites (26% areal coverage of ruts) resulted in significantly higher regeneration densities than either severe or no rutting and supported adequate seedling growth. These results suggest that black spruce lowland sites may benefit from a moderate level of site disturbance. It is important to note that when this study was established (prior to the guide), all noticeable ruts were measured, including those that would not have met the current standard metrics of depth (30 cm) and length (4 m). Thus, actual areal extent of ruts meeting or exceeding the standard metrics would have been lower than the 42%, 26% and 9% reported for severely rutted, moderately rutted, and non-rutted blocks, respectively. However, measured rutting depth was fairly consistent across the rutted blocks averaging 25-30 cm.

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The Ministry's Forest Guides and Silviculture Section (FGSS) of the Crown Forest Lands and Policy Branch supported the re-measurement of this site disturbance plot network in 2018, 23 years post-harvest. CNFER re-measured the plots in severely-rutted, moderately-rutted and non-rutted blocks for tree composition, growth, and density. Similar to the 11-year post-harvest results reported by Morris et al (2009), the 23-year post harvest results (Kwiaton and Morris (in prep)) found significant positive effects for on seedling growth, survival, and recruitment for plots with a moderate coverage of rutting.

The results of this long-term study suggest that the current rutting threshold of 50% may be too high to result in acceptable regeneration success on clearcut harvested lowland sites and thereby support reducing the maximum coverage threshold for the 0.1 ha plot to $\leq 40\%$ (approximate areal coverage of ruts in the severely rutted areas).

In 2013, the Ministry's FGSS also supported the re-measurement of the site disturbance plot network near Longlac, Ontario originally established by Kimberly-Clark Inc. (Wiebe et al 2004) in plantations established between 1986 and 1993 in rutted and non-rutted lowland black spruce sites. Results from 2013 re-measurement were analyzed by CNFER in conjunction with the analysis of the 2018 remeasurement of the CNFER study (Kwiaton and Morris in prep). Similar to the CNFER study, the 2004 and 2013 data from the Kimberly-Clark plots indicated that rutted areas were similar to, or better than, non-rutted areas when comparing growth (height and root collar diameter). Coverage of ruts averaged 18% in the Kimberly-Clark study, however, ruts were measured at least 10 years post-harvest. This time period would have allowed for the ruts to partially or fully recover (e.g., fill in) naturally. Rut coverage immediately after harvest would have likely been higher (Groot 1996). Kwiaton and Morris (in prep) found that after 23 years, rut coverage (as defined by breaking and churning of the forest floor but not necessarily to the guide threshold depth) in the CNFER study decreased by 57% and 49% in moderately rutted and severely rutted plots, respectively.

Ministry and industry compliance staff will follow the approach to measuring rutting, the definition of a roadside work area, and percent coverage of extraction trails in Appendix 5.2a. This approach will be documented in the FMP.

Revised guide status and rationale:

Direction reworded.

Direction is still relevant. However, a sampling of current FMPs across the managed forest indicated that this direction has not been equally implemented/documented. Thus, it is now required that any approach developed be documented in the FMP. Based on feedback from many Stand and Site Guide field transfer sessions held across the province, approaches are recommended for measuring ruts and extraction trail coverage, and defining roadside work areas in Appendix 5.2a. See original Background and Rationale for Direction for rationale.

The area of rutting and compaction will be minimized.

Revised guide status and rationale:

No changes made to direction.

Direction is still relevant as it emphasizes the desired result, which is as little rutting and compaction as possible. This guideline addresses the concern in the five-year review of the guide that it may be perceived that under the current direction, it is acceptable that all rutting below the threshold is acceptable. See original Background and Rationale for Direction for rationale.

Standards: Removed

No ruts permitted that channel water into, or within 15 m of lakes, ponds, rivers, streams, woodland pools, or those portions of mapped non-forested wetlands dominated by open water or non-woody vegetation (see Section 4.1).

Revised guide status and rationale:

Current standard removed.

This direction removed from Section 5.2 since already covered in Section 4.1. Direction is related specifically to potential adverse impacts of rutting on water quality and aquatic organisms in adjacent water features which is covered under general conditions for working around water in Section 4.1.

Best management practices: Retained, revised, or new

Refer to Appendix 5.2b for suggested strategies and techniques to minimize rutting and compaction during field implementation.

Revised guide status and rationale:

No change to BMP.

BMP and suggested strategies and techniques provided in Appendix 5.2c. are still relevant to all silviculture systems (Labelle et al 2022).

Equipment operators should be trained in the identification of sites susceptible to rutting and compaction.

Revised guide status and rationale:

No change to BMP.

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Minor rewording. BMP is still relevant (Labelle et al 2022). Removed reference to Figure 5.2c as it provides little illustrative value.

Identify susceptible sites in advance of operations (e.g., via ground reconnaissance, drone-captured aerial imagery, remote sensing). An approach to dealing with these areas should be developed and communicated to operators and supervisors.

- The site disturbance susceptibility table in Appendix 5.2c can be used as a starting point.
- Hydrological modeling tools (e.g., flow accumulation models, LiDAR derived digital elevation models (Figure 5.2c)) can be used as an additional source of information for the possible location of susceptible sites. The outputs of these tools are not to be thought of as requiring verification, but equally they should not replace normal field reconnaissance.

Revised guide status and rationale:

No change to BMP. Minor rewording of second bullet.

BMP remains relevant (Labelle et al 2022).

Develop local standard operating procedures to prevent, minimize, and/or mitigate disturbance for various site type and machine combinations that may potentially result in compaction and rutting.

Revised guide status and rationale:

No change to BMP.

BMP remains relevant (Labelle et al 2022).

Selection of areas for harvest, both at individual and multi-year temporal scales, should consider susceptible sites and equipment limitations and seek a balance between stands in which operations can occur at any time of the year and those where operations are best carried out in the winter or the driest part of the summer.

Revised guide status and rationale:

Two current BMPs related to summer/winter balance of available harvest areas combined into a single BMP.

Where practical and feasible, maintain a choice of operating blocks within an economical floating distance to be able to move from susceptible areas during periods

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of abnormal environmental conditions (e.g., high rainfall, early thaw, late freeze) with minimal interruption in production.

Revised guide status and rationale:

No change to BMP.

BMP remains relevant (Labelle et al 2022).

Best management practices: Removed

When applying the second guideline in this section (develop an approach to measuring ruts), foster a common understanding at a level broader than the management unit (e.g., regional) to gain efficiencies and maximize consistency.

Revised guide status and rationale:

BMP removed.

BMP deemed no longer relevant because recommended approaches (in Appendix 5.2a) to measuring ruts and extraction trail coverage, and defining roadside work areas are already based on regional and provincial-level feedback (i.e., level broader than the management unit) received during Stand and Site Guide field transfer sessions that have been held across the province.

Where other factors allow, summer/winter balance should be maintained during implementation such that flexibility is maintained across multiple years.

Revised guide status and rationale:

BMP removed. Combined with another BMP.

When selecting areas for harvest, the availability, flexibility, and limitations of equipment in relation to susceptible sites should be considered.

When practical and feasible, access should be planned to prevent or minimize site damage (e.g., build roads well in advance of operations so lack of access is not a recurring reason for off-season operations on susceptible sites).

Revised guide status and rationale:

BMPs removed.

BMPs are not operationally relevant.

ii) Clearcut silviculture system (excluding commercial thinning)

Standards: Retained, revised, or new

No more than:

- 5% of any 20 ha area (or the operating block if less than 20 ha) is permitted in ruts in shallow soils (<30 cm)
- 10% of any 20 ha area (or the operating block if less than 20 ha) is permitted in ruts in all other soils.

Revised guide status and rationale:

No changes made to direction.

Direction is still relevant. No new empirical information that would warrant revising the current stand scale cumulative thresholds of 5% (shallow soils) and 10% (all other soils) rut coverage in any 20 ha area. See original Background and Rationale for Direction for rationale.

Best management practices: Retained, revised, or new

In clearcut operations, where advanced regeneration is a significant contributor to future forest development (e.g., CLAAG, HARP, white pine advanced regeneration, tolerant hardwood understory), the area in extraction trails will be minimized. On sites susceptible to rutting, achievement of this guideline will have to be balanced against the increased rutting that may occur when extraction is concentrated on fewer trails.

Revised guide status and rationale:

Currently a guideline for clearcut silviculture system, reclassified as BMP.

Unless a compliance inspector was aware of all the factors/conditions that the skidding operator(s) took into account at the time of operations, it would be difficult to assess whether trail coverage was minimized or not. Additionally, this direction should be specified in the forest operation prescription and/or SGR for the block/treatment area, not in this guide. If excessive trail coverage significantly reduces advance regeneration, then it the responsibility of the SFL holder to assign a more appropriate SGR.

iii) Selection and shelterwood (including irregular shelterwood) silviculture systems, commercial thinning

Standards and guidelines: Retained, revised, or new

No more than 900 m of rutted extraction trails for any continuous 20 ha area is permitted.

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If the threshold standard above is exceeded, ruts are to be rehabilitated within one year of completion of operations using the appropriate equipment and during conditions (e.g., summer) that will not cause additional damage to the site. Follow the assessment method outlined in Appendix 5.2a.

Revised guide status and rationale:

Direction revised. Replaces the current standard of no more than 2% of any 20 ha area permitted in ruts.

Rutting has many possible impacts on stands (e.g. hydrology, future use of trails), residual stems (e.g. productivity, mortality), and regeneration (e.g. microsite suitability, root penetration). This direction is intended to address potential impacts to residual stems.

Rutting is almost always on an extraction trail. Extraction trails, even after just a couple passes, can be associated with significant compaction (Graecen and Sands 1980), which can impact the productivity of adjacent trees (Smith et al 2010). In addition to the general compaction of an extraction trail, rutting can drive compaction deeper, shear and expose roots to pathogens, and cause excessive drying of the adjacent soil. The proposed revision to limit the amount of rutting per distance of trail is intended to address the additional impact of rutting on residual stem productivity over and above the impact of general compaction associated with trails. (note: refer to separate guideline limits on area in extraction trails).

Changing from an areal coverage approach (i.e., 2% of 20 ha) to a distance approach for (i.e., 900 m in 20 ha) for quantification is intended to address consistent feedback from compliance staff received during Stand and Site Guide field transfer sessions and formal guide review that an area-based assessment, particularly an area as large as 20 ha, is not practical in partial harvest areas.

Two options for a distance approach to quantifying ruts were originally considered by a Great Lakes - St. Lawrence site disturbance sub-team of the Stand and Site Guide revision technical advisory team including a 200 m of ruts of 300 m of trail (200 in 300) assessment and a '50% trail length' assessment. It was decided by the sub-team to pilot test the 200 in 300 assessment method in two heavily rutted areas of hardwood shelterwood harvest blocks in the French-Severn and Nipissing Forests. Rutting coverage/severity at both sites was deemed to be not acceptable primarily due to impact on rooting systems of adjacent acceptable growing stock (AGS) and impact on site hydrology. However (for the most part), assessment of rutting coverage on trails appeared to fall below the proposed revised limit (200 m in 300 m). It was also difficult to assess a contiguous segment of extraction trail with numerous forks and shorter side trails.

