

Appendix 1: Invasive Species Lists and Fact Sheets

Found in this Appendix:

- Top 10 invasive plants in the Credit River watershed (Flyer)
- CVC list of invasive plant species (directly below). This list rates the species in 5 categories from the most invasive (Category 1) to potentially invasive plants (Category 5) and a watch list of species. You will also find a column in this list that gives a Plant Aggressiveness (PA) score which reflects how difficult the plant is to control (the lower the number, the more aggressive the plant). You will need this number in section 4.2 of the manual when developing your priorities for implementing control of these species on your property.
- Other resources inserted into this Appendix:
 - o Invasive plant ID book
 - o Gardening Wisely brochure
 - o Native woodland plant ID book

CVC Priority Invasive Plants

Legend

Utilized Habitats

UF - Upland forest, tableland forest types with mostly dry to fresh soils

FF - Floodplain forest, generally lowland forest types with fresh to moist soils

W - Wetland, includes swamp, marsh, and aquatic communities

MS - Meadow and Successional, includes meadow, woodland, savannah and prairie

* Plant Aggressiveness (PA) score rates the aggressiveness of the species in terms of controlling its spread. This may differ in some cases with its category rating which encompasses a number of evaluation criteria.

* Note that scientific nomenclature and common names may vary across literature. To compound this situation many species listed below have horticultural variants which cause further confusion for readers of this list. For this reason readers should be aware of these cautions and speak to a knowledgeable professional or CVC staff when dealing with any species that shares either the same genera as a species listed here or a similar common name.

List based on the original SER Ontario Invasive species list. Invasive Exotic Species Ranking for Southern Ontario

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SCIENTIFIC NAME	COMMON NAME	Utilized Habitats			PA score
		PRIMARY	SECONDARY	TERTIALY	
Category 1-Transformers - Species that exclude all other species and dominate sites indefinitely. Plants in this category are a threat to natural areas wherever they occur because they tend to disperse widely (for example, through transport by birds or water). They are the top priority for control but control may be difficult. Upon detection immediate removal is recommended and control of spread into other areas.					
<i>Acer negundo</i>	Manitoba maple	FF	UF	MS	2
<i>Aegopodium podagraria</i>	Goutweed	FF	UF	MS	1
<i>Alliaria petiolata</i>	Garlic mustard	UF	FF	MS	1
<i>Alnus glutinosa</i>	Black alder	W	FF		2
<i>Butomus umbellatus</i>	Flowering rush	W			2
<i>Celastrus orbiculatus</i>	Oriental bittersweet	MS	FF	UF	1
<i>Cynanchum nigrum</i>	Black swallow-wort	MS	UF	FF	1
<i>Cynanchum rossicum</i>	Pale swallow-wort	MS	UF	FF	1
<i>Glyceria maxima</i>	Rough manna grass	W	FF		2
<i>Heracleum mantegazzianum</i>	Giant hogweed	W	FF		1
<i>Hesperis matronalis</i>	Dames rocket	FF	MS		2
<i>Hydrocharis morsus-ranae</i>	European frog-bit	W			1
<i>Impatiens glandulifera</i>	Himalayan balsam	W	FF		2
<i>Lonicera japonica</i>	Japanese honeysuckle	UF	FF	MS	2
<i>Lonicera maackii</i>	Amur honeysuckle	UF	FF	MS	1
<i>Lonicera morrowi</i>	Morrow's honeysuckle	UF	FF	MS	1
<i>Lonicera tatarica</i>	Tartarian honeysuckle	UF	FF	MS	1
<i>Lonicera x bella</i>	Hybrid honeysuckle	UF	FF	MS	1
<i>Lonicera xylosteum</i>	European fly honeysuckle	UF	FF	MS	1
<i>Lythrum salicaria</i>	Purple loosestrife	W			1
<i>Morus alba</i>	White mulberry	UF	FF	MS	2
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	W			1
<i>Nymphoides peltata</i>	Floating heart	W			1
<i>Phragmites australis</i>	Common reed	W			1
<i>Polygonum cuspidatum</i>	Japanese knotweed	W	FF		1
<i>Potamogeton crispus</i>	Curly pondweed	W			1
<i>Rhamnus cathartica</i>	Common buckthorn	UF	FF	MS	1
<i>Vinca minor</i>	Periwinkle	UF	FF	MS	1
Category 2 - Highly invasive - Species that are highly invasive but tend to dominate only certain niches or do not spread rapidly from major concentrations. Many spread by vegetative means or seeds that drop close to the parent plant. Most persist in dense populations for long periods. Control where necessary and limit their spread into other areas.					
<i>Acer platanoides</i>	Norway maple	UF	FF	MS	2
<i>Acer pseudoplatanus</i>	Sycamore maple	UF	FF	MS	2

SCIENTIFIC NAME	COMMON NAME	Utilized Habitats			PA score
		PRIMARY	SECONDARY	TERTIALY	
<i>Ailanthus altissima</i>	Tree-of-heaven	UF	FF	MS	2
<i>Cirsium arvense</i>	Canada thistle	MS			2
<i>Convallaria majalis</i>	Lily-of-the-valley	UF	FF		2
<i>Coronilla varia</i>	Crown vetch	MS			2
<i>Elaeagnus umbellata</i>	Autumn olive	MS			2
<i>Hedera helix</i>	English ivy	UF	FF		2
<i>Lysimachia nummularia</i>	Moneywort	FF			2
<i>Miscanthus sacchariflorus</i>	Eulalia	W			2
<i>Miscanthus sinensis</i>	Eulalia	W			2
<i>Populus alba</i>	White poplar	MS	FF		3
<i>Rhamnus frangula</i>	Glossy buckthorn	W	FF	UF	1
<i>Robinia pseudo-acacia</i>	Black locust	MS	FF	UF	3
<i>Rosa multiflora</i>	Multiflora rose	MS	FF	UF	3
<i>Scilla siberica</i>	Scilla	FF	UF		3
<i>Typha angustifolia</i>	Narrow-leaved cattail	W			2
<i>Typha x glauca</i>	Hybrid cattail	W			2
<i>Ulmus pumila</i>	Siberian elm	UF	FF	MS	2
Category 3 - Moderately invasive- Species that are moderately invasive but can become locally dominant given certain conditions e.g. soils, recreational impacts or disturbances. Control where necessary and limit their spread into other areas.					
<i>Abutilon theophrasti</i>	Velvet-leaf	MS			3
<i>Acer ginnala</i>	Amur maple	MS	FF	UF	3
<i>Acinos arvensis</i>	Mother-of-thyme	MS			3
<i>Artemisia absinthium</i>	Absinth sage	MS			3
<i>Barbarea vulgaris</i>	Yellow rocket	MS			3
<i>Berberis thunbergii</i>	Japanese barberry	UF	FF		3
<i>Berberis vulgaris</i>	Common barberry	UF	FF		3
<i>Berteroia incana</i>	Hoary-alyssum	MS			3
<i>Betula pendula</i>	European birch	W	MS		3
<i>Bromus inermis</i>	Smooth brome	MS			3
<i>Carduus nutans</i>	Nodding thistle	MS			3
<i>Centaurea maculosa</i>	Spotted knapweed	MS			3
<i>Convolvulus arvensis</i>	Field bindweed	MS			3
<i>Crataegus monogyna</i>	Singleseed hawthorn	MS			3
<i>Dactylis glomerata</i>	Orchard grass	MS			3
<i>Dipsacus sylvestris</i>	Teasel	MS			3

SCIENTIFIC NAME	COMMON NAME	Utilized Habitats			PA score
		PRIMARY	SECONDARY	TERTIARY	
<i>Elaeagnus angustifolia</i>	Russian olive	MS			3
<i>Eleutherococcus sieboldianus</i>	Five-leaved aralia	UF	FF		3
<i>Elymus repens</i>	Quack grass	MS			3
<i>Euonymus alata</i>	Winged euonymus	UF	FF		2
<i>Euonymus europaeus</i>	Spindle-tree	UF	FF		3
<i>Euonymus fortunei</i>	Wintercreeper euonymus	UF	FF		3
<i>Euphorbia cyparissias</i>	Cypress spurge	MS			3
<i>Festuca arundinacea</i>	Tall fescue	MS			3
<i>Forsythia suspensa</i>	Weeping forsythia	UF	FF		3
<i>Forsythia viridissima</i>	Forsythia	UF	FF		3
<i>Galium mollugo</i>	White bedstraw	UF	FF	MS	3
<i>Galium verum</i>	Yellow bedstraw	MS			3
<i>Geranium robertianum</i>	Herb robert	UF	FF		3
<i>Glechoma hederacea</i>	Ground ivy	FF	MS		3
<i>Humulus japonicus</i>	Japanese hop	FF	MS	W	3
<i>Iris pseudoacorus</i>	Yellow flag	W			3
<i>Kochia scoparia</i>	Summer cypress	MS			3
<i>Ligustrum vulgare</i>	Privet	MS	UF	FF	3
<i>Lotus corniculatus</i>	Bird-foot trefoil	MS			3
<i>Lycopus europaeus</i>	Bugleweed	W			3
<i>Lysimachia nummularia</i>	Creeping Jennie	FF			3
<i>Melilotus alba</i>	White sweet clover	MS			3
<i>Melilotus officinalis</i>	Yellow sweet clover	MS			3
<i>Pastinaca sativa</i>	Wild parsnip	MS			3
<i>Pinus sylvestris</i>	Scots pine	MS			3
<i>Poa pratensis</i>	Kentucky bluegrass	MS			3
<i>Ranunculus repens</i>	Creeping buttercup	MS			3
<i>Rhodotypos scandens</i>	Jetbead	UF	FF	MS	3
<i>Rorippa amphibia</i>	Marsh cress	W			3
<i>Salix alba</i>	White willow	FF			3
<i>Salix fragilis</i>	Crack willow	FF			3
<i>Salix x rubens</i>	Hybrid willow	FF			3
<i>Saponaria officinalis</i>	Bouncing-bet	MS			3
<i>Solanum dulcamara</i>	Bittersweet nightshade	FF	W		3
<i>Sorbaria sorbifolia</i>	False spiraea	UF	FF	MS	3

SCIENTIFIC NAME	COMMON NAME	Utilized Habitats			PA score
		PRIMARY	SECONDARY	TERTIALY	
<i>Syringa vulgaris</i>	Lilac	MS			3
<i>Tanacetum vulgare</i>	Tansy	MS			3
<i>Thymus praecox</i>	Creeping thyme	MS			3
<i>Urtica dioica</i> ssp. <i>dioica</i>	European stinging-nettle	FF	UF	MS	3
<i>Vicia cracca</i>	Cow vetch	MS			3
<i>Vicia sativa</i> ssp. <i>nigra</i>	Common vetch	MS			3
<i>Vicia tetrasperma</i>	Slender vetch	MS			3
Category 4 - Minimally Invasive- Species that do not pose an immediate threat to natural areas but do compete with more desirable native species. Once established, many can reproduce aggressively and become difficult to eradicate. Some are similar to native species and are often substituted by nurseries. Control where necessary and limit their spread to other areas.					
<i>Aesculus hippocastanum</i>	Horse-chestnut	UF	FF		4
<i>Ajuga reptans</i>	Creeping bugleweed	FF	UF	MS	4
<i>Alnus incana</i> ssp. <i>incana</i>	European white alder	W	FF		4
<i>Campanula rapunculoides</i>	Creeping bellflower	FF	UF	MS	4
<i>Euphorbia esula</i>	Leafy spurge	MS			4
<i>Hemerocallis</i> ssp.	Day lily	MS			4
<i>Hieracium aurantiacum</i>	Orange hawkweed	MS			4
<i>Hieracium caespitosum</i>	Yellow hawkweed	MS			4
<i>Hieracium lachenalii</i>	Common hawkweed	MS			4
<i>Hieracium x floribundum</i>	Pale hawkweed	MS			4
<i>Hypericum perforatum</i>	St. John's-wort	MS			4
<i>Inula helenium</i>	Elecampane	MS			4
<i>Linaria vulgaris</i>	Butter-and-eggs	MS			4
<i>Lolium perenne</i>	Perennial rye grass	MS			4
<i>Malva moschata</i>	Musk mallow	MS			4
<i>Medicago lupulina</i>	Black medick	MS			4
<i>Medicago sativa</i>	Alfalfa	MS			4
<i>Mentha x piperita</i>	Peppermint	MS			4
<i>Myosotis scorpioides</i>	True forget-me-not	W			4
<i>Nepeta cataria</i>	Catnip	MS			4
<i>Origanum vulgare</i>	Wild marjoram	MS			4
<i>Pachysandra terminalis</i>	Japanese spurge	UF	FF	MS	4
<i>Phalaris arundinacea</i>	Reed canary grass	W			4
<i>Populus x canadensis</i>	Carolina poplar	UF	FF		4
<i>Rumex acetosella</i>	Sheep sorrel	MS			4

SCIENTIFIC NAME	COMMON NAME	Utilized Habitats			PA score
		PRIMARY	SECONDARY	TERTIALY	
<i>Salix caprea</i>	Goat willow	W	FF		4
<i>Salix purpurea</i>	Purple willow	W			4
<i>Senecio jacobaea</i>	Tansy	MS			4
<i>Setaria spp.</i>	Foxtail	MS			4
<i>Sorbus aucuparia</i>	European mountain ash	UF	FF		4
<i>Symphoricarpos albus</i> var. <i>laevigatus</i>	Western snowberry	UF	FF		4
<i>Trifolium arvense</i>	Rabbit-foot	MS			4
<i>Trifolium pratense</i>	Red clover	MS			4
<i>Trifolium repens</i>	White clover	MS			4
<i>Tussilago farfara</i>	Sweet coltsfoot	W	MS		4
<i>Viburnum opulus</i> sp. <i>opulus</i>	Guilder rose	FF	UF	W	4
Category 5 - Potentially Invasive - Species to Monitor- Some of these species have the potential to become invasive in Ontario. They can reproduce aggressively on occasion but have not yet been shown to be a serious threat to natural areas in Ontario. Some are very similar to indigenous species and may therefore be difficult to identify. Where the early stages of invasion are detected, removal is recommended. Monitoring of occurrences strongly suggested.					
<i>Anthiscus sylvestris</i>	Wild Chervil	MS	FF	W	4
<i>Artemisia vulgaris</i>	Common mugwort	MS			4
<i>Cornus alba</i>	Tatarian dogwood	W	FF		4
<i>Daphne mezereum</i>	Mezer's Daphne	FF			4
<i>Fraxinus excelsior</i>	European ash	FF	UF		4
<i>Humulus lupulus</i>	Common hop	MS			4
<i>Isatis tinctoria</i>	Dyer's woad	MS			4
<i>Lapsana communis</i>	Nipplewort	MS			4
<i>Najas minor</i>	Minor naiad	W			4
<i>Populus tremula</i>	European aspen	UF	FF	MS	4
<i>Prunus avium</i>	Bird cherry	MS	UF	FF	4
<i>Prunus mahaleb</i>	Perfumed cherry	MS	UF	FF	4
<i>Sambucus racemosa</i> sp. <i>racemosa</i>	European red elder	FF	UF	MS	4
<i>Tilia cordata</i>	European linden	UF	FF		4
<i>Torilis arvensis</i>	Hedge parsley	FF	MS	UF	4
<i>Ulmus glabra</i>	Scotch elm	UF	FF		4
<i>Viola odorata</i>	Sweet violet	UF	FF		4
Category 6 - Watch list- These are invasive species known to have significant economic, health or environmental impacts in adjacent jurisdictions and are not yet known to be present in the Credit River watershed, but are at risk of being introduced. Awareness and monitoring of these species and immediate removal upon detection is the recommended action.					
<i>Ampelopsis brevipedunculata</i>	Porcelainberry	UF	FF		1
<i>Cabomba caroliniana</i>	Fanwort	W			1

SCIENTIFIC NAME	COMMON NAME	Utilized Habitats			PA score
		PRIMARY	SECONDARY	TERTIALY	
<i>Egeria densa</i>	Waterweed	W			1
<i>Hydrilla verticillata</i>	Hydrilla	W			1
<i>Microstegium vimineum</i>	Japanese stilt grass	UF	FF		1
<i>Myriophyllum aquaticum</i>	Parrotfeather	W			1
<i>Persicaria perfoliata</i>	Mile-a-minute weed	MS	FF	W	1
<i>Phellodendron amurense</i>	Amur cork-tree	UF			1
<i>Pistia stratiotes</i>	Water Lettuce	W			1
<i>Pueraria lobata</i>	Kudzu	MS	FF	UF	1
<i>Stratiotes aloides</i>	Water soldier	W			1
<i>Trapa natans</i>	Water-chestnut	W			1
<i>Polygonum x bohemicum</i>	Bohemian Knotweed	W	FF		1
<i>Polygonum sachalinense</i>	Giant Knotweed	W	FF		1
<i>Polygonum polystachyum</i>	Himalayan Knotweed	W	FF		1

Appendix 2: Mapping and Data Forms

MAPPING DATA FORM - POLYGON SAMPLING METHOD

Determining Project Priority- Summary Method Approach Worksheet

Project Number	Removal method to be used	Cost of method	Time required	Biodiversity value (High) (Low)	Comments	Summary and assigned priority (1) High to (5) Low
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

Determining Project Priority- Scoring Method Approach Worksheet

1. How many invasive plants do I have? 1 point - Just a small amount but it's spreading 2 points - A fair amount and it's spreading 3 points - A lot! It's all over the area	2. Are there features within the area I want to protect? 1 point - There are many rare plants or community types in the area 2 points - There are a few rare plants or community types in the area 3 points - The invasion is happening near disturbed edges or areas I don't really care about
3. What impact is it having and how aggressive is the plant? Please see the Top Invasive Plant list to help you rank Plant Aggressiveness (PA) if you are unfamiliar with the plant. 1 point - It is so aggressive and it changes the area so much that few other species survive. PA=1 2 points - It invades undisturbed areas and outcompetes native species. PA=2 3 points - It doesn't out-compete native species but natives don't regenerate. PA=3 4 points - It only invades disturbed areas such as edges. PA= no rank assigned	4. How hard is it to control? 1 point - Fairly easy, one treatment and it's pretty much gone 2 points - Takes multiple treatments, but eventually it's gone and native species will replace it 3 points - Takes multiple treatments, but native plants won't regenerate, and will need replanting 4 points - No effective treatment has been found for this species.

