Niagara River Corridor Conservation Action Plan
Executive Summary

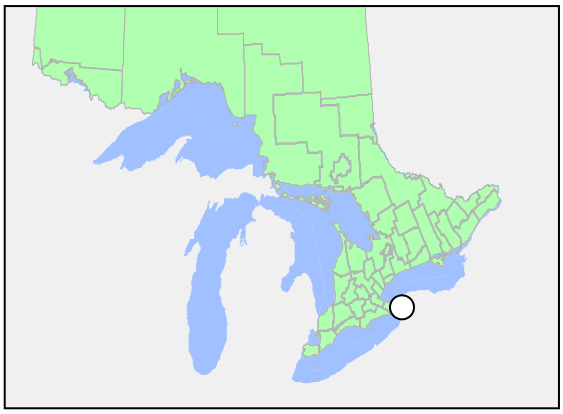
Vision Statement

The Niagara River Corridor supports a full range of healthy terrestrial and aquatic habitats, including characteristic Niagara Escarpment features, Carolinian deciduous upland and lowland forests, dry oak woodlands, prairies and savannahs, seepage zones, marshes, and riparian and aquatic ecosystems. Species At Risk thrive in secure habitats, which contribute to the overall connected matrix of natural cover. Natural heritage systems are restored in order to connect fragmented natural areas, and river and stream corridors. Stewardship and site management focuses on further conserving and enhancing the biodiversity values of the area. The local community takes pride in the natural beauty and health of the area, and members from all sectors and backgrounds participate in stewardship and conservation. Relationships between conservation partners are strong and reciprocal, allowing for maximum success in conservation efforts across the interconnected, ecologically functional landscape.

Goals

1. To maintain existing and establish new functional ecological linkages between core natural areas.
2. To complete securement of core natural areas.
3. To maintain and recover viable populations of Species At Risk and restore their habitats.
4. To improve water quality and aquatic habitats.
5. To manage invasive species populations so no net increase in their extent occurs.
6. To strategically increase natural cover through restoration to reconnect fragmented woodlands, wetlands and riparian corridors.
7. To direct incompatible development and land uses away from natural areas.
8. To enhance community support and understanding of the Niagara River Corridor CAP area.
9. To encourage and support local policies that promote conservation.
10. To enhance information and monitoring of biodiversity values, natural processes and threats.
11. To support and enhance conservation partnerships across the Niagara River Corridor CAP area.

Conservation Context and Rationale



The Niagara River Corridor CAP area (Figures 1 and 2) covers approximately 20,000 ha (200 km^2) extending between Lake Ontario in the north and Lake Erie in the South. The Welland Canal and the Niagara River form its western and eastern boundaries, respectively. The area supports plants and animals characteristic of the Carolinian life zone, many of which are provincially, nationally and globally rare. At least 24 federally- and provincially-designated Species At Risk (SAR) have been recorded in the area within the past 30 years, with an additional 14 or more having occurred historically. Although its urban areas are intensively developed, the Niagara River Corridor includes some of the most

biologically diverse natural areas in the Golden Horseshoe, Canada's most densely-populated region. Within the CAP area are a number of Provincially Significant Wetlands (PSWs) and Areas of Natural and Scientific Interest (ANSIs), several conservation authority areas, and approximately 300 ha of natural area protected by the Niagara Parks Commission.

With the support of Environment Canada's Habitat Stewardship Program and the provincial Species At Risk Stewardship Fund, a collaborative effort between the Carolinian Canada Coalition, Ontario Ministry of Natural Resources, Ontario Parks, Niagara Peninsula Conservation Authority, Niagara Land Trust, Department of Fisheries and Oceans, Trees Unlimited, The Nature Conservancy of Canada, Regional Municipality of Niagara, Bert Miller Nature Club, Niagara Restoration Council, Ontario Power Generation, Welland River Keepers, as well as other groups, will aim to achieve community outreach, landowner contacts, field research, and conservation and restoration successes over the long term.

Biodiversity Targets

1. Marshes and Shorelines
2. Upland Deciduous Forests
3. Lowland Swamp Forests
4. Lakes, Rivers, Streams and Riparian Ecosystems
5. Edges, Thickets and Fields
6. Dry Oak Woodlands, Prairies, Savannahs and Seepage Fens
7. Ecological Services on Rural Lands
8. Habitat in Drains

Conservation Targets	Nested Targets (confirmed and potential)
1. Marshes and Shorelines	American Water-willow, Swamp Rose Mallow (X), Blanding's Turtle, Lake Chubsucker (X), Grass Pickerel, Common Snapping Turtle
2. Upland Deciduous Forests	Hooded Warbler, Spoon-leaved Moss, White Wood Aster, Dwarf Hackberry, Shumard Oak, Broad Beech Fern, Butternut, American Chestnut, Red Mulberry, Round-leaved Greenbrier, Allegheny Mountain Dusky Salamander, Northern Dusky Salamander, Common Gray Fox, American Columbo (X), American Ginseng (X), Southern Flying-squirrel (?), Cerulean Warbler (X?), Woodland Vole (?),Timber Rattlesnake (X); Seepage Zones: Allegheny Mountain Dusky Salamander, Northern Dusky Salamander
3. Swamp / Lowland Forests	Seepage zones; older-growth and interior forest; Broad Beech Fern, Cucumber Tree, Green Dragon, False Hop Sedge (?), Drooping Trillium (X)
4. Lakes, Rivers and Streams	Blanding's Turtle, Redside Dace, Lake Chubsucker, Common Snapping Turtle, American Eel, Atlantic Salmon (L. ON pop.), Lake Sturgeon, Grass Pickerel, Northern Brook Lamprey, River Redhorse, Kidneyshell, Round Hickorynut, Round Pigtoe, Snuffbox, Eastern Pondmussel, Fawnsfoot, Mapleleaf, Rainbow, Spring Salamander (X)
5. Prairies, Savannahs, Dry Oak Woodlands	Deerberry, Eastern Hog-nosed Snake, Bird's-foot Violet (X), Pink Milkwort (X), Purple Twayblade (X), Spotted Wintergreen (X)
6. Edges, Thickets, Fields	Eastern Flowering Dogwood, Round-leaved Greenbrier, Dwarf Hackberry, Barn Owl, Common Gray Fox, Milksnake, Common Hoptree, Eastern Hog-nosed Snake
8. Ecological Services on Rural Lands	Barn Owl, Dense Blazing-star, Milksnake, Short-eared Owl, Yellow-breasted Chat, Willow-leaved Aster, Eastern Hog-nosed Snake
9. Habitat in Drains	?

Threats to Biodiversity Targets[1]

Threats Across Targets – Niagara River Corridor		Marshes and Shorelines	Upland Deciduous Forests	Lowland Swamp Forests	Lakes, Rivers, Streams and Riparian Ecosystems	Edges, Thickets and Fields	Dry Oak Woodlands, Prairies, Savannahs	Ecological Services on Rural Lands	Habitat in Drains	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	7	8	
1	Development	-	Very High	Very High	Medium	Very High	-	-	-	Very High
2	Incompatible water management	Very High	-	Medium	Very High	-	-	-	Very High	Very High
3	Contamination, effluents, sedimentation	High	-	-	Very High	-	-	-	Very High	Very High
4	Incompatible land management and use	Medium	Medium	Medium	High	High	Very High	High	-	Very High
5	Perception, values	-	-	-	-	Very High	-	Medium	Very High	Very High
6	Property economics (land values, profiteering, tax laws, grants)	-	-	-	-	-	-	Very High	-	High
7	Terrestrial invasive species	-	High	Medium	-	Medium	High	-	-	High
8	Fire suppression, mowing	-	-	-	-	-	High	-	-	Medium
9	Incompatible legislation	-	-	-	-	-	-	-	High	Medium
10	Aquatic invasive species (goby, carp, Phragmites)	-	-	-	Medium	-	-	-	-	Low
Threat Status for Targets and Project		High	High	High	Very High	Very High	High	High	Very High	Very High

[1] - Human activities and natural processes with a potentially deleterious effect on biodiversity are often deemed "threats."

Conservation Actions[2]

Importance (U/N/B)[3]	Objective	Strategic Action(s)	Action Steps / Timelines	Target(s) Addressed	Threats / Impacts Addressed	Recovery Strategy Links	Agency Lead(s)[4]	Cost Estimate / Funding Source(s)
Urgent	1. Establish and ensure ongoing public and stakeholder support for the CAPs	1.1. Write job spec for outreach / education / social marketing coordinator by 2012.	1.1.1. Secure funding to hire and find office to house staff . 1.1.2. Work with nature clubs and other stakeholders to implement outreach activities (e.g., landowner contact, dissemination of materials, workshops, etc.).	All	All (especially 2, 4 and 5)	All relevant SAR	NLT, CCC, nature clubs (volunteers to implement)	$25K-$50K / year
Urgent	2. Series of natural heritage system map created by 2011 for both CAP areas using existing information compiled from all key sources.	2.1. Synthesize updated NH data and mapping to confirm CAP area boundaries. 2.2. Create publicly-available on-line NH mapping and data access portal. 2.3. Create a restoration and opportunities map to identify conservation targets, priority sites, activities and appropriate methods necessary to enhance SAR recovery and protection by 2013.	2.1. By spring 2011: a) OMNR/LCN to provide SAR mapping data. b) NPCA and Niagara R.M. to provide recent NAI data. c) Consult with local naturalists and groups to verify locations and completeness of data set for mapping. 2.2. By spring 2011: a) Summarize strengths, usefulness and applications of each available mapping source for web site. b) Identify how and where each source can be obtained. c) Upload this information to web site (e.g., NEST). 2.3. By 2011/2012: a) Write job spec for GIS person to create map series that links restoration to SAR needs for both Niagara CAP areas. b) Secure funding and find office / agency to house staff person.	All	1, 3, 4, 6, 7, 8, 9	All relevant SAR	1. NPCA, OMNR, Niagara College, NCC(?). 2. CCC, NLT; 3. Niagara College.	$85K / t.b.d.

[2] - This Executive Summary includes all urgent and necessary strategic actions; consult Section 3 of the report for the complete list of recommended actions.
[3] - U = Urgent; N = Necessary; B = Beneficial
[4] - ***** It should be noted that the definition of responsibility for the identified "lead agencies" is that these groups will take the leadership role in initiating the implementation of recommended actions. It is anticipated that other agencies and private landowners will also become involved as actions evolve.

Importance (U/N/B)[3]	Objective	Strategic Action(s)	Action Steps / Timelines	Target(s) Addressed	Threats / Impacts Addressed	Recovery Strategy Links	Agency Lead(s)[4]	Cost Estimate / Funding Source(s)
Urgent	3. No net loss of early-successional communities (fields, thickets) from 2009 levels.	3.1. Support existing programs and reprint educational materials 3.2. Research and promote positive incentive approaches for farmers to conserve biodiversity on their land such as Alternative Land Use Services-type initiatives, Ecosystem Goods and Services cost-benefit analyses and Environmental Farm Plan cost-sharing by 2012.	t.b.d.	#5	1, 4, 5, 6, 8, 9	EFDO, RLGB, DWHA, BAOW, COHO, HOSN	t.b.d.	t.b.d.
Necessary	4. Top 10 sources of water pollution identified and appropriate actions relating to each identified by 2012.	4.1. Work through SAR list for CAP areas and identify the key local stresses to each. 4.2. Link these to local sources. 4.3. Develop strategies to reduce these impacts.	4.1-3. a) Write job spec for contractor to undertake project. b) Secure funding and hire contractor by 2011/2012.	#1,3,4,8	All	All aquatic SAR	t.b.d.	t.b.d.
Urgent	5. Control invasive species in natural areas.	5.1. Develop and implement a plan for control of invasive species of concern and key priority areas.	5.1. a) Identify invasive species of concern by 2011. b) Determine measurable goals for control by 2011. c) Identify target areas for control program by 2012. d) Identify appropriate control mechanisms by 2012. e) Secure funding to proceed (2010, ongoing). f) Initiate on-the-ground control programs by 2013 (ongoing). g) Undertake public outreach (aquatic, terrestrial). h) Engage horticultural community. i) Lobby for improvements to federal policies relating to the sale of invasive species. k) Monitor program (develop measurable plan and track initiatives)	All	7, 10	All SAR impacted by invasive species	LCN, Niagara College (?), OFAH (?, re: BMP's)	EC Invasive Species Fund

Importance (U/N/B)[3]	Objective	Strategic Action(s)	Action Steps / Timelines	Target(s) Addressed	Threats / Impacts Addressed	Recovery Strategy Links	Agency Lead(s)[4]	Cost Estimate / Funding Source(s)
Necessary	6. Promote and increase land securement for conservation.	6.1. Engage community and increase awareness of Niagara Land Trust.	6.1. a) Purchase priority conservation lands identified through other objectives and strategic actions of this CAP. b) Secure priority lands through conservation easements. c) Enhance the priority lands through incentive programs through MFTIP and CLTIP.	All	All	All relevant SAR	NLT and other CAP partners	
Necessary	7. [Realistic number of] ha of private lands owned by corporations within the CAP area have conservation or restoration programs in place by 2015.	7.1. Engage corporate and industrial landowners in conservation within CAP area.	By 2011: 7.1.1. Meet with Wildlife Habitat Council, Wildlife Habitat Canada and key corporate and conservation partners to develop strategies for engaging corporate partners in CAP implementation. 7.1.2. Prepare an assessment of: 1) existing corporate partners in conservation projects within the CAP area; 2) key corporate landowners based on extent, locations and ecological characteristics of their lands; 3) develop a prioritized list of potential corporate partners. 7.1.3. Begin implementation of conservation actions on corporate lands by 2012.	All	All	All relevant SAR	CCC, OPG, Wildlife Habitat Canada, Wildlife Habitat Council, and other CAP partners	t.b.d.

Importance (U/N/B)[3]	Objective	Strategic Action(s)	Action Steps / Timelines	Target(s) Addressed	Threats / Impacts Addressed	Recovery Strategy Links	Agency Lead(s)[4]	Cost Estimate / Funding Source(s)
Necessary	NR1. Increase the extent of upland and lowland forest cover by realistic quantitative target by 2020. (e.g., Landowners of at least 500 acres of private lands agree to restoration projects on their properties between 2010 and 2020.)	NR1.1. Determine quantitative targets. NR1.2. Scope existing mapping and work with SAR bios to determine priority upland forest and lowland swamp sites by late 2010; NR1.3. Evaluate need for restoring hydrological functions. NR1.4. Focus on privately-owned upland forests and publicly-owned lowland swamp forests first because private land (PSW) wetlands have legislated protection. NR1.5. Develop landowner contact and incentive program by 2012 (ongoing). NR1.6. Engage agricultural community in swamp forest restoration. NR1.7. Provide funding support to existing landowner programs; NR1.8. Identify a planned timeline for restoration on private lands. NR1.9. Develop adequate conditions for restoration. NR1.10. Acquire and restore sites.	NR1.1.1. Determine historic and current extent of upland and lowland forest types (February 2010) NR1.2.1. Map lowland and upland forest priority areas (Spring 2010). NR1.2.2. Review maps and other resources to identify gaps (i.e., ecological linkages, sites that would increase forest interior, etc.) by 2011. NR1.5.1. Initiate ongoing landowner contact by 2012. NR1.5.2. Investigate opportunities for priority landowners for tax relief on smaller properties of significant value. NR1.5.1. Identify funding opportunities, write funding proposals and secure funding for restoration and securement (2011-ongoing). NR1.8.1. Secure native seed sources for restoration (ongoing), accounting for SAR permit requirements and implications of presence of SAR at restoration sites. NR1.8.2. Engage Ducks Unlimited and drainage superintendents in evaluating hydrology of lowland swamp sites. NR1.9.1. Develop stewardship, restoration and monitoring plans. NR1.9.2. Start restoration in 2011.	#2,3	1, 2, 3, 4, 5, 7, 9	All Carolinian woodland SAR	NPCA, NLT, NRC, OPG, WHC, LCN, NPCA, NLT, NPC, Ducks Unlimited + other groups	Alternative incentives: tree swap; ALUS; public acknowledgement; user fees. >$2,000,000 / OMNR SAR Stewardship Fund, LandCare Niagara (aid), 50 Million Tree Program (Trees Ontario Foundation), Habitat Stewardship Program, Ontario Power Generation, Environment Canada, private foundations, corporate sponsors
Necessary	NR2. Increase the extent of upland deciduous forest interior by realistic quantitative target by 2020.	See Objective NR1 (above). NR2.1. Identify optimum properties to increase extent of forest interior. NR2.2.Target public lands (e.g., municipal parks Baden Powell Park – Vedaland, Willoughby Marsh CA, Niagara Parks Commission lands such as Paradise Grove) for restoration, and for securement of adjacent lands (by 2013).	See Objective NR1 (above) Timing: 2013 – ongoing. NR2.1.1. Map / Determine (see Lowland Swamp Forest): - historical distribution - SAR habitat needs - Quality of existing habitat - Potential to create quality habitat - Feasibility	#2	1, 4	ACFL / HOWA and all SAR that benefit from undisturbed forest interior habitats	CAP partners + municipal-lities	t.b.d.