The sub-team proposed a third assessment method that involved establishing a threshold length of rutted trail for a 20 ha area. After a second pilot testing session in the field on the Nipissing Forest in the fall of 2021, it was determined that 900 m would

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be a relevant threshold (900 m long x 4.5 m wide trail = 0.4 ha or ~2% of 20 ha). This assessment method would likely involve a fair amount of walking, however, it would only need to be implemented when the amount of rutting is suspected to be approaching or exceeding the threshold. It could be relatively easily implemented by operators/supervisors and used to track whether the rutting threshold is being approached for a 20 ha area during operations and when operations may need to shut down or relocate.

Area in extraction trails will be minimized and will not exceed the following values unless a higher value is required to meet objectives and specified in the FMP (e.g., silvicultural ground rule, conditions on regular operations):

- 20% for selection
- 30% for shelterwood and thinning.

Revised guide status and rationale:

No changes made to direction.

The existing direction is consistent with values reported in the literature (e.g., Smith et al 2010) and operational studies (e.g., Sutherland 2009, Woods et al 2007, Partington and Lirette 2005) for reasonable trail coverage. While trail coverage below 20/30 is possible on some sites, terrain and other factors can make it difficult to achieve on others (e.g., Pinto and Smith 2007). It is not practical to define criteria in advance where a lower value may be possible.

To support the five-year review of the Stand and Site Guide, the Ministry undertook a modelling study to investigate the impact of extraction trails on productivity. Using a stem map from a representative selection stand, and typical coverage of trails, impacts on stand level productivity were less than 5%, consistent with typical assumptions used in development of the management direction (McPherson 2014, unpublished).

In general, 30% trail coverage in commercial thinning operations will be too high to realize expected gains – the stand level effect of trails will negate any stem level gains. However, some initial applications of row thinning will approach this number by design. The Silviculture Guide includes additional direction to ensure extent of trails in commercial thinning operations is consistent with assumptions of future growth.

Local criteria will be developed to identify when stabilization, repair, and/or work stoppage must occur to mitigate effects of ruts on long or short, steep slopes that may cause significant erosion that can degrade sites and prevent future use of extraction trails.

Revised guide status and rationale:

Direction reworded but intent remains.

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Direction is still relevant. See original Background and Rationale for Direction for rationale.

A new BMP (see below) has been added to compliment this guideline.

Best management practices: Retained, revised, or new

When developing local criteria to address erosion potential, ruts longer than 20 m on slopes greater than 20% should be stabilized (during operations) and/or rehabilitated (upon completion of operations). Stabilization and rehabilitation can include practices such as levelling, diverting runoff water to surrounding vegetation (e.g., water bars), controlling sediment (e.g., brush matting, straw bales) and/or other techniques appropriate to the circumstances.

Revised guide status and rationale:

New BMP.

The guideline (see above) allowing the development of local criteria appears to be working as all FMPs where partial harvesting occurs have included local criteria, many with significant detail (e.g., role of the Ministry, SFL, and logging company staff). The proposed additional rule-of-thumb (20m/20%) was common across a number of plans and appears to be a practical application worth sharing as a BMP for future planning teams to consider.

(C&R) 5.2.2 Erosion

Preamble/Direction

Revised guide status and rationale:

Minor rewording but content remains largely unchanged. No changes recommended to direction for erosion in the five-year review.

Added a direction description to be consistent with other sections. Moved only erosion-related standard to direction description.

Guidelines: Retained, revised, or new

Stabilize (during operations) and/or rehabilitate (upon completion of operations) extraction trails constructed on steep slopes by levelling, diverting runoff water to surrounding vegetation (e.g., water bars – Figure 5.2e), and controlling sediment (e.g., brush matting, straw bales or other techniques appropriate to the circumstances).

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Revised guide status and rationale:

Direction revised.

Reworded current guideline: replaced “decommission” with stabilize and/or rehabilitate to be comparable with wording in similar direction in Section 5.2 related specifically to ruts on steep slopes. This direction applies to extraction trails as non-rutted trails (i.e., with compaction that does not meet rutting dimensions) are also capable of channeling runoff and causing erosion.

Standards and guidelines: Removed

No specific standard - refer to direction for roads and water crossings (Section 5.1), rutting and compaction (Section 5.2.1), and aquatic and wetland ecosystems (Section 4.1).

Revised guide status and rationale:

Current standard removed – requirement moved to direction description.

Mitigate or rehabilitate areas of significant erosion that are transporting, or are likely to transport, sediment into a water feature.

Revised guide status and rationale:

Current guideline removed.

Removed guideline to rehabilitate areas of significant erosion that are transporting, or are likely to transport, sediment into a water feature. Difficult to define “significant” erosion and this direction is covered under Section 4.1 under general conditions for working around water.

Best management practices: Retained, revised, or new

Refer to Appendix 5.2b for a partial list of strategies and techniques that may be used to minimize erosion during operations.

Revised guide status and rationale:

No changes made to BMP.

Identify susceptible sites (see Appendix 5.2c for a starting point) and develop local standard operating procedures to minimize the risk of erosion on those sites.

Revised guide status and rationale:

No changes made to BMP.

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Minimize mineral soil exposure to that required for efficient operations and effective silviculture (i.e., consistent with silvicultural ground rule for the site).

Revised guide status and rationale:

New BMP to recognize that erosion issues can result from silviculture operations (e.g., mechanical site preparation).

Field supervisors and equipment operators should be trained in:

- Recognizing/locating sites susceptible to erosion
- The significance and potential consequences of soil exposure and erosion.

Revised guide status and rationale:

New BMP created by combining current third and fourth BMPs together.

Areas susceptible to mass wasting (e.g., steep sloped alluvial river banks, soil over steep bedrock) should be treated carefully. Silvicultural ground rules or individual plans should be developed for the areas and include specific measures to minimize erosion potential.

Revised guide status and rationale:

No changes made to BMP.

Best management practices: Removed

On broad sloping alluvial areas, care should be taken not to orient the cut blocks such that the entire width (with slope) of the area is cut in a single operation.

Revised guide status and rationale:

BMP removed – not operationally relevant.

Rehabilitate areas where soil has been deposited on the roots of residual trees and an impact on productivity is likely.

Revised guide status and rationale:

BMP removed – not operationally relevant.

(C&R) 5.2.3 Nutrient loss

Preamble/Direction

Revised guide status and rationale:

Minor rewording but content remains largely unchanged. No changes recommended to direction for nutrient loss in the five-year review. Of note, since the original development of the guide, further empirical evidence is available on the use of the full-tree logging method on sites susceptible to nutrient loss. Full-tree logging retained >60% of the estimated pre-harvest crown material (foliage, live branches, and cones) in the block on very shallow soiled sites (Morris et al 2016) and retained a sufficient amount of slash (coarse and fine) to result in black spruce seedling growth rates that were comparable to stem-only logged sites 15 year post-harvest (Morris et al 2014).

Additionally, Morris et al (2019) found that full-tree logging resulted in soil C and nutrient reserves that were comparable for all elements (N, P, and K) to stem-only logging. Both logging methods were also generally comparable to pre-harvest levels 20 years post-harvest on nutrient poor sites.

These recent studies suggest that past restrictions on full-tree harvesting on sites with very shallow or coarse textured, sandy soils were unwarranted and further support the revised Silviculture Guide now recommending that full-tree logging on very shallow soils has a high probability of meeting future stand objectives provided rotation length exceeds 80 years.

Added a direction description to be consistent with other sections.

Standards: Retained, revised, or new

Refer to the *Forest Management Guide to Silviculture in the Great Lakes-St. Lawrence and Boreal Forest of Ontario* for direction for specific site and treatment combinations that may be susceptible to nutrient loss.

Revised guide status and rationale:

Direction revised but original intent remains unchanged.

Replaces current standard and guideline in direction.

Best management practices: Retained, revised, or new

Refer to Appendix 5.2b for a partial list of strategies and techniques that may be used to minimize the risk of nutrient loss during operations on susceptible sites.

Revised guide status and rationale:

No changes made to BMP.

Identify susceptible sites (see Appendix 5.2c for a starting point) and develop local standard operating procedures to minimize the risk of nutrient loss on those sites.

Revised guide status and rationale:

Minor re-wording of BMP to be consistent with wording in equivalent BMP for rutting/compaction and erosion.

(C&R) 5.2.4 Loss of productive forest area

Preamble/Direction

Revised guide status and rationale:

No changes made to content.

Added a direction description to be consistent with other sections.

Standards: Retained, revised, or new

Coverage of operational roads and landings and unutilized slash and chipper debris will not impact the ability of a harvested area to meet the renewal standard (i.e., site occupancy, species composition) of the predominant silvicultural ground rule in a block.

Revised guide status and rationale:

The five-year review of guide recommended that a more objective measure of loss of productive land (e.g., a % of the block, allocated areas, unit) be considered as current direction is subjective and can be widely interpreted.

This direction takes a results-based approach towards minimizing conversion to non-forest area. Forest managers are responsible for accounting for the coverage of operational roads and associated landings in the assessment of renewal of the adjacent block. This direction does not apply in all-aged silviculture systems where periodic returns (e.g., every 20-30 years) to harvest would require the re-use of existing operational roads and landings.

Best management practices: Retained, revised, or new

As a rule-of-thumb, strive to keep the area of roads and landings to less than 4% on a per block basis (it is recognized that operational constraints may require more road in some circumstances and that less road may be possible, and therefore desirable, in others).

Revised guide status and rationale:

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No changes made to BMP.

Each FMP contains management objectives relating to social and economic objectives, including managed Crown forest available for timber production.

A recent sampling of 24 current FMPs (including four 2020-2030 Draft FMPs) across the managed forest, revealed that desirable levels for assumptions for Crown forest productive area lost to roads and landings used in modelling ranged from 1 to 5% with an average of 3%. Thus, the threshold of 4% is in line with current assumptions.

The FMPM requires that an assessment of objective achievement (including managed Crown forest available for timber production) be undertaken as part of the final year annual report (Part E, Section 3.5). Additionally, the final year annual report will discuss progress towards the recovery of productive land (Part E, Section 2.1.4 (f)) and any implications on the achievement of objectives (Part E, Section 3.1.7).

Roads, landings, and forestry aggregate pits that have naturally regenerated or have been artificially regenerated to productive forest (capable of producing trees and supporting tree growth) would not be counted in the measure.

Of note, as part of the five-year review of the guide, a jurisdictional scan revealed that only British Columbia and Newfoundland have definitive provincial standards with British Columbia limiting the area in a cutblock that is occupied by permanent access structures to 7% and Newfoundland which provides a threshold for all disturbances of the forest including ruts, roads, and landings at 6%.

Refer to Appendix 5.2b for a partial list of strategies and techniques that may be used to achieve the standard addressing loss of productive forest area during operations.

Revised guide status and rationale:

No changes made to BMP.

Avoid piling unutilized fiber on productive non-forested cover types (e.g., brush and alder, wetlands).

Revised guide status and rationale:

No changes made to BMP.

Best management practices: Removed

Area converted to non-forest or non-productive forest (slash/debris piles, operational roads, landings, flooding, etc.) should be quantified and monitored for recovery into

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productive land. Use existing process (e.g., free-to-grow survey) as much as possible to obtain this data. The results should be used to further refine forecasts of area converted to non-forest and non-productive forest.