* Total all scores. The lower the score, the higher the priority rating the project should receive.

Project #	1. How many plants?	2. Feature to protect?	3. How aggressive is the plant?	4. How hard is the plant to control?	Final score
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Appendix 3: Rare Vegetation Communities of Ontario

This appendix provides a look at some of the rare community types in Ontario broken down between southern Ontario (south of the Canadian Shield, page 14) and northern Ontario (Canadian Shield and north, page 24) and a description of each. A short list is provided at the end on pg. 29



In the description of some of the rare plant communities in this document you may see soil moisture regime is often included within the description as it can sometimes differentiate between a rare community type and a similar one that is more common. Soil moisture regime identifies the amount of moisture typically present within the soil. A soil's moisture regime is a product of the physical properties and arrangement of its soil particles, which in turn define the capacity of it to retain or drain water.

You will also see in this document "Provincial Ranks" associated with each rare plant community type. Below is a description of these ranks.

- S1 Critically Imperiled**—Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
- S2 Imperiled**—Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
- S3 Vulnerable**—Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
- S? Not Ranked Yet; or if following a ranking, Rank Uncertain (e.g. S3?)**.
- S#S# Range Rank** —A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

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Marshes (p. 15)



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Bogs (p. 17)



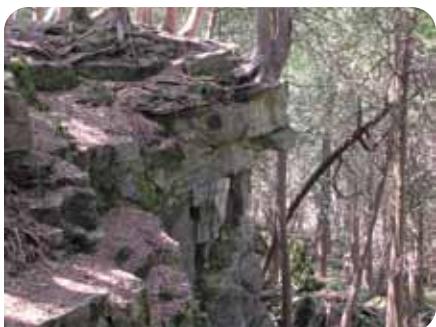
Shorelines/Beaches (p. 17)



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Crevices and Caves (p. 19)



Rock Barrens (p. 20)



Sand Barrens (p. 20)



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Tallgrass Prairies (p. 22)



Tallgrass Savannahs (p. 22)



Credit: Bill McIlveen

Credit: Bill McIlveen

Tallgrass Woodlands (p. 23)



Credit: Bill McIlveen

Forest (p. 23)



SOUTHERN ONTARIO

I) AQUATIC

Definition: Shallow to deep open water (>2 metres) without emergent vegetation dominance (standing water always present)

Rare Aquatic Community Types

Provincial Rank

A) Shallow Aquatic containing American Lotus

S1

II) WETLANDS

Definition: Communities that are seasonally or permanently flooded by shallow water, or the water table is close to the surface; The resulting wet soils favour the dominance of plants that grow wholly or partially in water (NHIC, 2009 http://nhic.mnr.gov.on.ca/MNR/nhic/communities/comm_list_wetland.cfm)

Wetlands are classified here into 4 different types: Marshes, Swamps, Fens and Bogs. These are further defined below, and are provided with a brief description of the rare types of each.

1) MARSHES

Definition: Frequently or continually flooded wetlands characterized by emergent herbaceous vegetation adapted to wet soil conditions and changing water flows. Tree and shrub cover less than or equal to 25%; dominated by emergent wetland plants; Water depth <2m. (2002 CyberNatural Software, <http://www.aquatic.uoguelph.ca/> and OMNR 1998 ELC Guide).

Rare Marshes

The only rare types of marshes identified in southern Ontario are classified as **Meadow Marshes**. These marshes are generally only flooded in the spring, but are moist to dry by summer. The vegetation that occurs within these marshes is less tolerant of prolonged flooding. Meadow Marshes are described as the area where aquatic and terrestrial ecosystems meet.

A) Great Lakes Coast Meadow Marsh:

Occurs in near-shore areas of the Great Lakes; contains sandy, gravelly or cobble surface materials

a) Dominated by grasses	S2
b) Dominated by Shrubby Cinquefoi	S1

B) Tallgrass Meadow Marsh:

A community type dominated by typical prairie grasses including Indian Grass, Little Bluestem, Big Bluestem etcetera.

a) Dominated by Bluejoint and Prairie Slough Grass	S3
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C) Mineral Meadow Marsh

Usually dominated by grasses or sedges; richer areas are dominated by colonial species; wave swept, ice scoured areas are sparsely vegetated, contain mineral surface materials of sand, gravel or cobble. These are often areas exposed by shoreline energies and disturbance, such as wind and wave action.

a) Dominated by Prairie Slough Grass	S3
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D) Organic Meadow Marsh

Areas dominated by grasses and sedges and other colonial species. Organic soils (> 40 cm depth of organic/peaty material) where shoreline energies and disturbance is low.

a) Dominated by Prairie Slough Grass	S3
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2) SWAMPS

Definition: Often confused with marshes but distinguished by >25% tree and shrub cover, most growing wholly or partly in water. Swamps occur on wet soils and are flooded for most, if not all the growing season; >2m standing water or vernal pooling comprising >20% of ground coverage. (2002 CyberNatural Software, <http://www.aquatic.uoguelph.ca/> and OMNR, 1998, ELC Guide).

Rare Types

Provincial Rank

A) Thicket Swamp

Tree cover less than or equal to 25% with greater than 25% shrubs growing wholly or partially in water

a) Mineral Thicket Swamp

Wet soils with < 40 cm of organic/peaty soil.

i) Dominated by Buttonbush	S3
ii) Dominated by Southern Arrow-wood	S3
iii) Dominated by Paw-paw	S3

b) Organic Thicket Swamp

Organic soil materials >40 cm

i) Dominated by Buttonbush	S3
ii) Dominated by Spicebush	S3
iii) Dominated by Poison Sumac	S3
iv) Dominated by Huckleberry	S1

B) Oak Deciduous Mineral Swamp

Tree or shrub cover >25% with trees that are > 5m in height. Deciduous tree species >75% of canopy cover; Typically fern and sedge rich; wet soils with <40 cm of organic/peaty soil.

a) Dominated by Swamp White Oak	S2S3
b) Dominated by Bur Oak	S3
c) Dominated by Pin Oak	S2S3

3) FENS

Definition: A type of peatland resembling a bog with saturated peat/organic soils >40cm, rarely flooded, dominated by sedges, grasses and low shrubs (<2m in height), contain less than or equal to 25% tree cover (>2m in height). (2002 CyberNatural Software, <http://www.aquatic.uoguelph.ca/> and OMNR, 1998, ELC Guide).

Rare Types

Provincial Rank

A) Open Fen

Tree cover less than or equal to 10% and shrub cover less than or equal to 20%.

a) Graminoid Fen Ecosite

i) Dominated by Twig-rush	S3?
ii) Perched Mineral Prairie Fen	S1

Dominated by fen and prairie grasses

b) Shrub Fen dominated by Highbush Blueberry-Leatherleaf

S2S3

B) Treed Fen

Tree cover between 10% and 25%

a) Dominated by Gray Birch	S2S3
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4) BOGS

Definition: Characterized by >40 cm organic peat accumulation, high water table (saturated soils) with acidic-loving vegetation, trees (>2m high) are less than or equal to 25% of cover; rarely flooded; stagnant, nutrient poor environments (2002 CyberNatural Software, <http://www.aquatic.uoguelph.ca/> and OMNR, 1998, ELC Guide).

Rare Types	Provincial Rank
A) Shrub Kettle Peatland Tree cover between 10% and 25% with continuous <i>Sphagnum</i> moss cover	
a) Dominated by Leatherleaf	S3
b) Dominated by Highbush Blueberry	S1S2B
B) Treed Kettle Peatland Tree cover between 10% and 25% with continuous <i>Sphagnum</i> moss cover	
a) Dominated by Tamarack and Leatherleaf	S3

III) TERRESTRIAL

1) SHORELINE

Rare Types	Provincial Rank
A) Beach / Bar Vegetation cover varies from patchy and barren to more closed and treed; tree cover less than or equal to 60%; subject to active shoreline processes: ice scour, wave energy, erosion and deposition; coarse parent surface material such as rock, sand or bedrock above the seasonal high-water mark; subject to extremes in moisture and temperature.	
a) Open Sand Beach / Bar Tree cover less than or equal to 25%; shrub cover less than or equal to 25%; openness maintained by active shoreline processes; cover varies from patchy and barren to continuous meadow; sandy surface material.	
i) Dominated by Sea Rocket	S2S3
b) Gravel / Shingle / Cobble Beach / Bar	
i) Gravel Beach dominated by Wormwood	S2S3
ii) Shingle Beach dominated by Red Cedar – Common Juniper	S1
c) Limestone Bedrock Beach / Bar Cover varies from patchy and barren to continuous meadow; carbonate bedrock; average soil depth <15cm; exposed bedrock surfaces cover >50% of area.	
i) Dominated by Shrubby Cinquefoil	S2
d) Sandstone Bedrock Beach / Bar Cover varies from patchy and barren to continuous meadow; carbonate bedrock; average soil depth <15cm, exposed sandstone surfaces cover >50% of area.	

B) Sand Dune

Vegetation cover varies from patchy and barren to more closed and treed; tree cover less than or equal to 50%; active rolling sand hills formed by wave and wind processes; restricted to the near-shore areas of the Great Lakes; stability of surface materials are variable with little to no accumulation of organic materials and low nutrient availability; subject to drought and temperature extremes.

a) Grassland Sand Dune

Cover varies from patchy and barren to continuous meadow; dominated by grasses; restricted to most active, least stable sand.

i) Dominated by Little Bluestem, Switchgrass	S2
ii) Dominated by Little Bluestem, Long-leaved Reed Grass, Great Lakes Wheat Grass	S2

b) Shrubland Sand Dune

Tree cover less than or equal to 25%; shrub cover less than or equal to 25%; cover varies from patchy and barren to continuous thicket. Usually dominated by grasses with scattered to dense shrub cover; more stable, less disturbed sand.

i) Dominated by Sand Cherry	S2
ii) Dominated by Juniper	S2
iii) Dominated by Hop-tree	S1

c) Savannah (Treed) Sand Dune

Tree cover > 25% but less than or equal to 60%; cover varies from savannah to woodland, usually variably treed with understory dominated by grasses; relatively stable sand.

i) Dominated by Cottonwood	S1
ii) Dominated by Red Cedar	S1
iii) Dominated by Balsam Poplar	S1

2) CLIFF

Vegetation cover varies from patchy and barren to more closed and treed; Tree cover less than or equal to 60%; vertical or near-vertical exposed bedrock >3m height; sharp to variably broken edges, faces and rims; average soil depth <15cm, highly exposed and subject to extremes in temperature and moisture.

Rare Types

Provincial Rank

A) Open Limestone / Dolostone Cliff

Tree cover less than or equal to 25%; shrub cover less than or equal to 25%; typically found on vertical or near-vertical bare bedrock faces; cover patchy and barren; carbonate rock.

a) Unshaded cliff face dominated by Cliffbrake, Lichen	S3
b) Shaded cliff face dominated by Bulblet Fern, Herb Robert	S3
c) Unshaded cliff face dominated by Canada Bluegrass	S3
d) Open Limestone/Dolostone Seepage Cliff	S3

Excess moisture due to water seepage

e) Open Limestone/Dolostone Cliff Rim	S2
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B) Shrubland Limestone / Dolostone Cliff

a) Cliff rim dominated by Common Juniper	S2S3
b) Cliff rim dominated by Round-leaved Dogwood	S3

C) Treed Limestone / Dolostone Cliff

Tree cover >25% but less than or equal to 60%; typically restricted to narrow cliff rim, dependent on how broken and fractured the cliff rim and face are; cover varies from patchy and barren to more closed in nature (i.e. savannah or woodland).

- a) Dominated by White Cedar S3
- b) Dominated by Sugar Maple, Ironwood, White Ash S3

3) TALUS

Vegetation cover varies from patchy and barren to more closed and treed; tree cover less than or equal to 60%. Slopes of rock rubble at the base of cliffs; coarse rocky debris >50% of ground surface; average soil depth <15 cm; bedrock type important.

Rare Types

Provincial Rank

A) Open Limestone / Dolostone Talus

Tree cover less than or equal to 25%; shrub cover less than or equal to 25%; bare rock surfaces predominate; soil availability limited; carbonate rock.

- a) Dry Herbaceous Limestone / Dolostone Talus S2
- Herb Robert, Poison Ivy, Canada Bluegrass and Maidenhair Spleenwort; dry to fresh soil moisture regimes
- b) Wet Herbaceous Limestone / Dolostone Talus S2
- Herb Robert, Spotted Touch-me-not and White Snakeroot, moist to fresh soil moisture regimes.

B) Shrubland Limestone / Dolostone Talus

Tree cover less than or equal to 25%; shrub cover >25%; boulders strewn with pockets of soil.

- a) Dominated by Round-leaved Dogwood S2S3
- b) Dominated by Mountain Maple S3

C) Treed Limestone / Dolostone Talus

Tree cover >25% but less than or equal to 60%; cover varies from patchy and barren to more closed in nature (i.e. savannah or woodland); greater availability of soil accumulated between rocks; carbonate rock.

- a) Dry Talus dominated by White Birch S3
- b) Dry Talus dominated by White Cedar S3
- c) Moist Talus dominated by Sugar Maples S3
- d) Basswood, White Ash, Butternut Moist Tree Limestone Talus S2
- e) Hemlock, Sugar Maple Moist Limestone Talus S2

D) Open Sandstone Talus

S1

E) Shrubland Sandstone Talus

S1

F) Treed Sandstone Talus

S1

4) CREVICE AND CAVE

Vegetation cover patchy and barren, influenced by extreme shading; trees and shrubs absent; sheltered, mostly enclosed cavities and crevices in bedrock; extreme shading and cool temperatures; rock type important.

Rare Types

Provincial Rank

A) Limestone / Dolostone Solution Cave

S1

Caves formed by a chemical process whereby the calcium carbonate in limestone or calcium magnesium carbonate in dolomite is dissolved by rainwater to form chambers and excavation passages; tube-like formation are formed by completely flooded conditions, and canyon-like formations are a result of an underground stream in an air-filled passage.

B) Limestone / Dolostone Crevice Cave

S1

Formed in areas where the bedrock has split and pulled away, such as on the edge of a cliff, creating a crack or crevice

5) ROCK BARREN

Vegetation cover varies from patchy and barren to more closed and treed; tree cover less than or equal to 60%; variable bedrock from undulating bare rock with mounds and pits, to broken rock with fissures; rock type important; patchy soil development; soil depth <15cm and variable; extremes in moisture and temperatures; possible understorey species include Harebell, Early Saxifrage, Bristle-leaved Sedge, Poverty Grass, and Ebony Spleenwort

Rare Types

Provincial Rank

A) Limestone / Dolostone Barren

a) Open Limestone / Dolostone Barren

Tree cover less than or equal to 25%; shrub cover less than or equal to 25%; found where conditions are most extreme; bare rock surfaces or small patches of very shallow soil.

i) Dry Limestone / Dolostone Barren

S2S3

Cover patchy and barren; carbonate rock.

b) Shrubland Limestone / Dolostone Barren

Tree cover less than or equal to 25%; shrub cover less than or Equal to 25%; found where conditions may be less extreme, where rock is broken and cracked or where limited soils have accumulated.

i) Dominated by Common Juniper

S3

ii) Dominated by Round-leaved Dogwood

S3

c) Treed Limestone / Dolostone Barren

Tree cover > 25% but less than or equal to 60%; found where bedrock is broken and cracked or where shallow soils have accumulated; carbonate Bedrock; cover varies from patchy and barren to more closed in nature (i.e. savannah or woodland).

i) Dominated by Red Cedar

S1

ii) Dominated by Hackberry

S1

iii) Dominated by Oak trees

S1

B) Sandstone Barren

a) Open Sandstone Barren

Tree cover less than or equal to 25%; shrub cover less than or equal to 25%; found where conditions are most extreme; Bare rock surfaces or small patches of very shallow soil.

i) Dry Sandstone Barren

S1

Cover patchy and barren; Sandstone rock.

b) Shrubland Sandstone Barren

S1

Tree cover less than or equal to 25%; shrub cover less than or Equal to 25%; found where conditions may be less extreme, where rock is broken and cracked or where limited soils have accumulated.

c) Treed Sandstone Barren

S1

Tree cover > 25% but less than or equal to 60%; found where bedrock is broken and cracked or where shallow soils have accumulated; sandstone bedrock; cover varies from patchy and barren to more closed in nature (i.e. savannah or woodland).

C) Granite Barren

a) Shrubland Granite Barren

Tree cover <25%, shrub cover <25% Found where conditions may be less extreme where rock is broken and cracked or where limited soils have accumulated; cover patchy and barren to continuous thicket.

i) Dominated by Chokeberry S2

b) Treed Granite Barren

Tree cover > 25% but less than or equal to 60%; found where bedrock is broken and cracked or where shallow soils have accumulated; cover varies from patchy and barren to more closed in nature (i.e. savannah or woodland).

i) Dominated by Red Cedar S1

ii) Dominated by Pitch Pine S1

6) ALVAR

Vegetation cover varies from patchy and barren to more closed and treed, tree cover greater than or equal to 60%. Level, unfractured limestone (carbonate) bedrock, patchy mosaic of bare rock pavement and shallow soils over bedrock, soil depth 15cm seasonal alternation between inundation and drought

Rare Types

Provincial Rank

A) Open Alvar

Tree cover less than or equal to 25%, shrub cover less than or equal to 25%, typically restricted to bare rock pavement and patchy shallow soils

a) Pavement Type

Vegetation patchy and barren; dry moisture regime.

i) Dominated by Shrubby Cinquefoil, Creeping Juniper, S2
Scirpus-like Sedge (*Carex scirpoidea*) S2
ii) Dominated by Philadelphia Panic Grass, False Pennyroyal S1

b) Grassland Type

Vegetation more continuous meadow; dry to fresh moisture regime.

i) Dominated by Northern Dropseed, Little Bluestem, Scirpus-like Sedge S2S3
ii) Dominated by Tufted Hairgrass, Canada Bluegrass, S2S3
Philadelphia Panic Grass S2S3
iii) Dominated by Canada Bluegrass, Nodding Onion S1

B) Shrub Alvar

Tree cover less than or equal to 25%; shrub cover > 25%; on very shallow soils or in rock fractures.

a) Dominated by Common Juniper, Creeping Juniper, Shrubby Cinquefoil S2
b) Dominated by Common Juniper, Fragrant Sumac, Hairy Beardtongue S2

C) Treed Alvar

Tree cover >25% but less than or equal to 60%; on very shallow soils or in rock fractures; cover varies from patchy and barren to more closed in nature (i.e. savannah or woodland); bedrock more fractured or greater soil accumulation.

a) Dominated by White Cedar, Jack Pine, Shrubby Cinquefoil S1
b) Dominated by Jack Pine, White Cedar, Low Calamint S1
c) Dominated by White Cedar, White Spruce, Philadelphia Panic Grass S3
d) Dominated by Red Cedar, Early Buttercup S2
e) Dominated by Chinquapin Oak, Nodding Onion S1
f) Dominated by Shagbark Hickory, Prickly Ash, Philadelphia Panic Grass S1
g) Dominated by Jack Pine, White Cedar, Common Juniper S2

7) SAND BARREN

Vegetation cover varies from patchy and barren to more closed and treed; tree cover less than or equal to 60%; bare sand surface materials not associated with distinct topographic features (i.e. sand dune); subject to periods of prolonged drought and disturbances (e.g. fire).