Importance (U/N/B)[3]	Objective	Strategic Action(s)	Action Steps / Timelines	Target(s) Addressed	Threats / Impacts Addressed	Recovery Strategy Links	Agency Lead(s)[4]	Cost Estimate / Funding Source(s)
Necessary	NR3. Buffer and restore [realistic quantitative target] of riparian habitat by 2020.[5]	See Objective NR1 (above) A) Natural Creeks – work with existing programs and SAR bios to target prioirtity SAR areas and provide supplementary funding. B) Drains – work with local drainage superintendents to ensure ecologically friendly maintenance practices and provide supplementary funding. NR3.1. Continue riparian restoration as identified in watershed plans. NR3.2. Determine # of km appropriate for riparian restoration target by 2011. NR3.3. Reduce erosion (qualitative measure of restoration success). NR3.4. Identify opportunities along municipal drains. NR3.5. Engage agricultural community in riparian restoration (e.g., with help of OSCA)	A) Contact SAR bios to determine prioirity areas. B) Contact SAR bios to dertermine priority areas. NR3.1-4. a) Lobby local government for stronger buffer requirements. b) Lobby local government for ecologically appropriate design in relation to stormwater run-off into coldwater streams. SH3.1-5. a) Secure funding for priority area mapping. b) Determine priority restoration sites along Twelve, Fifteen, Sixteen and Eighteen Mile Creeks by 2011/2012. c) Hold Environmental Farm Plan workshops. d) Identify and create riparian restoration demonstration sites. e) Provide riparian restoration information to landowners (ongoing).	#1, 4, 8	1, 2, 3, 4, 5, 8, 9, 10	All SAR that use riparian, wetland and aquatic habitats	CAP partners + FOFEC NPCA, NRC, LandCare Niagara, OSCA	t.b.d.

[5] - Use NHIC, MNR Guelph District, NPCA NAI, Regional Municipality of Niagara, LandCare Niagara, Nature Conservancy of Canada data/mapping

Niagara River Corridor Conservation Action Plan
Table of Contents

Niagara River Corridor Conservation Action Plan (CAP)

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1. CONSERVATION CONTEXT AND RATIONALE

A. CONTEXT

This Conservation Action Plan (CAP) for the Niagara River Corridor is intended to complement and enhance past and ongoing conservation initiatives in the area, particularly from the perspective of Species At Risk (SAR) and ecosystem recovery. This section summarizes those efforts, and provides the geographic, ecological and socioeconomic context for the CAP.

i. GEOGRAPHIC CONTEXT

The Niagara River CAP area covers approximately 20,000 ha (200 km^2) extending from Lake Ontario in the north to the City of Fort Erie in the south. The Welland Canal and the Niagara River form the western and eastern borders of the area, respectively. The Niagara River CAP is within the Niagara Peninsula Watershed, and includes several sub-watersheds: One Mile Creek, Two Mile Creek, Six Mile Creek, Thompson's Creek, Hunter's Drain, Lyon's Creek, Ussher's Creek and Baker Creek.

The CAP area contains portions of Ontario's ecodistricts 7E-3 and 7E-5, which are both part of Ecoregion 7E, colloquially known as the Carolinian life zone. The CAP area supports plants and animals characteristic of this ecoregion, many of which are provincially, nationally and globally rare. At least 24 federally- and provincially-designated Species At Risk (SAR) have been recorded within the area within the past 30 years, with an additional 14 or more having occurred historically.

Although its urban areas are intensively developed and much of the area has been converted to agriculture (primarily vineyards and orchards), the Niagara River corridor contains some of the most biologically diverse natural areas in the Golden Horseshoe, Canada's most densely-populated region. Several Provincially Significant Wetlands (PSWs) and Areas of Natural and Scientific Interest (ANSIs) have been designated within the area. A significant amount of important conservation lands and waters are protected by the Niagara Parks Commission, the Niagara Peninsula Conservation Authority, by municipalities, by zoning of the Niagara Escarpment Plan, and in private nature reserves.

The CAP area boundary was initially interpolated from Carolinian Canada's hotspot analysis (Kraus *et al*. 2007). The boundary was subsequently adjusted slightly by the CAP team to include associated areas of LandCare Niagara's Natural Heritage Ecological Framework (LandCare Niagara 1998) and to address priorities relating to ecological functions, stewardship and implementation (Figure 1).

Twelve municipalities make up the Niagara Region. Of the twelve municipalities that comprise Niagara Region, Niagara-on-the-Lake, Niagara Falls and Fort Erie occur within the Niagara River Corridor CAP area. Thorold, Welland and Port Colborne overlap partially with the CAP area. The area is part of the Niagara Fruit Belt, with vineyards and orchards making up a major portion of the land base and contributing significantly to the local economy and character.

Figure 1 (right). Niagara River Corridor CAP area

ii. ECOLOGICAL CONTEXT

Carolinian Canada – Ecoregion 7E

The Niagara River Corridor CAP area is located near the southeast limit of Ecoregion 7E, colloquially known as the Carolinian life zone, which includes all of Ontario south of a line running between Grand Bend and Toronto. This life zone encompasses the northernmost edge of the deciduous forest region of eastern North America. Although it is smaller than other Canadian vegetation zones, it has more species of flora and fauna than any other ecosystem in Canada. In fact, the Carolinian life zone occupies less than 0.25% of Canada's landmass, yet it provides habitat for over 40% of Canada's vascular plant species and an equally large proportion of vertebrate and invertebrate fauna (Jalava *et al.* 2009).

However, one quarter of Canada's human population lives here, and, as a result, extensive conversion to human land uses has occurred. In southern Ontario, 94% of upland forest has been cleared over the past two centuries, while more than 70% of all pre-settlement wetlands have been converted, and more than 99% of prairies and savannahs have been lost (Bakowsky 1993). On a heavily-modified working landscape such as this, fragmentation has reduced most natural cover to patch sizes much smaller than the "landscape scale". Overall, natural cover across the Carolinian life zone now ranges from less than 7% in some areas, to just under 18% in others. These high levels of land conversion mean that many of the essential ecological processes and functions have been severely compromised. Because of this, combined with the fact that many of its species are near the northern limits of their distribution, the ecoregion has the greatest number and concentration of Species at Risk (SAR) in Canada. (Jalava *et al.* 2009)

The zone is characterized by mainly deciduous-dominated forests of Sugar Maple (Acer saccharum), including some conifer species such as Eastern Red-cedar (*Juniperus virginiana*), White Pine (*Pinus strobus*), as well as many southern trees at their northern range limits such as Tulip Tree (*Liriodendron tulipifera*), Sassafras (*Sassafras albidum*), Shumard Oak (*Quercus shumardii*), Chinquapin Oak (*Quercus muhlenbergii*), Pawpaw (*Asimina triloba*), Cucumber Tree (*Magnolia acuminata*), Cherry Birch (*Betula lenta*), and many others, along with shrubs and herbaceous species not found in other parts of Canada (Lindsay 1984). In Carolinian Canada, over 70 native tree species, 2,200 plant species and more than half of all Canadian bird species are found (Solymár *et al.* 2008).

Ecodistrict 7E-3

The majority of the Niagara River Corridor occurs within Ecodistrict (formerly, Ecological Site District) 7E-3 (Grimsby), which extends from the Niagara River west to Hamilton and north into southern Halton Region. This ecodistrict includes the southernmost portion of the Niagara Escarpment in Canada, as well as the Iroquois Plain and Lake Ontario shorelines below the escarpment. (Henson and Brodribb 2005)

Approximately 19% of Ecodistrict 7E-3 remains naturally-vegetated, primarily as forest. Niagara Escarpment forest makes up ~25% of this, with sand plain forest complexes comprising 15%, and till moraine forest complexes 14%. These forest complexes are predominantly deciduous. Ten percent of the remaining natural cover is wetland, with 75% being swamp. (Henson and Brodribb 2005)

Sixty percent of the ecodistrict has been converted to agricultural uses, with nearly half being developed agricultural lands (40,524 ha), and another 9,066 hectares as pastures and abandoned fields. Approximately 20% of the ecodistrict, nearly 16,500 hectares, has been developed for residential, commercial and industrial uses, and these include the larger urban centres of Hamilton and St. Catharines. (Henson and Brodribb 2005)

Approximately 8% (6,735 ha) of Ecodistrict 7E-3 is protected in conservation lands. Conservation Authority properties account for nearly half of this total (3,005 ha). Another 4,000 hectares have been designated as provincially significant life science ANSIs, of which 83 hectares coincide with provincial parks. Seventy percent of all extant rare species and vegetation community occurrences in this ecodistrict have been recorded in identified conservation lands, mostly within provincially significant life science ANSIs. (Henson and Brodribb 2005)

Ecoregion 7E-5

The extreme southern portion (<25%) of the Niagara River Corridor lies within Ecoregion 7E-5, which consists of the Haldimand Clay Plain portion of Hills's Site District 7E-2. Overall, nearly 22% of Ecodistrict 7E-5 remains as natural cover, predominantly as forest. Clay plain forest complexes comprise two-thirds of the remaining natural cover, with over half of this being clay plain deciduous forest. Nearly 10% of the remaining natural cover is sand plain deciduous forest complex. Another 15% of the remaining natural cover is wetland, primarily treed swamp. Two-thirds of the Ecodistrict have been converted to developed agricultural land (238,234 ha), and an additional 32,247 ha are pastures and abandoned fields. Nearly 10,000 hectares are devoted to settlement and other associated developed lands, including the cities of Fort Erie and Niagara Falls. (Henson and Brodribb 2005)

Approximately 4% of Ecodistrict 7E-5 (14,443 ha) is protected to some degree. Conservation authorities have secured 20% of these (3,035 ha), and another ~9,500 hectares have been identified as provincially significant wetlands, and 4,430 ha are provincially significant life science ANSIs. Approximately five hectares of provincially significant ANSIs are within provincial parks and 202 ha are within provincial conservation reserves. Nearly half of the occurrences of documented species and vegetation communities of high conservation importance are within these conservation lands, primarily provincially significant life science ANSIs and provincially significant wetlands. (Henson and Brodribb 2005)

Climate

The Niagara River Corridor CAP area is situated within the Niagara Fruit Belt Climatic Region, one the warmest regions in Ontario (Brown *et al.* 1980). As with much of Southern Ontario, this region experiences a continental climate, which is modified by the Great Lakes. Continental climates are characterized by seasonal extremes of temperature, typically with hot summers and cold winters. The huge inland lakes which surround southern Ontario on three sides tend to ameliorate these fluctuations, allowing for warm summers, relatively mild winters, and resulting in a fairly long growing season with generally reliable rainfall (Brown *et al.* 1980). The mean annual frost free period ranges from 157 to 191 days, comparable to those encountered in extreme southwestern Ontario. The region has relatively mild winters, with mean daily minimum January temperatures ranging from -7.2°C to -9.8°C. Minimum temperatures are an important limiting factor for many southern plant species. Topography greatly influences the area's climate. Comparisons of sites below and above the Niagara Escarpment indicate significantly shorter frost-free periods and lower July and January temperatures above the escarpment compared to areas on the lake plain below the escarpment. (Riley *et al.* 1996)

Geology, Physiography and Glacial History

Two of the most prominent features of the Niagara River Corridor CAP area are the linear Niagara Escarpment, which bisects it, and the Niagara River that forms its eastern boundary. The tallest cliffs of the Niagara Escarpment on the Niagara Peninsula are in the Niagara Gorge, and some of the most extensive talus slopes occur in the Niagara River Corridor as well. The Niagara Gorge is the largest gorge along the entire Niagara Escarpment, extending for more than 10.7 km and reaching heights of up

to 90 m. The gorge has formed over the past 12,000 years by the erosive action of the Niagara River, with the great waterfalls having receded gradually to where they are now from their original position near Queenston at the escarpment brow (Chapman and Putnam 1984, Riley *et al.* 1996).

The Niagara River itself is the historic drainage path of Great Lakes water from Lake Erie to Lake Ontario, with some of the water now re-routed through the Welland Canal as well as for hydroelectric power generation in the Niagara Falls – Queenston area.

At the south end of the Niagara River corridor, "the topography of the South Niagara Falls watershed was shaped, in large part, through glacial action. Isostatic rebound, which is the rise of land masses that were depressed by the huge weight of ice sheets during the last ice age, contributed to the rise and fall of Lake Erie water levels and the formation of drainage outlet routes of the post-glacial Great Lakes. Between 4,000 and 5,000 years ago, the level of Lake Erie rose 3 to 4 metres above its current level. As a result, the land between 177 and 178 metres became discharge routes for Lake Erie waters. The new discharge routes created the temporary Lake Wainfleet (now the Wainfleet Bog). In addition, the existing shoreline of the Niagara River flooded, and a diversion channel of the Niagara River was created in the vicinity of what is now known as Usshers Creek and Willoughby.

"Overall, the glacial events that carved out this portion of the Niagara Peninsula resulted in a gently rolling to flat topography with a dendritic drainage pattern….

"The primary physiographic region above the Niagara Escarpment on the Niagara Peninsula is the Haldimand Clay Plain. The Haldimand Clay Plain was overlain by post-glacial Lake Warren and much of it is covered by lacustrine clay deposits. The Niagara Falls Moraine, located just north of the South Niagara Falls watershed, is visible as a ridge in the clay plain except at Lundy's Lane where it is topped by a gravel bar. The quaternary geology of the South Niagara Falls watershed is comprised of fine textured glaciolacustrine deposits with some very small areas of coarse textured glaciolacustrine deposits, glaciolacustrine derived silty to clayey till and alluvial deposits…." (NPCA 2008b)

At the north end of the Niagara River Corridor, "the major landform in the Niagara-on-the-Lake watershed is the Iroquois Plain, extending north of the Niagara Escarpment to Lake Ontario. The Iroquois Plain represents land that was flooded by Lake Iroquois until approximately 10,000 years ago. The Iroquois deposits include (from north to south) sand, silt and clay that overlie the Halton Till. The Halton Till is a silty-clay, stony till deposited during the last ice advance.

"The average depth to bedrock is approximately 20 - 25 metres and may comprise significant thickness (several metres) of sand and gravel lenses, particularly at the bedrock interface. This contact zone and the upper part of the bedrock represent a significant regional aquifer. Another local aquifer exists in the St. David's Buried Gorge, and there are reports of artesian conditions here. Sand and gravel deposits at surface near Lake Ontario represent beaches, shoals, bars and shallow water features deposited by glacial Lake Iroquois before water levels fell to the present-day Lake Ontario. The bedrock over the area north of the Niagara Escarpment is the Queenston Formation, consisting of red shale. In the St. David's area, there exists a buried bedrock valley, the St. David's Buried Gorge, which cuts approximately 60 to 130 m into the bedrock formations and is believed to be a previous alignment of the Niagara River. It is infilled with glacial and interglacial sediments, consisting of fine grained sands with thinly interbedded clay and silt.