Revised guide status and rationale:

BMP removed.

The FMPM requires that an assessment of objective achievement (including managed Crown forest available for timber production) be undertaken as part of the final year annual report (Part E, Section 3.5). Additionally, the final year annual report will discuss progress towards the recovery of productive land (Part E, Section 2.1.4 (f)) and any implications on the achievement of objectives (Part E, Section 3.1.7).

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(C&R) 5.3 Spread of invasive species

Preamble/Direction

Revised guide status and rationale:

Content revised.

Has been updated to now refer to the Ontario Invasive Species Strategic Plan and the Invasive Species Act, 2015, which have all been released post-2010. Neinhuis and Wilson (2018) provide a discussion on the recent policy implementation actions Ontario has undertaken to address the threat of invasive species on biodiversity and the province's forest sector.

Have added BMPs that may be applied through conditions on regular operations.

Best management practices: Retained, revised, or new

Forest workers should be trained to identify invasive species in their local area and know what actions can be employed to minimize their spread. Various sources may be consulted for the latest information on invasive species such as:

- Ontario Invasive Plant Council website (ontarioinvasiveplants.ca)
- Canadian Forest Service's Forest Invasive Alien Species of Canada website (www.exoticpests.gc.ca)
- Ontario Federation of Anglers and Hunters' Invading Species Awareness Program website (www.invadingspecies.com)

Revised guide status and rationale:

New BMP.

Converted second paragraph in existing Section 5.3 to a BMP.

Follow the *Clean Equipment Protocol for Industry* (Halloran et al 2013) when moving equipment from areas where an invasive plant species is known to occur to minimize the risk of transporting and introducing the species to new locations.

Revised guide status and rationale:

New BMP.

The *Clean Equipment Protocol for Industry* has been implemented during construction, agriculture, and forestry operation in parts of Ontario since 2013.

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(C&R) 6.0 SALVAGE AND BIOFIBRE HARVEST

(C&R) 6.1 Salvage harvest

Preamble/Direction

Revised guide status and rationale:

Revised preamble and direction description.

Removed reference to the Forest Management Guide for Natural Disturbance Pattern Emulation (NDPEG) as it will no longer directly precede the revised SSG as the source of direction of salvage harvesting.

The predicted increase in natural disturbance events due to climate change could potentially increase the amount of fibre harvested and removed from disturbed areas. In the five-year review of the guide, it was suggested that the current salvage direction be reviewed in light of this possibility.

A substantial amount of research has been conducted since the mid-2000's addressing the effects of salvage logging on ecosystem processes and biodiversity (Leverkus et al 2018, Lindenmayer et al 2018). The existing body of research continues to suggest that the potential ecological impact of salvage harvesting needs to be weighed against the economic benefits of recovering timber lost to natural disturbance and offsetting costs of reforestation (Leverkus et al 2018, Perera and Buse 2014). For example, the compound disturbance of post-fire salvage harvesting resulted in cumulatively greater long-term impacts on forest floor and soil properties, which persisted for 10 years and exhibited a different recovery trajectory than either wildfire or harvesting alone (Kishchuk et al 2015).

Salvage harvesting can reduce the richness and/or abundance of deadwood dependent taxonomic groups species (e.g., groups. In contrast, a number of open habitat community species may respond positively to salvage harvesting (Thorn et al 2018). Cobb et al (2010, 2011) reported that post-fire salvage harvesting reduced populations of the white-spotted sawyer and species richness of other pyrophilous insect species compared to harvested sites and unsalvaged burned sites. The synergistic effect of both fire and harvesting on the occurrence of deadwood-associated beetle assemblages led to altered soil and food web dynamics, deadwood decomposition, and growth of colonizing plants species. They recommended the retention of some burned trees to maintain the persistence of saproxylic beetle species and their ecological functions in early post-fire successional forests.

Other scientists are also recommending limitations be put on the amount of salvage harvesting that is occurring (Müller et al 2018). However, there still does not appear to be an imminent need to restrict the amount of salvage harvesting occurring in Crown forests in Ontario. Based on an analysis of salvage harvest data from FMP annual reports from 2002-2019 in the clearcut system across the province, salvage operations

took place in 42 of the 256 fires reported. Of the total 452,402 ha burned during that time period, 23,488 ha (5%) were salvaged harvested. The average proportion of an individual fire salvage harvested was 25% (with a range between 1% to 90%) between 2002 and 2019. Individual wildfires that were more 50% salvaged were all less than 100 ha in size. Thus, salvage operations in Crown forests in Ontario remain relatively uncommon, and in many areas where they do take place, the end result is only a partial salvage of the disturbance.

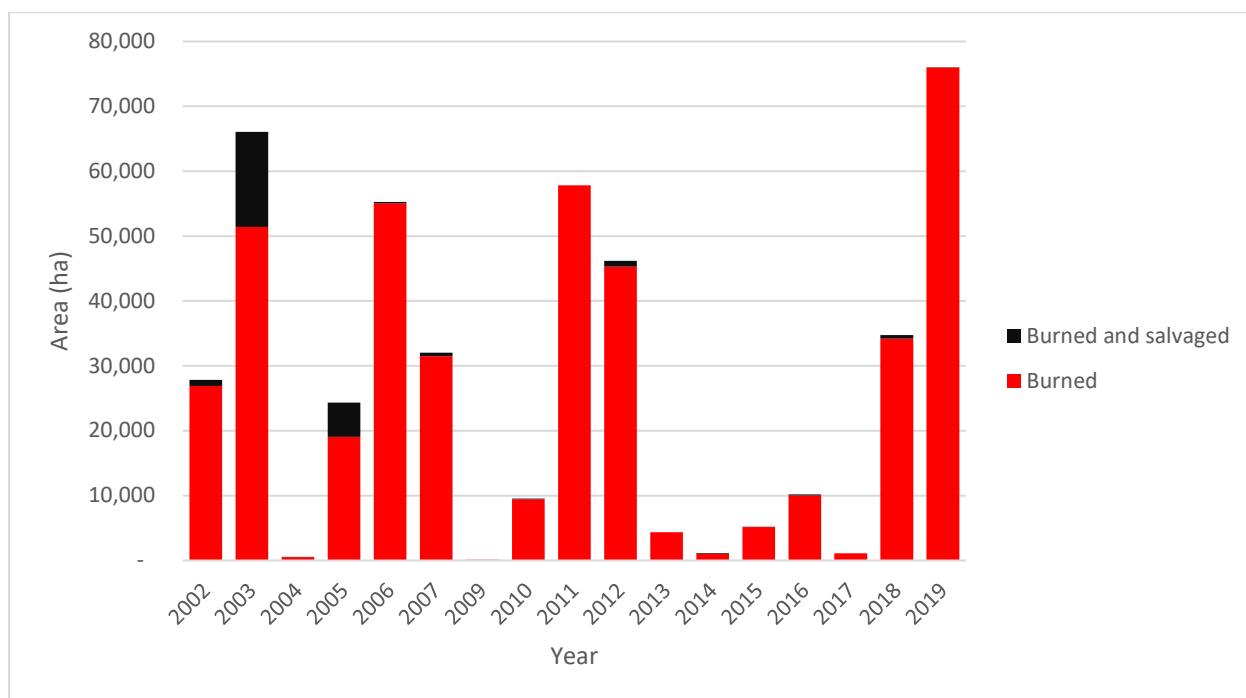


Figure 6.1a. Salvage harvest data reported in annual reports from 2002-2019 from Crown forest area wildfires in Ontario.

Recently, researchers have attempted to establish an evidence-based threshold for the proportion of a naturally disturbed area to be retained to conserve biodiversity, however, threshold estimates vary widely. In Quebec, Nappi et al (2011) recommended a minimum retention target of 15% for each wildfire and 30% of cumulative burned forest area over a five-year period calculated for an individual management unit. Waldron et al (2014) suggested the 30% threshold could also be applied to windthrow disturbances. Using a global data set, Thorn et al (2020) found that $75 \pm 7\%$ (mean $\pm$ SD) of a naturally disturbed area of a forest needs to be left unlogged to maintain 90% richness of its unique species, whereas retaining 50% of a naturally disturbed forest unlogged maintains $73 \pm 12\%$ of its unique species richness.

Many areas affected by natural disturbances will be left to natural processes because they are uneconomic to harvest (e.g., no existing access, low volumes of harvestable wood), or because the volume of salvaged timber that markets can absorb is limited (Nappi et al 2011, Peter and Bogdanski 2010). Additionally, depending on disturbance severity and condition of the stand at the time of disturbance, the rapid onset of decay in

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dead standing timber limits the temporal feasibility of salvage operations. However, some forest companies will salvage harvest areas >2 years post-fire for pulp production (Nappi et al 2011, T. Ratz, pers comm Sept 2021). For windstorms, Ruel et al (2010) found that lumber grade of balsam fir and black spruce was not affected after one year, but lumber grade and moisture content diminished rapidly after four years.

A combination of unharvested and salvaged natural disturbances on the landscape results in a mosaic of forest conditions that will help to foster the maintenance of high biodiversity levels in bird communities (Thorn et al 2016) and arthropod species (Wermelinger et al 2017). Leaving large portions of a wildfire footprint unsalvaged allows for early successional and ecosystem recovery processes associated with a high density of recently killed standing trees (e.g., invasion of beetles followed by woodpeckers) to continue (Perera and Buse 2014).

Guidelines: Retained, revised, or new

Consistent with direction in Section 3.2.3.1, salvage harvest will normally retain a minimum average of ≥ 25 stems/ha at least ≥ 3 m in height and ≥ 10 cm dbh. This is the minimum average for the harvest block (or minimum average per 20 ha if the harvest block ≥ 20 ha) contingent upon the availability of sufficient numbers and types of standing stems in a condition suitable for retention.

Revised guide status and rationale:

No changes made to direction.

The recent literature affirms the ecological importance of retaining structure and special habitat features (e.g., standing trees and fallen dead wood) on those sites where salvage harvesting is undertaken similar to the retention requirements of wildlife trees and residual patches for the clearcut silviculture system (Müller et al 2018, Leverkus et al 2018, Lindenmayer et al 2018, and Thorn et al 2018). Lindenmayer et al (2018) quantified the response of forest birds to wildfire, clearcut harvesting, and post-fire salvage harvesting in south-eastern Australia. They found the most intense disturbance (salvage harvesting with no retention) resulted in the greatest reduction in bird species richness and recovery, likely due to a reduction in stand structural elements as potential nesting and foraging habitat.

Thorn et al (2014) recommended retaining downed tree tops and individual windthrown trees when salvaging in blowdown areas to sustain deadwood resources for colonizing saproxylic beetles of early decay stages.

Salvage operations will consider strategic landscape objectives.

Revised guide status and rationale:

No changes made to direction.

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Direction is still relevant. No new literature was found to warrant a change in the direction. During the development of an FMP, strategic objectives are set for landscape level patches of various sizes of young and old conifer and hardwood based on harvesting as the predominant disturbance as it is difficult to spatially and temporally predict the incidence of natural disturbances. When planning to undertake salvage operations in a major natural disturbance (e.g., wildfire, insect outbreak, blowdown), the unplanned natural disturbance(s), as well as the anthropogenic disturbances yet to be completed, need to be considered in relation to disturbance thresholds at the landscape scale.