Rare Types

Provincial Rank

A) Open Sand Barren

Tree cover less than or equal to 25%, shrub cover less than or equal to 25%. Cover varies from patchy and barren to continuous meadow; extremely dry; disturbed sands.

a) Dominated by Bracken Fern	S2
b) Dominated by Sedge	S1
c) Dominated by Wheat-grass	S1

8) TALLGRASS PRAIRIE, SAVANNAH AND WOODLAND

Ground layer dominated by prairie grasses including Big Bluestem, Little Bluestem and Indian Grass; variable cover or open-grown trees; tree cover less than or equal to 60%; on unconsolidated mineral soil, soil depth >15cm, well-drained sands, loams and sometimes clay; subject to seasonal extremes in moisture conditions; spring flooding and summer drought; frequent disturbance by fire.

Rare Types

Provincial Rank

A) Open Tallgrass Prairie

Tree cover less than or equal to 25%, shrub cover less than or equal to 25%.

a) Dry Tallgrass Prairie	S1
Dominated by prairie grasses, prolonged periods of drought. Associate species include Cylindric Anemone, Rock Sandwort, Pinweed, Scribner's Panic Grass and Bluets.	

b) Moist-Fresh Tallgrass Prairie	S1
Dominated by prairie grasses and forbs (herbaceous flowering plants); seasonal flooding followed by summer drought; Associate species include Dense Blazing Star, Gray Coneflower, Ohio Spiderwort, Prairie Dock and Ironweed; fresh to moist soil moisture regimes.	

B) Tallgrass Savannah

Tree cover >25% but less than or equal to 25%; see Open Tallgrass Prairie vegetation types for characteristic vegetation.

a) Dry Tallgrass Savannah

Widely spaced, open-grown trees with an understory of prairie grasses and forbs; prolonged periods of drought.

i) Dominated by Black Oak	S1
ii) Dominated by Black Oak and Pine	S1

b) Moist Tallgrass Savannah

Widely spaced, open-grown trees with an understory of prairie grasses and forbs; seasonal flooding followed by summer drought.

i) Dominated by Pin Oak and Bur Oak	S1
ii) Dominated by Black Oak	S1

C) Tallgrass Woodland

Tree cover >35% but less than or equal to 60%; (see Open Tallgrass Prairie vegetation types for characteristic vegetation).

a) Dry Tallgrass Woodland

Open-grown trees with an understorey of prairie grasses and forbs; Pennsylvania Sedge common; dry to fresh moisture regimes; prolonged periods of drought.

i) Dominated by Black Oak, White Oak	S1
ii) Dominated by Bur Oak, Shagbark Hickory	S1

Shallow soils over carbonate bedrock.

b) Moist Tallgrass Woodland

Open-grown trees with an understorey of prairie grasses and forbs; seasonal flooding followed by summer drought.

i) Dominated by Black Oak, White Oak	S1
ii) Dominated by Pin Oak	S1

9) FOREST

Tree cover >60%, site conditions and soil types variable.

Rare Types

Provincial Rank

A) Deciduous Forest

Deciduous tree species >75% of canopy cover.

a) Dry Oak Deciduous Forest

Red Oak, White Oak and Black Oak separately dominant or in variable mixtures with Red Maple, White Pine and Black Cherry as common associates; canopy cover variable; often relatively open (60 to 80% canopy closure); subject to some extremes in conditions or disturbance (e.g. fire, historical land use).

i) Dominated by Black Oak	S3
Bracken Fern present.	

b) Dry-Fresh Deciduous Forest

Tree species associations that are either relatively uncommon or a result of disturbance or management; Sugar Maple is absent or comprises less than 10% of canopy cover; sands and loams; upper to middle slopes or tableland topographic positions.

i) Dominated by Hackberry	S2
Associated with Red Oak, Basswood, Chinquapin Oak, White Ash and Green Ash; long-styled Sweet-cicely, Herb Robert, Jumpseed; usually on carbonate sands or shallow soils over carbonate bedrock; only found in extreme southwestern Ontario.	

c) Moist-Fresh Sugar Maple Deciduous Forest

Sugar Maple with Green Ash, Black Ash, Red Maple, White Elm, Yellow Birch, Basswood and Beech associates; dominant species vary; occurs on middle to lower slopes with potentially poor drainage; mix of terrestrial and wetland species.

i) Dominated by Sugar Maple and Black Maple Mix	S3
Moist yet well drained sites, often along floodplains	

d) Moist-Fresh Lowland Deciduous Forest

White Elm, Willow, Black Walnut, Black Maple, Basswood, Green Ash and Black Ash dominate separately or in variable mixtures with other hardwood associates; typically more open canopies, may be <60% tree cover; some shrubs with greater presence of vines and a mix of herbaceous species common to wet sites.

i) Dominated by Black Walnut

S2S3

Typically associated with riparian zones and terraces; stream and river banks and floodplains.

e) Moist-Fresh Hackberry Deciduous Forest

S2

B) Mixed Forest

Conifer tree species >25% and deciduous tree species >25% of canopy cover.

a) Dry Oak-Pine Mixed Forest

Red Oak, White Oak, Chinquapin Oak, Pitch Pine, White Pine and Red Pine in variable mixtures; Canopy typically open in nature; Low Sweet Blueberry, Buffalo Berry and Common Juniper. Bracken Fern.

i) Dominated by Oak and Pitch Pine

S1

Pitch Pine, Red Oak and, to a lesser extent, White Oak in variable mixtures; Restricted to shallow soils and bare rock surfaces associated with rock outcrops (knobs and ridges) on the Canadian Shield (Frontenac County).

ii) Dominated by Chinquapin Oak and Pine

S2

Chinquapin Oak with Red Pine and White Pine; Associates of Prickly Ash and Fragrant Sumac; Bracken Fern; On droughty, well-drained sands and shallow soils over carbonate, basic or acidic bedrock.

NORTHERN ONTARIO

I) Wetlands

Definition: 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 either case the presence of abundant water has caused the formation of wet soils that favour the dominance of plants that grow wholly or partially in water (NHIC, 2009 http://nhic.mnr.gov.on.ca/MNR/nhic/communities/comm_list_wetland.cfm)

Wetlands are classified here into 4 different types: Marshes, Swamps, Fens and Bogs. These are further defined below, and are provided with a brief description of the rare types of each.

1) MARSHES

Definition: Frequently or continually flooded wetlands characterized by emergent herbaceous vegetation adapted to wet soil conditions, and changing water flows. Tree and shrub cover less than or equal to 25%, dominated by emergent wetland plants, water depth <2m. (2002 CyberNatural Software, <http://www.aquatic.uoguelph.ca/> and OMNR 1998 ELC Guide).

Rare Types

Provincial Rank

A) Atlantic Coastal Plain Shallow Marsh

S3

These communities occur inland but exemplify characteristics of communities found along the Atlantic coast. The types of species that comprise these coastal marshes include the following (please note that it may take an expert for accurate identification): Small-headed Beaked-rush (*Rhynchospora capitellata*), Common Meadow-beauty (*Rhexia virginica*), Longbeak Beaksedge (*Rhynchospora scirpoides*), Hall's bulrush (*Scirpus hallii*). Also contains other herbaceous vegetation.

B) Bulrush - Stiff Arrowhead - Pondweed Shallow Marsh

S4

Dominated by Hard-stemmed Bulrush (*Scirpus acutus*), River Bulrush (*Scirpus fluviatilis*), Stiff Arrowhead (*Sagittaria rigida*), and Pondweed (*Potamogeton* spp.).

2) SWAMPS

Definition: Often confused with marshes but distinguished by >25% tree and shrub cover, most growing wholly or partly in water. Swamps occur on wet soils and are flooded for most, if not all the growing season; >2m standing water or vernal pooling comprising >20% of ground coverage. (2002 CyberNatural Software, <http://www.aquatic.uoguelph.ca/> and OMNR, 1998, ELC Guide).

Rare Types

Provincial Rank

A) White Pine - White Birch Mineral Mixed Swamp

S3

Tree cover >25% (of trees >5m in height); Deciduous tree species >25% and coniferous tree species >25% of canopy cover; vegetation is a mixture of conifer swamp and deciduous swamp species; typically fern rich and dominated by Eastern White Pine (*Pinus strobus*), Alder species (*Alnus spp.*) and Royal Fern (*Osmunda regalis*).

3) FENS

Definition: A type of peatland resembling a bog with saturated peat/organic soils >40cm, rarely flooded, dominated by sedges, grasses and low shrubs (>2m), contain less than or equal to 25% tree cover (of trees >2m) (2002 CyberNatural Software, <http://www.aquatic.uoguelph.ca/> and OMNR, 1998, ELC Guide).

Rare Types

Provincial Rank

A) Boreal Open Seepage Fen

S2S3

Tree cover less than or equal to 10%; shrub cover less than or equal to 25%. Contains: Slender Sedge (*Carex lasiocarpa*), Cespitose Bulrush (*Scirpus cespitosus*), Capillary Beaked-rush (*Rhynchospora capillacea*), Bog Rosemary (*Andromeda glaucophylla*).

B) Grassy Open Poor Fen

S5

Tree cover less than or equal to 10%; shrub cover less than or equal to 25%. contains: Running Bog Sedge (*Carex oligosperma*), Slender Sedge (*Carex lasiocarpa*), Peat moss species (*Sphagnum spp.*), Moss species (*Polytrichum spp.*).

C) Black Spruce - Tamarack - Leatherleaf Patterned Fen

S5

Between 10-25% tree cover. Dominated by Swamp Birch (*Betula pumila*), Leatherleaf (*Chamaedaphne calyculata*), Bog Rosemary (*Andromeda glaucophylla*), Running Bog Sedge (*Carex oligosperma*).

4) BOGS

Definition: Characterized by >40 cm organic peat accumulation, high water table (saturated soils) with acidic-loving vegetation, tree cover (>2m) less than or equal to 25%, rarely flooded; stagnant, nutrient poor environments (2002 CyberNatural Software, <http://www.aquatic.uoguelph.ca/> and OMNR, 1998, ELC Guide).

Rare Types

Provincial Rank

A) Virginia Chain Fern Open Bog

S3

Tree cover less than or equal to 10%, shrub cover less than or equal to 25%; ground cover dominated by Sphagnum species and sedges; dominated by Virginia Chain Fern (*Woodwardia virginica*).

II) Terrestrial

1) SHORELINE

Rare Types	Provincial Rank
A) Bedrock Shoreline	
a) Acidic Open Bedrock Shoreline Great Lakes Granite/Metamorphic Lakeshore	S5
b) Great Lakes Arctic-Alpine Basic Open Bedrock Shoreline Basalt (Conglomerate) Bedrock Lakeshore Sparse Vegetation	S3
B) Sand Dune	
Vegetation cover varies from patchy and barren to more closed and treed; tree cover less than or equal to 50%; active rolling sand hills formed by shoreline and wind processes; restricted to the near-shore areas of the Great Lakes; stability of soil variable; little to no accumulation of organic materials, low nutrient availability, subjected to drought and temperature extremes.	
a) Sand Cherry - Wormwood - Canada Wild Rye Shrub Dune Cover varies from patchy and barren to continuous thicket; Usually dominated by grasses with scattered to dense shrub cover; Dominated by Sand Cherry and Wormwood.	S1
b) American Dune Grass - Beach Pea - Sand Cherry Dune Grassland Cover varies from patchy and barren to continuous thicket; Usually dominated by grasses with scattered to dense shrub cover; Dominated by Beach Pea (<i>Strophostyles helvola</i>), Sand Cherry (<i>Prunus pumila</i>) and contains American Beach Grass (<i>Ammophila breviligulata</i>).	S2

2) CLIFF

Vegetation cover varies from patchy and barren to more closed and treed; tree cover less than or equal to 60%; vertical or near-vertical exposed bedrock >3m height; bedrock type important; sharp to variably broken edges, faces ad rims; average soil depth <15 cm, highly exposed and subject to extremes in temperature and moisture.

Rare Cliffs

The only rare types of cliffs identified in northern Ontario are classified as **Open Cliffs**. These areas possess tree cover that is less than or equal to 25%. The vegetation cover is sparse, patchy and barren, and they are typically found on the vertical or near-vertical bare bedrock faces. There are four different types, each with different ground material properties, as identified below.

Rare Types	Provincial Rank
A) Basic Open Cliff S3S4 Diabase / Basalt	
B) Boreal Carbonate Open Cliff Limestone	S1S2
C) Boreal Acidic Sandstone Open Cliff Sandstone	S2
D) Acidic Granite Open Cliff Type Granite / Metamorphic	S3S4

3) TALUS

Vegetation cover varies from patchy and barren to more closed and treed; tree cover less than or equal to 60%; slopes of rock rubble at the base of cliffs; coarse rocky debris greater than 50% of surface ground materials; average soil depth <15 cm; bedrock type important.

Rare Talus

The only rare types of talus identified in northern Ontario are classified as **Open Talus**. These areas possess tree cover that is less than or equal to 25%. Vegetation cover is sparse, patchy and barren. There are three different types of talus, each with different ground material properties, as identified below.

Rare Types

Provincial Rank

A) Basic Open Talus S3S4

Diabase / Basalt

B) Acidic Open Granite Talus

S3S4

Granite / Metamorphic

C) Basic Open Glacier Talus

S1

Glacier Talus. Contains more herbaceous vegetation.

4) ROCK BARREN

Rare Rock Barren

The only rare types of Rock Barren identified in northern Ontario are **Treed Rock Barren** communities. These possess between 25-60% tree coverage, and are found where bedrock is broken and cracked or where shallow soils have accumulated.

Rare Types

Provincial Rank

A) Hill's Oak - White Pine - Poplar Acidic Treed Rock Barren

S3

Dominated by Eastern White Pine (*Pinus strobus*), Red Pine (*Pinus resinosa*), Northern Pin Oak (*Quercus ellipsoidalis*), Northern Red Oak (*Quercus rubra*), and Eastern Red Cedar (*Juniperus communis*).

B) Bur Oak Acidic Treed Rock Barren Type

S2S3

Dominated by Bur Oak (*Quercus macrocarpa*), and Northern Pin Oak (*Quercus ellipsoidalis*)

5) ALVAR

Vegetation cover varies from patchy and barren to more closed and treed; tree cover greater than or equal to 60%; level, unfractured limestone (carbonate) bedrock; patchy mosaic of bare rock pavement and shallow soils over bedrock; soil depth <15cm; seasonal alternation between inundation by water and drought.

Rare Types

Provincial Rank

A) Bur Oak Treed Alvar

S1S2

Cover varies from patchy and barren to more closed in nature (ie. savannah or woodland); bedrock is more fractured or there is a greater accumulation of soil than open and shrub alvar communities; dominated by Bur Oak (*Quercus macrocarpa*), Poverty Oat Grass (*Danthonia spicata*), Prairie Smoke (*Geum triflorum*).

6) SAND BARREN

Vegetation cover varies from patchy and barren to more closed and treed; tree cover less than or equal to 60%; bare sandy ground material not associated with distinct topographic features (i.e. sand dune); subject to periods of prolonged drought and disturbances (e.g. fire).

Rare Types

Provincial Rank

A) Dry Hay Sedge Sand Barren

S1

Dominated by Hay Sedge (*Carex foenea*), Bracken Fern. (*Pteridium aquilinum*), Kalm's Brome (*Bromus kalmii*)

B) Dry Sweet Fern - *Carex lucorum* Sand Barren

S1

Dominated by Sweet Fern (*Comptonia peregrine*), Bracken Fern. (*Pteridium aquilinum*), and Kalm's Brome (*Bromus kalmii*).

7) TALLGRASS PRAIRIE, SAVANNAH AND WOODLAND

Ground layer dominated by prairie grasses including Big Bluestem, Little Bluestem and Indian Grass. Variable cover or open-grown trees; tree cover less than or equal to 60%. On unconsolidated mineral soils, soil depth >15cm, well-drained sands, loams and sometimes clay. Subject to seasonal extremes in moisture conditions; spring flooding and summer drought; frequent disturbance by fire.

Rare Types

Provincial Rank

A) Open Tallgrass Prairie

Tree cover less than or equal to 25%; shrub cover less than or equal to 25%.

a) Dry Fescue Mixed-grass Prairie

S1

Contains: Rough Fescue (*Festuca scabrella*), *Stipa* (grass) species

b) Northern Moist-Fresh Tallgrass Prairie

S1

Contains: Big Bluestem (*Andropogon gerardii*), Porcupine Bunchgrass/Needlegrass (*Stipa spartea*), Northern Dropseed (*Sporobolus heterolepis*)

B) Tallgrass Savannah

Tree cover greater than 25% but less than or equal to 25%; (see Open Tallgrass Prairie vegetation types for understory vegetation).

a) Northern Fresh – Moist Bur Oak Tallgrass Savannah

S1

Dominated by Bur Oak (*Quercus macrocarpa*)

8) FOREST

Tree cover >60%; site conditions and soil types variable.

Rare Forests

The only rare forest types identified in northern Ontario are classified as **Deciduous Forest** communities. Greater than 75% of the canopy of these forests is comprised of deciduous species.