"Soils generally reflect the surficial geology and are generally sandier in the north and east portions of the study area, with richer, silty loam to clayey loam soils in the central portion of the study area. Natural drainage is generally poor, and as a result, the majority of the land has been extensively tile drained for agricultural purposes. The sandy soils and wet subsoils, combined with the temperate climate make this area ideal for fruit growing." (NPCA 2008a)

Biodiversity

The Niagara River Corridor is situated in one of the southernmost portions of Canada and is home to a remarkable diversity of southern vegetation, flora and fauna, many of them at the northern limits of their ranges. Southern vegetation types found include forests dominated by Chinquapin Oak, Sugar Maple – Tulip-tree, Sugar Maple – Red Elm, Sycamore, Shagbark Hickory, Black Walnut and Eastern Cottonwood. Southern plant species include trees such as Sassafras, Swamp White Oak, Chinquapin Oak, Black Oak, American Chestnut, Eastern Flowering Dogwood, Northern Pin Oak, Red Mulberry, Pawpaw, Tulip-tree, Cucumber Tree, Shumard Oak, Pignut Hickory, Pumpkin Ash, Shellbark Hickory and Common Hop-tree, as well as shrubs such as Deerberry, several hawthorn species, and Dry-land Blueberry. Many southern herbaceous plants, sedges and grasses also reach their northern limits on the Niagara Peninsula, including: Yellow Giant Hyssop, Black Cohosh, Sweet Joe-Pye-weed, Slender Satin Grass, Smooth Solomon's-seel, Biennial Gaura, White Trout Lily, Tall Bellflower, Protruse Fragile Fern, White Wood Aster, American Columbo, Rue-anemone, Twinleaf, Schreber's Aster, Sharp-leaved Goldenrod, Eastern Bellwort, Panicled Hawkweed, Wild Yam, Davis's Sedge, James's Sedge, Greenish Sedge, Hirsute Sedge, Right-angled Sedge, Artitecta Sedge, Loose-flowered Sedge and Forked Panic Grass. (Riley *et al.* 1996)

Characteristic southern fauna include breeding birds such as Red-bellied Woodpecker, Tufted Titmouse, Carolina Wren, Northern Mockingbird, Hooded Warbler and Orchard Oriole, and mammals such as Virginia Opossum, Southern Flying Squirrel and Woodland Vole. The largest forest tracts on the Niagara Peninsula provide suitable habitat for area-sensitive and forest interior breeding birds such as Sharp-shinned Hawk, Ruby-throated Hummingbird, Eastern Wood-Pewee, Great Crested Flycatcher, Wood Thrush, Red-eyed Vireo, Scarlet Tanager and Rose-breasted Grosbeak (Cadman *et al.* 2007). The more extensive wetlands provide habitat for breeding Great Blue Heron, Least Bittern, Green Heron, Canada Goose, Wood Duck, Mallard, Common Moorhen, American Coot, Virginia Rail and Sora, as well as migrating waterfowl and shorebirds. The wetlands also provide important habitat for reptiles and amphibians, including SAR turtles such as Blanding's Turtle and Common Snapping Turtle. However, because of the high levels of habitat loss as well as direct persecution of some species, several reptile and amphibian taxa have been extirpated from the Niagara Peninsula that probably occurred within the NA in the past; these include Timber Rattlesnake, Eastern Massasauga, and possibly Spring Salamander. (Riley *et al*. 1996)

A number of plant species with prairie and western affinities also occur within the CAP area. This combination of southern and western species, combined with the many taxa whose ranges are centred on southern Ontario, and the varied Niagara Escarpment, clay plain and lake plain topography with their associated habitat types, results in outstanding diversity of species at many of the key sites within the natural area. For example, more than 565 vascular plant species have been documented at the Niagara Gorge Area of Natural and Scientific Interest (ANSI), of which more than 70 extant species are considered nationally, provincially, regionally or locally rare. The Niagara River Corridor is famous for its concentrations of waterbirds, most notably migrant and wintering gulls. At least 18 species of gulls have been documented there, perhaps the highest total for any location in the world. (Riley *et al.* 1996)

Natural Areas

The spectacular Niagara Falls near the midway point of the Niagara River Corridor CAP area gives the region its international fame. However, from an ecological perspective, many other natural features and areas are critical to the long term viability of the area's biodiversity, as well as to water quality, air quality and quality of human life.

Significant natural areas within the CAP area include: provincially significant Life Science Areas of Natural and Scientific Interest (ANSIs) (Willoughby Clay Plain Forest; Navy Island, Niagara Gorge, Two Mile – Four Mile Creek Plain) and Earth Science ANSIs (Niagara River Bedrock Gorge, Ridgemount Quarry and Ridgewood Raised Beaches); provincially significant wetlands (Lyon's Creek Corridor woodlots 13, 26, 36 and 43 wetlands, Lyon's Creek, Fort Erie Area 14, 20, 25, 32, 35, 36, 40, 44, 45, 46, 47, 48, 49 and 50 wetlands, Willoughby Marsh, Black Creek, Beaver Creek, Four Mile Creek Estuary, Grassy Brook, Niagara Falls Woodlot #1 Wetland, Tea Creek, Navy Island, Miller's Creek and Frenchman's Creek); regionally significant life science ANSIs (Queenston Escarpment, Paradise Grove Plain); several sites identified under the International Biological Program; as well as a number of other woodlots and wetlands of local significance (Boyer's Creek Bush, Niagara Parkway, Willoughby Marsh CA, the Old Lincoln Street Woodlot, Ramsay Road Woodlot, Marineland Woodlot, Fort Erie Woodlot 38, 41 and 43 wetlands, Fort Erie 16, 17, 30 and 37 wetlands, Ridge Road Woodlot, Waverly Woodlot, Cyanamid Corners, Beaver Creek, Dufferin Islands / Victoria Park, Yokom Woodlot, McKenny Road Woodlot, Frenchman Creek Bush, Cyanimid Windfall Slough Forest, Niagara Falls Woodlot 2 Wetland, Montrose Junction Slough Forest, Chippawa Slough Forest, Miller's Creek Woodlot, Queenston Quarry, Ridgemount Road Woodlot, Summer Street Woodlot, Thompson's Woodlot, William Nassau Park, Willoughby Drive Woodlot, Young Woodlot, and Zuk's Zone).

There are several types of Natural Heritage designations that apply to these natural areas, as summarized in Table 1.1. For a more complete list of the Natural Heritage sites in the NA, please see Appendix B.

Table 1.1: Natural Heritage Designations – Niagara River Corridor

Designation	IUCN PAM Category[1]	Area in ha	Reference
Provincial Park (Nature Reserve)		none	
Conservation Authority Area - Two Mile Creek (9 ha) - Virgil Dam and Reservoir (49 ha) - Woodend (47 ha) - Shriner's Creek (32 ha) - Willoughby Marsh (232) - Smith-Ness Forest (29 ha) - Stevensville (49 ha) - Humberstone Marsh (82 ha)	II	529	NPCA 2009
Niagara Parks Commission Sites (natural areas)	II	~300	NPC 2010
Area of Natural and Scientific Interest (Earth Science) 1. Niagara River Bedrock Gorge (228.0 ha) 2. Ridgewood Raised Beaches (71.0 ha) 3. Ridgemount Quarry (2.3 ha)	n/a	301.3	NHIC 2009
Area of Natural and Scientific Interest (Life Science) 1. Willoughby Clay Plain Forest (228 ha) 2. Navy Island (171 ha) 3. Niagara Gorge (79 ha) 4. Lyon's Creek Floodplain and Wetlands (79 ha) 5. Two Mile – Four Mile Creek Plain (57 ha)	n/a	614	NHIC 2009
Carolinian Canada Site 1. Willoughby Clay Plain	n/a	122.73	Eagles & Beechey 1985
Important Bird Areas (Globally Significant) 1. Niagara River Corridor IBA (2,800 ha) 2. West End of Lake Ontario IBA (130,000 ha)	n/a	132,800	IBA Canada 2004a,b

Designation	IUCN PAM Category[1]	Area in ha	Reference
International Biological Program Site 1. Lyon's Creek Claylands (151.8 ha) 2. Two Mile Creek Clay Plain (10.9 ha) 3. Navy Island (129.5 ha) 4. Miller's Creek (4 ha)	n/a	296.2	Falls *et al.* 1990
Provincially Significant Wetland 1. Lyon's Creek Corridor Woodlot 36 Wetland (4.98 ha) 2. Fort Erie Area 48 Wetland (24.8 ha) 3. Willoughby Marsh (362.8 ha) 4. Fort Erie Area 47 Wetland (8.5 ha) 5. Fort Erie Area 44 Wetland (0.9 ha) 6. Fort Erie Area 14 Wetland (3.2 ha) 7. Black Creek (37.2 ha) 8. Beaver Creek (113.6 ha) 9. Fort Erie Area 36 Wetland (1.9 ha) 10. Lyon's Creek Corridor Woodlot 43 Wetland (4.12 ha) 11. Lyon's Creek Corridor Woodlot 26 Wetland (31.5 ha) 12. Lyon's Creek Corridor Woodlot 44 Wetland (4.72 ha) 13. Lyon's Creek Corridor Woodlot 13 Wetland (17.22 ha) 14. Four Mile Creek Estuary (9.0 ha) 15. Virgil Conservation Area Wetland (15.6 ha) 16. Grassy Brook (7.9) 17. Fort Erie 50 Wetland (81.0 ha) 18. Fort Erie 46 Wetland (4.74 ha) 19. Niagara Falls Woodlot #1 Wetland (128.1 ha) 20. Tea Creek Wetland (15.8 ha) 21. Fort Erie Area 45 Wetland (1.2 ha) 22. Fort Erie Area 49 Wetland (14.3 ha) 23. Lyon's Creek (150.5 ha) 24. Fort Erie Area 35 Wetland (20.3 ha) 25. Fort Erie Area 40 Wetland (11.6 ha) 26. Fort Erie Woodlot 38 Wetland (7.1 ha) 27. Fort Erie 17 Wetland (20.8 ha) 28. Navy Island Wetland (25.78 ha) 29. Fort Erie 32 Wetland (6.9 ha) 30. Fort Erie 20 Wetland (3.3 ha) 31. Miller's Creek Wetland (17.1 ha) 32. Fort Erie 25 Wetland (27.4 ha) 33. Frenchman's Creek (4.5 ha)	n/a	1,188.36	NHIC 2009

[1] IUCN (2006b) Protected Area Management (PAM) Categories: Ia. Nature Reserve or wilderness area nature reserve*; Ib. Wilderness area*; II. National/provincial park*; III. Natural monument; IV. Habitat/species management areas, V. Protected landscape or seascape, VI. Managed resource protected areas; * Strictly regulated protected areas. Some areas may have more than one IUCN category because of internal zoning.

iii. NATURAL COVER / ECOSYSTEM TYPES

The southerly location of the Niagara River Corridor and the moderating effect of the Great Lakes on the climate of the region results in a high diversity of ecosystem types characteristic of the Carolinian life zone in the CAP area. At the time of the time of European settlement, early settlers observed the natural cover to be generally deciduous forests, including, maple-beech-oak, oak-hickory-elm, oak-ash, elm-ash-oak, and tulip tree-walnut-ash woods (Gayler 1994). These typical Carolinian forests also supported additional southern elements such as Sassafras, Tulip-tree and Cucumber Tree.

Currently, natural cover in the Niagara Region ranges between 12% and 13% (May *et al.* 2008, Muller and Middleton 1994). Even though every patch of remaining woodland could be considered to have ecological importance, Muller and Middleton (1994) caution this figure includes wetlands and forest fragments as small as 0.07 km^2. There is therefore much room for improving continuity of habitats across the CAP area.

Numerous creeks, streams and rivers on the Niagara Peninsula in addition to engineered watercourses such as agricultural drains and the Welland Canal. The lakeshores and Niagara River shoreline also supports several wetlands as do some inland areas, such as the Willoughby Clay Plain. A fifth of the world's freshwater, supplying a drinking water source for over 25 million people, travels down the 58 km stretch of Niagara River before draining into Lake Ontario. Not surprisingly, according to the NPCA, the area is one of the most complex watersheds in the entire province (NPCA 2009).

Niagara Escarpment Ecosystems

The varied topography of the Niagara Escarpment in the Niagara River Corridor area adds to the diversity of ecosystem and habitat types within the CAP area. Escarpment features include bedrock and soil-mantled escarpment plain and terraces, escarpment rims, cliffs and talus slopes.

The soil-mantled escarpment plain and associated bedrock-based terraces are typically covered in fresh Sugar Maple forests and drier oak and hickory forests, with the latter normally being dominated by Red Oak and less frequently White Oak, Black Oak and Shagbark Hickory. The largest example of dry-fresh forest on the escarpment plain on the Niagara Peninsula is found within the Niagara River CAP area at the Queenston Escarpment ANSI. Successional forests also frequently occur on the escarpment plain, with Black Walnut, White Ash, Ironwood, Large-toothed Aspen, Trembling Aspen, White Birch, Bitternut Hickory and White Elm being the most frequent tree dominants. Successional thickets also occur, with Grey Dogwood, hawthorns, Staghorn Sumac and Prickly Ash being the most frequently encountered shrubs. Wetlands tend to be infrequent on the escarpment plain, with occasional Silver Maple, Red Maple and Red Ash deciduous swamps, often mixed with Bur Oak, White Ash or White Elm occurring in bedrock depressions. At Niagara Gorge a small swamp of Red Maple – Northern Pin Oak – White Ash occurs. Small thicket swamps of Buttonbush, Spicebush, Red-osier Dogwood, Grey Dogwood and Pussy Willow are also occasionally present on the plain, as are meadow marshes and marshes dominated by Common Cattail, Reed Canary Grass, Rice Cut Grass and Creeping Bent Grass. (Riley *et al.* 1996)

Where there are extremely shallow soils over bedrock on the escarpment plain, rich Sugar Maple forests typically develop. On drier shallow soils above the Niagara Gorge are relict patches of Chinquapin Oak woodland, with Red Oak, Pignut Hickory, White Oak and White Ash as secondary species. At the escarpment rim Ironwood tends to be the dominant tree species, while sections of the rim of the Niagara Gorge are dominated by semi-open Chinquapin Oak stands with prairie openings of Rough Dropseed and Little Bluestem.

The exposed cliffs of the Niagara Escarpment are usually moist and shaded, and dominated by Bulblet Fern. Dry, exposed cliffs are sparsely vegetated by Smooth Cliff-brake and Poison Ivy. Extensive seepage cliffs occur at the Niagara Gorge that are dominated by moss-covered marl with scattered patches of Satin Grass, White Snakeroot and Bulblet Fern. Talus slopes are extensive below the Niagara Escarpment cliffs in the Niagara River Corridor area, and are usually dominated by fresh Sugar Forests, often with rich understoreys of Pale Jewelweed. Black Maple and Red Elm may occasionally be co-dominant or even dominant. Openings on the upper talus slopes are usually dominated by Red-berried Elder, Riverbank Grape and Staghorn Sumac, while open seepage zones on talus slopes of the Niagara Gorge sustain thickets of Ninebark.

Occasional, isolated woodlots on the Lake Iroquois plain below the Queenston Escarpment include a moist young stand of Bur Oak and Swamp White Oak and extensive thickets of European Alder and other shrubs.

One Mile Creek Watershed

Because 30% of the area is urbanized and much of the remainder is under agricultural use, forest and wetland habitat is limited within the One Mile Creek Watershed. Upland forests consist mainly of coniferous plantations. Fragmented deciduous forest stands exist in some valleys and on private properties. Dominant native trees in these areas include White, Black and Red Oak, White Ash, Black Cherry and Sugar Maple (NPCA 2005).

Lansdowne Pond and a few other private land sites sustain some deciduous swamp features. The Pond provides habitat for waterfowl, including Mallard and Wood Duck. While urban wildlife is frequently reported (deer, racoon, skunk, coyote), the area is also known to support amphibians such as frogs and Blue-spotted Salamander (NPCA 2005). In general, invasive species such as Norway Maple, Manitoba Maple and Garlic Mustard are especially problematic in the forested valleys. While MNR has not identified the riparian woodlands and Lansdowne Pond with any special status, the area is considered an important spawning and nursery site for Lake Ontario fish communities and wildlife habitat for species such as Least Bittern. There is also a questionable historic report for site for Scarlet Oak at the site, a species never confirmed in Ontario.

Also within the watershed, a 30 ha woodlot known as Paradise Grove contains remnant oak savannah, for which a successful prescribed burn was undertaken in 2008.

Niagara On The Lake Watershed

Information on this watershed is adapted primarily from NPCA (2008a). The Niagara-On-The-Lake (NOTL) watershed study encompasses several sub-watersheds within the Niagara River Corridor CAP area. These include Two Mile Creek, Four Mile Creek and Six Mile Creek and Four Mile Pond. Eight Mile Creek is also included in this watershed, but is only partially represented within the CAP area.

Natural features within the NOTL watershed are largely limited to areas along the Niagara Escarpment and some woodlot and riparian zones. Because of their location within the Carolinian life zone, these areas tend to support a high level of representative Carolinian species, such as Tulip Tree, Pawpaw, Sycamore, Pignut Hickory, Black Walnut, Shumard Oak, Black Walnut and Pin Oak. The greatest number of Carolinian and southern species have been documented in Maple Mineral Deciduous Swamp and Dry-Fresh Oak Deciduous Forest ecosites.

Within the NOTL watershed area, 34 different types of vegetation communities have been identified (six of these being cultural types, but others include different types of wetlands such as swamps and marshes),

14 different categories of forest, as well as a beach bar and bluff. Among the wetland communities, the provincially significant Swamp White Oak Deciduous Swamp and a Pin Oak Mineral Deciduous Swamp were identified (S2/S3 provincial ranking, see Appendix).