When finalizing boundaries of a salvage operation that results from wildfire, the area of undisturbed forest included in the salvage operation will be minimized.

Revised guide status and rationale:

No changes made to direction.

Residual forested areas left unburned within a wildfire boundary, also referred to as biological legacies (Nappi et al 2011) or fire refugia (Meddens et al 2018, Perera and Buse 2014), contribute to post-disturbance ecosystem recovery. They provide shelter and travel corridors for wildlife species associated with mature forests. They are also sources for recolonization of adjacent disturbed areas by organisms with low tolerance of post-fire conditions (e.g., lichen and bryophytes) or with seeds not resistant to fire (e.g., white spruce, balsam fir) (Nappi et al 2011). Retention of unburned forested areas contributes to a spatial and temporal heterogenous forest structure mosaic in the wildfire footprint that habitats for a greater range of organisms.

When finalizing boundaries of a salvage operation that results from blowdown, insect infestation, or other factors (e.g., ice storms), the area of the salvage operation can include undisturbed forest. When salvage operations include undisturbed area, Section 3.2.2 will apply.

Revised guide status and rationale:

No changes made to direction.

Direction is still relevant. No new literature was found to warrant a change in the direction. See existing Background and Rationale for Direction for rationale.

The trees retained following salvage operations will have a range of distribution patterns (relatively even spaced to some clumping), recognizing operational limitations, and subject to the availability of standing trees.

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Revised guide status and rationale:

No changes made to direction.

The recent literature continues to support the existing background and rationale for this direction. In Quebec, Nappi et al (2011) recommend distributing residual forest evenly throughout a wildfire footprint to establish connectivity and ensure that no large area is void of residual forest. They also recommend that individual residual forest patches vary in size (i.e., large patches (>20 ha) and smaller patches), shape, and composition (i.e., species and size classes of both commercial and no commercial value).

In a study by Lindenmayer et al (2018), post-fire salvage harvesting without retention of uncut islands altered stand structure and plant species composition (and hence modification of bird habitat suitability) reducing bird species richness and delaying patterns of recovery. Zmhorski (2010) reported a similar bird response with post-windthrow salvage harvesting. These studies continue to highlight the importance of retaining patches of uncut forest not only within clearcut harvest, but also in naturally disturbed areas that are salvage harvested.

Adjust the timing of entry and/or other operational factors to minimize unnecessary site disturbance that could potentially result in ecological damage (e.g., avoid salvaging a swamp in the frost-free period).

Revised guide status and rationale:

No changes made to direction.

The post-disturbance environment, particularly post-fire, may be highly disturbed and any additive soil disturbance could potentially increase erosion, promote the invasion of exotic plants, or kill tree seedlings and other plants that re-establish post-disturbance (Nappi et al 2011). Wagenbrenner et al (2015) recommended that salvage harvesting be undertaken on frozen ground or when soils are dry to minimize compaction of tracked areas and reduce the potential increase in sediment production.

Royo et al (2016), Waldron et al (2014), and Man et al (2013) found that machinery involved in post-windstorm salvage harvest operations damaged advanced regeneration released post-disturbance. However, this advanced regeneration may be replaced by other tree species, thus increasing overall understory community richness and diversity (Slyder et al 2019). Waldron et al (2014) also reported that post-windstorm salvage harvesting reduced forest floor heterogeneity by reducing bryophyte coverage (sphagnum, mosses, and lichens) compared to unsalvaged blowdown areas.

Windrowing of post-disturbance debris, an operation to facilitate regeneration activities, was found to reduce important structural features including downed wood distribution and cover of standing deadwood (Schafer et al 2014). They also found that the operation may affect understory composition by increasing aspen regeneration and the presence of vegetatively reproducing herbaceous plants and shrubs.

Guidelines: Removed

Reasonable efforts will be made to avoid windrowing or crushing of downed woody material.

Revised guide status and rationale:

Current guideline removed.

BMPs to minimize the windrowing and/or crushing of downed woody material already exist in Section 3.2.3.2.

Best management practices: Retained, revised, or new

Whenever possible, the trees retained following harvest will be the same species and size classes as those that would have been retained following normal harvest (as per direction in Section 3.2.3.1).

Revised guide status and rationale:

No changes made to BMP.

BMP is still relevant. No new literature was found to warrant a change in the direction. In fact, in Quebec, Nappi et al (2011) support this practice by recommending areas left unsalvaged in a wildfire footprint be similar in pre-burn composition and structure so that a mix of mature and commercially less valuable younger forests are left to provide the greatest range of available habitats.

When leaving unsalvaged patches of disturbed forest, give preference to areas adjacent to, or in close proximity to, the undisturbed forest.

Revised guide status and rationale:

No changes made to BMP.

The recent literature continues to support the existing background and rationale for this direction. The periphery of a burned forest adjacent to unburned forest is important habitat as a transitional zone for a number of vertebrate and invertebrate wildlife species (Nappi et al 2011). Retaining portions of residual burned forest adjacent to unburned forest areas ensures connectivity and facilitates colonization of disturbed areas by reducing the dispersal distance for birds and insects (Bognounou et al 2021, Nappi et al 2011). Boucher et al (2016) observed that these transitional zones represent habitat used by several burn-associated saproxylic beetle species found in low numbers in green forests but whose populations benefit from the availability of both burned and unburned habitats.

Limit skid trail coverage when salvage operations are extended for ≥ 3 years, particularly in fire salvage areas.

Revised guide status and rationale:

BMP reworded.

Empirical evidence continues to suggest that the skid trail (and feller buncher trail to a lesser degree) coverage from post-fire salvage harvesting is the highest and most persistent source of increase in sediment production. Wagenbrenner et al (2015) found that sediment production rates from salvage operations were primarily a function of rainfall intensity, ground cover, and compaction associated with logging traffic. Wagenbrenner et al (2016) also reported that trails created by logging machinery with burned forests removed all live vegetation in the trafficked areas and caused increased runoff rates that lasted up to three years and did not recover as in the control plots. They suggested that site-specific best management practices aimed at reducing the risk of sediment delivery to aquatic features are needed to minimize the adverse impacts of post-fire salvage harvesting.

The pit-and-mound microtopography and associated soil turnover created by trees uprooted during windthrow events are physical attributes that facilitate early establishment and regeneration of vegetation in areas of exposed mineral soil. To maintain this natural microsite heterogeneity during salvage harvesting, Waldron et al (2013) recommended that machinery trail coverage be minimized as machinery was responsible for returning uprooted stumps to their pre-windthrow position.

In fire salvage areas, preferably retain conifers such as jack pine and black spruce as wildlife trees.

Revised guide status and rationale:

No changes made to BMP.

Boucher et al (2014), Perera and Buse (2014), and Nappi et al (2011) suggest that removal of conifers in a salvage operation reduces the aerial seedbank of jack pine and black spruce and thus the proportion of conifers in the regenerating stand in favour of trembling aspen suckering. Retention of intact burned areas and conifers as wildlife trees may mitigate the potential deviation of post-salvage forest composition from post-fire natural composition.

Retention of conifers would also benefit specialized species such as the black-backed and three-toed woodpeckers. In conifer-dominated forests in central Quebec, Tremblay et al (2015) observed that selection of nest trees by black-backed woodpeckers was partially influenced by tree species and recommended the retention of dead jack pine

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trees in proportion of their availability in conifer-dominated stands. Nappi and Drapeau (2011) reported that fire-killed trees with a minimum dbh of 15 cm were used for foraging by black-backed woodpeckers in recently burned boreal forest in Quebec because they represented high quality substrates for wood-boring insects.

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(C&R) 6.2 Biofibre harvest

Preamble/Direction

Revised guide status and rationale:

Revised preamble and direction description.

Minor reorganization of content - remains largely unchanged. The 2008 version of the Ministry's directive for biofibre allocation and use was reviewed in 2013 and 2018 (OMNR 2013) and the definition of forest biofibre in the directive remains unchanged. Removed reference to 'other forest management guides' – at the time of development of the original Stand and Site Guide, a separate guide for forest biomass harvesting was being considered – this is no longer the case. Moved the only standard from previous Table 6.2a into direction description.

Despite significant increases over the last two decades, new economic activity from bioenergy production and advanced bioproducts has remained modest. As of the end of 2019, it was estimated that modern bioenergy (from all biomass-based feedstocks) constituted 2.2% of worldwide electricity production, and about 5% of heating and cooling for the buildings sector in 2018 (REN21 2020). The volume of Ontario's Crown forest biofibre harvested has fluctuated in recent years (2008-2020) with an average annual harvest volume of 500,000 m³ and a peak volume of approximately 920,000 m³ in 2015-16. Much of Ontario's modern bioenergy production can be attributed to the generation of bioenergy in mills and combined heat and power plants and the production of wood pellets (OMNRF 2021).

Biofibre harvesting may impact post-harvest forest structure by altering standing live, dying, and dead trees, pre-harvest downed woody material, and the quantity and quality of post-harvest residues (Berch et al 2011). Biofibre harvesting may reduce the number of these structural features which may negatively impact critical habitat (e.g., substrates) for and composition of saproxylic mosses, fungi and insects, and breeding, foraging, and refuge habitat for small mammals and birds (Work et al 2014, Lattimore et al 2013, Rupp et al 2012, Riffell et al 2011). Additionally, the harvesting and removal of undersized branches and tops, may alter soil productivity under specific site and stands conditions including climate, microclimate, soil texture, organic carbon, and regenerating species (Lattimore et al 2013, Thiffault et al 2011). However, operational biofibre harvesting methods that generally target undersized, unmarketable and/or unmerchantable trees or parts of trees, including branches and tops (e.g., roadside debris), typically retain >25% of the total aboveground biomass on site (Ralevic et al 2010).

In light of the emerging potential for increased utilization of forest biofibre for non-conventional forest products such as bioenergy and high value bioproducts, as identified in Ontario's Forest Biomass Action Plan (MNDMNRF 2022), the need for science-based policy direction that ensures biofibre extraction is balanced with the retention of some woody material to fulfill its ecological functions is critical (Puddister et

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al 2011). However, as the bioproducts sector continues to be comparatively small to the conventional forest product sectors in Ontario (4.1% of total harvest volume compared to 93% for sawlogs, pulpwood, composite and paper), the current direction remains adequate.

Guidelines: Retained, revised, or new

Stumps and all below ground portions of a tree are not available for utilization as a forest product. Movement or removal associated with normal operations (e.g., construction of roads, landings, and skid trails; renewal and tending; slash piling), including incidental movement or removal during harvest operations, is permitted but will be minimized to that required for efficient operations. Removal for forest health purposes is permitted.

Revised guide status and rationale:

No changes made to direction.

Direction is still relevant. The five-year review of the guide determined that the existing direction was adequate as long as Sections 3.1.3.1 (wildlife trees) and 3.2.3.2 (DWM) continue to provide appropriate direction on retaining material on-site.

A considerable amount of new literature continues to support the existing direction. Stump harvesting may lead to potential undesirable environmental impacts including physical soil damage (e.g., compaction, mixing, rutting and erosion), reduced soil fertility and carbon storage, long-term reductions in site productivity, and loss of habitat/substrate for saproxylic species (Persson and Egnell 2018, Berch et al 2012, Bunnell and Houde 2010, Wamsley and Godbold 2010). However, stump removal is a potential strategy to manage the spread and reduce the impact of root disease in regenerating stands (Persson and Egnell 2018, Hannam 2012).