Rare Types

Provincial Rank

A) Moist -Fresh Bur Oak-Green Ash-Trembling Aspen Deciduous Forest

S2S3

Dominated by Bur Oak (*Quercus macrocarpa*), Green Ash (*Fraxinus pennsylvanica*), Trembling Aspen (*Populus tremuloides*); Contains Saskatoon Berry (*Amelanchier alnifolia*), Wild Sarsaparilla (*Aralia nudicaulis*), Assiniboia Sedge (*Carex assiniboinensis*)

B) Bur Oak - Saskatoon Berry Dry Deciduous Woodland

S2

Dominated by Bur Oak (*Quercus macrocarpa*), and Saskatoon Berry (*Amelanchier alnifolia*). Contains Hazelnut (*Corylus americana*).

SUMMARY OF RARE PLANT COMMUNITIES:

Description (from NHIC)	Prov. Rank	ELC *
SOUTHERN		
Aquatic		
Floating-leaved Shallow Aquatic Ecosite	S1	
American Lotus Floating-leaved Shallow Aquatic Type		SAF1-2
Wetland		
Marsh		
Meadow Marsh		
Great Lakes Coastal Meadow Marsh Ecosite		
Graminoid Coastal Meadow Marsh Type	S2	MAM4-1
Shrubby Cinquefoil Coastal Meadow Marsh Type	S1	MAM4-2
Wet - Moist Tallgrass Prairie Meadow Marsh Ecosite		
Wet Bluejoint-Prairie Slough Grass Tallgrass Prairie Meadow Marsh Type	S3	MAM6-1
Mineral Meadow Marsh Ecosite		
Prairie Slough Grass Mineral Meadow Marsh Type	S3	MAM2-8
Organic Meadow Marsh Ecosite		
Prairie Slough Grass Organic Meadow Marsh Type	S3	MAM3-7
Swamp		
Thicket Swamp		
Mineral Thicket Swamp Ecosite		
Buttonbush Mineral Thicket Swamp Type	S3	SWT2-4
Southern Arrow-wood Mineral Thicket Swamp	S3	SWT2-11
Paw-paw Mineral Thicket Swamp Type	S1	SWT2-12
Organic Thicket Swamp Ecosite		
Buttonbush Organic Thicket Swamp Type	S3	SWT3-4
Spicebush Organic Thicket Swamp Type	S3	SWT3-11
Poison Sumac Organic Thicket Swamp Type	S3	SWT3-13
Huckleberry Organic Thicket Swamp Type	S1	SWT3-14
Deciduous Mineral Swamp		
Oak Deciduous Mineral Swamp Ecosite		
Swamp White Oak Mineral Deciduous Swamp	S2S3	SWD1-1
Bur Oak Mineral Deciduous Swamp Type	S3	SWD1-2
Pin Oak Mineral Deciduous Swamp Type	S2S3	SWD1-3

*ELC is an acronym for the Ecological Lands Classification System for Southern Ontario. 1998.

Harold Lee, Wasyl Bakowsky, John Riley, Jane Bowles, Mike Puddister, Peter Uhlig, Sean McMurray.

Fen

Open Fen

Graminoid Fen Ecosite		
Twig-rush Graminoid Fen Type	S3?	FEO1-1
Perched Mineral Prairie Fen Type	S1	

Shrub Fen

Shrub Fen Ecosite		
Highbush Blueberry - Leatherleaf Shrub Fen Type	S2S3	

Treed Fen

Treed Fen Ecosite		
Gray Birch Treen Fed Type	S2S3	

Bog

Open Kettle Peatland

Shrub Kettle Peatland Ecosite		
Leatherleaf Shrub Kettle Peatland Type	S3	
Highbush Blueberry Shrub Kettle Peatland Type		S1S2

Treed Kettle Peatland

Treed Kettle Peatland Ecosite		
Tamarack - Leatherleaf Treed Kettle Peatland Type	S3	

Terrestrial**Shoreline**

Beach / Bar

Open Sand Beach / Bar Ecosite		
Sea Rocket Sand Beach Type	S2S3	BBO1-1
Gravel / Shingle / Cobble Beach / Bar Ecosite		
Wormwood Gravel Beach Type	S2S3	BBO1-2
Red Cedar - Common Juniper Shingle Beach Type	S1	BBS1-1
Limestone Bedrock Beach / Bar Ecosite		
Shrubby Cinquefoil Limestone Beach Type	S2	BBO2-1
Sandstone Bedrock Beach / Bar Ecosite		

Sand Dune

Dune Grassland Ecosite		
Little Bluestem - Switchgrass - Beachgrass Dune Grassland	S2	SDO1-1
Little Bluestem - Long-leaved Reed Grass - Great Lakes		
Wheat Grass Dune Grassland	S2	SDO1-2
Dune Shrubland Ecosite		
Sand Cherry Dune Shrubland Type	S2	SDS1-1
Juniper Dune Shrubland Type	S2	SDS1-3
Hop-tree Dune Shrubland Type	S1	SDS1-2

Dune Savannah Ecosite			
Cottonwood Dune Savannah Type	S1	SDT1-1	
Red Cedar Dune Savannah Type	S1	SDT1-3	
Balsalm Poplar Dune Savannah Type	S1	SDT1-2	
Cliff			
Open Limestone / Dolostone Cliff Ecosite			
Cliffbrake - Lichen Open Unshaded Limestone / Dolostone Cliff Face Type	S3	CLO1-1	
Bulblet Fern - Herb Robert Open Shaded Limestone / Dolostone Cliff Face Type	S3	CLO1-2	
Canada Bluegrass Open Unshaded Limestone / Dolostone Cliff Face Type	S3	CLO1-3	
Open Limestone / Dolostone Seepage Cliff Type	S3	CLO1-4	
Open Limestone / Dolostone Cliff Rim Type	S2	CLO1-5	
Limestone / Dolostone Cliff Shrubland Ecosite			
Common Juniper Open Limestone / Dolostone Cliff Rim Shrubland Type	S2S3	CLS1-1	
Round-leaved Dogwood Open Limestone / Dolostone Cliff Rim Shrubland Type	S3	CLS1-2	
Treed Limestone / Dolostone Cliff Ecosite			
White Cedar Treed Limestone Cliff Type	S3	CLT1-1	
Sugar Maple - Ironwood-White Ash Treed Limestone Cliff	S3	CLT1-2	
Open Sandstone Cliff Ecosite	S1		
Sandstone Cliff Shrubland Ecosite	S1		
Treed Sandstone Cliff Ecosite			
Talus			
Open Limestone / Dolostone Talus Ecosite			
Dry Herbaceous Limestone / Dolostone Talus	S2		
Wet Herbaceous Limesone / Dolostone Talus	S2		
Limestone / Dolostone Talus Shrubland Ecosite			
Round-leaved Dogwood Open Limestone / Dolostone Talus Shrubland Type	S2S3	TAS1-1	
Mountain Maple Open Limestone Talus Shrubland Type	S3	TAS1-2	
Treed Limestone / Dolostone Talus Ecosite			
White Birch Dry Treed Limestone Talus Type	S3	TAT1-2	
White Cedar Dry Treed Limestone Talus Type	S3	TAT1-3	
Sugar Maple Moist Treed Limestone Talus Type	S3	TAT1-4	
Basswood - White Ash - Butternut Moist Treed Limestone Talus	S2		
Hemlock - Sugar Maple Moist Limestone Talus Type	S2	TAT1-6	
Open Sandstone Talus Ecosite	S1		
Sandstone Talus Shrubland Ecosite	S1		
Treed Sandstone Talus Ecosite	S1		
Crevice and Cave			
Limestone / Dolostone Solution Cave Ecosite	S1		
Limestone / Dolostone Crevice Cave Ecosite	S1		

Rock Barren

Open and Treed Rock Barren

Open Limestone / Dolostone Barren Ecosite

Dry Limestone / Dolostone Barren Type	S2S3	RBO1-1
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Limestone / Dolostone Shrubland Barren Ecosite

Common Juniper Limestone / Dolostone Shrubland Barren Type	S3	RBS1-1
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Round-leaved Dogwood Limestone / Dolostone Shrubland Barren	S3	RBS1-2
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Treed Limestone / Dolostone Barren Ecosite

Red Cedar Treed Limestone Barren Type	S1	RBT1-1
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Hackberry Treed Limestone Barren Type	S1	RBT1-2
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Oak Treed Limestone Barren Type

S1	RBT1-3
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Open Sandstone Barren Ecosite

Dry Sandstone Barren Type	S1	
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Sandstone Barren Shrubland Ecosite

S1	
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Treed Sandstone Barren Ecosite

S1	
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Granite Shrubland Barren Ecosite

Chokeberry Granite Shrubland Barren Type	S3	RBS2-1
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Treed Granite Barren Ecosite

Red Cedar Treed Granite Barren Type	S1	RBT2-2
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Pitch Pine Treed Granite Barren Type	S1	RBT3-1
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Alvar

Open Alvar Ecosite

Shrubby Cinquefoil - Creeping Juniper - Scirpus-like Sedge Alvar Pavement Type	S2	
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Philadelphia Panic Grass - False Pennyroyal Alvar Pavement Type	S1	
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Northern Dropseed - Little Bluestem - Scirpus-like Sedge Alvar Grassland Type	S2S3	
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Tufted Hairgrass - Canada Bluegrass - Philadelphia Panic Grass Alvar Grassland Type	S2S3	
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Canada Bluegrass - Nodding Onion Alvar Grassland Type	S1	
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Alvar Shrubland Ecosite

Common Juniper - Creeping Juniper - Shrubby Cinquefoil Alvar Shrubland Type	S2	
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Common Juniper - Fragrant Suman - Hairy Beardtongue Alvar Shrubland Type	S2	
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Treed Alvar Ecosite

White Cedar - Jack Pine - Shrubby Cinquefoil Treed Alvar Shrubland Type	S1	
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Jack Pine - White Cedar - Low Calamint Treed Alvar Grassland Type	S1	
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White Cedar - White Spruce - Philadelphia Panic Grass Treed Alvar Grassland Type	S3	
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Red Cedar - Early Buttercup Treed Alvar Grassland Type	S2	ALT1-5
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Chinquapin Oak - Nodding Onion Treed Alvar Grassland Type	S1	ALT1-1
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Shagbark Hickory - Prickly Ash - Philadelphia Panic Grass Treed Alvar Grassland Type	S1	ALT1-2
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Jack Pine - White Cedar - Common Juniper Treed Alvar Shrubland Type

S2	
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Sand Barren

Sand Barren Ecosite

Bracken Fern Sand Barren Type	S2	SBO1-1
Hay Sedge Sand Barren Type	S1	SBO1-2
Slender Wheat-grass Sand Barren Type	S1	SBO1-3

Tallgrass Prairie, Savannah and Woodland

Dry Tallgrass Prairie Ecosite

Dry Tallgrass Prairie Type	S1	TPO1-1
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Moist - Fresh Tallgrass Prairie Ecosite

Moist - Fresh Tallgrass Prairie Type	S1	TPO2-1
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Dry Tallgrass Savannah Ecosite

Dry Black Oak Tallgrass Savannah Type	S1	TPS1-1
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Dry Black Oak -Pine Tallgrass Savannah Type	S1	TPS1-2
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Moist - Fresh Tallgrass Savannah Ecosite

Moist - Fresh Pin Oak - Bur Oak Tallgrass Savannah Type	S1	TPS2-1
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Moist - Fresh Black Oak Tallgrass Savannah Type

Dry Tallgrass Woodland Ecosite

Dry Black Oak - White Oak Tallgrass Woodland Type	S1	TPW1-1
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Dry But Oak - Shagbark Hickory Tallgrass Woodland Type	S1	TPW1-2
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Moist - Fresh Oak Tallgrass Woodland Ecosite

Moist - Fresh Black Oak - White Oak Tallgrass Woodland	S1	TPW2-1
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Moist - Fresh Pin oak Tallgrass Woodland Type	S1	TPW2-2
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Forest

Deciduous Forest

Dry Deciduous Forest Ecosite		
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Dry Black oak Deciduous Forest Type		FOD1-3
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Dry - Fresh Hackberry Deciduous Forest Ecosite		
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Dry - Fresh Hackberry Deciduous Forest Type	S2	FOD4-3
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Moist - Fresh Sugar maple - Mixed Deciduous Forest Ecosite

Moist - Fresh Sugar maple - Black maple Deciduous Forest	S3	FOD6-2
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Moist - Fresh Black Walnut Deciduous Forest Ecosite

Moist - Fresh Black Walnut Deciduous Forest Type	S2S3	FOD7-4
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Moist - Fresh Hackberry Deciduous Forest Ecosite

Moist - Fresh Hackberry Deciduous Forest Type	S2	
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Mixed Forest

Dry Oak - Pine Mixed Forest Ecosite		
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Dry Oak - Pitch Pine Mixed Forest Type	S1	FOM1-1
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Dry Chinquapin Oak - Pine Mixed Forest Type	S2	FOM1-2
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NORTHERN

Wetland

Marsh

Atlantic Coastal Plain Shallow Marsh Type
Bulrush - Stiff Arrowhead - Pondweed Shallow Marsh Type

Swamp

White Pine - White Birch Mineral Mixed Swamp Type

Fen

Boreal Open Seepage Fen Type
Graminoid Open Poor Fen Type
Black Spruce - Tamarack - Leatherleaf Patterned Fen Type

Bog

Virginia Chain Fern Open Bog Type

Terrestrial

Shoreline

Great Lakes Arctic-Alpine Basic Open Bedrock Shoreline Type
Acidic Open Bedrock Shoreline Type

Sand Dune

American Dune Grass - Beach Pea - Sand Cherry Dune Grassland Type
Sand Cherry - Wormwood - Canada Wild Rye Shrub Dune Type

Cliff

Basic Open Cliff Type
Acidic Granite Open Cliff Type
Boreal Carbonate Open Cliff Type
Boreal Acidic Sandstone Open Cliff Type

Talus

Basic Open Glaciere Talus Type
Basic Open Talus Type
Acidic Open Granite Talus Type

Rock Barren

Hill's Oak - White Pine - Poplar Acidic Treed Rock Barren Type
Bur Oak Acidic Treed Rock Barren Type

Alvar

Bur Oak Treed Alvar Type

Sand Barren

Dry Sweet Fern - Carex lucorum Sand Barren Type
Dry Hay Sedge Sand Barren Type

Tallgrass prairie, Savannah and Woodland

Northern Moist-Fresh Tallgrass Prairie Type

Dry Fescue Mixedgrass Prairie Type

Northern Moist - Fresh Bur Oak Tallgrass Savannah

Forest

Bur Oak - Saskatoon Berry Dry Deciduous Woodland Type

Moist - Fresh Bur Oak - Green Ash - Trembling Aspen Deciduous Forest Type

Appendix 4: Control Methods

Document below reproduced from CVC control methods document

The following is a list of the most current prescriptive methods of control for a select number of invasive plant species. The recommendations are a combination of methods supplied by Tove Christensen and Silvia Strobl of the MNR, the City of Toronto Parks, Forestry and Recreation department (Cara Webster pers. comm.), Greg Bales of the MNR and CVC staff (Rod Krick and Freyja Forsyth). Other sources used are listed throughout the text. This list will be refined by CVC over time as new information becomes available. Species are organized by Upland Shrubs, Upland Flora, Wetland Flora and the appendix concludes with Trees.

Choice of methods may vary depending on a number of criteria, e.g. whether you are opting for non-chemical (pesticide) methods, the size and intensity of the infestation you are dealing with, and whether there are non-target plants in the vicinity that you must preserve, adjacency of water or public safety concerns. The tables below attempt to provide some guidance in this regard.

DISCLAIMER: The below suggested control methods have been compiled from many sources. Before using any pesticide the reader must ensure that the pesticide is registered by the Pest Management Regulatory Agency (has a Pest Control Products Act registration number) and is classified for use in Ontario. The pesticide label will provide instructions on how the pesticide can be used, what pests it may be used to control and safety equipment required. All label directions must be followed. It is an offence to use an unregistered or unclassified pesticide or to use a pesticide in contravention of the label directions. Licences and additional requirements under the Pesticides Act and Regulation 63/09 may also apply to the use of certain pesticides.

Infestation Level definitions:

Light	A patch or patches of plants that is small. Isolated clusters of plants can be easily counted or distinguished across an area of habitat. Patches generally do not exceed more than 5 metres in diameter and are remote from other patches of the invasive plant.
Moderate	Isolated small patches are beginning to blend into each other, but are not yet one cohesive 'infestation'. Patches can be anywhere from 5 metres to 50 metres (e.g. the size of two tennis courts placed end to end) in diameter and may be associated with other nodes of infestation. The plants in question are not yet a part of the dominant community form; whether in the ground, shrub, or canopy layer.
Heavy	The plant species in question are almost consistently found in abundance across the habitat. The plant species forms a dominant or co-dominant component of the habitat either in the ground, shrub or canopy layer.

Upland Shrubs

Autumn olive

- See methods for buckthorn and honeysuckles

Other notes: Hand wrenching not recommended as this shrub will heavily sucker from un-removed roots fragments.

Buckthorns, common and glossy (*Rhamnus cathartica*, *R. frangula*)

Habitat

- Open areas, disturbed forest edges, ravines, forests, thickets, wetlands.
- Will germinate in full sun or shade.
- Shade tolerant under forest canopy.

Reproduction and Dispersal

- Prolific seed production, seed dispersed by birds.
- Produces seed at very young age.
- Root suckers, resprouts vigorously from cut stumps.
- Forms a persistent seed bank. Seed can remain viable for 2-3 years (Kaufman et al., 2007).

Suggested Method of Control

- 4-5 years of control can be required to control seedbank.
- Burning effective if repeated over several years.

Infestation level	Method/Management
Light (pioneer)	Non-herbicide Hand wrenching if shrubs are still small and soil disturbance can be minimized as this may bring the seed bank to the surface. Girdling alone not effective.
Light to heavy and large areas	Chemical It is suggested that an over-the-counter acetic acid (vinegar) product (a mixture of acetic acid and citrus oils) (e.g. EcoSense or EcoClear) could be effective at smaller scales. The stump is cut about 2 or 3 inches above the ground and then mashed up with an axe. Stump is then thoroughly soaked with the solution. An early summer application followed by a second application (stump must be re-wounded again) 3 or 4 weeks later can be highly effective. Basal bark application of 30% Triclopyr (e.g. Garlon) in an oil carrier is the most effective . Coat a 5cm or so band on bark totally around each stem, or use a 5% foliar spray in late summer, early fall. As a less expensive but also slightly less effective alternative, apply 100% glyphosphate (e.g. Roundup) with a paint brush after peak flowering (May-July) to cut/girdled stems. Both methods will require follow-up treatments as no method is 100% effective.