Because of the heavy conversion of lands to agricultural and residential uses, only limited opportunities remain to connect habitats within the NOTL watershed. Narrow agricultural drains tend to provide some connectivity. Few species are adapted to breeding in this type of agricultural "habitat", with best breeding sites occurring in the larger connected forested areas along the Niagara Escarpment

South Niagara Falls Watershed

The following discussion of natural cover and ecosystems in the South Niagara Falls (SNF) watershed is derived mainly from NPCA (2008b). The South Niagara Falls watershed is primarily agricultural, supporting abundant tender fruit farm operations and vineyards. It spans four municipalities – Niagara Falls, City of Welland, City of Port Colborne and the Town of Fort Erie. It is also located within the Niagara River Area of Concern (AOC), meaning that the area's water quality and aquatic environment has been severely degraded.

Historically, this watershed plan area was dominated by lowland forests which included communities on saturated mineral soils or wet areas on organic soils (such as those found in the Willoughby marsh area). These areas contained species such as Black Ash, Pin Oak, Swamp White Oak and willows; Tamarack occurred in bog-like areas. The vegetation of two representative natural areas is described below:

The Lyons Creek Floodplain and Wetlands ANSI is a contiguous 79 hectare site along Lyons Creek. It represents the best interior wetland community development recorded for an incised meander stream basin in the area, and the expression of the meander stream landforms is very diverse (Macdonald 1980). Many of its wetland communities developed following the inundation of the basin during road construction. These include: submerged aquatic meadows; wet meadows of sedges; marshes of cattail; thicket swamps of Buttonbush, Meadowsweet, dogwood and willow; swamp forest groves of Green Ash, Silver Maple and White Willow. Embankment slope groves of red oak and maple are also found here.

The Willoughby Clay Plan Muck Basin Forest and Marsh ANSI measures 228 hectares and consists of a small organic basin, which is part of Ussher's Creek. Here gently rolling, slough-patterned heavy clay plain supports an extensive forest complex. The southern half of the ANSI is located primarily in the Willoughby Marsh Conservation Area. This portion of the site is characterized by a series of broad wet basins that support a variety of swamp forest, scrub and marsh communities. The swamp forests are dominated by very wet willow-ash or by wet Silver Maple - White Elm - Swamp White Oak. The scrublands are primarily comprised of Meadowsweet, arrow-wood, elderberry and willow. Adjacent to these basins and extending elsewhere through the site are gently rolling heavy clay plains that contain well developed slough pond landforms and associated community patterns, as well as a series of clay plain forests dominated by Red Maple, Red Oak, Northern Pin Oak and Shagbark Hickory (Macdonald 1980).

iv. DOMINANT ENVIRONMENTAL PROCESSES

Much of the Niagara River Corridor CAP area was historically dominated by eastern deciduous forests on Niagara Escarpment, Iroquois Lake Plain and Haldimand Clay Plain physiographic features. These deciduous forests once formed the dominant matrix community throughout southern Ontario, were relatively stable, and supported wide-ranging species (Davis 1996, Anderson and Bernstein 2003). Nested within these large forests were large and small patch habitat types (Anderson and Bernstein 2003)

that often resulted in response to unique or specific terrain. Within the Carolinian life zone large patch communities include marshes, savannahs and prairies.

Minimum Dynamic Area

Minimum dynamic area (MDA) is often used to determine the minimum area needed to maintain natural ecological processes and to ensure that examples of all successional stages will exist within a given habitat type under all disturbance regimes (e.g. wind, fire, insects) (Pickett and Thompson 1978). Most forests in southern Ontario experienced average disturbances of less than 2 hectares (4 acres), and early successional stages were limited to gaps created in the canopy by windstorms, downbursts and ice-storms (Riley and Mohr 1994, Larson *et al.* 1999). It has been estimated that protected landscapes must be 50 to 100 times larger than average disturbance patches in order to maintain a relative equilibrium of habitats (Shugart and West 1981). In such landscapes, the proportions of different successional stages (e.g. young forest, old growth forest) would be relatively constant over time, even though the sites occupied by different stand types would change. On this basis, minimum recommended area for core forests in southern Ontario would be between 100 and 200 hectares (~250 and 500 acres). Given projections for larger, more frequent storms due to climate change, a conservative strategy would recommend cores of at least 200 hectares (~500 acres) in size. No forest patches north of Niagara Falls meet this minimum requirement, with the largest patch (~60 ha) being a narrow, linear strip along the Niagara Escarpment west of Queenston. South of Niagara Falls, a few woodlots approach 100 ha in size, notably along the north side of the Welland River and in the Ussher's Creek – Tea Creek – Lyon's Creek area north of Fort Erie. Restoration of fragmented areas and creation of connected networks and corridors could increase the MDA of the forests in the CAP area, and these objectives will be discussed further in this document.

Fire

Primary disturbance regimes in the prairies and savannahs of southern Ontario were largely driven by drought and fire cycles. Most of these tallgrass systems occurred on sand plains (limited primarily to the lake plain in the Short Hills NA), which would have experienced fires every 5-15 years. Fire is a significant process in the functioning and maintenance of Ontario's remaining prairies (areas which historically supported grasses and herbs with few trees), grasslands (anthropogenic communities of grasses which occur as a result of abandoned cultural use such as farming) and savannahs [grasslands with 25-35% cover of woody species (Lee *et al.* 1998)], as well as drier oak woodland communities, which also occur in the Niagara River Corridor CAP area. Fire encourages species that respond to newly burned and open conditions and that benefit from the lack of competition from woody species, which cannot populate burned areas as quickly and efficiently. Natural fire regimes in southern Ontario have been suppressed or altered since European settlement, and as a result, many valuable natural areas have been, and continue to be, lost to succession. Succession is defined as the eventual encroachment of woody species, especially trees, into areas which will cause the cover to eventually become a woodland or forest. In this setting, woody species dominate and prairie or grassland species often die out due to shading or competition from these plants.

Savannahs exist as a delicate balance between scattered woody species and grassland species, and grow specifically in areas wet enough to support trees but dry enough to be subject to fire. They rely on frequent fire events to prevent forested oak woodland cover from becoming dominant. Grasslands and prairies are similar to savannahs but have less cover of fire-tolerant oak species and greater expanses of open land carpeted in herbaceous, fire-tolerant grasses. Fire is extremely important to maintaining grasslands, prairies and savannahs. Burning tallgrass prairies has been shown to stimulate growth of prairie plants and the mycorrhizae that aid plants in nutrient acquisition (Bentivenga and Hetrick 1991). Periodic fires would historically have maintained drier open oak-dominated woodlands, as well as the patches of prairie and savannah found on the escarpment plain near the rim of the Niagara Gorge.

Hydrology and Watersheds

The spectacular Niagara Falls near the midway point of the Niagara River Corridor CAP area gives the region its international fame. However, the Niagara River Corridor CAP area covers several subwatershed and drainage basins within the Niagara Peninsula Conservation Authority's (NPCA) jurisdiction. These include:

- One Mile Creek
- Two Mile Creek (NOTL Watershed Plan)
- Six Mile Creek
- Thompson's creek
- Hunter's Drain (S. Niagara Falls Watershed)
- Lyons Creek (S. Niagara Falls Watershed)
- Ussher's Creek (S. Niagara Falls Watershed)
- Baker Creek
- Miller Creek

and parts of the Tea Creek and Six Mile Creek watersheds.

Figure 2. Original Niagara River Corridor CAP area boundary with watersheds (see next page for updated CAP map)

Figure 3. Niagara River Corridor CAP Priorities for Conservation and Restoration

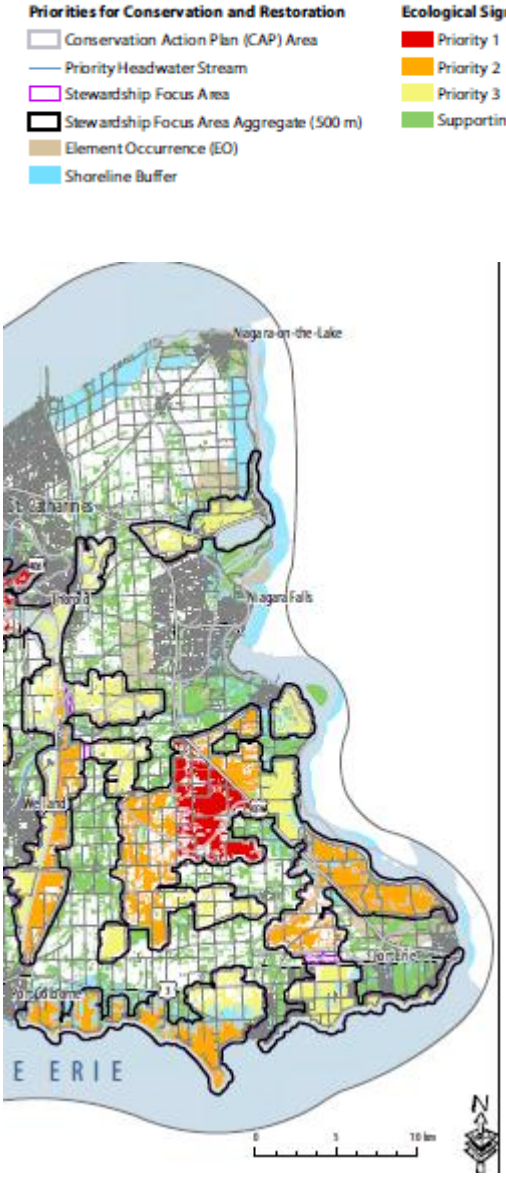
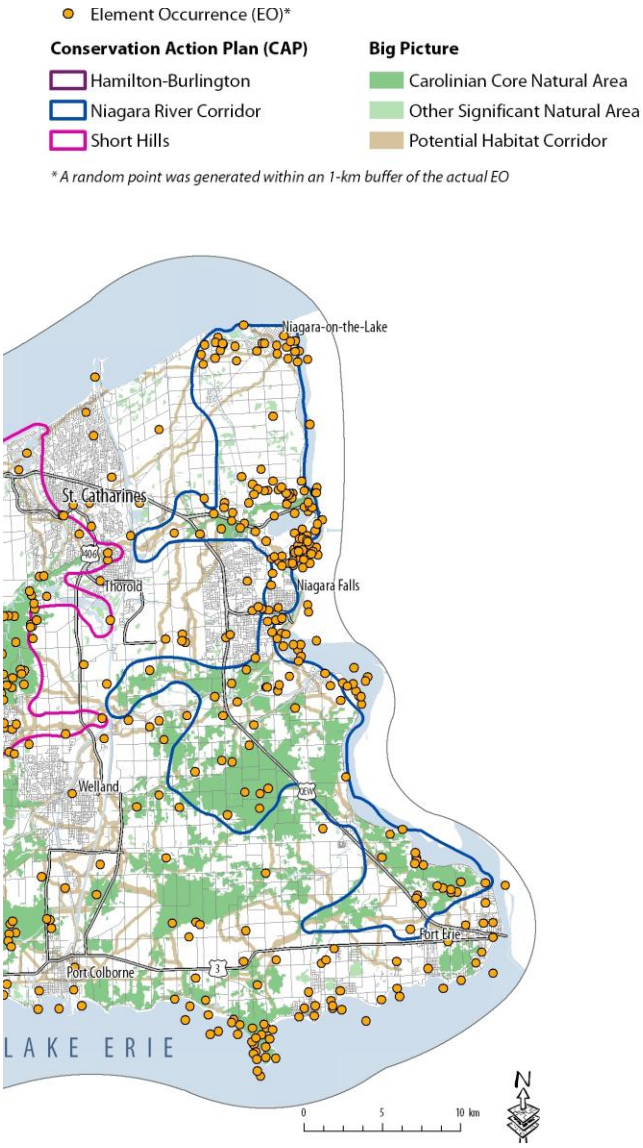


Figure 4. Niagara River Corridor CAP with Element Occurrences and Big Picture Cores and Corridors



v. SIGNIFICANT SPECIES

In the South Niagara Falls Watershed Plan study area, endangered, threatened and species of special concern have been documented by the OMNR, Dougan and Associates, the NPCA and many other researchers and naturalists. Among these are the endangered Butternut, Eastern Flowering Dogwood and Spoon-Leaved Moss, the threatened American Water-willow, Blanding's Turtle, Round-Leaved Greenbrier, White Wood Aster and Yellow-Breasted Chat, as well as species of Special Concern such as Cerulean Warbler and Shumard Oak, and a very long list of provincially rare plants and animals that have not received formal SAR designations, including Arrow-arum, Black Crowned Night-heron, Black Gum, and others. A number of globally and provincially rare rare habitats also occur. Examples include remnant prairie and savannah communities along the brow of the Niagara Gorge, and the Lyon's Creek riparian corridor supports a rare Buttonbush Mineral Thicket Swamp.

Despite the fragmentation of natural habitat, researchers have recently discovered a number of new species at risk within the Niagara Region. The Niagara Peninsula Conservation Authority, together with a variety of partners has recently undertaken a Natural Areas Inventory (NAI) within its jurisdiction. One of the goals of this initiative is to compile a comprehensive biological inventory for the watershed and provide baseline information for natural areas. Over the course of the past several years, staff have visited dozens of privately-owned natural areas and made many significant discoveries, including new sites for Species At Risk such as Eastern Flowering Dogwood (*Cornus florida*), American Chestnut (*Castanea dentata*), White Wood Aster (*Eurybia divaricata*), Round-leaved Greenbrier (*Smilax rotundifolia*), Butternut (*Juglans cinerea*) and Spotted Wintergreen (*Chimaphila maculata*), as well as many other plants of provincial conservation concern including James Sedge (*Carex jamesii*), Blunt-scaled Oak Sedge (*Carex albicans* var. *albicans*), Eastern Few-fruited Sedge (*Carex oligocarpa*), Weak Stellate Sedge (*Carex seorsa*), Swan's Sedge (*Carex swanii*), Yellow Corydalis (*Corydalis flavula*), Biennial Gaura (*Gaura biennis*), Black Gum (*Nyssa sylvatica*), and Robust Smartweed (*Polygonum robustius*) (Oldham, 2008). Also, in 2009, a population of the threatened Dwarf Hackberry was discovered in the Niagara Gorge, a species never before documented on the Niagara Peninsula (Gartshore pers. comm. 2009).

Aquatic habitats in the CAP area support several mussel SAR (Kidneyshell, Round Hickorynut, Round Pigtoe, Snuffbox, Eastern Pondmussel, Fawnsfoot, Mapleleaf, Rainbow) and two fish SAR (Grass Pickerel and Lake Chubsucker) (Figures 3 and 4, respectively). Grass Pickerel is recorded in Bayer's Creek, Grassy Brook, Lyon's Creek Tee Creek and Ussher's Creek. Lake Chubsucker is recorded in Lyon's Creek. These species are representative of an intermediately tolerant fish community, and fish habitat must be maintained or restored for the fish to maintain viable populations in the system (NPCA 2008b).