In many cases, increased harvest intensity, such as stump harvesting, exacerbates effects on forest soil productivity and carbon storage due to increased soil disturbance (Vanguelova et al 2017, Achat et al 2015, Thiffault, et al, 2011). The effects of stump removal following full-tree harvesting has primarily been studied in Scandinavian forests where stump harvesting is practiced for bioenergy production. Negative effects have been found on arthropod communities due to greater mineral soil exposure (Malmström 2012, Kataja-aho et al 2016) and a reduction in habitat for stump-inhabiting species with low dispersal ability (Taylor and Victorsson 2016). Furthermore, Toivanen et al (2012) reported that stump harvesting lead to a decrease in the occurrence of decomposer fungi due to a reduction in substrate availability.

However, some recent science indicates that stump harvesting may be a viable and sustainable practice. The ongoing Island Lake Biomass Harvesting Experiment (ILBHE), established by a group of researchers from the Canadian Forest Service (Great Lakes Forestry Centre, GLFC), the MNDMNRF and several universities, assesses the impacts

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of biomass harvesting intensity on boreal forest biodiversity, soil properties, and stand productivity (Boisvert-Marsh et al 2016, Kwiaton et al 2014). A wide range of organisms, including soil microbiota, arthropods, and vegetation, that are linked to nutrient cycling and site productivity are being investigated to determine the implications and thresholds associated with a range of biomass removal levels (ranging from tree-length to full-tree with stump and forest floor removal) and silviculture options. Preliminary results from the ILBHE indicate minimal effect of stump removal on soil organic and mineral carbon pools compared to conventional harvesting (Boisvert-Marsh et al 2016). Rousseau et al (2018) reported that the effects of stump removal on forest floor mesofaunal communities were not significantly different from the less intensive harvesting treatments including tree-length and full-tree methods. Furthermore, James et al (2021) found that whole tree harvest does not result in additional soil carbon losses compared to tree-length harvest suggesting that it could be used to extract additional biomass for bioenergy production without widespread reductions in soil carbon.

Despite these recent findings, commercial stump harvesting does not appear to be imminent in Ontario (Karen Jackson, MNDMNRF, pers. comm., Aug. 2021) likely due to current policy prohibiting the practice, low market demand, and costs associated with the harvesting, transporting, and processing of stumps and roots. Recognizing that woody biomass quantities observed in managed stands already tend to be less than those found in comparably-aged natural stands (Franklin 1990, Kerr 1999, Hunt et al. 2010, Moroni et al. 2015, Omari and MacLean 2015), stump harvesting would undermine the Ministry's philosophy of emulating natural disturbance. For these reasons, proposing new direction to enable the harvesting of stumps and below ground portions of trees is not supported.

Organic matter that is not part of a harvested tree (including boles, branches, roots, bark, leaves, needles, debris, soil carbon, etc) will remain on site. Movement of such material for access or silvicultural purposes is permitted.

Revised guide status and rationale:

No changes made to direction.

Direction is still relevant. The five-year review of the guide determined that the existing direction was adequate as long as Sections 3.1.3.1 (wildlife trees) and 3.2.3.2 (DWM) continue to provide appropriate direction on retaining material on-site. Furthermore, a considerable amount of new literature continues to support the existing direction.

The literature continues to suggest that maintaining surface organic matter horizons during harvesting is critical for long-term tree growth, soil nutrient dynamics, and water conservation. In a meta-analysis from published data and the North American Long-Term Soil Productivity (LTSP) study, James et al (2021) reported that whole tree harvesting with slash and forest floor (O horizon) removal or with forest floor removal resulted in a 25% and 9% reduction in soil carbon, as well as a reduction in soil nitrogen, compared to tree-length harvest, respectively. Hazlett et al (2021) also

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reported full-tree harvesting plus organic horizon removal reduced soil nitrogen (N) availability more than operational tree-length harvesting.

Intensive forest biomass harvesting that includes the removal of the forest floor can have a negative impact on soil microbial communities and function. Hartmann et al 2012 found that forest floor removal had a significant effect on community structure, composition and total biomass of soil microbiota, however, they observed relatively small differences between tree-length and full-tree harvest treatments. Removal of the forest floor reduced suitable microhabitats for mesofauna (Rousseau et al 2018). As a result of the cumulative effects of increased soil disturbance and loss of coarse wood, arthropod community composition in plots with forest floor removal was significantly different than that found in less intense harvest treatments (Venier et al 2017). In contrast, Smenderovac et al (2017) reported few microbial community structure differences among intensified harvesting treatments (tree-length, full-tree, full-tree with stump removal, full-tree with stump, and organic matter removal) within two years post-harvest, which may have been due to the short time period between harvesting and soil sampling.

Recent literature from Ontario's LTSP research project continues to suggest that removal of harvested tree-tops and branches through the full-tree method has limited impact on soil productivity compared to tree-length harvesting. Full-tree logging retained >60% of the estimated pre-harvest crown material (foliage, live branches, and cones) in the block (Morris et al 2016) and retained enough slash (coarse and fine) to result in black spruce seedling growth rates that were comparable to tree-length logged sites 15-year post-harvest (Morris et al 2014). Additionally, Morris et al (2019) and Hazlett et al (2014) found that full-tree logging resulted in soil C and nutrient reserves that were comparable to tree-length logging. Both logging methods were also generally comparable to pre-harvest levels 20 years post-harvest on nutrient poor sites (Morris et al 2019).

Shabaga (2016) investigated the impact of tree-length and more intensive biomass harvest (removal of approximately 50% of the branch and crown materials) on soil nutrient dynamics in a selection harvested hardwood forest in central Ontario. Despite tree-length harvesting resulting in 92% more woody debris than biomass harvesting, increased retrieval of smaller diameter wood did not result in a loss of nutrients, particularly base cations three years post-harvest.

In addition to the LTSP research project, as part of the ILBHE, full-tree harvesting with removal of undersized and poor quality stems did not appear to significantly modify mesofaunal community structure (Rousseau et al 2018), arthropod community composition (Venier et al 2017), or diversity and composition of saproxylic fungal communities in residual stumps five years post-harvest (Boué et al 2019) compared to tree-length harvesting.

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Thus, the recent literature continues to support the current direction restricting organic matter removal from a site while enabling the extraction of some woody debris associated with harvested trees.

Standards: Removed

Unless otherwise specified, the direction in this and other forest management guides will apply equally to all planned harvest areas regardless of the product derived.

Revised guide status and rationale:

Current standard removed – requirement moved to direction description.

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(C&R) 7.0 EFFECTIVENESS MONITORING

Preamble

Revised guide status and rationale:

Revised preamble.

Minor changes to content to reflect change legislative requirement for guide effectiveness monitoring (now required by CFSA and its provision of the FOSM) and the fact that the guide is being revised, not developed.

Revised Figure 7.1a to illustrate feedback loop from monitoring that informs future guide revisions.

(C&R) 7.1 Effectiveness monitoring principles

Preamble (content)

Revised guide status and rationale:

Revised content.

Minor editorial changes made. No recommendations from five-year review to revise content as it remains relevant.

(C&R) 7.2 What to evaluate – Identifying key uncertainties

Preamble

Revised guide status and rationale:

Minor revisions to preamble.

Current guide identifies 10 effectiveness monitoring (EM) questions. Rephrasing questions as testable EM hypotheses and grouping by theme (wildlife and terrestrial/aquatic ecosystems) for better organization.

Key uncertainties: Retained, revised, or new

H₀1: Within the context provided by direction in the Landscape Guide, if the coarse filter direction in Section 3.2.2 and fine filter direction in Section 4 produce a pattern of harvested and residual forest at stand and multi-stand scales similar to that found in habitats disturbed by natural events, then similar wildlife communities will be maintained.

Revised guide status and rationale:

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Current Q1 reworded as a testable hypothesis, however, premise of the uncertainty remains unchanged.

To effectively emulate natural disturbance patterns, wildlife community response to forest conditions (e.g., age class distribution and spatial arrangement) created by natural and managed disturbances needs to be compared at multiple scales, both spatially and temporally. Birds are believed to be an effective indicator of potential changes in habitat function between forests of natural and managed disturbance origin (Rempel et al 2016, Brown et al 2021). Börger and Nudds (2014) found that waterbird response to fire and harvesting were similar for 13 of the 14 most common species between 10-20 years post-disturbance. Similarly, Rempel et al (2016) found that most forest bird species (11 of 14) occurred with equal occupancy rate in habitat originating from natural and harvesting disturbances and that differences in quantity and/or quality of specific habitat types and/or features (e.g., standing residual trees) likely explain the variable responses. Zimmerling et al (2017) reported that more than half of 62 boreal forest bird species responded similarly to disturbances by fire and harvesting. However, in contrast, they observed lower species richness and abundance in post-harvest mid-successional stands (21-80 years) compared to post-fire mid-successional stands. They also observed that many species showed either significantly higher or lower abundances in the two disturbance types in early (0-20 years) (10 species) and mid-successional (18 species) stands. Moreover, Zlonis and Niemi (2014) found that unmanaged stands (i.e., older, mixed, and more structurally diverse) provided habitat for an increased abundance and richness of bird communities compared to managed stands, however, most early-successional species did not differ between the two disturbance types and species richness converged in mid-successional stands (31-75 years) in northern Minnesota hemiboreal forests.

The disparity in recent evidence for forest management practices effectively emulating natural disturbance patterns supports the need for continued research into what directional changes in the forest pattern and compositional mosaic would improve ecological similarity with natural conditions. Furthermore, as the direction in the Great Lakes – St. Lawrence and Boreal Landscape Guides (2010 and 2014) has only recently been implemented in the development of the management direction for FMPs across the managed forest, more time is required to effectively monitor and rigorously assess the coarse and fine filter direction in the SSG in the context provided by direction in the Landscape Guides. Collection of wildlife and habitat information through time, as part of the Ministry's wildlife monitoring program, may potentially permit some comparison of observed populations trends in wildlife species to desired management objectives for wildlife. Thus, this uncertainty should continue to be a high priority for consideration within the Ministry's effectiveness monitoring program.

H₀2: If the direction for AOCs (around water features and other site-specific values), small residual patches, wildlife trees, and downed woody material in Section 3.2.3 maintains or produces sufficient downed woody material through time similar to that

arising from natural events, then DWM-dependent wildlife, plant, and fungal communities and ecological processes (e.g., nutrient cycling) will be maintained.

Revised guide status and rationale:

Current Q4 reworded as a testable hypothesis.

Several recent scientific studies have been published or are ongoing related to post-harvest DWM volumes over space and time. To compare the temporal patterns of DWM supply between harvest and natural disturbance origin stands, Kwiaton et al (2020) analyzed long-term DWM measurements collected from the Ministry's Growth and Yield Program's permanent forest plot network. DWM measurements from ~ 3,480 plots in managed and unmanaged origin stands at various developmental stages and spanning 10 ecoregions and 40 forest management units (FMUs) across the boreal (3,414 plots) and GLSL (66 plots) forest regions were analyzed. Although their analysis showed a volume decline in DWM during the establishment stage (0-20 yrs) in managed versus unmanaged stands, the authors concluded that the current guidance provided in the SSG (i.e., retention/protection of legacy DWM, logging debris quantities associated with full-tree harvesting, and green tree retention of 25 trees/ha) is an acceptable approach to retain DWM at sufficient quantities out to and beyond the self-thinning stage of stand development.