Other notes: While buckthorn does not resprout from underground roots, it can resprout from buds at the base of the tree stem and herbicide treatment of the stump is strongly recommended. Roundup is non-selective and surrounding desirable vegetation can be damaged. Autumn is the preferred time to cut and stump-treat buckthorn, because 1) buckthorns retain green leaves late into the fall, making it easy to find all plants and 2) most native vegetation is dormant, minimizing the potential harm to non-target plants. To be effective, the herbicide mentioned above must be applied immediately after cutting. Herbicide chemicals can be applied either by spraying individual cut stumps with a low pressure hand sprayer or else by wiping the herbicide on each cut stump with a sponge applicator (sponge-type paint applicators can be used).

Buckthorn leaf litter increases the soil nitrogen content, which creates conditions favourable for buckthorn growth and which may harm native plants adapted to original soil conditions (Kaufman et al., 2007).

Triclopyr application during the dormant season reduces the potential for drift injury. Use of Triclopyr is best done in the dormant season to lessen damage to non-target species. Great care should be exercised to avoid getting any of the mixtures on the ground near the target plant since some non-target species may be harmed. Avoid using Triclopyr if rain is forecast for the following 1-4 days; otherwise runoff will harm non-target species (Heidorn, 1990)

Honeysuckles (Non-native) (*Lonicera tartarica*, *L. mackii*, *L. morrowii*, *L. bella*)

Habitat

- Disturbed successional communities, wetlands, woodland edges, woodlands.
- Moderately shade tolerant, canopy gaps.

Reproduction and Dispersal

- Prolific seed production berries highly attractive to birds, which disseminate seeds widely across the landscape.
- Seeds remain viable for 4-5 or more years.
- Sprouting occurs in established populations.

Suggested Method of Control

- Burning effective if repeated over several years.

Infestation level	Method/Management
Light to moderate	Non-herbicide Hand wrenching if shrubs are still small and soil disturbance can be minimized. Repeated yearly cutting to ground level in shaded forest can result in high mortality. Hand wrenching if shrubs are still small and soil disturbance can be minimized. Repeated yearly cutting to ground level in shaded forest can result in high mortality.
Light to heavy	Chemical Girdling/cutting to ground and application of 100% glyphosphate (e.g. Roundup) with paint brush (will require follow-up treatments to control resprouting). Basal bark application of 30% Triclopyr (e.g. Garlon) in an oil carrier is also very effective if done in early or late spring. Later season applications of triclopyr have had mixed success

Other notes: Winter clipping should be avoided as it encourages vigorous re-sprouting of the non-native honeysuckles. Recent studies have shown that some honeysuckles can have allelopathic effects similar to those of garlic mustard (Dorning et al., 2007)

Upland Flora

Canada thistle (*Cirsium arvense*)

Habitat

- Cultivated fields, pastures, roadsides, disturbed sites, forest openings, shorelines, savannahs, prairies.
- Grows best in open, disturbed sunny sites on well-drained, deep moist loamy clay soils.

Reproduction and Dispersal

- Reproduces primarily by vegetative growth of root system.
- Vertical roots can grow as deep as 6.8 m, horizontal roots can spread as much as 6 m in one season, patches can spread 1-2 m/year. Readily propagates from stem and root fragments.
- Produces seed, almost exclusively insect pollinated.

Suggested Method of Control

- Best strategy is to shade this species out by establishing trees.
- Late spring burning can be highly effective, although it may be necessary to continue for several years.
- Stem weevil, bud weevil and stem gall fly are commercially available biological controls.

Infestation level	Method/Management
Light to heavy	<p>Non-herbicide Deep root system makes hand pulling difficult. Repeated mowing, just as flowers are about to open continued over several years can be effective.</p> <p>Chemical Spot application with Glyphosate or with selective herbicide Clopyralid, or Metsulfuron. Spraying at flowering time (mid-June to early July) with Glyphosate can be quite effective.</p>

Dog-strangling vines (DSV) (or Swallow-worts) (*Cynanchum rossicum*, *C. nigrum*)

Habitat

- Fields, hydro corridors, disturbed forest edges, ravines.
- Not tolerant of heavy shade, but is capable of transforming healthy forest over time into more open woodlands.

Reproduction and Dispersal

- Prolific seed production, seed wind-dispersed over long-distances.
- Able to regenerate from root crown pieces.

Suggested Method of Control

- Burning ineffective and can encourage populations.

Infestation level	Method/Management
Light	<p>Non- herbicide Can be controlled by removing plants, including root systems. Only effective in loose soils when plants are still young. Solarisation for up to 2 years an option in small monoculture patches.</p> <p>Chemical Wick with glove (car wash mitt) – spray 22% glyphosphate (e.g. Roundup) (mixed with dye) – carefully wipe onto leaves to avoid damage to other plants; 2 treatments per season, follow-up required.</p>
Heavy infestations in isolated colonies or woodlot edges	<p>Non-herbicide Solarisation for up to 2 years, followed by replanting of native aggressive species. Mowing and cutting is ineffective but can reduce biomass and contain population by preventing seed production. Mow at least two times per season and target the first time just as the seed pods are forming.</p> <p>Chemical Spray with 3-5% glyphosphate (e.g. Roundup), applied by backpack sprayer at onset of flowering (mid-June); minimum 2 treatments per season for 2-3 years. Second treatment 2 to 3 weeks later. Triclopyr (e.g. Garlon) and imazapyr (e.g. Arsenal) also effective. Dichlorprop also shows some promise in efficacy trials.</p>
Heavy infestations in linked corridors	<p>Chemical Pesticide application cannot be justified on this basis – too much labour and herbicide product would be required – not sustainable; possible strategy – introducing competitive vegetation in gradual phases over time and cutting DSV manually to allow vegetation to establish & eventually shade out DSV.</p>

Other notes: Some recent information has shown that DSV treated in shaded areas with glyphosphate does not respond well. May need to consider alternatives or higher concentrations than those listed above. Dog-strangling vine is a plant that is difficult to control with no single method or combination of methods able to eradicate this forest invader. Cooperation with surrounding landowners is required to prevent established Dog-strangling vine colonies from spreading into new areas. Limit your travel through areas infested

with Dog-strangling vine during seed dispersal to prevent seed spreading into new areas. Take the trouble to remove seeds from your boots and clothes, pets, bicycle and other equipment when coming out of infested areas.

Garlic mustard (*Alliaria petiolata*)

Habitat

- River floodplains, forests, roadsides, wooded edges and forest openings.
- Tolerates full sun to full shade, prefers partial canopy.
- One of a few non-native herbs that dominate the understory of forested areas.

Reproduction and Dispersal

- Biennial, a rosette of leaves formed during first half of a two-year cycle.
- In second spring, rosettes develop rapidly into mature plants that flower, produce seed and die by late June.
- A single plant can produce thousands of seeds that scatter as much as several meters from the parent plant.
- Long-distance dispersal is most likely aided by humans and wildlife (e.g., deer).
- Spreads rapidly, can displace native plants within 10 years of becoming established.

Suggested Method of Control

- There are two basic monitor/control measures that are effective for garlic mustard. The first is to focus on identifying and eradicating new (or satellite) infestations before a seed bank is established, and the more difficult task of eradicating longer, established 'invasion fronts'. Garlic mustard can easily invade disturbed sites therefore reduce disturbances to soil and vegetation found near these invasion fronts.
- 2-5 years of treatments will be necessary to deplete seed banks.
- Burning stimulates germination of stored seeds and seedling growth, and must be conducted annually for 3 to 5 years to achieve effective control.
- Four beetles are currently being investigated as biocontrols, may be available in the near future.

Infestation level	Method/ Management
Light	<p>Non-herbicide</p> <p>Pull out plants at time of flowering prior to seed pod development (early May); pulling may not be feasible on erosion-prone sites. Soils disturbance must be minimized. In long established populations, pulling may simply unearth buried seeds. Pulling can only be effective if site can be revisited a number of times a year over an extended number of years sufficient to exhaust the seed bank.</p>
Moderate-heavy in large patches/ woodlot edges etc. ; monocultures	<p>Non-herbicide</p> <p>Good control requires removal of this plant before it sets seed. Cut at the time of flowering with weed whipper type equipment and ensure the plants are cut down to ground level. Use a chopping method with the weed whipper to cut the plant into short segments and this will prevent the cut garlic mustard plant from producing seed (pers comm. – Cara Webster). Whereas cutting to 10 cm above the ground allows some of the plants to survive and release seed.</p> <p>Cutting with brushcutters or manually at time of flowering (early to mid-June) is effective only if repeat cutting performed 2-4 weeks later; plants have to be cut as close to base as possible otherwise they will resprout. Use a chopping method with the weed whipper to cut the plant into short segments and this will prevent the cut garlic mustard plant from producing seed (pers comm. – Cara Webster). Take care not to damage nearby native species and instead pull the garlic mustard found near desirable plant species. Must repeat over several years.</p> <p>Solarisation- placement of tarp/plastic over select areas. Replanting with aggressive native species and mulching around plantings to counter disturbance of seed bed. Proceed in a phased approach.</p> <p>Chemical</p> <p>Glyphosate (amitrole or triclopyr may be more effective) provides effective control of heavy infestations when applied in mid-spring; in the fall and early spring Glyphosate (3% solution) can be applied to rosettes (first year plants).</p> <p>Where lack of snow cover provides the opportunity spraying three times between November and March can be very effective provided temperature is above 10° C.</p>
Moderate-heavy in large patches in highly significant areas	<p>Chemical</p> <p>Due to the widespread distribution of Garlic mustard – control with herbicide is not recommended on a large scale; selective patches could be sprayed with 3% glyphosphate (e.g. Roundup) in late fall while plants are in the rosette stage – should only be considered after other methods have been attempted.</p>

Other notes: Garlic mustard has known allelopathic effects that prevent the successful germination and growth of native species. Consider this in restoration. Pulled flower stems can still form viable seeds if left lying on the ground and therefore must be removed from the site and properly disposed of.

Giant hogweed (*Heracleum mantegazzianum*)

Habitat

- Commonly found along riverbanks, streams and wet places with soil deep enough for tap root development.
- Target populations along rivers and streams and urban stormwater systems. Coordinate throughout the entire drainage system. Sites upstream should be controlled first, since seeds will be dispersed downstream.
- Germination of seeds requires moisture.
- Giant hogweed thrives on a variety of sites and can tolerate well drained and saturated sites with silty and sandy soils.

Reproduction and Dispersal

- One plant can produce between 27 000-50 000 seeds.
- Seeds dispersal may occur short distances by wind or by watercourse.
- Seed longevity is about 3-5 years.
- In addition to reproduction by seeds individuals can reproduce by bud growth on both crown and stalk.

Suggested Method of Control

- Management programs should span between 3-5 years to account for the plants capability of storing carbohydrates below ground as well as the plants ability to produce thousands of seeds. Non-herbicide, chemical and biocontrol methods may all be implemented in giant hogweed control.

Infestation level	Method/Management
Light	<p>Non-Herbicide</p> <p>Pulling may be effective as long as it is ensured that all roots are removed. It is also effective to cut roots 3-4 inches beneath soil surface in early spring. Great care and precaution must be taken to avoid skin contact with clear sap which causes photodermatitis. Follow-up required in mid-season to deal with resprouts and over subsequent years.</p> <p>Solarisation with a black tarp or plastic can be effective over several years of application.</p> <p>Chemical</p> <p>Early application of 2% Glyphosate (e.g. Round-up) may be applied to plants leaves during budding and the period of active plant growth. Early May-June is the best time before the plant becomes too tall. Cutting the stem (or use of an injection tool) and injecting 5-6 ml of glyphosphate into the hollow stem also effective.</p> <p>Follow-up at each application site necessary to deal with any resprouts or missed plants.</p>
Moderate-Heavy	<p>Non-herbicide</p> <p>Consistent mowing may deplete energy stores in the roots.</p> <p>Chemical</p> <p>See as above, however cut and inject may not be practical at this level, rather use a foliar/spray application. Foliar spray application generally the faster acting and most effective approach.</p>

Other notes: This species causes phototoxic burns when skin comes into contact with any sap. It may even cause blindness if sap enters the eye. When working around this species wear all appropriate protective equipment [gloves, non-absorbent clothing (e.g. PVC suit), and eye protection] and wash down all equipment and clothing when work is completed.

Goutweed (*Aegopodium podagraria*)

Habitat

- Commonly found along roadsides, forest understories and forest edges.
- Moist soils and shaded areas are easily invaded by goutweed.
- Goutweed is known to carpet the forest ground cover where it out competes native wildflowers (Kaufman et al., 2007).

Reproduction and Dispersal

- When shaded goutweed can spread via underground stems. Seeds do not germinate in the shade.
- Seeds are generally not long lived and germinate within their first year (Plant Conservation Alliance, 2009).
- Populations commonly escape garden boundaries into natural areas.
- Seeds have no special adaptation to facilitate dispersal through animals or wind.

Suggested Method of Control

- When pulling, care should be taken to ensure that rhizomes have been removed.
- There is no known biological control in North America (Kaufman et al., 2007).

Infestation level	Method/Management
Light	Non-herbicide May be pulled with the removal of all rhizomes. Pulling may disturb the soil in a way that encourages seed recruitment. Will need to revisit in subsequent years to deal with resprouts. Solarisation Patches can be covered with a dark plastic sheet in the spring (Kaufman et al., 2007). Leave plastic down for up to 2 years.
Moderate-heavy	Chemical Spraying with Glyphosate herbicides most effective in early spring. Repeated applications will be necessary over the course of one season. Triclopyr (e.g. Garlon) in a 1-2% solution can also be highly effective Contact herbicides are ineffective since goutweed readily recovers from defoliation. Non-herbicide May be mowed frequently or mowed and then covered with landscape fabric and heavy mulch (Kaufman et al., 2007).

Other notes: Seedlings need strong light to establish, in woody areas population growth is mainly due to rhizomes (Plant Conservation Alliance, 2009). Most types of eastern deciduous forests are vulnerable to goutweed invasion. Infestations can usually be traced to abandoned or ill-kept gardens.

Kentucky bluegrass (*Poa pratensis*)

Habitat

- Meadows, open woodlands, disturbed sites.
- Favours moist conditions, avoids acid soils and heavy shade.

Reproduction and Dispersal

- Reproduces by seed and rhizomes.
- Germination primarily occurs in early spring, but can also occur in early autumn if soil moisture is adequate.
- Readily expands population base vegetatively and aggressively; sod-forming.

Suggested Method of Control

- Spring burning is the most widely used tool to control cool season grasses. However, it may be necessary to burn annually for several years. Burning most likely to be effective at “boot” stage, when flowering head still enclosed in sheath.

Infestation level	Method/Management
Light to heavy	Non-herbicide Difficult to eradicate with non chemical controls. Small patches can be hand grubbed, making sure all roots are removed. Chemical Glyphosate (e.g. Roundup) has been effectively used to shift dominance from non-native to native grasses. Apply in early spring while native species are dormant.

Periwinkle (*Vinca minor*)

Habitat

- Rich moist soils
- Does not tolerate full sunlight, is shade tolerant and often found in open forests (Kaufman et al., 2007).

Reproduction and Dispersal

- Underground runners and rootlets that form at leaf nodes allow periwinkle to quickly spread (Kaufman et al., 2007).
- Periwinkle produces seed but primarily spreads through runners.

Suggested Method of Control

It has been found that the effectiveness of Glyphosate has been compromised due to the plants waxy leaves. There is no known biocontrol method for periwinkle control.

Infestation level	Method/Management
Light	Non-herbicide If pulled by hand ensure that root fragments are completely removed. Since periwinkle hardly spreads through seeds, recruitment of new seeds through pulling is not an issue (Kaufman et al., 2007).
Moderate-Heavy	Chemical Because of the plants waxy cuticle herbicide uptake is a challenge. Suggest wounding or cutting the plant with a weed whipper first. After cutting/wounding, plants may be sprayed with a 3% solution of glyphosphate (e.g. Roundup). Triclopyr (e.g. Garlon) has been found to be less effective than Glyphosate .

Other notes: No biological controls are known. Periwinkle is a very robust plant and many of the herbicides that are used to control it may have impacts on surrounding native plants.

Wetland Flora

Himalayan balsam (*Impatiens glandulifera*)

Habitat

- Moist riverbanks, damp woods.

Reproduction and Dispersal

- Annual, single plant can produce up to 800 seeds, which are explosively released several metres from adult plant.
- Seeds can survive long periods in water, and can float downstream to invade new areas.

Suggested Method of Control

Infestation level	Method/Management
Light to heavy and small/large patches	Non-herbicide Cut once in full flower July to August to deplete seed bank; interplant with trees and shrubs and slowly out shade over time. Repeat in successive years to address resprouts. Solarisation an option in small patches. Chemical Foliar treatment with 2-3% Glyphosate (e.g. Roundup).

Japanese knotweed (*Polygonum cuspidatum*)

Habitat

- Damp to dry soils, along streams and rivers, in low-lying areas, waste places, old homesteads.
- Found primarily in moist, unshaded habitats.
- Does not appear to invade forest understories.

Reproduction and Dispersal

- In North America, seeds do not appear to be a significant mode of reproduction.
- Mainly reproduce through extensive rhizomes that reach 15-20 m in length.
- Rhizome fragments are washed downstream or transported in fill.
- Rhizomes can regenerate from small fragments and when buried up to 1 m deep.