Figure 5: Distribution of Mussel SAR in the NOTL Watershed

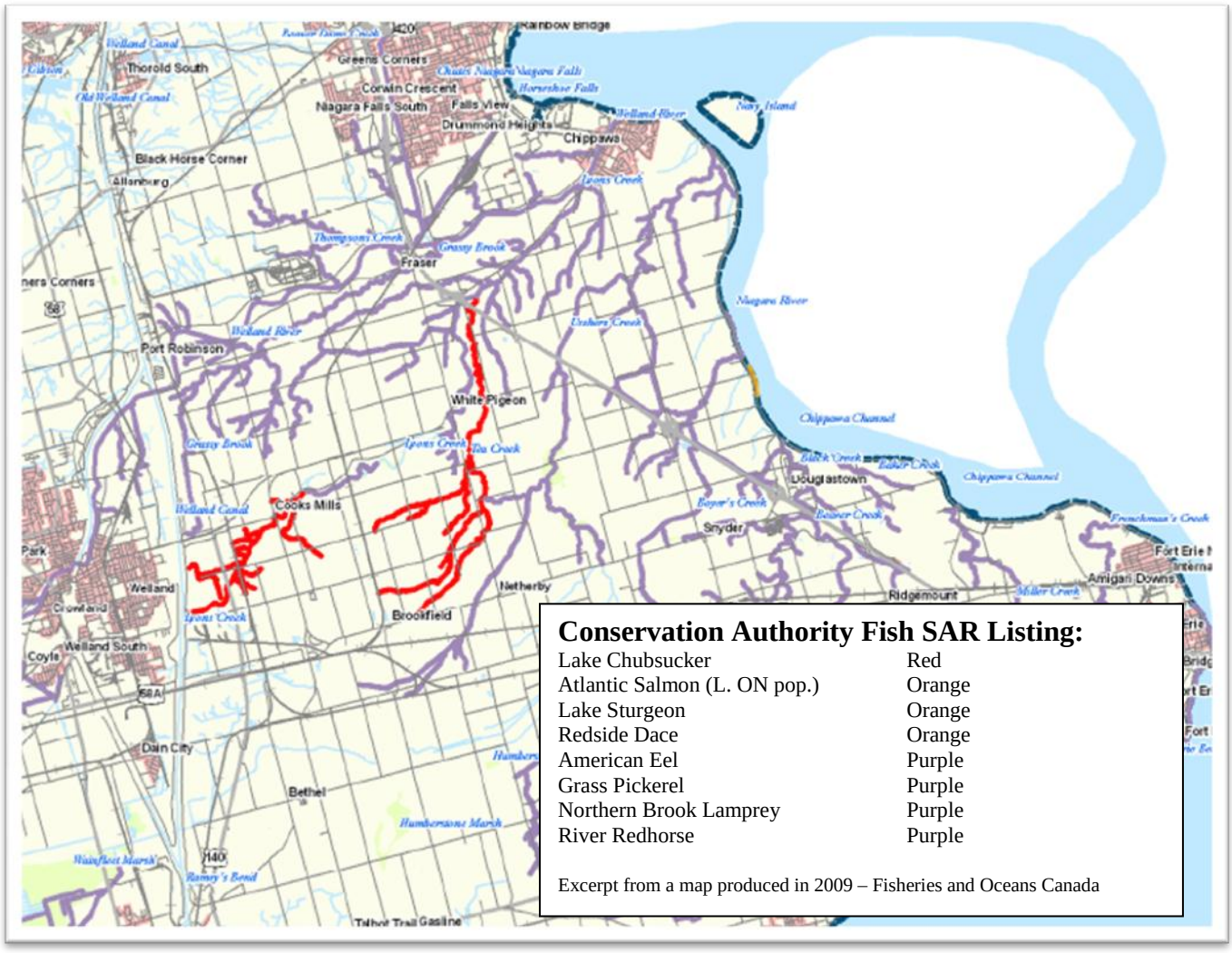


Figure 6: Distribution of Fish SAR in Niagara

Unless otherwise indicated, data in the tables below are from NHIC (2009) but are generally not current to 2009. Only designated Species At Risk (SAR) (Endangered, Threatened or Special Concern) are included. Many additional globally and provincially rare species and vegetation communities occur in these areas, and some of them may be considered as focal conservation targets during the CAP process.

Records have in some cases have not been included for locally extirpated species (indicated with X) occurring at sites considered so modified that they are not recoverable. However, records of many historic (indicated with H) and extirpated taxa are presented since these could conceivably recolonize (or be reintroduced) as habitats are restored.

Table 1.4 Federally and Provincially Designated SAR in the Niagara River Corridor CAP Area

Key to codes and abbreviations:
SHF = Short Hills – Fonthill CAP Area NR = Niagara River CAP Area; OBBA = Ontario Breeding Bird Atlas; RT = Recovery Team; RS = Recovery Strategy; NHIC = Natural Heritage Information Centre
COSEWIC / OMNR Status: EXP = Extirpated; END = Endangered; THR = Threatened; SC = Special Concern
Recovery Strategy Status (as of January 2009): A = Completed Strategy Available; D = Draft prepared, available; DN = Draft prepared, not available; N = strategy not available; P = part of multi-species or ecosystem-based strategy; ? = status unknown; MP = Management Plan (in place of Recovery Strategy for Special Concern species).
Species Status in CAP Area: X = extant, or recorded within past 20 years XX = extirpated, or not recorded within past 20 years

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G[6]/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
White Wood Aster ***Eurybia divaricata***	2. Upland Deciduous Forests /	THR	THR	G5 S2	?	NHIC: Issues: management (logging), many new populations being found. (Donald Kirk) RS not available.	MNR SAR Program (D. Kirk, K. Beriault) 12 Mile Creek Headwaters IBA Conservation Plan Protecting SAR at HNC Nature Sanctuaries	HNC: Conducting detailed SAR surveys and developing Management Plan at Short Hills NS (2009)

[6] - G Rank based on NatureServe 2010

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G[6]/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Hooded Warbler ***Wilsonia citrina***	2. Upland Deciduous Forests / Openings in deciduous forests; oak woodlands.	THR	SC	G5 S3B	A	NHIC: 1985 breeding record Develop conservation agreement to conserve critical habitat at unprotected sites. Work with Environment Canada to contact landowners of important forests (whether containing critical habitat or not) and provide with information on how to manage for ACFL and HOWA and older-growth forests. Encourage landowners to place conservation easements on old-growth tracts or protect them through other stewardship mechanisms. Produce a "Habitat Best Management Fact Sheet" and distribute to planning authorities to ensure that they have current knowledge of the impacts of hydrological alteration, residential development, recreational activities, and forest management in and adjacent to ACFL and HOWA habitat, and encourage them to maintain old growth; include silvicultural tech guidelines and old-growth recommendation. Encourage incorporation of ACFL and HOWA habitat into long-term management planning on all public lands. Survey forests every five years to monitor populations, distribution, and availability of habitat. Monitor critical habitat to ensure populations are not declining due to overlooked threats. Develop a management strategy for invasive insects and pathogens that includes: monitoring the spread of tree-killing invasive insects and/or diseases; assessing impacts of insects and disease on habitat; encouraging land managers to undertake site-specific measures to stop or reduce impacts. Develop a management strategy for invasive plants that includes: assessing the extent critical habitat is being altered by invasive plants at occupied forests; assessing the extent to which the species is affected; recommendations on control of invasive plants.	BSC IBA (Jon McCracken, Debbie Badzinski) 12 Mile Creek Headwaters IBA Conservation Plan Protecting SAR at HNC Nature Sanctuaries	12-Mile Creek – Fonthill areas considered among the top six forested areas for ACFL/HOWA and worthy of additional recovery efforts & CAP focus (JM). HNC: Conducting detailed SAR surveys and developing Management Plan at Short Hills NS (2009)
American Columbo ***Frasera caroliniensis***	2. Upland Deciduous Forests /	END	END	G5 S2	2012*	NHIC: Considered extirpated from CAP area RS not available	MNR SAR (Donald Kirk, Amy Brant, Karine Beriault) 12 Mile Creek Headwaters IBA Conservation Plan	Inventory and occurrence updates for past 2 years, at CA properties and private land (when invited). (DK)
American Ginseng ***Panax quinquefolius***	2. Upland Deciduous Forests / Rich deciduous forest	END	END	G3G4 S2	DN	NHIC: a few historic EO's for Niagara. Considered extirpated from CAP area RS not available.	MNR SAR (Amy Brant)	New population found; nothing specifically being done, but plan to verify old occurrences (at least 2 sites extant in Niagara)
Southern Flying-squirrel ***Glaucomys volans***	2. Upland Deciduous Forests / Mature deciduous forests	SC	SC	G5 S3	N	NHIC data for Niagara incomplete.		

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G^6/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Cerulean Warbler ***Dendroica cerulea***	2. Upland Deciduous Forests / Mature deciduous forests	SC	SC	G4 S3B	N	NHIC: Breeding season record from 1990	Protecting SAR at HNC Nature Sanctuaries	HNC: Conducting detailed SAR surveys and developing Management Plan at Short Hills NS (2009)
Timber Rattlesnake ***Crotalus horridus***	2. Upland Deciduous Forests	EXP	EXP	? SX	A	Extirpated from CAP area and Ontario		
Shumard Oak ***Quercus shumardii***	2. Upland Deciduous Forest	SC	SC	G5 S3	n/a	Small population on DND lands at Two Mile – Four Mile creek.		
Woodland Vole ***Microtus pinetorum***	Mature deciduous forests	SC	SC	G5 S3	N	May be extant. Probably more widespread than records indicate – updated information required.	Protecting SAR at HNC Nature Sanctuaries	
Broad Beech Fern ***Phegopteris hexagonop-tera***	2. Upland Deciduous Forests; 3. Lowland Swamp Forests / Moist deciduous forests	SC	SC	G5 S3	n/a	NHIC: Two historic/extirpated records (NOTL – Queenston area, and “near Niagara Falls”)	Protecting SAR at HNC Nature Sanctuaries	HNC: Conducting detailed SAR surveys and developing Management Plan at Short Hills NS (2009)
Green Dragon ***Arisaema dracontium***	3. Lowland Swamp Forests /	SC	SC	G5 S3	n/a	NHIC: EO ranked B NW of Ft. Erie in NR.		

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G^6/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Butternut ***Juglans cinerea***	2. Upland Deciduous Forests; 3. Lowland Swamp Forests; 4. Edges, Thickets and Fields / Deciduous forests and edges	END	END	G5 S3	A	Formerly widespread and relatively common on Niagara Peninsula. Declining rapidly due to Butternut canker disease. Conduct inventories for butternut following a standardized protocol and a statistically valid method for population estimation and tracking. Educate landowners on butternut identification, and identification and assessment of canker in the field. Encourage landowners to assess extent of disease and abstain from harvesting putatively resistant individuals and trees predicted to survive ≥15 years based on health assessment. Engage landowners , stakeholders and others in recovery implementation and actions, including maintaining populations on the landscape. Locate and monitor putatively resistant trees.	MNR SAR Program (Amy Brant) Priority species for LandCare Niagara 15-16-18-Mile Creek Watershed Plan Protecting SAR at HNC Nature Sanctuaries	Noted during site visits (genetic purity uncertain), DNA sampling required; signage stickers magnets created (AB). LCN undertaking surveys to monitor health HNC: Establishing a long-term monitoring program at Short Hills NSfor based on draft RS. Permanently mark all trees. Conduct a disease assessment of following approved guidelines. ID any healthy trees, and any “vigorously surviving” trees for nut or plant material collection. HNC developing Management Plan (2009)
American Chestnut ***Castanea dentata***	2. Upland Deciduous Forests; 4. Edges, Thickets and Fields / Deciduous forests and edges	END	END	G4 S2	A	COSEWIC (2006): NHIC: Last NHIC observation from 2000 Assess status of populations every 5-10 years using methods outlined in RS. From existing information, and information collected from status assessments, identify and promote conservation of at least 15 core populations. A management strategy will be initiated in ten of the 15 populations. The remaining five populations will initially be unmanaged and will serve as controls for comparison. The management strategy could include: 1) removing dead, sporulating chestnut tissue from the site to reduce inoculum; 2) suppressing canker development using selected treatments; 3) encouraging recruitment of new individuals through pollination; 4) transplanting uninfected individuals from other sites; and 5) thinning or other microhabitat management to improve survival and growth of seedlings. Work cooperatively with planning agencies, conservation authorities, forestry consultants and municipal by-law officers to protect known populations and their habitats within their jurisdictions, following the Provincial Policy Statement under the Planning Act for the protection of habitat of endangered and threatened species. Information and status of regional populations from the inventory should be made available to these agencies. Undertake landowner contact and encourage stewardship. Involve the Nature Conservancy of Canada, local land trusts, and regional stewardship networks to bring about land securement through such mechanisms as landowner contact and stewardship, conservation easements, or acquisition. Promote awareness of the status of American chestnut to the general public through communication with farm, forestry, naturalist, and, planning organizations.	15-16-18-Mile Creek Watershed Plan Protecting SAR at HNC Nature Sanctuaries Priority species of LandCare Niagara (Mike Rose)	HNC: Initiating a long-term AC monitoring program at Short Hills Nature Sanctuary based on the RT’s protocol. Initial phase: permanently label all AC trees; take soil samples and determining soil type and pH; collect and submit leaf, bud, and twig specimens to RBG. HNC: Conducting detailed SAR surveys and developing Management Plan at Short Hills NS (2009) LCN undertaking surveys to monitor health (MR).

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G^6/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Eastern Flowering Dogwood ***Cornus florida***	2. Upland Deciduous Forests; 5. Edges, Thickets and Fields / Deciduous woodland edge, clearings, wet floodplain oak forests	END	END	G5 S2	N	Widespread but in decline on Niagara Peninsula due to Dogwood anthracnose disease. Several occurrences in the CAP area. RS in prep., not available.	MNR SAR Program (Amy Brant, Donald Kirk, Karine Beriault) 12 Mile Creek Headwaters IBA Conservation Plan Priority species for LandCare Niagara (Mike Rose) 15-16-18-Mile Creek Watershed Plan	LCN/MNR have produced ID cards, stickers; reuseable grocery bags and signage; also inventory and occurrence updates for past 2 years, at CA properties and private land (when invited). Updated map available. Seed collection for LCN. (A. Brant, K. Beriault) New populations being found – health is the issue (e.g., Lathrop property – most trees dead, also mortality at Short Hills sanctuary) (DK) Monitoring, propagation and future planting by LCN (MR).
Red Mulberry ***Morus rubra***	2. Upland Deciduous Forests / Deciduous forests	END	END	G4 S2	A	NHIC: 4 Niagara Glen EO ranked AB (21 trees counted, 18 of them less than 20 cm dbh, 1 with greater than 50 cm dbh), 2 historic EO's in NR. Threats include hybridization with White Mulberry (the main threat), twig blight, pollution, habitat loss, invasive species and predation. Initiate targeted searches for RM in potential habitat such as Niagara Escarpment. Communicate the negative effects and discourage planting of White Mulberry. Complete ELC surveys of all extant populations of Red Mulberry. Contact private landowners and encourage habitat stewardship. Work with municipalities and other planning agencies to protect significant habitats and populations by providing generalized maps and advice on official plans for municipal land use and other planning processes such as the PPS. Develop site-specific management plans for core populations; retain one site as a control. Initially eradicate White Mulberry within habitats of core populations, then within pollination range, while minimizing the impacts of these activities on other associated species, vegetation communities and ecological processes; assess effects of eradicating hybrids on retention of Red Mulberry alleles. Examine habitats for other threats and develop approaches within site management plans. Cooperate with other initiatives to connect and expand forest fragments to create potential future habitat. Monitor populations and threats.	MNR SAR Program (Donald Kirk, RT Co-chair)	RS (2007): Niagara Glen and Ball's Falls identified as core areas for protection.

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G[6]/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Drooping Trillium ***Trillium flexipes***	2. Upland Deciduous Forests; 3. Lowland Swamp Forests	END	END	G5 S1	D	NHIC: Last NHIC observation from 1950	MNR SAR Program (Donald Kirk)	Niagara populations inventoried / monitored in 2005/06 by OMNR staff (DK)
Round-leaved Greenbrier ***Smilax rotundifolia***	2. Upland Deciduous Forests; 4. Edges Thickets and Fields / Deciduous woodlands, edges	THR	THR	G5 S2	D	NR South Niagara Falls (Fern Park) EO Rank B, 1989-03-14 (13 male, 8 female clusters, 3 vegetative, Private? Plants in good vigour); Garner Road, Niagara Falls, EO Rank B, 2003-06-01 (11 clusters, all femalePrivate land? Plants in good vigour in 1989); East of Welland (Cook's Mills) EO Rank B?, 1985, 2 sub-populations, 6 clusters, all vegetative, Private land?; Fernwood Development, EO Rank C, 2003-06-01, Two small clusters and a single plant; both sexes present; two fruit found, Private land; Lyon's Creek North, EO Rank D, 1999-09-22, Exact number of plants unknown but probably <6, private land; light trails, some wood removal in woodlot. • Conduct population counts of extant populations, characterize habitat and assess threats. • Inventory sites of unconfirmed historic reports. • Identify and survey additional sites with potentially suitable habitat. • Identify the positive and/or negative impacts of land-use and management practices. • Clarify land ownership of some populations. • Develop Best Management Practices (BMPs). • Provide recommendations and BMPs to landowners and land managers. • Apply monitoring protocol in association with monitoring other priority species of the overall Carolinian Woodlands Recovery Strategy • Identify key sites for securement in the context of the overall Carolinian Woodlands Recovery Strategy. • Secure key sites through easements or purchase. • Identify key sites with suitable but degraded habitat for restoration. • Restore or rehabilitate habitat at key sites. • Based on assessments of threats, studies of the species' biology and ecology, population viability analysis, determine the need and feasibility of reintroduction. • Reintroduce species to historic or other suitable sites, if deemed necessary and feasible.	MNR SAR Program (Donald Kirk)	Niagara populations inventoried / monitored in 2005/06 by OMNR staff (DK)
Common Grey Fox	2. Upland Deciduous Forests; 4. Edges, Thickets and Fields / Deciduous forests and marshes; dens in dense thickets usually near water.	THR	THR	G5 SNA	N	NHIC: Last NHIC observation from 1954 Status of species in the CAP areas is uncertain; there has never been evidence of breeding or longer-term persistence. Individuals may be transients or vagrants from populations in the U.S. RS not available.		