Jones and McPherson (2012) evaluated coarse woody debris (CWD) loads in shelterwood harvested blocks in the GLSL forest region using tree-length and full-tree logging methods, and the effects of full-tree harvesting on CWD in partial cuts. Despite efforts to increase utilization of material from the full-tree study sites, no significant differences were observed in CWD volume or the distribution of that volume across decay classes, and CWD volumes measured in the study were comparable to the ranges of values published in the literature for managed and unmanaged forests elsewhere.

In 2011, a group of researchers from both the federal and provincial governments and several universities established the Island Lake Biomass Harvest Experiment to assess the impacts of biomass harvesting on boreal forest biodiversity (e.g., DWM and saproxylic communities), soil properties, and stand productivity. Results from this ongoing project will help to improve our understanding of the effects of biofibre harvesting and biomass removal on forest ecosystems (Berch et al 2011, Puddister et al 2011) and may warrant additional direction in future versions of the guide for limiting removal of forest biofibre (e.g., inclusion of forest biomass retention thresholds). A summary of the preliminary results has been published (Boisvert-Marsh et al 2016).

However, the aforementioned studies do not describe wildlife response to the quantity and quality of DWM volumes resulting from the guide direction and while science cannot currently recommend definitive threshold volumes to meet biodiversity and site productivity needs, it is beginning to focus on this hypothesis. The Ministry's Ontario Wildlife Monitoring Network (OWMN), although more landscape scale-focused, may potentially help in providing some information on wildlife species (e.g., small mammals)

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responses to downed woody material through time and across a gradient of forest successional stages in the managed forest. Recently, minimum retention levels of DWM that would provide suitable habitat for a variety of deadwood dependent species have been reported (e.g., Work et al. 2004, Tremblay et al. 2009, Müller and Bütler 2010, Vanderwel et al 2010, Work and Hibbert 2011, Venier et al 2017, Brown et al 2021). However, these studies fall short in providing minimum threshold amounts of DWM to retain post-harvest that would ensure an adequate temporal supply of deadwood for wildlife species and species assemblages similar to that found in naturally disturbed areas. Thus, this uncertainty should continue to be a high priority for consideration within the Ministry's effectiveness monitoring program.

H₀3: If forest management operations permitted within shoreline AOCs (Sections 4.1.1 and 4.1.2) create a diversity of ages of shoreline forest similar to that found in habitats arising from natural events, then similar riparian wildlife communities (including beavers) will be maintained.

Revised guide status and rationale:

Current Q8 reworded as a testable hypothesis.

Several recent studies (e.g., Dragotescu and Kneeshaw 2012, Araya et al 2015, 2016, Newaz et al 2020) have investigated post-disturbance (fire) residual vegetation patterns to assist in the management of shoreline vegetation that emulates natural disturbance (END) patterns. Results indicate that shorelines are not left completely unburned, which is contrary to existing practice of retaining fixed-width shoreline buffers. It may imply that under END based management, harvesting of shoreline forest is possible in some areas that are left unharvested under a fixed-width riparian buffer management system. Newaz et al (2020) suggests that GIS-based models developed based on the hydrological and topographical features associated with the unburned shorelines and lakeshed areas might be useful to predict shoreline residual forest pattern and facilitate END based shoreline forest management. However, these studies did not assess post-disturbance riparian conditions from a wildlife habitat perspective.

Empirical evidence continues to support the assumption of the shoreline forest direction in Section 4.1 that aims to supply a mix of varying aged forest to create habitat conditions for riparian wildlife communities similar to those that arise from natural disturbance events. When considering forest management operations in riparian areas, species that explicitly use shoreline areas to survive and reproduce (e.g., beaver) should continue to be of particular concern (Larsen-Gray and Loehle 2022). Moreover, beavers, as ecosystem engineers, are increasingly being included in climate change adaptation and mitigation strategies (Hood and Bayley 2008, Stoll and Westbrook 2020).

Suitable beaver habitat requires a consistent water source and a supply of preferred forage (e.g., woody vegetation) in the riparian zone (Scamardo et al 2022). Recent studies continue to suggest the importance of shoreline disturbance to maintain beaver

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habitat and activity and hence wildlife communities associated with beaver ponds. For example, Landriault et al (2009) suggested that the presence of 21-35 year shoreline clearcuts adjacent to a lodge, combined with the associated water feature type, was the best predictor of lodge activity in central Ontario. Presence of beavers in Illinois was predicted by the width of riparian forest and the % of stems <15 cm dbh (Cox and Nelson 2009). In Maine, the number of beaver ponds peaked 30 years after a large fire (Little et al 2012). In Michigan, the number of beaver ponds was correlated with the area of young (10-19 years) aspen forest within the study watershed (Martin et al 2015). Stoll and Westbrook (2020) and Scamardo et al (2022) reported that a shift in vegetation composition with less preferred forage (e.g., aspen succeeding to conifer) lead to declines in beaver dam capacity in Riding Mountain National Park, Manitoba and Colorado, respectively.

Recent empirical evidence also suggests that the benefits of stand-replacing disturbance in shoreline forest is unlikely to be limited to beavers. Musetta-Lambert et al (2017, 2019) found that fire-derived early successional riparian forests provided significantly greater and compositionally distinct leaf litter material and resulted in more abundant aquatic invertebrate communities in headwater streams compared to harvested (with 30 m riparian buffers) and undisturbed riparian forests.

Borger and Nudds (2014) found that forest harvesting and fire affected the probability of occupancy of 10 of 14 waterbird species (waterfowl, wetland, and riparian) and response varied over time with forest successional status (0-10 years, 10-20 years, mature forest) and among species. Three species avoided forests older than 20 years and/or strongly preferred early successional forests. The Canada goose was the only species to respond to fire and timber harvest differently, with a negative response to recently harvested sites that disappeared after 10 years. They suggested responses will likely be strongly affected by the maintenance of non-harvested buffer zones around waterbodies and in-block residual tree retention.

In the boreal forest near White River, Ontario, Holmes et al (2017) found that open woodland and early successional bird communities benefited from partial harvesting in riparian reserves while populations of forest interior species declined, but were not eliminated. As total bird abundance declined in harvested riparian reserves, it was thought that displaced forest interior species were able to find suitable habitat elsewhere. Likewise, in a literature review on terrestrial wildlife responses to riparian buffers in the eastern United States, Larsen-Gray and Loehle (2022) suggest it may not be practical to manage riparian buffers to benefit forest interior species and that a landscape with varying riparian buffer widths (including no buffers) may provide for the greatest diversity of wildlife species. This is further supported by Kardynal et al (2009) who recommend cutting closer to water bodies instead of uniform width buffer strips on all water bodies to create post-disturbance shrubby habitat preferred by some species such as the common yellowthroat and Lincoln's sparrow.

Although direction in Section 4.1 enables some harvesting in shoreline areas, operational reluctance to clearcut to the edge of standing waters, due to direction

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complexity, potential environmental consequences if improperly carried out, as well as societal resistance, has constrained its application to sustain riparian ecosystems. However, operational comfort with harvesting in shoreline areas is gradually increasing with knowledge gained through experience and practice and is becoming more common. It will be important to continue monitoring and evaluating wildlife community responses to specific forestry practices and natural disturbances in riparian zones to allow for potential refinement of the current direction. Thus, this hypothesis should remain a high priority for consideration within the Ministry's effectiveness monitoring program.

H₀4: The fine filter direction for moose in Section 3.3.4 will create habitat that sustains a higher density of moose (or a higher harvest of moose) than that produced by the general coarse filter direction in the Landscape and Stand and Site Guide.

Revised guide status and rationale:

Current Q5 reworded as a testable hypothesis.

To partially address this EM hypothesis, as part of the Moose Guidelines Effectiveness Monitoring Project, the Ministry's CNFER has analyzed moose aerial inventory data to evaluate the composition targets for the fine filter direction (i.e., moose emphasis areas (MEAs)). The new models (Rempel et al. in preparation) provide improved predictions of moose habitat requirements for each the boreal and GLSL forest regions.

The Ministry's CNFER has also analyzed data collected as part of the project that has provided further insight into the thermal cover requirements of moose in the boreal forest region of Ontario (Street et al 2015). Additionally, studies completed by the Ministry's Wildlife Research and Monitoring Section have provided valuable information on moose habitat selection in the GLSL forest region (Hussey 2010, Lowe et al 2010).

The Stand and Site Guide introduced MEAs as a new approach to managing habitat for moose. Because MEAs are large landscape patches, they are planned for during the strategic phase of FMP development. Given the current FMP renewal schedule across the province, a majority of new 10-year plans have only recently been developed, approved, and implemented. Thus, since guide release, MEAs have been incorporated into FMPs in a significant way only in the last three to four years. The success of MEAs is largely dependent on operational implementation and effectiveness can only be fully evaluated by comparing moose response (controlling for hunter harvest) inside and outside areas identified for application of this fine filter direction. Thus, at this time, it may be premature to fully assess the effectiveness of MEAs in creating habitat and land use planning that could potentially sustain a higher density of moose. As operational implementation of MEAs becomes more widespread, including provisions for habitat development and road use considerations, a more comprehensive assessment of moose population dynamics (i.e., focused short and long term scientific research and use of moose aerial inventory information) should remain as a high priority within the Ministry's effectiveness monitoring program.

H₀5: Within the context provided by direction in the Landscape Guide, if the coarse filter direction in Section 3.2.2 and fine filter direction in Section 4 retain residual forest that is spatially arranged in catchments similar to that observed in naturally disturbed catchments, then hydrological effects resulting from forest management operations will not exceed observed and acceptable levels for specific parameters (e.g., methylmercury).

Revised guide status and rationale:

Current Q2 reworded as a testable hypothesis and focus has been revised from quantifying the amount of residual forest to retain in catchments to determining the spatial arrangement of residual forest to better emulate catchment natural disturbance patterns and mitigate potential hydrological impacts.

The literature continues to suggest that forest harvesting intensity within catchments may lead to numerous transitory impacts associated with increased water yield such as increased stream discharge and increased exports of nutrients, and other elements and compounds (Wei et al 2022, Shah et al 2022). The magnitude of these effects is often (but not always) proportional to the percentage of catchment disturbed (e.g., Abdelnour et al 2011, Zhang and Wei 2012, Bathurst and Iroume 2014). Results from the Forest Watershed and Riparian Disturbance Project (FORWARD) project (McEachern 2016) reported that watershed harvest intensity below 50% resulted in no detectable changes in runoff with wetlands, contributing more to mitigating hydrologic and water quality impacts than riparian buffers. Additionally, increased runoff in harvested watersheds initially responded similarly to burned watersheds, but recovered more quickly (within five years) to pre-disturbance values. Erdozain et al (2021) found that stream abiotic indicator responses (e.g., sediment deposition, dissolved organic carbon (DOC) concentration, water temperature) to forest harvesting that are typically reported as positively related to total proportion of catchment disturbance for small streams, were also observed at downstream sites.