Suggested Method of Control

Infestation level	Method/Management
Light to moderate - small patches	Non-herbicide Mowing and cutting may be effective if done close to the ground, twice per month between April and August, then monthly until the first frost. Repeat this treatment for at least 5 years to exhaust root reserves. Mechanically controlled areas should be monitored throughout the growing season to ensure new infestations do not develop from root fragments.
Light to heavy and small/large patches	Non-herbicide Solarisation can also be used, be aware that tarp must extend at least 3 or 4 metres beyond outer boundary to prevent rhizomes escaping under the tarp. Leave in place 2 years. Chemical Effective herbicides include: imazapyr, Glyphosate, and triclopyr. Cut 1-2 times over season; spray resprout in early fall and following spring with 1.34% glyphosate. Will need to treat in subsequent years. Stem injections/cut surface treatments are most effective in the summer or fall, while foliar applications are most effective at the late bud stage.

Other notes: Recent studies have shown that if treated and top killed, the rhizomes can persist for up to 2 years before resprouting. This stresses the need for monitoring and long term control (Holmen et al., 2007).

Purple loosestrife (*Lythrum salicaria*)

Habitat

- Wetlands, stream and river banks, lakeshores, ditches and other disturbed wet areas.

Reproduction and Dispersal

- Perennial, single plant can produce hundreds of thousands of seeds, seeds have high viability; rapid build up of seedlings possible.
- Dispersal mainly by wind, but seeds also transported on feet of waterfowl and other wetland animals, also dispersed by water currents.
- Can spread vegetatively by resprouting from cut stems and regeneration from pieces of root stock.

Suggested Method of Control

- University of Guelph studied and piloted the use of several European beetles as a control agent. Results were successful. Beetles can be purchased as a very effective control agent when dealing with large populations.

Infestation level	Method/Management
Light	Non-herbicide Can be removed by hand; entire rootstock must be pulled out.
Light to heavy	Non-herbicide Biological control: Commercially available (<i>Galerucella</i> spp.) beetles. Chemical Most commonly controlled with Glyphosate (in areas with no standing water); treatment should occur after peak blooming period (July-August).

Common reed (*Phragmites australis*)

Habitat

- Readily invades open wetlands, especially those with disturbance.

Reproduction and Dispersal

- Produces wind born seeds, but moves most rapidly through a stoloniferous root system.

Suggested Method of Control

Infestation level	Method/Management
Light	<p>Non-herbicide</p> <p>Hand wrenching making sure all portions of the rhizome are removed. Dispose of plant parts off site. Will need to monitor repeat over several years.</p>
Moderate to heavy	<p>Non-herbicide</p> <p>Solarisation over 1 year when in monocultures. Method works best in direct sunlight. May need to combine with touch up sprays with a herbicide to control any plants that have managed to poke through the tarping material or at edges.</p> <p>*Mowing 2 times a season with follow up spot spraying is the best integrated approach.</p> <p>Chemical</p> <p>Anticipate having to do two applications in one season to gain high levels of control. Late spring application followed by late summer or early fall (no later than mid-September.)</p> <p>Apply 2% Glyphosate (e.g. Round-up Ultra 2 or Weathermax). Imazapyr at similar concentrations more effective than Glyphosphate but also a more expensive product. After 2 or 3 weeks following application of Glyphosate, cut or mow down the stalks to stimulate the emergence and growth of other plants previously suppressed.</p> <p>In areas with sensitive species: A foliar spray can be applied or injected with a handheld or backpack sprayer with a nozzle into the cut stem. Stems can also be wicked with a wash glove soaked in Glyphosphate</p>

Other notes: Has known allelopathic effects on other wetland plants. Ontario Ministry of Natural Resources has completed a Phragmites Best Management Practices document which can be consulted for greater detail.

Reed canary grass (*Phalaris arundinacea*)

- See methods for common reed.

Other notes: Post treatment restoration recommendations – some success in the United States has been had with live staking areas treated by Glyphosate with aggressive native willow species 2 to 3 feet apart e.g. *Salix exigua*, *S. discolor*. This method reduced reed canary grass biomass by 56 to 68% respectively (Kim et al. 2007).

Rough manna grass (*Glyceria maxima*)

Habitat

- Nutrient rich, moist soils.
- *Glyceria maxima* is a wetland plant and does best along river banks and in fresh water (Global Invasive Species Database, 2009).

Reproduction and Dispersal

- Flowing water is the main seed dispersal method but livestock also play a lesser role.
- Dense populations use vegetative reproduction to spread into adjacent areas.
- Seed production occurs in summer and autumn.
- Most seeds tend to germinate immediately but some remain dormant for a few years (Global Invasive Species Database, 2009).

Suggested Method of Control

- Since *Glyceria maxima* grows in and around water herbicides should be used with precaution to ensure that impact on non target plants and organisms is minimal. Different surfactants in many different herbicide products have been shown to cause damage to fish and amphibians.

Infestation Level	Method/Management
Light	<p>Non-herbicide</p> <p>If removal is done by hand ensure that the roots are removed to avoid resprouting. Revisit to deal with resprouts.</p>
Moderate-Heavy	<p>Solarisation</p> <p>Dark plastic tarps or sheeting may be placed over patches. Leave in place for 2 seasons.</p> <p>Non-herbicide</p> <p>Cutting may be done in the fall to deplete carbohydrate stores utilized in spring growth. Cut areas may also be flooded to discourage regrowth (Nature Conservancy, 2009b)</p> <p>Herbicides like Glyphosate (e.g. Round-up) may be used with care at a 2% concentration.</p>

Other notes: Grazing is not encouraged since young shoots have high concentrations of cyanide (Nature Conservancy, 2009b). Most methods call for immediate revegetation with native species upon removal of *Glyceria maxima*.

Trees

Siberian elm (*Ulmus pumila*)

Habitat

- Disturbed woods, roadsides, pastures, alongside streams.
- Tolerant of poor soils and low moisture.

Reproduction and Dispersal

- Produces 1-seeded samaras that are wind dispersed.
- Seeds germinate readily and seedlings grow rapidly, forms thickets of hundreds of seedlings in bare ground.

Suggested Method of Control

Infestation level	Method/Management
Light to heavy	<p>Non-herbicide</p> <p>Small seedling can be removed by hand or with weed wrench. Girdling in late spring to mid summer effective if follow up occurs to deal with resprouting.</p> <p>Chemical</p> <p>Can also be controlled using cut stem applications of 20% Glyphosate (e.g. Roundup) in the fall.</p>

Manitoba maple (*Acer negundo*)

Habitat

- Disturbed woods (more often floodplains), roadsides, pastures.
- Tolerant of poor soils.

Reproduction and Dispersal

- Produces winged seeds that are wind dispersed.
- Seeds germinate readily and seedlings grow rapidly, forming monoculture woodlands.

Suggested Method of Control

Infestation level	Method/Management
Light to heavy	<p>Non-herbicide Hand wrenching if trees are still small and soil disturbance can be minimized. Girdling mostly ineffective as it resprouts heavily, follow up over several years needed to deal with resprouts.</p> <p>Chemical Girdling/cutting and application of 100% Glyphosate (e.g. Roundup) with paint brush (will require follow-up treatments to control resprouting) in fall.</p>

Norway maple (*Acer platanoides*)

Habitat

- Disturbed forests often associated in areas of development.
- Tolerant of poor soils and forms a dense canopy.

Reproduction and Dispersal

- Produces winged seeds that are wind dispersed.
- Seeds germinate readily and seedlings grow rapidly often replacing native maples as the dominant tree species.

Suggested Method of Control

Infestation level	Method/Management
Light to heavy	<p>Non-herbicide Hand wrenching or use of a weed wrench highly effective if trees are still small and soil disturbance can be minimized.</p> <p>Girdling can be effective on large trees (>25 cm DBH). Trees may take several years to die. Monitor over this period and re-girdle if needed.</p> <p>Chemical Girdling/cutting and application of 100% Glyphosate (e.g. Roundup) at the stump with paint brush (will require follow-up treatments to control resprouting) in fall. Basal bark application of 30% Triclopyr (e.g. Garlon) also effective. With large trees a second application may be needed.</p>

Tree-of-heaven (*Ailanthus altissima*)

- See methods for Norway maple.

Other notes: Post treatment restoration recommendations- studies have shown that in low light conditions shade tolerant species such as red maple can out-compete this species. Similarly in open conditions staghorn sumac has proven to out-compete tree-of-heaven (Huebner, 2007). This species is also known for its ability to sucker from root stock. Any method that allows for the cutting of the trunk seems to encourage root suckering. The City of Toronto is now experimenting with nicking the bark and applying a herbicide through these cuts to kill both the tree and suppress the biological triggers for root suckering.

Notes when using a basal bark application for Triclopyr (e.g. Garlon)

Basal bark treatments with triclopyr (e.g. Garlon) should not be used in temperatures over 80° F as chemical will volatize and drift.

Stem diameter	Species	Treatment
<15 mm	Buckthorn, Norway maple, Tree-of heaven	Paint 10 inches of stem, one side
15mm-50mm		Paint 10 inches of stem, both sides
>50 mm		Paint full circumference of stem
Any	Thicker barked species: Honeysuckle, Multiflora rose, Barberry, Oriental bittersweet	Cut stump and paint

(Table. Nature Conservancy. 2007)

Herbicide timing chart- Triclopyr and Glyphosphate

- Winter applications (see comments)
- Optimal timing
- Partly effective, but not optimal timing
- Not enough data, trials required

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APPENDIX 5: Tools and Equipment for Invasive Species Removal

Unless otherwise noted this appendix (text and photos) draws upon the following resource:

Miller, James H. 2003. Nonnative invasive plants of southern forests: a field guide for identification and control. Gen. Tech. Rep. SRS-62. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 93p. <<http://www.invasive.org/eastern/srs/control.html>>

DISCLAIMER: The below suggested control methods have been compiled from many sources.

Before using any pesticide you must ensure that the pesticide is registered by the Pest Management Regulatory Agency (has a Pest Control Products Act registration number) and is classified for use in Ontario. The pesticide label will provide instructions on how the pesticide can be used, what pests it may be used to control and safety equipment required. All label directions must be followed. It is an offence to use an unregistered or unclassified pesticide or to use a pesticide in contravention of the label directions. Licences and additional requirements under the Pesticides Act and Regulation 63/09 may also apply to the use of certain pesticides.

Tools shown below are provided with brief descriptions and examples of some supplier in Ontario/Canada. This manual is in no way endorsing specific products; they are listed as examples only.

Herbicide application

Although treating extensive inaccessible infestations may require broadcast treatments of herbicide sprays or pellets by helicopter or tractor mounted application systems, the best approach is usually selective applications of herbicides to target invasive plants while avoiding or minimizing application to desirable plants.

The selective methods described are

- directed foliar sprays,
- stem injection,
- cut-treat,
- basal sprays, and

Directed Foliar Sprays

Directed foliar sprays are herbicide-water sprays aimed at target plant foliage to cover all leaves to the point of run off, usually applied with a backpack sprayer (use low pressure, drift retardants, and spray shields to avoid drift). Herbicide application by directed foliar spray is the most cost effective method for treating most types of invasive plant species. With this method, herbicides are thoroughly mixed in water, often with a non-ionic surfactant, and applied to the foliage and growing tips of woody plants or to completely cover herbaceous plants. Foliar sprays are usually most effective when applied from midsummer to late fall, although spring and winter applications have use on specific plants and situations. Selective treatment is possible because the applicator directs the spray towards target plants and away from desirable plants. The addition of a water-soluble dye can assist in tracking treatment and detecting spray drift on desirable plants. Although dyes are messy and short-lived as a visible marker, they are helpful in training and tracking critical applications. Another safeguard is to only use foliar active herbicides, because directed sprays of soil-active herbicides can damage or kill surrounding plants when their roots are within the treatment zone. Never use herbicides with soil activity to treat invasive plants under desirable trees or shrubs.



Directed sprays are usually applied with a backpack sprayer and a spray wand equipped with a full cone, flat fan, or adjustable cone spray tip. These tips and spraying pressures of 20 to 30 pounds per square inch can ensure productivity with only a few fine droplets that may drift to surrounding plants. To safeguard surrounding plants from damage by spray drift, suspend applications during windy conditions. A spray shield that attaches to the end of the wand can further minimize drift. Adding a drift retardant to the spray mixture can eliminate drift although effectiveness may be diminished.

Plants up to 6 feet tall can be treated with this equipment, while the addition of a commercially available wand extension can slightly increase height capabilities. To treat plants up to about 18 feet tall, use higher spray pressures with a straight-stream or narrow flat fan tip.

Directed foliar sprays are also applied using wands on hoses attached to spraying systems mounted on all-terrain vehicles, trucks, or tractors. Also, a spray gun with a narrow flat fan tip can replace a wand for some applications. Another useful alternative for treating different sized woody plants is a spray gun with a swivel that holds two tips—narrow and wide-angled—that can be quickly changed during application.

Stem Injection

Stem injection (including hack-and-squirt) involves herbicide concentrate or herbicide-water mixtures applied into downward incision cuts spaced around woody stems



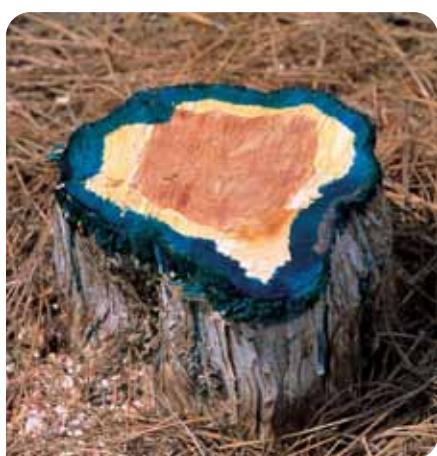
made by an axe, hatchet, machete, brush ax, or tree injector. Tree injection, including the hack-and-squirt technique, is a selective method of controlling larger trees and shrubs (more than 2 inches in diameter) with minimum damage to surrounding plants. It requires cuplike downward incisions spaced around the stem with a measured amount of herbicide applied into each of the incisions. Special tree injectors are available to perform this operation, or a

narrow-bit axe, hatchet, or machete along with a spray bottle can be used in sequence to perform the hack-and-squirt method. Completely filling the stem with edge-to-edge cuts or injections is required for very large stems or difficult-to-control species. The herbicide should remain in the injection cut to avoid wasting herbicide on the bark and to prevent damage of surrounding plants. Avoid injection treatments if rainfall is predicted within 48 hours.

Tree injection treatments are most effective when applied in late winter and throughout the summer. Heavy spring sap flow in spring can wash herbicide from incision cuts, making this an ineffective time to use this method.



Cut-Treat



Cut-treat involves herbicide concentrates or herbicide-water mixtures applied to the outer circumference of freshly cut stumps or the entire top surface of cut stems, applied with a backpack sprayer, spray bottle, wick, or paint brush. Freshly cut stems and stumps of woody stems, including canes and bamboo, can be treated with herbicide mixtures to prevent resprouting and to kill roots. Cutting is usually by chainsaw or brush saw, but can be accomplished by handsaws or cutting blades. To



minimize deactivation of the herbicide, remove sawdust from stumps before treatment. Treat stems and stumps as quickly as possible after cutting with a backpack sprayer or utility spray bottle for spray applications or a wick applicator, lab wash bottle, or paintbrush for small stems.

For stumps over 3 inches in diameter, completely wet the outer edge with the herbicide or herbicide mixture. Completely wet the tops of smaller stumps and all cut stems in a clump.

The most effective time for the stump spray method is late winter and summer. Although winter treatments are slightly less effective than growing season applications, the absence of foliage on cut stems and branches produces some offsetting gains in application efficiency.

Basal Sprays

Basal sprays are herbicide-oil-penetrant mixtures sprayed or daubed onto the lower portion of woody stems, usually applied with a backpack sprayer or wick applicator. Full basal treatments require that the lower 12 to 20 inches of target woody stems be completely wetted on all sides with an oil-based spray mixture. Application is to smooth juvenile bark. Full basal sprays are usually effective in controlling woody stems less than about 6 inches in diameter or larger diameters of susceptible species, before bark becomes thick, corky, and furrowed. The appropriate equipment for this treatment is a backpack sprayer with a wand or spray gun fitted with a narrow-angle flat fan, cone, or adjustable tip. A wick applicator can also be used.

Herbicides that are soluble in oil (e.g. Garlon 4) are mixed with a commercially available basal oil, vegetable oil or crop oil (avoid diesel fuel, or kerosene) Some herbicides are sold ready to use with these ingredients.

A modified method, streamline basal sprays, is effective for many woody species up to 2 inches in diameter, as well as trees and shrubs up to 6 inches in diameter if the species is susceptible. Equipment for this treatment is a backpack sprayer with a spray gun and a low-flow straight-stream or narrow-angle spray tip. To prevent waste, maintain pressure below 30 pounds per square inch with a pressure regulator. At this pressure, an effective reach of 9 feet is possible while bark splash is minimized. For treating stems less than 2 inches in diameter, apply the stream of spray up-and down single stems for about 6 to 8 inches, or apply across multiple stems creating 2- to 3-inch-wide bands. This same multiple band treatment can be effective on larger stems. Direct the spray stream to smooth juvenile bark at a point about 4 to 18 inches from the ground. Stems that are thick barked or near 3 inches in diameter require treatment on all sides.

Avoid ester herbicide formulations on hot days to prevent vapor drift injury to non-target plants.



Streamline basal spray (CVC)

Weed-wickers/Applicators

This is a great tool for herbicide application in situations where you need to avoid herbicide drift or are working around sensitive non-target plants. Most models have ball valves to control herbicide flow and various sized and shaped application sponges or fabric sleeves.

Rittenhouse is the supplier of the Wickweeder
1402 Fourth Ave., R.R. #3
St. Catharines, ON, Canada L2R 6P9
1-877-488-1914, email: consumersales@rittenhouse.ca



Basal bark application with a weed-wicker (CVC)

Mechanical Removal

Weed Wrenches



Various weed wrenches (CVC)

These tools are great for pulling out large shrubs up to 2 to 2 1/2 inches in diameter. There are a variety of them out there. Below are listed a couple of companies that supply such tools in Canada.

The Extractigator - <http://www.extractigator.com/>

The Pullerbear - <http://www.pullerbear.com/>

Tree girdlers

These tools remove a strip of bark away from a tree or shrub. The cut must be deep enough to remove the vascular cambium of the tree/shrub (a spongy inner layer of the bark). Depending on the species this will eventually starve it of nutrients and it will die over a period of a year or two. This type of wounding may allow also for the uptake of a herbicide through the wound that would not penetrate the bark such as a Glyphosphate product.