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G^6/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Deerberry ***Vaccinium stramineum***	6. Dry Oak Woodlands, Prairies, Savannahs, Seepage Fens / Dry, relatively open, sandy or rocky woodlands and thickets	THR	THR	G5 S1	A	NHIC: Observations to 2001 RS: "Niagara population is located near the City of Niagara Falls and perhaps along the Bruce Trail (presumed to be extirpated). However, these populations possess few individual plants. A number of sites in the Niagara Region formerly supported Deerberry, which has been extirpated. Extirpated sites are listed in Ford (1994) as St. David's Gorge, Niagara Falls, Niagara-on-the-Lake, Niagara Glen, Queenston and Queenston Heights. Last dates of observation include 1896, 1956 and the 1960s for some of these sites. Representative specimens listed from these sites include collections by Dearness, McCall, Miller, Fleischmann, Soper, Scott and Cameron. These locations have recently been searched by Meyers (1985), Ford and Varga (1989) and Thompson (2000) among others. Only two populations were verified in the 1990s and Thompson could not find one of these in 2000. Thompson reported that the City of Niagara Falls population possessed only two stems in 2000 (M. Thompson pers. comm. 2001). One well documented extirpation is that at St. David's Buried Gorge, where Deerberry was seen in the late 1960s by Meyers (G. Meyers pers. comm. 2001) but was later found to have been destroyed by grazing and/or trampling by Meyers (1985)." Continue to protect known sites on lands managed by Niagara Parks Commission. Examine the habitat of historical occurrences and extant populations. Investigate forest history using tree-ring analysis (e.g., fire scars in oaks). Research historical and current plant associations at sites in the Niagara Area. Define critical/recovery/survival habitat. Produce education materials to increase public awareness of Deerberry and species at risk issues (poster, pamplets, signs, etc). Using standard guidelines developed by the RT: collect and cultivate a stock of cuttings and seeds; incorporate restoration of Deerberry into oak forest/savanna restoration activities; enhance or augment existing populations, if appropriate. Collaborate with regional conservation initiatives.	12 Mile Creek Headwaters IBA Conservation Plan	Could potentially benefit from naturalization efforts along Niagara Parkway
Bird's-foot Violet ***Viola pedata***	6. Dry Oak Woodlands, Prairies, Savannahs, Seepage Fens	END	END	G5 S1	Tallgrass	NHIC: 1906 observation		

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G^6/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Barn Owl ***Tyto alba***	4. Edges, Thickets, Fields; 6. Dry Oak Woodlands, Prairies, Savannahs; 7 Ecological Services on Rural Lands / Native grasslands & agricultural areas	END	END	G5 S1	A*	NHIC: Last NHIC record from 1962 Identify priority sites for conservation, restoration, and protection efforts; collaborate with grassland and grassland species recovery teams, conservation organizations, government, private sector, rural landowners, and farmers; promote land trusts and conservation easements to secure habitat; approach landowners of priority sites regarding the establishment of grassland reserves; provide information on Conservation Tax Incentive Program, Species at Risk Stewardship Fund and Species at Risk Farm Incentive Program to interested landowners; identify, demonstrate and promote sustainable grassland management practices and engage landowners and farmers in these practices; provide rural landowners and farmers with contact information for funding agencies, organizations with expertise in grassland conservation, and sources for grassland species and habitat information; promote awareness of legal protection of Barn Owls; continue to evaluate areas of potential Barn Owl habitat and promote erection of nest boxes in barns and silos in these areas; conduct periodic monitoring of nest boxes to study use by Barn Owls & potential competitors	MNR SAR Program (KB, DK)	
Northern Bobwhite ***Colinus virginianus***	4. Edges, Thickets, Fields; 6. Dry Oak Woodlands, Prairies, Savannahs; 7 Ecological Services on Rural Lands / Native grasslands & agricultural areas	END	END	G5 S1	A*	NHIC: Last NHIC record from 1900 Identify priority sites for conservation, restoration, and protection efforts; collaborate with grassland and grassland species recovery teams, conservation organizations, government, private sector, rural landowners, and farmers; promote land trusts and conservation easements to secure habitat; approach landowners of priority sites regarding the establishment of grassland reserves; provide information on Conservation Tax Incentive Program, Species at Risk Stewardship Fund and Species at Risk Farm Incentive Program to interested landowners; identify, demonstrate and promote sustainable grassland management practices and engage landowners and farmers in these practices; provide rural landowners and farmers with contact information for funding agencies, organizations with expertise in grassland conservation, and sources for grassland species and habitat information; promote awareness of legal protection of Barn Owls; continue to evaluate areas of potential Barn Owl habitat and promote erection of nest boxes in barns and silos in these areas; conduct periodic monitoring of nest boxes to study use by Barn Owls & potential competitors		
Milksnake ***Lampropeltis triangulum***	4. Edges, Thickets, Fields; 6. Dry Oak Woodlands, Prairies, Savannahs, Seepage Fens; 7 Ecological Services on Rural Lands / Woodlands, fields.	SC	SC	G5 S3	n/a			

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G[6]/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Eastern Hog-nosed Snake ***Heterodon platirhinus***	4. Edges, Thickets, Fields; 6. Dry Oak Woodlands, Prairies, Savannahs, Seepage Fens; 7 Ecological Services on Rural Lands / Thickets and scrubby regenerating fields	SC	SC	G5 S3	A	Last NHIC observation 1988 Habitat protection · Prioritize private sites for urgency and conservation importance · Identify and contact owners · Determine ideal protection strategy for each site		
Yellow-breasted Chat ***Icteria virens***	4. Edges, Thickets, Fields; 6. Dry Oak Woodlands, Prairies, Savannahs, Seepage Fens; 7 Ecological Services on Rural Lands / Thickets and scrubby regenerating fields	SC	SC	G5 S2	DMP	Last NHIC observation 1985. Objective 2. Habitat management Sites of high current, recent historical or potential value to this species on public lands (e.g., Crown Land, Provincial and National Parks, Conservation Authority lands) and on private lands under the ownership or management of conservation organizations (e.g., Nature Conservancy of Canada, Ontario Nature) must be identified, and Conservation Action Plans produced for those sites. The plans must consider the chat in the larger Carolinian context, so that its needs can be balanced with those of other Species at Risk and significant ecosystem requirements within the Carolinian region. For sites of high current, recent historical or potential value to this species on private lands, where possible, land management agreements should be created with the owners (e.g., farmers), including conservation agreements to protect and maintain old fields and other early successional habitats.		
Dense Blazing Star ***Liatris spicata***	6. Dry Oak Woodlands, Prairies, Savannahs and Seepage Fens / Prairies	THR	THR	G4 S2	Tallgrass / DN	Mapped for south end of Niagara River Corridor CAP area on SARA web site and in COSEWIC report, but status in the area is unclear.		

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G^6/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Common Hoptree ***Ptelea trifoliata***	4. Edges, Thickets, Fields / Sandy beach ridges and relict beach ridges	THR	THR	G5 S3	D	NHIC: Niagara Glen EO ranked D, with only ~5 plants (1989 data). Encourage local landowners and the public to report species locations and monitor populations on private lands. Prioritize properties for protection. Encourage the inclusion of the Common Hoptree in management plans for protected areas. Identify characteristics and locations of critical habitat for Lake Erie shoreline as well as inland populations. Develop workshops and materials to inform appropriate staff of the presence of Common Hoptree. Develop workshops and material to educate landowners about value of the Common Hoptree on their property	MNR SAR Program (Amy Brant, Karine Beriault)	MNR field staff have conducted surveys along the Lake Erie shoreline in the Niagara Peninsula (RS); created educational signage, id cards, stickers, magnets, invasives removal, partnered with NPC/Landcare Niagara growing trees for planting (seeds from L. Erie shoreline) (AB). LCN is actively planting (KB)
Swamp Rose Mallow ***Hibiscus moscheutos***	1. Marshes and Shorelines / Marshes, wetland edges	SC	SC	G5 S3	n/a	COSEWIC (2004): Considered extirpated from Welland Canal, Niagara On The Lake and Queenston sites. Threats include invasion by Phragmites australis, shoreline development, and impacts on water quality and hydrology.	MNR SAR Program (Amy Brant, Karine Beriault) Priority species of LandCare Niagara (Mike Rose)	seed collection along Niagara R. & further inland & N. Falls; seed being grown & being shipped to LandCare Niagara (AB). Invasive species removal at Lake Gibson (KB).
Bald Eagle ***Haliaeetus leucocephalus***	1. Marshes and Shorelines / Marshes, wetland edges	NAR	SC	G5 S4B	n/a	NHIC: Last NHIC observation from 1998	MNR SAR Program (Amy Brant, Karine Beriault) Priority species of LandCare Niagara (Mike Rose)	seed collection along Niagara R. & further inland & N. Falls; seed being grown & being shipped to LandCare Niagara (AB). Invasive species removal at Lake Gibson (KB).
American Water-willow ***Justicia americana***	1. Marshes and Shorelines / Marshes, wetland edges	SC	SC	G5 S1	DN	NHIC: Last NHIC observation from 1986	MNR SAR Program (Amy Brant, Karine Beriault) Priority species of LandCare Niagara (Mike Rose)	seed collection along Niagara R. & further inland & N. Falls; seed being grown & being shipped to LandCare Niagara (AB). Invasive species removal at Lake Gibson (KB).

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G[6]/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Blanding's Turtle ***Emydoidea blandingii***	1. Marshes and Shorelines; 2. Lakes, Rivers, Streams and Riparian Systems / Lakes, ponds, rivers, wetlands	THR	THR	G4 S3	Multi-species Turtle / DN	NHIC: Last observation from 1985 Conduct surveys for 1) populations lacking current information; 2) targeted locations of potential populations; 3) known populations to determine spatial extent and quality of available habitat. Solicit observations from public and from within protected areas. Ensure necropsies are performed when unusual deaths occur. Identify areas of significant traffic mortality. Evaluate traffic mortality reduction techniques at significant sites. Conduct quantitative assessment of effect of boating on mortality. Determine effective techniques to reduce incidental mortality in fishing traps. Collected DNA samples from all turtles handled in any research program & identify population markers. Develop and disseminate guidelines for BMPs (for new roads, existing roads and off-road vehicles). Enforce restrictions of off-road vehicles in protected areas. Prioritize protection of privately owned sites based on urgency and conservation importance; identify and contact land owners; determine and implement appropriate protection approaches for selected sites. Create or enhance nesting sites where required and monitor use and nesting success. Develop recommended nest protection techniques. Encourage the permanent marking of all handled turtles so that illegally collected turtles can be identified to source. Develop headstarting protocols for populations with little evidence of natural recruitment. Develop rehabilitation techniques and share with vets. Develop and deliver awareness program to enforcement officials regarding SAR turtle issues.	OMNR SAR Program (Suzanne Robinson – RT Co-chair)	In Niagara there has been significant interest (research) in engaging commercial fishing industry to reduce off-catch of turtles (a significant problem for MATU STIN BLTU) – Carlton U (SR).
Least Bittern ***Ixobrychus exilis***	Marshes	THR	THR	G5 S3	DN	Reported from Lansdowne Pond.		

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G[6]/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Lake Chubsucker ***Erimyzon sucetta***	1. Marshes and Shorelines; 5. Lakes Rivers, Streams and Riparian Ecosystems / Marshes and lakes with clear, still waters and abundant aquatic plants	END	THR	G5 S2	A	See Figure 4. DFO posted a proposed RS (includes critical habitat, which has been increased downstream since RS posted); high priority, most easterly pop'n, significant pop'n, PCB issue, degradation further down – restoration potential? Best to speak to Anne Yagi & NPCA or others involved in area. Waterway very disturbed, canal water pumped into Lyon's Creek to maintain habitat (rel. good water quality pumped in artificially) complicated by Niagara R. RAP and highly contaminated (very controversial) (SS) Lyons Creek (Niagara River drainage): LC presently occurs along a 1.8 km stretch of clear water maintained by the clean overflow water of the Welland Canal. Remainder of creek is highly degraded and siltation may remain an immediate threat to this population. In addition, PCB contamination within Lyons Creek has been an ongoing concern with site remediation plans in the early stages. Conduct targeted surveys of Lyon's Creek, preferred habitats in Tea Creek and upper tributaries of Niagara River. Implement a standardized index population and habitat monitoring program with a specific sampling and training protocol. Determine the seasonal habitat needs of all life stages. Evaluate the impacts of exotic species (including carp and exotic plants) on the LC and its habitat. Investigate and evaluate the significance of threat factors that may be impacting extant populations (see RS). Take steps to mitigate immediate threats. Monitor LC watersheds for exotics of concern in cooperation with aquatic ecosystem recovery teams. Investigate impacts of regulated water levels (i.e., diked wetlands) vs. natural wetlands (undiked or with natural barriers) on habitat conditions for lake chubsucker. Investigate the degree to which populations within diked wetlands are connected to adjacent waters. Measure sediment and nutrient loads emitted from streams.	MNR SAR Program Niagara River RAP DFO (Shawn Staton)	Noted in South Niagara Falls Watershed Plan
American Eel ***Anguilla rostrata***	1. Marshes and Shorelines; 5. Lakes Rivers, Streams and Riparian Ecosystems	SC	END	G5 S1?	N	See Figure 4. American Eel numbers in Lake Ontario and its watersheds remain drastically lower than former levels, and the positive trends in some indicators for the Gulf of St. Lawrence are too short to provide strong evidence that this component is increasing. Possible causes of the observed decline, including habitat alteration, dams, fishery harvest, oscillations in ocean conditions, acid rain, and contaminants, may continue to impede recovery. (COSEWIC 2006)	MNR SAR Program NPCA, NRC and LandCare Niagara riparian restoration projects DFO (Amy Boyko, Shawn Staton)	NPCA and LandCare Niagara riparian restoration projects
Grass Pickerel ***Esox americanus*** **(**also: **Northern Brook Lamprey, River Redhorse)**	1. Marshes and Shorelines; 5. Lakes Rivers, Streams and Riparian Ecosystems	SC	SC	G5 S3	n/a	See Figure 4.	MNR SAR Program Niagara River RAP DFO (Shawn Staton)	Noted in South Niagara Falls Watershed Plan

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G^6/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
Redside Dace ***Clinostomus elongatus***	5. Lakes, Rivers, Streams, Riparian Ecosystems / Clean clear streams	SC	END	G5 S3	A	See Figure 4. NHIC: Last record from 1975 Encourage planning authorities to protect RD habitat in OPs. Encourage the incorporation of RD protection goals in NH plans and growth management plans. Conduct fieldwork to refine and map distribution. Work with baitfish harvesters and the Bait Association of Ontario to protect and monitor RD. Ensure that potential impacts on populations are considered when introductions are proposed. Ensure that potential invasion by exotic species is considered when removal of barriers is planned. Evaluate health of RD populations and habitats to identify degraded sites and investigate feasibility of restoration. Encourage BMPs in rural streams to restore a healthy riparian zone, reduce livestock access, establish manure storage and runoff collection systems, encourage conservation tillage and reduce tile drain impacts. Offer financial incentives as part of a stewardship program. Focus riparian rehabilitation re-establishment of grasses and shrubs. Identify candidate streams for RD re-introduction. Encourage development of EFPs and Nutrient Management Plans. Conduct rapid fluvial geomorphological assessments of select RD habitats. Identify critical habitats required for spawning, incubation and larval development. Investigate seasonal use of habitat, particularly over- wintering areas. Investigate movements and physiological tolerances. Conduct inventory of riparian buffer areas and their health. Identify key factors associated with urban development and agricultural practices that may contribute to population declines. Foster public support and awareness by developing appropriate materials and programs identified in the strategy.	DFO SAR program (A. Boyko, S. Staton) NPCA watershed restoration Niagara Water Quality Protection Strategy	Watershed habitat restoration initiatives and water quality improvement programs.
Common Snapping Turtle	1. Marshes and Shorelines; 5. Lakes Rivers, Streams and Riparian Ecosystems / Lakes, rivers, wetlands	SC	SC	G5 S4	n/a		MNR SAR Program (Amy Brant, Suzanne Robinson – RT Co-chair)	Part of Ontario Herpetfaunal Summary. In Niagara there has been significant interest (research) in engaging commercial fishing industry to reduce off-catch of turtles (a significant problem for MATU STIN BLTU) – Carlton U.