The catchment level forest harvest effect on mercury in fish continues to vary substantially (increases of 0-80%) and remains uncertain, due in part to the variation associated with mercury (Hg) transformation downstream, in-lake water chemistry, food-web structure, individual fish biology, and catchment properties (Eklöf et al 2016, Thomas et al 2020, Bishop et al 2020). Bishop et al (2009) estimated that 9-23% of mercury in fish in lakes surrounded by forested catchments in Sweden resulted from exports associated with forest operations. However, Eklöf et al. (2016) suggest this estimate may be too narrow and high given that some more recent studies have reported a lower degree of influence post-harvest. Wu et al (2018) reported the largest mercury increases in fish occurred in lake catchments with the highest proportion (36 – 40%) of catchment harvested in Sweden. Conversely, in an effectiveness monitoring study by the Comparative Aquatic Effects Program (CAEP) at the Ministry's Centre for Northern Forest Ecosystem Research (CNFER), Danco (2013) found no relationship between the proportion of the surrounding catchment disturbed by forest harvesting (or

wildfire) and the concentration of mercury in fish in 243 lakes sampled in northern Ontario. Similarly, Lucotte et al (2016) suggested a weak positive relationship between the concentration of mercury in fish in 90 lakes sampled in northern Quebec and the percentage of catchment disturbed by forest harvesting.

A comparative study between natural disturbance and forest harvesting effects on catchment spatial residual pattern has been conducted by the Ministry's CAEP. Hayes (2016) found the frequency and spatial extent of disturbance by harvesting and fire was not similar when compared at the catchment scale (30 km² catchments studied). Fires frequently disturbed >50% of catchments and occurred in less catchments, while harvesting rarely disturbed more than 20% and occurred in more catchments. Thus, if forest operations are to better emulate the pattern created by natural disturbance (and thus presumably the hydrological response), they should occur in fewer catchments but disturb a greater proportion of each catchment. However, a more spatially dispersed disturbance pattern created by harvesting (i.e., amount of edge for optimal interspersion of food and cover) may benefit some species like moose. Moreover, it may be undesirable to harvest a greater proportion of catchments to better emulate natural disturbance spatial extent due to the evidence suggesting short-term increases in Hg in fish (see above) associated with larger proportions of catchments harvested (e.g., >36% reported by Wu et al 2018).

Newaz et al (2020) quantified post-fire residual vegetation patterns in 123 Ontario lakesheds varying in size between 0.2 - 105 km². They found that the proportion of lakeshed area burned ranged from 1.5 - 100% (M=59%, SD=35%). Their results indicate that in order to emulate natural watershed disturbance patterns, maintaining a range of harvest levels (and hence residual cover) within watersheds across the landscape should be considered instead of establishing a single disturbance threshold.

Addressing the spatial heterogeneity of hydrological conditions and biogeochemical processes associated with site-scale topography will help to create a more natural pattern of residual forest, both within riparian and upland areas. Because wet, organic soils in riparian forests are the most connected to adjacent surface waters, are more sensitive to potential site disturbance caused by heavy machinery traffic, and are presumably less likely to burn, retention of residual forest associated with these areas of hydrological connectivity (*sensu* Kuglerová et al 2014) may help create a more natural forest pattern while addressing groundwater discharge and methylation hotspots (Kuglerová et al 2017). Erdozain et al (2020) found hydrological connections to be more sensitive to forest management activities (e.g., roads) than non-connected riparian areas along streams in Acadian forests in New Brunswick. Thus, a shift from systematic, fixed-width buffers to site-specific, variable-width buffers would likely better protect wet areas and groundwater discharge hotspots in the riparian forest. Permitting harvest in other riparian areas with lower ecological, biogeochemical, and hydrological significance could offset the potential economic and wood supply losses associated with hydrologically adapted residual retention (Kuglerová et al 2017, Tiwari et al 2016).

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Thus, the recent science supports revising the focus of this hypothesis from quantifying the amount of residual forest to retain in catchments to determining the spatial arrangement of residual forest that better emulates catchment natural disturbance patterns and mitigates potential hydrological regime impacts from forestry operations.

H₀6: Direction in Sections 4.1, 4.1.1, and 4.1.2 will mitigate undesirable effects (e.g., harmful alteration, disruption, or destruction of fish habitat) of forest management activities permitted within shoreline AOCs on water quality and aquatic biota.

Revised guide status and rationale:

Current Q6 reworded as a testable hypothesis and remains a high priority for EM.

Reviews by Buttle et al (2009), Buttle (2011), Kreutzweiser et al (2013), Richardson and Beraud (2014), Webster et al (2015), Cristan et al (2016), and Kuglerová et al (2017) provide a contemporary summary of the effects of forest management operations on hydrological, biological, and chemical processes in lakes, streams, and wetlands.

Furthermore, based on the extensive number of published research projects across Ontario, our knowledge of the effects of forestry operations in shoreline AOCs on aquatic systems has expanded over the last 15 years (e.g., Sibley et al. 2012, Naylor et al. 2012, Moore and Richardson 2012). The findings and recommendations from these projects to date and our progress towards incorporating emulation of natural disturbance patterns in riparian forest management are reflected in the draft revised direction for shoreline harvesting and residual retention.

Overall findings from the Canadian Forest Service's White River Riparian Harvesting Impacts Project (Kreutzweiser 2012) indicate partial harvesting (up to 50% uniform removal of merchantable basal area) in riparian areas had minimal short-term impact on aquatic invertebrate populations, stream sedimentation, and stream temperature when carried out during winter months. Also, as part of this project, Holmes et al (2017) found that the effects of the partial harvesting treatment in the riparian buffers on breeding bird communities were relatively minor compared to non-riparian clearcut harvesting. Thus, they believed this practice appeared to be a reasonable approach to balancing the need for protecting riparian areas and promoting ecosystem disturbance at a level that approaches that of natural disturbances.

As part of the federal (Canadian Forest Service) Turkey Lakes Watershed Study (Webster et al 2021), recent publications related to hydrological response to differing forest harvesting and silviculture treatments within shoreline AOCs and catchments include Buttle et al (2018a), Buttle et al (2018b), Caputo et al (2016), and Mengistu et al (2014). Research conducted at this long-term study site (established in 1979) has and continues to contribute to our understanding of the effects of forestry operations on various aspects of water quality and aquatic biota in lakes and streams in the Great Lakes–St. Lawrence Forest.

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The empirical and anecdotal evidence (from within and outside Ontario) suggest our growing understanding of the effects of forest management operations on aquatic systems have helped to address many of the uncertainties associated with direction in the guide. However, given the continued public perception and interest about harvesting to adjacent aquatic systems, this uncertainty should continue to be a high priority and the Ministry should continue to review and evaluate new relevant scientific literature, and apply any new knowledge acquired will be used to revise direction as appropriate.

H₀7: Direction in Sections 4.1, 5.1, and 5.2 will mitigate undesirable effects of forest management operations on hydrological linkages between upland forest and aquatic habitats.

Revised guide status and rationale:

Current Q7 reworded as a testable hypothesis and remains a high priority for EM.

Recent literature continues to suggest that areas of groundwater discharge may be 'hotspots' for the accumulation and methylation of Hg (Mitchell et al 2008, Vidon et al 2010, Kulgerova et al 2014) and that these areas of hydrological connection between terrestrial and aquatic ecosystems are more sensitive to forest management operations (e.g., roads) than non-connected areas (Kuglerová et al 2017, Erdozain et al 2020). The extent to which forest management operations (e.g., off-road heavy machinery traffic) may alter groundwater flow paths and potentially impact downstream water quality through sediment transport, methylmercury production, export and bioaccumulation, and nutrient leakage depends on the extent of hydrological connectivity between disturbed location and adjacent streams (Laudon et al 2016). The strong influence of local topography on hydrological flowpaths and soil biogeochemical properties allows for the use of high-resolution LiDAR capable of providing digital elevation models, which when coupled with hydrological modelling algorithms, can accurately predict the location of these hydrological flowpaths for appropriate protection measures during forestry operations (Kuglerová et al 2014, Ågren et al 2015, Laudon et al 2016, Leach et al 2016).

Using flow accumulation and digital elevation models (DEM), the Ministry's CNFER has mapped flow paths for Ontario's managed forest. Forest managers will be provided a spatial product identifying the potential locations of hydrological connections (flowpaths) based on this modelling that can be applied in residual retention planning in riparian zones as well as in the layout of in-block roads, landings, and extraction trails. The information value and accuracy of this product will continue to be improved with the acquisition and application of airborne light detection and ranging (LiDAR) derived DEM as part of the province's enhanced forest resource inventory.

The recent science also suggests that mitigation measures, such as reducing soil compaction and disturbance and disruption of hydrologic connections and wetlands (e.g., fens, alder swamps) may be more effective at mitigating potential mercury impacts than arbitrary catchment harvest thresholds (Eklöf et al (in prep)). Eklöf et al (2016) and

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Bishop et al (2009) have recommended operational guidelines that aim to minimize the mobilization and export of MeHg to aquatic systems which have been incorporated in the revised direction as best management practices in Section 4.1.4. Additionally, a group of academic, government (including the Ministry's CNFER) and industry partners have commenced a long-term research project near Dryden, Ontario to study how and where mercury may be mobilized by forest management actions and evaluate the effectiveness of forest management practices to mitigate these risks. One of the objectives of the project is to recommend operational best management practices to mitigate mercury contamination in managed forests. Results from this study likely won't be available for this revision of the guide. However, they may help with development of 'interpretive notes' (e.g., appropriate structures for crossing potential mercury methylation sites) to support implementation of the revised guide.

Furthermore, as part of the Ministry's effectiveness monitoring program to address this uncertainty, the CNFER is continuing with ongoing research examining how forestry operations potentially impact watershed and site scale post-disturbance export of mercury to aquatic systems and how mercury moves through forest streams and fish.

Despite the aforementioned completed and ongoing research, this uncertainty should continue to be a high priority within the Ministry's effectiveness monitoring program.

H08: Restrictions on rutting and skid trail coverage in Section 5.2.1 will result in acceptable growth of residual trees (partial harvests) and regeneration success (all harvests).

Revised guide status and rationale:

Current Q10 reworded as a testable hypothesis and focus has been revised to primarily concentrate on block-level (i.e., 20 ha) site disturbance measure.

Recent research by the Ministry's CNFER partly supports this hypothesis. Kwiaton and Morris (in prep) re-measured tree growth in 23-year old rutting plots in the boreal forest. Results indicated that moderate coverage of rutting (~26%) resulted in significant positive effects on seedling growth, survival, and recruitment and that severe rutting (~42% coverage) resulted in reduced seedling survival and number of plantable microsites which were attributed to altered hydrologic function. Based on 11 (Morris et al 2009) and 23-year old results from CNFER rutting study, the area of localized, concentrated rutting (0.1 ha) threshold has been reduced from 50 to 40% in the revised direction. This research focused specifically on the potential impacts of rutting on site productivity (e.g., tree growth, survival, and recruitment). The objective of future effectiveness monitoring should potentially shift to investigating the impacts of rutting and site damage specifically on site hydrology as addressed under ongoing studies associated with Q2 and Q7.