Tree girdlers (CVC)

Commercial Solutions - www.csinet.ca/field-forestry-mining-supply.php

True North Specialty Products - www.truenorthspecialty.com/english/Equipment/barkblaster.htm

Appendix 6: Resources and Contacts

Information Categories: 1. Restoration advice and assistance
 2. Potential funding
 3. Information on provincially or regionally rare species
 4. Invasive species information
 5. Reporting invasive species
 6. Native plant species information (plant identification, species lists, species habitat conditions, etc)
 7. Potential removal assistance

*Resources that have information specific to the Credit Valley watershed

Information Category	Organization	Contact Information	Description and Website Information (if applicable)
CONSULTANTS/NURSERIES			
1,6	Acorus Restoration	722 6th Conc. Rd RR#1 Walsingham, ON N0E 1X0 Tel: 519-586-2603 Email: info@ecologyart.com	Native plant source, information and advice: http://www.ecologyart.com/
1	Ecological Outlook and Ontario Parks Association	Authors: D. Havinga and J.M. Daigle Publishers: Ecological Outlook and Ontario Parks Association	<i>Restoring Natures Place</i> -A guide to naturalizing Ontario parks and greenspace.
1,6	Grow Wild	3784 Hwy # 7 Omemee, ON K0L 2W0 Nursery Address: 4735 Durham/York 30 Claremont, ON L1Y 1A3 Phone: 705-799-2619 Cell: 416-735-7490 No email – online contact form: http://www.grow-wild.com/contact.php	Native plant source, information and advice: http://www.grow-wild.com/
7	Lands & Forests Consulting	Head Office - Hanover Dave Taylor 421608 Con 6 NDR. R.R.#1, Elmwood, ON. N0G 1S0 Tel: 1-519-364-tree (8733) Toll free: 1-888-923-9995 Fax: 1-519-364-8736 Email: trees@bmts.com	Forestry and professional prescribed burn contractor: http://www.landsandforests.com/

Information Category	Organization	Contact Information	Description and Website Information (if applicable)
NON-GOVERNMENT ORGANIZATIONS			
4, 6	Canadian Wildlife Federation (CWF)	<p>350 Michael Cowpland Drive Kanata, ON K2M 2W1</p> <p>Tel: 1-800-563-9453 Fax: 613-599-4428</p> <p>No email - online contact form: http://www.cwf-fcf.org/en/contact-us/contact-us.html</p>	<p>Invasive species encyclopaedia which provides information about native and invasive ranges, invasion pathway, status, impacts and control measures: www.cwf-fcf.org/en/resources/encyclopedias/invasive-species/</p> <p>Wild About Gardening- A list of native plant suppliers for Ontario: www.wildaboutgardening.org/en/gab/section3/ontario/index.htm</p> <p>List of plants native to each region of Canada: old.wildaboutgardening.org/en/growing/section4/encyclopedia/index.asp</p>
1, 3	Eastern Ontario Model Forest	<p>P.O. Bag 2111 Kemptville ON K0G 1J0</p> <p>Tel.: (613) 258-8241 Fax.: (613) 258-8363</p> <p>Email: modelforest@eomf.on.ca</p>	<p>The Enhancing Species at Risk Habitat in Your Eastern Ontario Woodlot booklet is intended as a tool to assist landowners in enhancing species at risk habitat: http://www.eomf.on.ca/en/information-reports/publications/information-reports/page-2-10</p> <p>(Scroll down the page and click on "Click here to view")</p>
1, 4, 6	Evergreen	<p>355 Adelaide Street West, 5th Floor Toronto, ON M5V 1S2</p> <p>Tel: 416-596-1495 Toll free: 1-888-426-3138 Fax: 416-596-1443</p> <p>email: info@evergreen.ca</p>	<p>Native plant database: nativeplants.evergreen.ca/</p> <p>Invasive species fact sheets and profiles: www.evergreen.ca/en/resources/native-plants/fact-sheets.sn</p>
1, 3, 4, 6	Federation of Ontario Naturalists (FON)	<p>Head Office 366 Adelaide Street West, Suite 201 Toronto, ON M5V 1R9</p> <p>Tel: 416-444-8419 Toll free: 1-800-440-2366 Fax: 416-444-9866</p> <p>Email: info@ontarionature.org</p>	<p>Ontario Nature- An organization that protects wild species and wild spaces through conservation, education and public engagement: www.ontarionature.org/index.php</p> <p>A variety of downloadable fact sheets are also available: www.ontarionature.org/discover/resources/publications.php</p> <p>Habitat Creation with Native Plants www.ontarionature.org/discover/resources/PDFs/mis.../misc/habitat_creation.pdf</p> <p>Backyard Habitats www.ontarionature.org/discover/resources/PDFs/id.../id_guides/backyard.pdf</p> <p>Wetland Restoration and Rehabilitation www.ontarionature.org/discover/resources/PDFs/mis.../misc/wetland_restoration.pdf</p> <p>Natural Invaders www.ontarionature.org/discover/resources/PDFs/id.../id_guides/natural_invaders.pdf</p> <p>Species at Risk in Ontario www.ontarionature.org/discover/resources/PDFs/id.../id_guides/SAR_brochure.pdf</p>

Information Category	Organization	Contact Information	Description and Website Information (if applicable)
NON-GOVERNMENT ORGANIZATIONS			
4, 6	Lake Huron Centre for Coastal Conservation	P.O. Box 178, Blyth, ON N0M 1H0 Phone: (519) 523-4478 Email: coastalcentre@lakehuron.on.ca	Information on invasive species, with a focus on species that are having serious impact on Lake Huron's ecology: http://lakehuron.ca/index.php?page=invasive-species Importance of native plants: http://lakehuron.ca/index.php?page=importance-of-native-plants
1	Landscape Ontario*	7856 Fifth Line South Milton, ON L9T 2X8 Tel: (905) 875-1805 Fax: (905) 875-3942	Lists landscaping companies in Ontario who provide professional service and whose principles include to respect and improve the environment: www.landscapeontario.com
3,4	Nature Canada	Tel: 1-800-267-4088 Email: info@naturecanada.ca	Discusses endangered species and species at risk in Canada, with select profiles on some species: http://www.naturecanada.ca/endangered.asp Brief general information about invasive species mentioned as a threat to parks and natural areas. Does highlight a few invasive species: http://www.naturecanada.ca/parks_cons_invasive.asp
4	NatureServe	N/A	Invasive species database – A search engine for invasive species: www.natureserve.org/explorer/servlet/NatureServe
1, 6	North American Native Plant Society (NANPS)	PO Box 84, Station D Etobicoke, ON M9A 4X1 Voicemail: (416) 631-4438 Email: nanps@nanps.org	Information about why native plants should be used and how to start gardening with native plants: www.nanps.org A variety of fact sheets about native plant species and gardening: www.nanps.org/index.php/resources/publications Butterfly Gardening: Attracting Butterflies to Gardens in the Great Lakes Watershed www.nanps.org/pdfs/butterfact.pdf Native Plant Gardening: An Introduction to the Benefits of Landscaping with Nature www.nanps.org/pdfs/nativefact.pdf Native Trees: For Gardeners in the Great Lakes Watershed www.nanps.org/pdfs/treefact.pdf

Information Category	Organization	Contact Information	Description and Website Information (if applicable)
NON-GOVERNMENT ORGANIZATIONS			
4, 6	Ontario Invasive Plant Council (OIPC)	P.O. Box 2800 4601 Guthrie Drive Peterborough, ON K9J 8L5 Tel: 705 - 748-6324 ext 243 Fax: 1-705-748-9577	<p>A non-profit, multi-agency organization in response to the threat of invasive plants providing information regarding invasive plants and links to other websites related to invasive plants and native plants: www.ontarioinvasiveplants.ca</p> <p>A variety of fact sheets regarding invasive species: www.ontarioinvasiveplants.ca/index.php/publications</p> <p>Quick reference Guide to Invasive Plant Species- A selection of common invasive plants, with details on how to identify them. This is also available from Credit Valley Conservation's invasive website. www.ontarioinvasiveplants.ca/files/Invasive_speciesCards_CVC_HR_sm.pdf</p> <p>A Landowner's Guide to Controlling Invasive Woodland Plants- A guide detailing how to deal with a selection on invasive species (in partnership with: Ontario Federation of Angler's and Hunters, Oak Ridges Moraine Foundation, Victoria Land and Water Stewardship Council and the Government of Ontario): www.ontarioinvasiveplants.ca/files/LandownerGuideInvasive_species_web.pdf</p>
PUBLIC INSTITUTIONS			
4,6	Canadian Biodiversity Web Site	N/A	<p>Provides general information on native and invasive species: http://canadianbiodiversity.mcgill.ca/english/species/index.htm</p>
4	Canadian Botanical Conservation Network, Royal Botanical Gardens	Royal Botanical Gardens Attention: Dr. David Galbraith P.O. Box 399 Hamilton, ON L8N 3H8 Tel: 1-905-527-1158, ext. 309 Fax: 1-905-577-0375	<p>Has lists of invasive plants in Canada, providing information on such things as species description, habitat, provincial locations, control methods: http://www.rbg.ca/cbcn/en/projects/invasive_species/i_list.html</p>
4,6	Canadian Museum of Nature	240 McLeod Street Ottawa, ON K1P 6P4 (613) 566-4700 Tel: 613.566.4700 1.800.263.4433 Email: questions@mus-nature.ca	<p>On their Native Plant Crossroads website there is information native and invasive plants: http://nature.ca/plnt/index_e.cfm</p>

Information Category	Organization	Contact Information	Description and Website Information (if applicable)
PUBLIC INSTITUTIONS			
1, 6	Centre for Land and Water Stewardship, University of Guelph	Richards Building, University of Guelph Guelph, ON N1G 2W1 Tel: 519-824-4120 ext.58329 Email: claws@uoguelph.ca	Publications for the identification and management of woodland plants: www.uoguelph.ca/~claws/newsite/publications.html
4	University of Georgia, Center for Invasive Species and Ecosystem Health	The University of Georgia P.O. Box 748 4601 Research Way CPES 113 Administration Building Tifton, Georgia 31793 Phone: 229-386-3298 Fax: 229-386-3352 There are many emails listed online, therefore check this link for contacts: http://www.bugwood.org/ContactUs.html	Information on how to identify, control and report invasive species (although reporting is for the US), as well as videos and distribution maps (also of the US only): http://www.invasive.org/
BOOKS/MANUALS/FACT SHEETS			
1,4	DCNR Invasive Exotic Plant Tutorial for Natural Land Managers, Mid-Atlantic Exotic Pest Plant Council	Steve Young 5617 5th St. S. Arlington, VA 22204 Email: steveyoung[at]aol.com	Provides fact sheets, management and control information on listed invasive species: http://www.dcnr.state.pa.us/forestry/invasivetutorial/List.htm
6	N/A	Authors: D. Bennet and T. Tiner Publisher: McClelland & Stewart Ltd.	<i>Wild City: A guide to nature in urban Ontario, from termites to coyotes</i> - Provides natural histories of most of the common plants and wildlife found in Ontario's cities.
6	N/A	Authors: J. Diekelmann and R. Schuster. Publisher: The University of Wisconsin Press	<i>Natural Landscaping: Designing with Native Plant Communities</i> -Provides basic guidance in using native plants in landscaping, from planning and landscaping to planting.
6	N/A	Author: L. Johnson Publisher: Whitecap Books	<i>100 Easy-to-grow Native Plants for Canadian Gardeners</i> - Native species information and list of native nurseries.
6	N/A	Author: L. Johnson Publisher: Random House of Canada	<i>Grow Wild</i> - Provides information on low-maintenance and sure-success gardening with native plants
6	N/A	Author: D.W. Tallamy Publisher: Timber Press	<i>Bringing Nature Home</i> - Provides information on how to sustain wildlife with native plants. It also includes lists of native plants for region habitats.
4	N/A	Authors: S.R. Kaufman and W. Kaufman Publisher: Stackpole Books	<i>Invasive Plants</i> -A guide to identification and the impacts and control of common North American species.
4	N/A	Authors: R.K. Kohli, H.P. Singh and D.R. Batish Publisher: CRC Press, Taylor & Francis Group	<i>Invasive Plants and Forest Ecosystem</i> -Provides a foundation in invasive ecology, discusses the impacts on invasive species on natural systems and management tools for controlling invasive species.

Information Category	Organization	Contact Information	Description and Website Information (if applicable)
MUNICIPAL LEVEL ORGANIZATIONS			
1, 4, 6, 7	City of Toronto – Urban Forestry Services	Tel (Toronto city limits): 311 Tel (outside city limits): 416-392-2489 Fax: 416-338-0685 Email: 311@toronto.ca	Urban Forestry Services site provides information on native, invasive and endangered species, tree planting, by-laws and policies: http://www.toronto.ca/trees/ Fact sheet on controlling invasive plants: www.toronto.ca/trees/pdfs/Fact_3_Controling_Invasive_Plants.pdf Fact sheet on how to select and buy native plants, as well as plant soil and light requirements: www.toronto.ca/trees/pdfs/Fact_2_How_to_Select_and_Buy_Native_Plants.pdf
1, 3, 4, 5, 6	Conservation Halton	2596 Britannia Road West Burlington, ON L7P 0G3 Tel: 905-336-1158 Fax: 905-336-7014	<i>Lands and Forestry</i> - Provides information on their tree planting program, as well as information on Emerald Ash Borer and Gypsy Moth: ShowCategory.cfm?subCatID=787">http://www.conservationhalton.on.ca>ShowCategory.cfm?subCatID=787 <i>Species at Risk</i> - Information on species at risk, including a species list and reporting form: ShowCategory.cfm?subCatID=1328">http://www.conservationhalton.on.ca>ShowCategory.cfm?subCatID=1328 <i>Invasive Exotics</i> - Information on invasive species, including native and invasive species lists and a giant hogweed factsheet: ShowCategory.cfm?subCatID=1114">http://www.conservationhalton.on.ca>ShowCategory.cfm?subCatID=1114
1, 4, 5, 6, 7	Credit Valley Conservation (CVC)*	1255 Old Derry Road Mississauga, ON L5N 6R4 Tel: 905-670-1615 or 1-800-668-5557 Fax: 905-670-2210	<i>Stewardship programs and service</i> - Information on the different programs and services provided, including tree planting, ecological landscaping/gardening and restoration resources: http://www.creditvalleycons.com/programsandservices/stewardship.htm Information about what invasive species are, lists of types of invasive plants, and methods of control for invasive plants: www.creditvalleyca.ca/invasive_species <i>Caring for Your Land and Water</i> - A variety of fact sheets covering topics including natural gardening: www.creditvalleyca.ca/programsandservices/caringforyourland.htm List of ecological/landscape companies that can help landowners plan what they want for their property: www.creditvalleyca.ca/landscaping/downloads/EcologicalServiceProvider.pdf List of native plant nurseries for southern Ontario: www.creditvalleycons.com/landscaping/downloads/CVCNativePlantNurseries.pdf

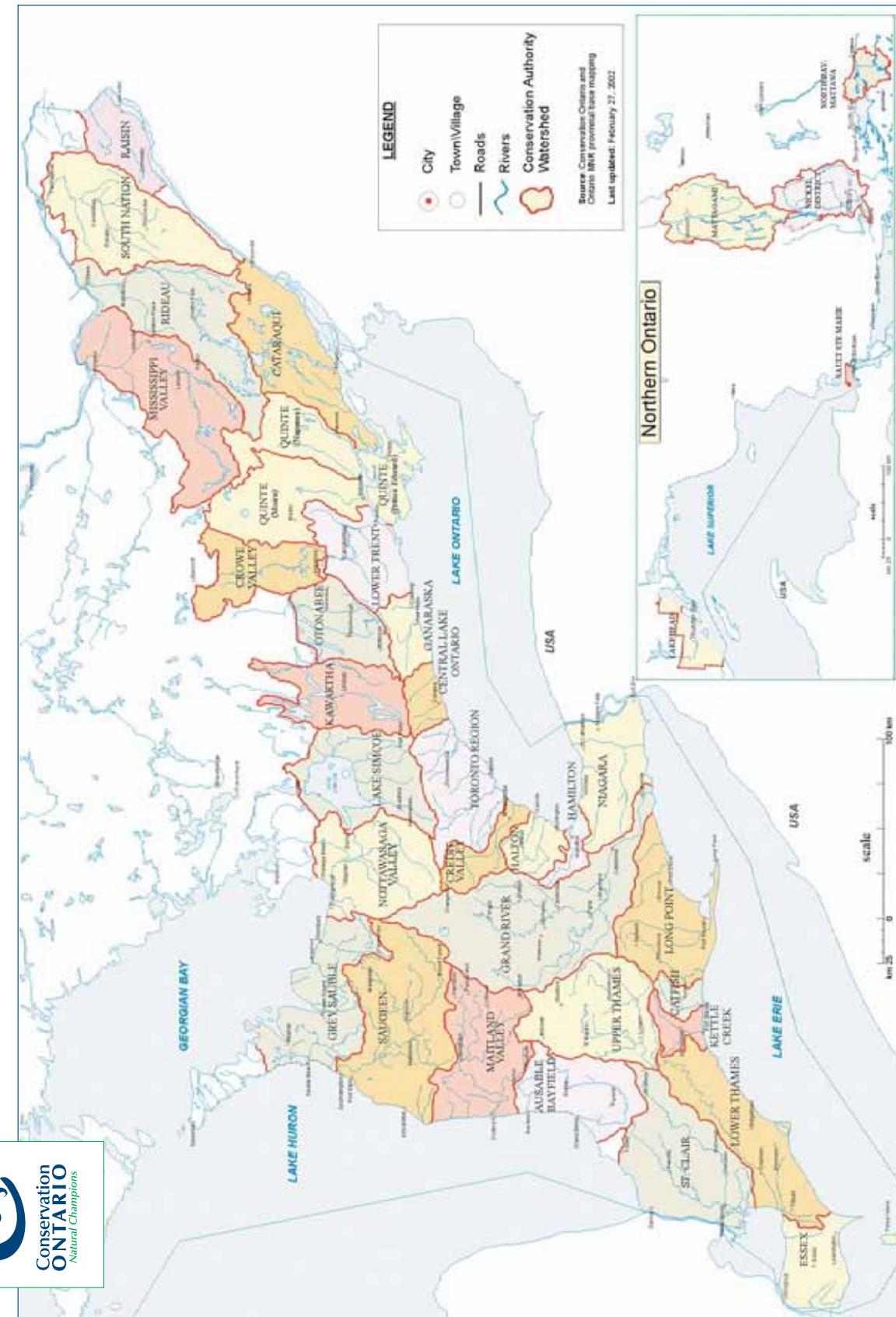
Information Category	Organization	Contact Information	Description and Website Information (if applicable)
MUNICIPAL LEVEL ORGANIZATIONS			
1, 4	Grand River Conservation Authority (GRCA)	400 Clyde Road, PO Box 729 Cambridge, ON N1R 5W6 Tel: 519-621-2761 Toll free: 1-866-900-4722 Fax: 519-621-4844 Email: grca@grandriver.ca	<i>Tree Planting</i> - Provide support for tree planting projects on private lands. http://www.grandriver.ca/index/document.cfm?Sec=48&Sub1=4 <i>Invasive Species</i> - Information on invasive species, and GRCA's forest management of invasive species: http://www.grandriver.ca/index/document.cfm?Sec=48&Sub1=6&Sub2=0
1, 6	Toronto and Region Conservation Authority (TRCA)	5 Shoreham Drive Downsview, ON M3N 1S4 Tel: (416) 661-6600 Fax: (416) 661-6898 Email: info@trca.on.ca	<i>Community Stewardship Program</i> - Provides programs including hands-on demonstrations, workshops, nature walks, planting and clean-up activities: http://trca.on.ca/get-involved/stewardship/index.dot <i>Healthy Yards Program</i> – Provides information and resources to help landowners create natural gardens using native plants: www.trca.on.ca/get-involved/stewardship/healthy-yards-program
1,4,6	Upper Thames River Conservation	1424 Clarke Road London, ON N5V 5B9 Tel: 519-451-2800 Fax: 519-451-1188	Information on invasive species: http://www.thamesriver.on.ca/invasive_species/Invasive_species.htm Tree planting program: http://www.thamesriver.on.ca/Stewardship_Grants/forestry.htm Information on native species, including what species to plant and gardening with natives: http://www.thamesriver.on.ca/Native_species/nativespecies.htm
PROVINCIAL AGENCIES			
1, 2, 3, 4, 5, 6	Conservation Ontario	Box 11, 120 Bayview Parkway Newmarket, ON L3Y 4W3 Tel: 905-895-0716 Fax: 905-895-0751 Email: info@conservationontario.ca	A list of all of Ontario's 36 conservation authorities based on the watershed. This provides links to all the conservation areas that can provide support for landowners in protecting and enhancing the natural areas of their properties. They also provide workshops, educational programs and volunteer events throughout their watersheds: www.conservation-ontario.on.ca/about/cas.html
2,3,4,6	Great Lakes Information Network	N/A	Information on various topics: <i>Endangered species</i> : http://www.great-lakes.net/envt/flora-fauna/endanger.html <i>Invasive species</i> : http://www.great-lakes.net/envt/flora-fauna/invasive/invasive.html <i>Plants of the Great Lakes Region</i> : http://www.great-lakes.net/envt/flora-fauna/plants.html <i>Funding and Grants in the Great Lakes Region</i> : http://www.great-lakes.net/infocenter/news/funding.html