Species (Nested Target)	Conservation Target (System) / Specific Habitat	COSEWIC	OMNR	G^6/S Rank	RS Status	Status / Major Threats / Recommended Recovery Actions Relevant to CAP	Relevant Projects (contacts)	Actions Underway
FRESHWATER MUSSELS: **1. Kidneyshell** ***Ptychobranchus fasciolaris*** **2. Round Pigtoe** ***Pleurobema intoxia*** **3. Round Hickorynut** ***Obovaria subrotunda*** **4. Snuffbox** ***Epioblasma triquetra*** **5. Eastern Pondmussel** ***Ligumia nasuta*** **6. Fawnsfoot** ***Truncilla donaciformis*** **7. Mapleleaf** ***Quadrula quadrula*** **8. Rainbow** ***Villosa iris***	5. Lakes, Rivers, Streams, Riparian Ecosystems / Clean clear streams	1-6. END 7. THR 8. END	1-4. END 5-6. ? 7-8. THR	1-2. G4G5S1 3. G4S1 4. G3S1 5. G4S1 6-7. G5S2 8. G5QS2S3	1-4. A 5-8. N	See Figure 3 for SAR mussel distribution in CAP area. Niagara River: The loss of the … Round Pigtoe… and Snuffbox from historical habitat in these water bodies can be largely attributed to the detrimental effects of zebra mussels. [However] Round Pigtoe is a short-term brooder and may be less susceptible to the harmful effects of the zebra mussel [and] …Snuffbox…burrow completely in the substrate and may escape serious infestation due to their preferred habitat. A single record exists for the Round Hickorynut in the Welland River consisting of a single shell collected in 1931 by an unidentified collector (COSEWIC 2003a). Its current status in this river is unknown. - Work with existing ecosystem recovery teams to implement recovery actions. - Encourage municipal planning authorities to consider Recovery Goals in official plans. - Work with drainage supervisors, engineers and contractors to limit the effects of drainage activities on mussel habitat. - Encourage the development of management plans for non SAR fish species within watersheds inhabited by SAR mussels. - Work with the baitfish industry to reduce the impacts of commercial baitfishing on host species. - Evaluate whether wastewater treatment plants are functioning up to specifications and encourage upgrading where appropriate. - Review stormwater management facilities for quantity and quality control in new developments, and retro-fit existing development where possible. - Establish riparian buffer zones in areas of high erosion potential by encouraging naturalization or planting of native species. - Work with landowners to mitigate the effects of tile drainage. - Encourage the active exclusion of livestock from the watercourse. - Assist with establishing adequate manure collection and storage systems to avoid accidental spills, and winter-spreading of manure. - Encourage the development and implementation of Environmental Farm Plans and Nutrient Management Plans. - Work with landowners to improve faulty septic systems. - Cooperating and coordinating efforts with stewardship councils and CAs. - Encourage soil testing to determine fertilizer application rates. - Increase public knowledge of stewardship options and financial assistance available to participate in activities. - Increase public awareness of the potential impacts of transporting/releasing exotic species. - Encourage public support and participation by developing awareness materials and programs.	DFO SAR program (A. Boyko, S. Staton) NPCA watershed restoration Welland Riverkeepers Niagara Water Quality Protection Strategy	Watershed habitat restoration initiatives and water quality improvement programs.

Other Provincially Rare Species Documented in the Niagara River Corridor CAP Area (NHIC 2009)
(year of most recent record is indicated for species that have not been documented since 1990)

A Hawthorn (*Crataegus conspecta*) SRF
A Hawthorn (*Crataegus persimilis*) S1 1981
Appalachian Sedge (*Carex appalachica*) S2S3 1882
Autumn Coral-root (*Corallorhiza odontorhiza*) S2 1899
Azure Bluet (*Enallagma aspersum*) S3
Black Cohosh (*Actaea racemosa*) S2
Biennial Gaura (*Oenothera gaura*) S3
Big-rooted Morning Glory (*Ipomoea pandurata*) S1 1902
Black-crowned Night-Heron (*Nyctocorax nycticorax*) S3B
Black Gum (*Nyssa sylvatica*) S3
Burning Bush (*Euonymus atropurpureus*) S3 1905
Carolina Vetch (*Vicia caroliniana*) S2 1897
Churchmouse Three-awned Grass (*Aristida dichotoma*) S1S2
Coast Barnyard Grass (*Echinochloa walteri*) S3
Deer-tongue Panic Grass (*Dichanthelium clandestinum*) S2
Downy Yellow False Foxglove (*Aureolaria virginica*) S1 1945
Dunbar's Hawthorn (*Crateaegus beata*) S1
Eastern Few-fruited Sedge (*Carex oligocarpa*) S3 1905
Eastern Green-violet (*Hybanthus concolor*) S2 1901
Eastern Pipistrelle (*Pipistrellus subflavus*) S3? 1933
Fern-leaved Yellow False Foxglove (*Aureolaria pedicularia*) S2? 1898
Grass Sedge (*Carex jamesii*) S4 1892
Great Plains Ladies'-tresses (*Spiranthes magnicamporum*) S3?
Greater Redhorse (*Moxostoma valenciennesi*) S3
Green Arrow-arum (*Peltandra virginica*) S2
Green Sedge (*Carex hirsutella*)
Hairy-jointed Meadow Parsnip (*Thaspium barbinode*) SH 1901
Halberd-leaved Tearthumb (*Persicaria arifolia*) S3
Honey-locust (*Gleditsia triacanthos*) S2 1980
Large Yellow Pond-lily (*Nuphar advena*) S3 1932
Lizard's-tail (*Saururus cernuus*) S3 1999
Long-leaf Dropseed (*Sporobolus compositus*) S4 1989
Northern Hawthorn (*Crataegus dissona*) S3 1977
Nottaway Brome (*Bromus nottawayanus*) S1S2
Pawpaw (*Asimina triloba*) S3
Perfoliate Bellwort (*Uvularia perfoliata*) S1 1959
Pignut Hickory (*Carya glabra*) S3
Prostate Tick-trefoil (*Desmodium rotundifolium*) S2 1906
Purple-stemmed Cliff-brake (*Pellaea atropurpurea*) S3
Purple Giant Hyssop (*Agastache scrophularifolia*) S1 1877
Puttyroot (*Aplectrum hyemale*) S2 1899
Scarlet Beebalm (*Monarda didyma*) S2 1904
Sundial Lupine (*Lupinus perennis*) S3 1971
Sharp-fruited Rush (*Juncus acuminatus*) S3 1901
Shellbark Hickory (*Carya laciniosa*) S3 1980
Shiny Wedge Grass (*Sphenopholis nitida*) S1 1892
Slender Vulpia (*Vulpia octoflora*) S2 1902
Slim-flowered Muhly (*Muhlenbergia tenuifolia*) S2 1948
Smith's Bulrush (*Schoenoplectus smithii*) S3 1896
Southern Slender Ladies'-tresses (*Spiranthes lacera* var. *gracilis*) S1 1980
Stiff Gentian (*Gentianella quinquefolia*) S2 1894
Stiff Yellow Flax (*Linum medium* var. *medium*) S3? 1877
Tufted Titmouse (*Baeolophus bicolor*) S4
Unicorn Clubtail (*Arigomphus villosipes*) S2S3 1943
Violet Bush-clover (*Lespedeza frutescens*) S1 1978
Waxy-fruit Hawthorn (*Crataegus formosa*) S2 1977
Weak Stellate Sedge (*Carex seorsa*) S2 1989
White-hair Witchgrass (*Dichanthelium villosissimum*) SU 1902
Whorled Milkweed (*Asclepias quadrifolia*) S1 1976
Willdenow's Sedge (*Carex willdenowii*) S1 1992
Yellow False Indigo (*Baptisia tinctoria*) S2 1891

vi. SOCIO-ECONOMIC / CULTURAL CONTEXT

Both the terrestrial ecosystems and hydrology of the Niagara River Corridor CAP area have been greatly influenced by human activities over the past two centuries. [aboriginal influences? / uses?] Farmers found the region's climate and rich soils so conducive to agriculture that the region is now famous for its crop production. In fact, it is known as Ontario's "fruit belt". It is particularly well known for its vineyards and tender fruit orchards, though a diversity of other land uses include greenhouses, intensive livestock and field crops abound (Gayler 1994).

The fertile soils and proximity to navigable waters created an ideal place for early European setters to make a living. The abundance of farming opportunities resulted in prolific crop production, and many hectares of land were drained and cleared for this purpose. In an analysis of land use change from 1936 to 1981, Muller and Middleton (1994), note that in the period from 1936-52, urban expansion began increasing at a rapid rate, which resulted in existing natural areas coming under increasing pressure to be developed as cropland. After the 1950s, the authors note that forests ceased being cleared at such a rapid rate. In some cases, wooded areas were replanted. However, they recognize these new woodlands could not represent climax Carolinian communities. Their assemblages of edge-type species tend to lower its conservation value.

In total, 12 municipalities make up the Niagara Region. Niagara-on-the-Lake, Niagara Falls, and the northern portion of Fort Erie are largely represented within the Niagara River Corridor CAP area. Thorold, Welland and Port Colborne are partially included.

Table 1.6. Population Statistics for the Niagara River Corridor CAP Area*

Name	Population (2006)	2001-2006 Population Growth
Niagara Falls	82,184	3,369
Niagara-on-the-Lake	14,587	748
Fort Erie**	29,928	1782

* all information from Statistics Canada 2006

**The town of Fort Erie is outside the CAP area, but portions of the municipality are included; data are presented to show population trend

B. BIODIVERSITY TARGETS AND ASSOCIATED IMPACTS

After considerable deliberation, the CAP team selected the following conservation targets as being representative of the full range of systems needing to be considered in order to maintain and recover native biodiversity in the Niagara River Corridor CAP area:

1. Marshes and Shorelines
2. Upland Deciduous Forests
3. Lowland Swamp Forests
4. Lakes, Rivers, Streams and Riparian Ecosystems
5. Edges, Thickets and Fields
6. Dry Oak Woodlands, Prairies, Savannahs and Seepage Fens
7. Ecological Services on Rural Lands
8. Habitat in Drains

Each of these conservation targets represents an ecosystem type or types upon which several or many species at risk (SAR) depend (Table 2.1). If measures are taken to maintain and enhance the health of key ecological attributes of each of the systems targets, the viability the nested species will normally also be enhanced. The viability, key ecological attributes and indicators of health of each of the conservation targets was assessed by the CAP team (Tables 2.2), based on expert knowledge and experience within the team. The indicators were selected on the basis of elements of the ecosystem that could feasibly monitored over the long term to determine the effectiveness of implementation of actions recommended in this plan.

i. BIODIVERSITY TARGETS AND THEIR VIABILITY

The following tables present the overall CAP conservation targets (Table 2.1), an assessment of their viability in the Niagara River Corridor CAP area.

Table 2.1. Overall biodiversity targets and nested targets.

Conservation Targets	Nested Targets (confirmed and potential)
1. Marshes and Shorelines	American Water-willow, Swamp Rose Mallow (X), Blanding's Turtle, Lake Chubsucker (X), Grass Pickerel, Common Snapping Turtle
2. Upland Deciduous Forests	Seepage zones; Hooded Warbler, Spoon-leaved Moss, White Wood Aster, Dwarf Hackberry, Shumard Oak, Broad Beech Fern, Butternut, American Chestnut, Red Mulberry, Round-leaved Greenbrier, Allegheny Mountain Dusky Salamander, Northern Dusky Salamander, Common Gray Fox, American Columbo (X), American Ginseng (X), Southern Flying-squirrel (?), Cerulean Warbler (X?), Woodland Vole (?),Timber Rattlesnake (X)
3. Swamp / Lowland Forests	Seepage zones; older-growth and interior forest; Broad Beech Fern, Cucumber Tree, Green Dragon, False Hop Sedge (?), Drooping Trillium (X)
4. Lakes, Rivers and Streams	Blanding's Turtle, Redside Dace, Lake Chubsucker, Common Snapping Turtle, American Eel, Atlantic Salmon (L. ON pop.), Lake Sturgeon, Grass Pickerel, Northern Brook Lamprey, River Redhorse, Kidneyshell, Round Hickorynut, Round Pigtoe, Snuffbox, Eastern Pondmussel, Fawnsfoot, Mapleleaf, Rainbow, Spring Salamander (X)
5. Prairies, Savannahs, Dry Oak Woodlands	Deerberry, Eastern Hog-nosed Snake, Bird's-foot Violet (X), Pink Milkwort (X), Purple Twayblade (X), Spotted Wintergreen (X)
6. Edges, Thickets, Fields	Eastern Flowering Dogwood, Round-leaved Greenbrier, Dwarf Hackberry, Barn Owl, Common Gray Fox, Milksnake, Common Hoptree, Eastern Hog-nosed Snake
8. Ecological Services on Rural Lands	Barn Owl, Dense Blazing-star, Milksnake, Short-eared Owl, Yellow-breasted Chat, Willow-leaved Aster, Eastern Hog-nosed Snake
9. Habitat in Drains	?

X – Extirpated or historically-occurring target; ? – Potential target

Table 2.2. Viability Summary

	Conservation Targets		Landscape Context		Condition		Size		Viability Rank
			Grade	Weight	Grade	Weight	Grade	Weight	
1	**Marshes and Shorelines**	**Key Attributes:** Extent / connectivity; hydrological regime; water quality; native species composition and diversity **Indicators:** Quantitative measures of the above attributes.	Good	1	Fair	1	Good	1	**Good**
2	**Upland Deciduous Forests**	**Key Attributes:** Forest interior habitat; native vegetation **Indicators:** Forest-interior bird species "index"; extent of invasives	Good	1	Good	1	Good	1	**Good**
3	**Lowland Swamp Forests**	**Key Attributes:** Hydrological regime; slough/ridge topography; connectivity and extent of forest cover; native vegetation **Indicators:** Amphibian diversity; presence of wetland obligate plant species; measure of change in extent / connectivity of swamp forests	Fair	1	Fair	1	Good	1	**Fair**
4	**Lakes, Rivers, Streams and Riparian Ecosystems**	**Key Attributes:** Extent / connectivity; hydrological regime; water quality; native species composition & diversity; natural drainage patterns **Indicator:** Quantitative measures of the above attributes.	Poor	1	Poor	1	Fair	1	**Poor**
5	**Edges, Thickets and Fields**	**Key Attributes:** Disturbance; "cultural attributes": windbreaks, soil stabilization, natural snow fencing **Indicators:** Diversity of open-country native bird species; presence of Gray Ratsnake	Fair	1	Good	1	Good	1	**Good**
6	**Dry Oak Woodlands, Prairies, Savannahs**	**Key Attributes:** Hydrological regime; native species composition Native species composition; open canopy fire or surrogate; native species composition and diversity (specific to system types). **Indicators:** Quantitative measures of the above attributes	Poor	1	Fair	1	Poor	1	**Poor**
7	**Ecological Services on Rural Lands**	**Key Attributes:** Stable, fertile soils; wildlife habitat; water quality **Indicators:** Productivity / yield; pollinators; profitable farm business; number of EFPs; number of rural landowners participating in stewardship programs	Poor	1	Poor	1	NA	1	**Poor**
8	**Habitat in Drains**	**Key Attributes:** water quality & quantity, diversity of aquatic habitat, presence of refugia, woody debris **Indicators:** Abundance levels of flow measurements; abundance of Grass Pickerel / Lake Chubsucker; chemical analysis	Poor	1	Poor	1	NA	1	**Poor**
Project Biodiversity Health Rank									**Fair**

Very Good	**Optimal Health**: Target is functioning at an ecologically desirable status, and requires little management.
Good	**Minimum Health**: Target is functioning within its range of acceptable variation; it may require some management.
Fair	**Likely Degradation**: Target lies outside range of acceptable variation; requires management. If unchecked, vulnerable to serious degradation.
Poor	**Imminent Loss**: If target remains in this condition for an extended period, restoration or preventing extirpation will be practically impossible.
Unknown	**Research Need**: The biodiversity target is known to occur, but information on this viability criterion is currently is unknown.
NA	**Not Applicable**: This criterion is not significant for assessing the health of this biodiversity target.

ii. IMPACTS

The Niagara River CAP area is dominated by human land uses such as the urban landscapes of the cities of Niagara Falls and Fort Erie, and extensive orchards and vineyards. Major transportation corridors bisect the area, including the Queen Elizabeth Way. As a result, there has been extensive loss of natural areas and heavy impact on ecological functions and processes. The major impacts were evaluated by the CAP team and are listed in Table 2.3, followed by more detailed summaries.