The Ministry (Smith et al 2010) studied extraction trail impacts on sugar maple growth in the Great Lakes – St. Lawrence forest. Based on the findings of this study, and

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subsequent residual stem map modelling by S. McPherson (unpublished), 20% coverage in extraction trails (threshold limit for selection harvesting specified in direction) has an estimated productivity impact of ~2-4% which is consistent with typical assumptions used in development of the management direction in FMPs.

In addition to the direction in this guide for protection of residual trees in partial harvest systems, the revised Silviculture Guide (released in 2015) requires that 90% of residual acceptable growing stock (AGS) basal area and 85% of the total residual basal area will be free of major damage (e.g., >25% of the root area exposed or severed). In addition to interacting with this standard in the Silviculture Guide, the direction in Section 5.2.1 will also interact with the requirement to meet the regeneration standards as identified in the approved FMP.

However, one of the individual measures included in Section 5.2.1, the block level (i.e., 20 ha) rutting coverage threshold, remains largely based on expert opinion. Thus, this specific measure should remain a high priority for consideration within the Ministry's effectiveness monitoring program.

Key uncertainties: Removed

Q3. Will the direction in Section 3.2.3 retain a sufficient number and variety of wildlife trees in harvested areas to support cavity-using wildlife communities similar to those found in habitats arising from natural events?

Revised guide status and rationale:

Question removed from priority list.

Since the release of this guide, research has been undertaken in Ontario (e.g., Tozer et al 2010, Straus et al 2011, Mancuso et al 2014, Geleynse et al 2014, Thompson et al 2016, Zimmerling et al 2017, Kirk et al 2020) and elsewhere (e.g., Cooke and Hannon 2012, D'Astous and Villard 2012, Roth et al 2014, Tremblay et al 2015, Craig et al 2019) that has provided new data and interpretation which informs the revised direction in Section 3.2.3. For example, based on predictive modelling (Kirk et al 2020), the revised direction requires retaining an increased density of supercanopy trees (when available). Additionally, based on recent empirical evidence, the revised direction prescribes the retention of a mix of living, dying, and dead trees (as opposed to retaining trees for their habitat features) to ensure a long-term, continuous supply of standing dead and downed wood for wildlife.

Although the quantity of post-disturbance standing dead trees in managed forests may be less than in natural forests (particularly in the clearcut silviculture system), it appears the dissimilarity tends to diminish after about 30 years (Hobson and Schieck 1999, Imbeau et al. 1999). However, across many ecoregions, distinct differences remain with respect to bird communities associated with post-harvest and post-fire standing deadwood (Zimmerling et al 2017).

Fully addressing this uncertainty will benefit from continued monitoring that assesses long-term responses (e.g., mid to late stages of stand development) of cavity-users to determine whether the current direction in the guide ensures adequate quantity and quality of wildlife trees. However, recent empirical evidence, for at least the early stages of stand development, suggests our growing understanding of the effects of harvesting on the amount and distribution of residual trees has helped to address many of the uncertainties associated with direction in Section 3.2.3 of the guide. Therefore, this effectiveness monitoring question is no longer considered to be in the top 10. However, the Ministry will continue to review and evaluate new relevant scientific research and apply any new knowledge acquired to revise direction as appropriate.

Q9. Will seasonal restrictions on forest management operations around occupied bird nests (Section 4.2.2) result in reproductive output comparable to nests in undisturbed situations?

Revised guide status and rationale:

Question removed from priority list.

As part of the revision of this guide, a literature review and additional modelling conducted by B. Naylor support addressing this uncertainty, however no empirical studies have been conducted in Ontario. Thus, the proposed changes to direction in Section 4.2.2 are still largely based on a theoretical model (slightly different from the one used in the original guide) for most species. However, the new model used to predict set-back distances from flushing distances was created by the United States Fish and Wildlife Service (Livezey et al 2016) and is based on a very thorough literature review for a wide range of bird species. Therefore, although this effectiveness monitoring question remains relevant, it is no longer considered a top priority.

(C&R) 7.3 Delivering effectiveness monitoring: Acquiring new knowledge

Preamble (content)

Revised guide status and rationale:

Revised content.

Identify and discuss the Ministry's two strategic science initiatives, the Integrated Science Action Plan and the Integrated Monitoring Framework, which direct the strategic planning and prioritizing of the science and monitoring agendas to ensure delivery meets the needs of policy development and resource management implementation.

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(C&R) APPENDICES

(C&R) Appendix 1 - Defining setback distances for bird nests

Human activities conducted in the vicinity of occupied nests can disturb nesting birds, and, in some cases, result in nest desertion, and/or increased egg, nestling, or adult mortality (Knight and Skagen 1988, Hockin et al 1992, Hill et al 1997). Buffers (subsequently referred to as set-back distances or SBDs) that restrict activities within a specified distance of occupied nests are frequently prescribed to minimize disturbance of nesting birds (e.g., Rodgers and Smith 1995, Richardson and Miller 1997, Livezey et al 2016).

Numerous approaches have been proposed to define SBDs. Most are based on either the distance at which birds initially respond to an approaching potential human threat (e.g., pedestrians, vehicles, watercraft, aircraft) by becoming alert (Alert Distance (AD)) (e.g., Vos et al 1985, Rodgers and Smith 1995, Fernandez-Juricic et al 2001) or the distance at which birds actually fly away from a threat (e.g., referred to as Flight Initiation Distance, Escape Flight Distance, or Flushing Distance (FD)) (e.g., Burger and Gochfeld 2007, Fox and Madsen 1997, Delaney et al 1999).

Current direction is based on the approach in Rodgers and Smith (1995) which uses AD (predicted from FD) to define SBDs. However, birds generally become alert well before they fly away from a threat; FD is generally about half AD (e.g., Cardenas et al 2005, Gulbransen et al 2006, Whitefield et al 2008). Thus, using AD results in larger SBDs, compared to using FD. However, AD-based SBDs are likely very conservative; activities that simply cause nesting birds to become alert are unlikely to have significant adverse effects on reproductive success. In contrast, flushing of nesting birds is considered potentially detrimental to reproductive success because flushing birds may attract nest predators or absence of parent birds may render eggs or young more vulnerable to predators or environmental stress. However, even use of FD to define SBDs may be a conservative approach because birds may leave nests for a variety of reasons and flushing by itself does not necessarily result in a measurable impact on productivity (e.g., Marks 1986, Hannon et al 1993, Verboven et al 2001). Thus, current direction is likely conservative.

Defining SDBs based on AD or FD has been criticized since studies documenting AD or FD rarely account for all factors that may affect these variables including habituation (see references in Whitfield et al 2008). Ideally, SDBs should be based on empirical evidence documenting distances at which forest management operations are shown to affect breeding success. However, this type of information does not exist. The US Fish & Wildlife Service recently developed SBDs (referred to as Minimum Approach Distance or MAD) for threatened and endangered bird species (Livezey et al 2016). After considering the numerous approaches presented in the literature they based MAD on Flight Initiation Distance (analogous to FD). The revised guide follows Livezey et al (2016) and bases proposed SBDs on FD.

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SDBs have been defined based on mean FD (Burger and Gochfeld 2007), 1.5 times mean FD (Livezey et al 2016), the 90th (Holmes et al. 1993), 95th (Anthony et al 1995), or 99th (Stalmaster and Newman 1978) percentile of FD or maximum FD (Delaney et al. 1999). Defining SDBs based on mean FD equates to a 50% chance that activities may flush nesting birds. Basing SDBs on the 95th percentile of FD equates to a 5% chance that activities may flush nesting birds. The latter approach seems more prudent considering the objective of direction is too minimize the risk of disturbing nesting birds. Unfortunately, most studies do not report percentiles of FD. However, 13 studies reviewed (Fraser et al 1985, Erwin 1989, Forbes et al 1994, Rodgers and Smith 1995, Osiejuk and Kuczynski 2007, Madsen et al 2009, Burger et al 2010, Lohnes 2010, Keeley and Bechard 2011, Miller et al 2013, Moller 2014, Meillere et al 2015, Wilson-Aggarval et al 2016) did document standard deviation (SD) (or standard error) for various species of nesting birds. On average, SD in these studies was about 60% of mean FD. Thus, assuming that FD is approximately normal, a SBD of about 2 times mean FD potentially avoids flushing nesting birds 95% of the time⁴.

Species	Mean FD	SD FD	CV%	N	Source
Bald eagle	476.0	239.0	50.2	34	Fraser et al 1985: 587
Feruginous hawk	393.8	149.4	37.9	19	Keeley and Bechard 2011: 1037
Black skimmer	67.5	18.3	27.1	145	Burger et al 2010: Table 3
Waterbirds	60.0	21.4	35.7	64	Erwin 1989: Table 1
Geese (3 species)	27.0	35.1	130.1	110	Madsen et al 2009: Table 1
Waterbirds	25.1	8.9	35.4	183	Rodgers and Smith 1995: 93-94
Plovers, coursers, & nightjars	21.8	12.3	56.5	171	Wilson-Aggarval et al 2016: Table 1
Canada geese	21.0	9.2	43.9	105	Miller et al 2013: 175
Greylag geese	16.5	15.7	95.0	96	Osiejuk and Kuczynski 2007: 14
Barn swallow	12.3	7.0	57.1	2196	Moller 2014: 1108
Common nighthawk	6.4	4.8	75.0	16	Lohnes 2010: 6
House sparrow	5.0	3.8	75.2	21	Meillere et al 2015: 4
Dabbling ducks	2.9	2.4	83.3	359	Forbes et al 1994: Table 4

Unweighted mean CV = 61.7%

Weighted mean CV = 60.0%

⁴ Based on assumption that mean FD + 1.645 SDs accounts for about 95% of the area under a normal curve and 1 SD = 0.6 x mean FD.

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Mean FD was based on values reported in the literature whenever possible. FDs reported in the literature reflect responses to various human activities, no studies looked specifically at forestry-related activities, and most studies report FD in response to the direct approach of a walking human 'intruder'. Studies documenting response of nesting birds to pedestrians may intuitively seem likely to underestimate SBDs necessary for forest management operations that involve large, noisy heavy equipment. However, numerous studies suggest that nesting birds react more strongly to humans directly approaching a nest than they do to aquatic or terrestrial vehicular traffic (e.g., Grubb and King 1991, Rodgers and Smith 1995, Nordell et al 2017). Birds may be more likely to associate people as potential threats than they do vehicles based on past lethal and non-lethal persecution (see discussion in Spaul and Heath 2017). Moreover, the range of sounds detected by birds and people differs; what is disturbing to humans is not necessarily disturbing to birds. For example, humans are sensitive to the low frequency sounds (typically < 100 Hz) generated by the engine and exhaust of heavy equipment such as logging trucks. In contrast, diurnal raptors are generally most sensitive to sounds above about 1000 Hz (see discussion in Grubb et al 2013).

Thus, SBDs calculated from mean FDs are used to define the distance required to minimize effects of High Potential Impact Operations. As per the current direction, buffers for Moderate and Low Potential Impact Operations are defined as 50% and 25% of the those prescribed for High Potential Impact Operations.

When empirical information was not available, mean FD was estimated based on body mass following the equation in Naylor (1999).

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