Information Category	Organization	Contact Information	Description and Website Information (if applicable)
PROVINCIAL AGENCIES			
1, 2, 3, 4, 6	Ontario Ministry of Natural Resources (OMNR)*	<p>Main Office 300 Water Street, P.O. Box 7000 Peterborough, ON K9J 8M5</p> <p>Tel: 1-800-667-1940</p> <p>No email - online contact form: http://www.mnr.gov.on.ca/en/ContactUs/index.html</p>	<p>A list of the MNR District Offices: www.mnr.gov.on.ca/en/ContactUs/2ColumnSubPage/STEL02_179002.html</p> <p>Downloadable fact sheets covering a variety of restoration related topics including preserving natural shorelines, managing forests and naturalizing your back yard: www.lrconline.com/Extension_Notes_English/index.html</p> <p>Tax incentive programs:</p> <p><i>Community Fisheries and Wildlife Involvement Program (CFWIP)</i> http://www.mnr.gov.on.ca/en/Business/LetsFish/2ColumnSubPage/STEL02_166030.html</p> <p><i>Conservation Lands Tax Incentive Program</i> http://www.mnr.gov.on.ca/en/Business/CLTIP/2ColumnSubPage/291172.html</p> <p><i>Managed Forest Tax Incentive Program</i> http://www.mnr.gov.on.ca/en/Business/Forests/Publication/MNR_E000245P.html</p> <p><i>Species at Risk Farm Incentive Program</i> http://www.mnr.gov.on.ca/en/Newsroom/LatestNews/258625.html</p> <p>Description of what a species at risk (SAR) is, as well as a list of the SAR in Ontario: www.mnr.gov.on.ca/en/Business/Species/index.html</p> <p>A list of species at risk (SAR) in Ontario: www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/276722.html</p> <p>Lists of SAR in Ontario by region*: www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/246809.html</p> <p><i>Invading Species Program</i> (In partnership with the Ontario Federation of Anglers and Hunters) see <i>Ontario Federation of Anglers and Hunters</i></p>
3, 6	Natural Heritage Information Centre (NHIC)*	Email: nhicrequests@ontario.ca	Compiles, maintains and distributes information on natural species, plant communities and spaces of conservation concern in Ontario: nhic.mnr.gov.on.ca/MNR/nhic/nhic.cfm
4, 5	Ontario Federation of Anglers and Hunters (OFAH)	<p>4601 Guthrie Drive, P.O. Box 2800 Peterborough, ON K9J 8L5</p> <p>Tel: 705-748-6324 Fax: 705-748-9577</p> <p>Email: info@invadingspecies.com</p>	<p><i>Invading Species Awareness Program</i> (In partnership with the Ministry of Natural Resources) – Information about various types of invasive species, downloadable fact sheets, an invasive species online reporting system and hotline (Reporting Hotline: 1-800-563-7711): www.invadingspecies.com</p> <p><i>Invasive Tracking System</i> : A web based reporting and networking tool designed to allow users to create, view and download invasive species sighting reports and maps: http://www.invasivestrackingsystem.ca</p>

Information Category	Organization	Contact Information	Description and Website Information (if applicable)
PROVINCIAL AGENCIES			
1, 2, 4	Ontario Stewardship	P.O. Box 7000 300 Water Street 4th floor, South Tower Peterborough, ON K9J 8M5 stewardship@ontario.ca	Provides a list of all of the stewardship councils in Ontario: www.ontariostewardship.org/index.php/local_council <i>Species at Risk Stewardship Fund</i> – A fund open to individuals and groups in support of stewardship activities that will improve the status of SAR and their habitats: www.ontariostewardship.org/index.php/financial_suport_incentives
4	Stewardship Network of Ontario	Email: info@stewardshipcentre.on.ca	A variety of information about invasive species and ways to contribute to fighting them: www.stewardshipcentre.on.ca
FEDERAL AGENCIES			
4	Canadian Food Inspection Agency (CFIA)	National Headquarters 1400 Merivale Road Ottawa, ON K1A 0Y9 Tel: 1-800-442-2342 no email - online contact form: http://www.inspection.gc.ca/english/tools/feedback/commene.shtml <i>Southwest</i> 1200 Commissioners Rd E, Unit 19 London, ON N5Z 4R3 Tel: 519-691-1300 Fax: 519-691-1314 <i>Central</i> 259 Woodlawn Road, West Suite A Guelph, ON N1H 8J1 Tel: 519-837-5817 Fax: 519-837-9774 <i>Toronto</i> 1124 Finch Avenue West, Unit 2 Downsview, ON M3J 2E2 Tel: 416-665-5055 Fax: 416-665-5069 and 416-667-4965 <i>North East</i> Unit 7 - 38 Auriga Dr. Nepean, ON K2E 8A5 Tel: 613-946-7897 Fax: 613-946-7902	Information about invasive plants as well as acts and regulations pertaining to invasive species: http://www.inspection.gc.ca/english/plaveg/invenv/invenve.shtml A summary report providing information such as the history of invasive plants, the economic, environmental and social impacts of invasive plants, and Canada's response to invasive plants: www.inspection.gc.ca/english/plaveg/invenv/techrpt/summrese.shtml <i>Invasive Alien Species Partnership Program</i> (Administered by Environment Canada and in partnership with Fisheries and Oceans Canada): see Environment Canada

Information Category	Organization	Contact Information	Description and Website Information (if applicable)
PROVINCIAL AGENCIES			
2, 4	Environment Canada	Inquiry Centre 351 St. Joseph Boulevard Place Vincent Massey, 8th Floor Gatineau, Quebec K1A 0H3 Tel: 1-800-668-6767 Email: enviroinfo@ec.gc.ca	<p>General information about what alien species are and Canada's response to them: www.ec.gc.ca/eee-ias/</p> <p><i>Invasive Species Web Portal</i> – information about invasive species, what people can do to help as well as a means of browsing or searching various invasive species related topics: www.invasive species.gc.ca</p> <p><i>Invasive Alien Species Partnership Program</i> (in partnership with Canadian Food Inspection Agency and Fisheries and Oceans Canada)- The strategy for combating alien species providing funding for provinces, municipalities, educational institutions, non-government organizations and other groups who are working to prevent, detect and manage invasive alien species:</p> <p>www.ec.gc.ca/eee-ias/Default.asp?lang=En&n=A49893BC-1</p> <p><i>Invasive Plants of Natural Habitats in Canada</i> - A review of wetland and upland species and the legislation governing their control:</p> <p>www.ec.gc.ca/eee-ias/78D62AA2-55A4-4E2F-AA08-538E1051A893/invasive species.pdf</p>

Appendix 7: Conservation Authorities of Ontario





**Conservation
ONTARIO**
Natural Champions

CONSERVATION ONTARIO

CONSERVATION AUTHORITIES OF ONTARIO

120 BAYVIEW PARKWAY, BOX 11
NEW MARKET, ON L3Y 4V3

info@conservation-ontario.on.ca

www.conservation-ontario.on.ca

Conservation Authority	Address	Telephone	Fax	E-mail	Website
Ausable Bayfield Conservation Authority	71108 Morrison Line, RR 3, Exeter, ON N0M 1S5	519-235-2610	1-888-288-2610	519-235-1963	info@abca.on.ca
Cataraqui Region Conservation Authority	Box 160, 1641 Perth Road, Glenburnie, ON K0H 1S0	613-546-4228		613-547-6474	circa@cataraquiregion.on.ca
Catfish Creek Conservation Authority	RR 5, Aylmer, ON N5H 2R4	519-773-9037		519-765-1489	ccca@execulink.com
Central Lake Ontario Conservation	100 Whiting Avenue, Oshawa, ON L1H 3T3	905-579-0411		905-579-0994	mail@cloca.com
Conservation Halton	2596 Britannia Road West, RR 2, Milton, ON L9T 2X6	905-336-1158		905-336-7014	admin@hrc.ca
Credit Valley Conservation	1255 Old Derry Road, Mississauga, ON L5N 6R4	905-670-1615	1-800-668-5557	905-670-2210	cvc@creditvalleycons.com
Crowe Valley Conservation	70 Hughes Lane, Box 416, Marmora, ON K0K 2M0	613-472-3337		613-472-5516	info@crowevalley.com
Essex Region Conservation Authority	360 Fairview Avenue West, Essex, ON N8M 1Y6	519-776-5209		519-776-8688	admin@erca.org
Greater Sudbury Conservation Authority	P.O. Box 328, Port Hope, ON L1A 3W4	905-885-8173		905-885-9824	info@grca.on.ca
Grand River Conservation Authority	400 Clyde Road, Box 729, Cambridge, ON N1R 5W6	519-621-2761		519-621-4844	grca@grandriver.ca
Grey Saugeen Conservation Authority	RR 4, Owen Sound, ON N4K 5M6	519-376-3076		519-371-0437	admin@greyaugeen.ca
Hamilton Conservation Authority	838 Mineral Springs Rd, Box 7099, Ancaster, ON L9G 3L3	905-525-2181		905-648-4622	nature@conservationhamilton.ca
Kawartha Conservation	2777 Kenrei Park Road, RR 1, Lindsay, ON K9V 4R1	705-328-2271		705-328-2286	geninfo@kawarthaconservation.com
Kettle Creek Conservation Authority	44015 Ferguson Line, R.R. 8, St. Thomas, ON N5P 3T3	519-631-1270		519-631-5026	bryan@kettlecreekconservation.on.ca
Lakehead Region Conservation Authority	Box 10427, 130 Conservation Rd, Thunder Bay, ON P7B 6T8	807-344-5857		807-345-9156	lakecca@thaytel.net
Lake Simcoe Region Conservation Authority	Box 282, 120 Bayview Parkway, Newmarket, ON L3Y 4Y1	905-885-1281		905-885-5881	info@lsica.on.ca
Long Point Region Conservation Authority	RR 3, Simcoe, ON N3Y 4K2	519-428-4623		519-428-1520	conservation@lprca.on.ca
Lower Thames Valley Conservation Authority	100 Thames Street, Chatham, ON N7L 2Y8	519-354-7310		519-352-3435	lvcvae@mts.net
Lower Trent Conservation	441 Front Street, Trenton, ON K8V 6C1	613-394-4829		613-394-5226	information@ltc.on.ca
Maitland Valley Conservation Authority	Box 127, 93 Marietta Street, Wroxeter, ON N0G 2X0	519-335-3557		519-335-3516	matland@mrvca.on.ca
Mattagami Region Conservation Authority	100 Lakeshore Road, Timmins, ON P4N 8R5	705-360-1382		705-360-1334	mrcat@city.timmins.on.ca
Mississippi Valley Conservation	Box 268, Lanark, ON K0G 1K0	613-259-2421		613-259-3468	info@mvic.on.ca
Niagara Peninsula Conservation Authority	250 Thorold Road West, 3rd Floor, Welland, ON L3C 3W2	905-788-3135		905-788-1121	npca@conservation-niagara.on.ca
Nickel District Conservation Authority	Tom Davies Square, 200 Brady Street, Sudbury, ON P3E 5K3	705-674-5249		705-674-7839	ndca@city.greatersudbury.on.ca
North Bay-Mattawa Conservation Authority	701 Oak Street East, North Bay, ON P1B 9T1	705-474-5520		705-474-9793	nbmca@nbmca.on.ca
Nottawasaga Valley Conservation Authority	8195 8th Line, Utopia, ON L0M 1T0	705-424-1479		705-424-2115	admin@nvca.on.ca
Otonabee Conservation	250 Millroy Drive, Peterborough, ON K9H 7M9	705-745-791		705-745-7488	otonabee@otonabee.com
Quinte Conservation	R.R. #2 2061 Old Hwy 2, Belleville, ON K8N 4Z2	613-968-3434		613-968-8240	quinteca@quintecconservation.ca
Raisin Region Conservation Authority	P.O. Box 429, 18045 County Road 2, Cornwall, ON K6H 5T2	613-938-3611		613-938-3221	info@rrca.on.ca
Rideau Valley Conservation Authority	Box 599, 1128 Mill Street, Manotick, ON K4M 1A5	613-692-3371		613-692-0331	postmaster@rideauvalley.on.ca
Saugeen Conservation	RR 1, Hanover, ON N4N 3B8	519-364-1255		519-364-6990	publicinfo@svca.on.ca
Sault Ste Marie Region Conservation Authority	1100 Fifth Line East, RR 2, Sault Ste Marie, ON P6A 5K7	705-946-8530		705-946-8533	nature@ssmrc.ca
South Nation Conservation	Box 69, 15 Union Street, Barwick, ON K0C 1G0	613-984-2948		613-984-2872	info@nation.on.ca
St. Clair Region Conservation Authority	205 Mill Pond Crescent, Stratford, ON N7G 3P9	519-245-3710		519-245-3348	stclair@scra.on.ca
Toronto and Region Conservation Authority	5 Shoreham Drive, Downsview, ON M3N 1S4	416-661-6800		416-661-6898	info@trca.on.ca
Upper Thames River Conservation Authority	1424 Clarke Road, London, ON N5Y 5B9	519-451-2800		519-451-1188	info@thamesriver.on.ca

Appendix 8: Ontario Ministry of the Environment – Regional Offices

REGION County/Township	REGIONAL OFFICE Mailing Address	Telephone/Toll Free/Fax
Central Region: Toronto, Halton, Peel, York, Durham, Simcoe and Muskoka	5775 Yonge St, 8th Floor Toronto, ON M2M 4J1	Tel (416) 326-6700 Toll Free 1-800-810-8048 Fax (416) 325-6347
West-Central Region: Haldimand, Norfolk, Niagara, Hamilton-Wentworth, Dufferin, Wellington, Waterloo and Brant	119 King St. W., 12th Floor Hamilton, ON L8P 4Y7	Tel (905) 521-7640 Toll Free 1-800-668-4557 Fax (905) 521-7820
Eastern Region: Frontenac, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville, Prescott & Russell, Stormont/Dundas & Glengarry, Peterborough, Kawartha Lakes, Northumberland, Renfrew, Ottawa, Lanark, District of Nipissing (Twp. of South Algonquin) and Haliburton	1259 Gardiners Road, Unit 3 Kingston ON K7P 3J6	Tel (613) 549-4000 Toll Free 1-800-267-0974 Fax (613) 548-6908
Southwestern Region: Elgin, Middlesex, Oxford, Essex, Kent, Lambton, Bruce, Grey, Huron and Perth	733 Exeter Rd. London, ON N6E 1L3	Tel (519) 873-5000 Toll Free 1-800-265-7672 Fax (519) 873-5020
Northern Region (east): Manitoulin, Nipissing, Parry Sound, Sudbury, Algoma (East), Timiskaming and Sault Ste. Marie	199 Larch Street, Ste 1101 Sudbury, ON P3E 5P9	Tel (705) 564-3237 Toll Free 1-800-890-8516 Fax (705) 564-4180
Northern Region (west): Algoma (West), Cochrane, Kenora, Rainy River, Timmins and Thunder Bay	435 James St. S., Suite 331 Thunder Bay ON P7E 6S7	Tel (807) 475-1205 Toll Free 1-800-875-7772 Fax (807) 475-1754