Table 2.3. Summary of Impacts
[based on IUCN classification of direct threats (IUCN-CMP 2006a) – see Appendix A for explanation of rankings]

Threats Across Targets		Marshes and Shorelines	Upland Deciduous Forests	Lowland Swamp Forests	Lakes, Rivers, Streams & Riparian Ecosystems	Edges, Thickets and Fields	Dry Oak Woodlands, Prairies, Savannahs	Ecological Services on Rural Lands	Habitat in Drains	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	7	8	
1	Development	-	Very High	Very High	Medium	Very High	-	-	-	Very High
2	Incompatible water management	Very High	-	Medium	Very High	-	-	-	Very High	Very High
3	Contamination, effluents, sedimentation	High	-	-	Very High	-	-	-	Very High	Very High
4	Incompatible land management and use	Medium	Medium	Medium	High	High	Very High	High	-	Very High
5	Perception, values	-	-	-	-	Very High	-	Medium	Very High	Very High
6	Property economics (land values, profiteering, tax laws, grants)	-	-	-	-	-	-	Very High	-	High
7	Terrestrial invasive species	-	High	Medium	-	Medium	High	-	-	High
8	Fire suppression, mowing	-	-	-	-	-	High	-	-	Medium
9	Incompatible legislation	-	-	-	-	-	-	-	High	Medium
10	Aquatic invasive species (goby, carp, Phragmites)	-	-	-	Medium	-	-	-	-	Low
Threat Status for Targets and Project		High	High	High	Very High	Very High	High	High	Very High	Very High

Development (Housing & Urban; Tourism & Recreation; Commercial & Industrial)

Residential, commercial and industrial development has had a substantial impact on portions of the CAP area. The construction of buildings and associated infrastructure results in direct, irreversible loss of habitat for native species, including species at risk (SAR). Associated impacts include the planting of lawns on natural habitat, cultivars invading surrounding natural areas, and the effects of associated applications of pesticides and fertilizers. Residential development occurs through the area, particularly in the major urban centres, but also rurally in the form of estate lots (Cheskey 2003).

Infrastructural improvement such as the building of new roads and the expansion of existing ones is almost always associated with development. Roads reduce the amount of interior habitat, and can isolate populations. Roads disrupt natural processes such as groundwater flow and the spread of wildfire; they affect plant dispersal and inhibit animal movements, and can drain aquifers and increase soil erosion (Forman and Alexander 1998, Forman *et al.* 1997). Road construction modifies soil density, topography, and surface and groundwater hydrology (Seiler 2001). Wetland and riparian habitats are especially sensitive to hydrological changes caused by roads (Findlay and Bourdages 2000). Roads also result in high faunal mortality, particularly for reptile species, which often use warmed pavement for thermoregulation and road embankments for egg-laying. As with roads, major impacts of utility and service lines include habitat fragmentation, increased edge effects, invasive species, and pesticide impacts if herbicides are used during maintenance.

Predation of reptiles, amphibians and small mammals by domestic pets is another well-documented impact that occurs in natural areas near residential areas. In the United States, rural cats kill an estimated one billion small mammals and many hundreds of millions of birds each year, and serious impacts on rare and endangered species, including reptiles, have been documented worldwide (ABC 2003).

Perception, Values

One of the most significant threats to SAR and the biodiversity of the Short Hills area identified by the CAP team involves the public perception and valuing of SAR and the habitats that support them. Most of the CAP area consists of private land, and many landowners are concerned about the implications of SAR habitat on property values and the permitted uses and activities on their lands. Successional thickets and fields are particularly susceptible to a widespread perception that they are wastelands of no value unless they are developed or farmed, and yet many of the region's (and the province's) most threatened SAR are grassland and shrubland species, notably birds (McCracken 2005). In such a heavily populated region, land use planners and land managers constantly are faced with having to balance the interests of development, recreation, resource extraction and conservation. The ecological needs of SAR and all native flora and fauna are often not fully understood or appreciated when land use decisions are made, although there has been much progress in this regard in recent decades (see Section C, "Opportunities", for a discussion of the many relevant programs and initiatives in the area). Some of the imbalances in perception and values may be alleviated through public education and the establishment in the community of a long term ethic of ecological health and sustainability as articulated in the "Vision Statement" of this Conservation Action Plan.

Incompatible Land Management and Use

The majority of the CAP area is under agricultural land use, and thus land stewardship by agricultural community is critical to the health of ecosystems. The continued presence of a high

diversity of Species At Risk in the area is evidence that farmers and other rural landowners have helped maintain the ecological integrity of forests, river systems and wetlands. Nevertheless, agriculture has impacted and continues to affect the ecosystems in many ways including:

- Forest clearing, habitat fragmentation and reduction of forest interior habitat;
- Drainage of swamps, marshes and other wetlands;
- Re-routing of watercourses through channelization, drains, ponds and dams;
- Introduction of non-native and invasive plants and animals;
- Creating habitat for generalist species that out-compete, predate or parasitize more specialized native species;
- Soil erosion and reduction in soil quality;
- Increased nutrient loads in lakes, rivers and wetlands from agricultural run-off;
- Air and water pollution from pesticides and fertilizes;
- Grazing impacts in forests, wetlands and other natural habitats;
- Effects of genetically modified crops on native flora and fauna;
- Reduction in overall biological diversity and ecological resilience;
- Contributions to climate change through CO_2 outputs and local microclimatic effects.

Timber harvesting occurs in woodlots throughout the CAP area. In general, incompatible logging practices can impact SAR populations through:

- introduction of invasive species;
- opening of the canopy, reducing habitat needed by shade-requiring species;
- soil compaction and erosion;
- increased evaporation, reduced soil moisture;
- increased edge effects;
- increased competition from successional species;
- increased habitat for generalists, predators and nest-parasites;
- reduced extent of forest interior habitat required by certain sensitive species;
- damage to vegetation;
- reduction in older-growth habitat and associated processes;
- interruption in SAR life cycles and movement patterns;
- loss of biomass;
- other disturbance to SAR habitat and individual species.

Given the proximity of urban centres and the extent of easily accessible natural areas, recreational activities have a significant impact on the quality of natural habitats in the CAP area. Some of the threats to habitats by recreational activities include:

i. Damage to plants and habitat from foot traffic and vehicles, and associated construction of access roads and trails;
ii. Habitat fragmentation and alterationt;
iii. Invasion by exotic taxa.

Some native plant SAR have attractive flowers. Their populations, particularly those in high-traffic recreational areas, are potentially threatened by people picking them for decorative or horticultural purposes. Collecting of SAR turtles for the pet trade is potentially a serious problem in the CAP area, but the extent to which it is occurring is not known.

All terrain vehicles (ATVs) and other off-road vehicles are a serious threat to most habitat types, but particularly sand dunes, wetlands and forests. The trails increase edge effects, provide habitat for invasive plant species, damage and remove natural vegetation, and, if used during wet periods, result in soil compaction, erosion and potential siltation in the run-off to local waters. Some off-road vehicle users appear to enjoy exploring virgin terrain, creating new trails, and rutting and disturbing natural habitats.

The noise created by vehicles using off-road trails disturbs wildlife, especially reptiles and certain mammals that are sensitive to human activity (e.g., Brant and Brown 1988, Bowles 1995, Bury 1980, Parent and Weatherhead 1998). Snowmobile and off-road vehicle trails are often routed through wilderness and their motors are generally less muffled than those of domestic vehicles. White-tailed Deer are known to flee approaching snowmobiles and off-road vehicles, and mortality due to such stress has been documented (Bollinger 1974, Dorrance *et al.* 1975).

Incompatible Water Management
Contamination, Effluents, Sedimentation

The Niagara River Corridor watersheds are dominated by rural and urban land-uses and are subject to many of the same disturbances seen in the larger rural watersheds of southwestern Ontario which have contributed to the decline of freshwater mussels in these systems. Intensive agricultural activity coupled with extensive tile drainage and reduced riparian vegetation has resulted in high sediment inputs, increased turbidity, elevated nutrient and bacterial levels and an overall reduction in the quantity and quality of aquatic habitat.

Along riparian corridors, beaches and other land/water interfaces in the natural area, impervious surfaces (*e.g.*, pavement, hardened shorelines, rip-rap) can be a significant problem. Such problems are particularly pronounced in the vicinity of larger urban areas where a significant percentage of surface area is impermeable to rainwater, resulting in greatly increased surface run-off. Shoreline modification may also affect fish habitat, and can impede the traditional movement of species both along the shoreline and from the waters to terrestrial habitats.

Within the CAP area, the NOTL watershed area is the most intensively farmed. The flat terrain of the Iroquois Plain and the loamy soils lend themselves well to supporting a number of different agricultural commodities including grapes, tender fruits and greenhouse operations. An extensive drainage network has been constructed to service these agricultural operations. As a result, stormwater runoff creates a flash hydrology regime that impacts water quality. When tested, these drains exhibit high levels of nutrients, bacteria, sediments and chloride levels. Nevertheless, adult Chinook Salmon (which are not native to these waters) were observed in all watercourses in 2005. While the Department of Fisheries and Oceans (DFO) does not have records of rare fish for this area, records indicate that some rare mussels can be found in local lakes and drains (DFO 2009).

Property Economics (land values, profiteering, tax laws, grants)

Land values within the Golden Horseshoe are highly inflated due to the economic opportunities and high levels of immigration to the area. As a result, organisations involved in securing and protecting lands for conservation are often at a considerable financial disadvantage in relation to development interests.

Terrestrial Invasive Species
Aquatic Invasive Species

The impacts on ecosystems of invasive, non-native plant species (such as Common Reed, Garlic Mustard, Common Buckthorn), insects (such as Emerald Ash Borer), other invertebrates (such as Zebra Mussels), fungal diseases (such as Butternut Canker) are widely known. Common Reed in particular is of great concern in wetlands both from biodiversity conservation and human use perspectives. Round Goby and Common Carp also pose significant threats to wetland and aquatic ecosystems. There is a need to control the use of exotic baitfish and potential collection of baitfish from streams and wetlands. Additionally, as noted above, domestic and feral cats are predators that efficiently prey on both adult and nestling birds, reptiles and native small mammals.

Fire Suppression and Mowing

Within the CAP area, natural succession in the form of increased cover by woody plants (shrubs and trees) has been noted in what may have been native prairies, savannahs, and in pine-oak woodlands. This succession may be due to suppression of natural wildfire. On the other hand, early-season mowing for hay can have a serious impact on grassland bird species that are nesting in the fields.

Problematic Native Species (Increased Herbivory, Predation and Parasitism)

Excessively high White-tailed Deer populations can lead to serious negative impacts on native vegetation due to heavy browsing. Deer culls have been used many areas where natural deer predators are absent, but these can be unpopular for ethical and practical reasons, particularly in the vicinity of heavily urbanized areas. With respect to native species imbalances that affect bird populations, Wilson and Cheskey (2001) write, "A stable population is one where natality (birth rates) and mortality (death rates) balance. When the scale is tipped towards mortality, a population declines and eventually becomes extirpated (goes extinct in the area)….When increased mortality resulting in population declines or extirpation is a result of human behaviour, there is a strong ethical argument to stop or change the behaviour. There is strong evidence the complex consequences of people living near or in forests or natural areas includes damage to many species' populations. Some of these activities result in increased numbers of natural nest predators including raccoons, squirrels, chipmunks, Blue Jays, Common Grackles and Common Crows. The Brown-headed Cowbird is a nest parasite which lays its eggs in other bird's nests, often at the expense of the host species. It also benefits from feedlots and certain types of bird feed…. Garbage and food wastes, waste grain, certain types of bird seed, and compost are all implicated in creating inflated populations of nest predators (and cowbirds). These species are consequently more abundant in our surrounding forests, and inflict a greater toll on forest birds, particularly those nesting in "open cup" type nests…."

Air-borne Pollutants

Although not listed by the CAP team as a target-specific threat, air-borne pollutants and associated climate change are a potentially serious threat to all targets and the overall biodiversity of the CAP area. Air-borne pollutants in this context refer to carbon dioxide and other greenhouse gases associated with climate change. The actual impact which we wish to highlight is climate change itself. Climate change is likely to be among the most significant threats to global biodiversity (Fischlin *et al.* 2007). Habitat management and species protection in a changing climate is likely to be difficult, and it can be expected that biodiversity targets which are already at risk may be lost, especially from isolated patches of habitat or areas with limited connectivity to other natural cover. Climate change could also allow additional exotic species to

become established and become invasive (Dukes and Mooney 1999). Climate change will be manifested in different ways in different regions. Although some regions may experience little change in temperature, they are likely to experience instead changes in weather patterns, with increasing frequency and severity of storms, or changing timing of storm events. In the Great Lakes region, this may have a dramatic effect on already naturally rare and anthropogenically disturbed coastal communities. Both the loss of at risk biodiversity targets, and the arrival of new invasive species, is likely to have a disproportionate effect on ecosystem functions in a system already stressed by changing temperature regimes and storm patterns. The unpredictable nature of both climate change, its effects on biodiversity targets, and the response of ecosystems to changing abundance or function of their components, means that the effects may be severe in ways we cannot predict (McFarlane pers. comm. 2009).

Air- and precipitation-borne nutrient loading (increases in available Nitrogen) have been shown to impact on fungal diversity (Arnolds 1991), and are therefore possibly a threat to the mycorrhizal associations required by many plant species.

C. OPPORTUNITIES

Existing Programs and Activities

The Niagara River Corridor CAP area is already benefitting from a broad range of conservation-oriented programs, projects and activities being undertaken by many different agencies, organisations and groups, often in partnership with one another. Some important programs and activities in the CAP area are summarised below, but it is important to note that these descriptions *do not represent all the conservation and ecological restoration work currently being undertaken in the area*.

Niagara Peninsula Natural Areas Inventory

Partners: NPCA, Niagara Region

Goals, Timelines, Activities: From 2006 through 2009, the Niagara Peninsula Conservation Authority, in collaboration with the Peninsula Field Naturalists and others, has been working on a Natural Heritage Areas Inventory. The project provides up-to-date natural areas information, building on existing data, confirming the significance of known sites, and filling information gaps where inventory work is outdated or has been lacking. The data collected provides a solid resource of information that will be of benefit in the development of greater environmental awareness within the community and, as a scientifically-defensible baseline for use in planning decisions and policy development. It provides current georeferenced SAR data as well as standardized ecological land classification (ELC) mapping in a geographic information systems (GIS) environment. The project has been funded by the Region of Niagara, Haldimand County, Ontario Trillium Foundation and others.

Niagara Pensinsula Conservation Authority (NPCA) Watershed Plans

Partners: NPCA

Goals, Timelines, Activities: Detailed, comprehensive watershed plans have been developed in recent years for the CAP area's watersheds (NPCA 2005, 2008ab, 2009). These plans provide

extensive background information on local hydrology, watershed functions, natural heritage values and human impacts, and a high level of expertise in relation to managing for healthier watersheds and improved water quality. The plans include the identification and prioritisation of areas for ecological restoration, and are therefore form an essential and highly complementary context for this CAP.

OMNR Species At Risk (SAR) Program

Partners: OMNR, LandCare Niagara, Niagara Parks Commission, Environment Canada's Habitat Stewardship Program

Goals, Timelines, Activities: The main focus of OMNR's SAR program in the Niagara area are surveys and monitoring of SAR populations (including updating historic records, especially for tree species), education and outreach, landowner contact, seed collection, and invasive species removal (Brant pers. comm. 2009). The current highest priority species are Eastern Flowering Dogwood, Common Hoptree (Beriault pers. comm. 2009). New recovery strategies will lead to additional work. Specific SAR-related activities in the NA (Brant pers. comm. 2009) include: 1. habitat improvement, tree planting; 2. sampling water quality, temperature; 3. Butternut has been noted during site visits (genetic purity uncertain), DNA sampling required; 4. activities for Eastern Flowering Dogwood and Common Hoptree have included creation of educational signage, i.d. cards, stickers, magnets, surveys, invasive species removal, propagation and planting; 5. activities for Swamp Rose Mallow have included seed collection along the Niagara River and further inland,with seed being grown & being shipped to LandCare Niagara; 6. the new Ontario Herpetofaunal Atlas will increase reporting and knowledge of occurrences of Common Snapping Turtle, Blanding's Turtle and SAR snakes; 7. activites relating to Cucumber Tree include landowner contact and site visits, verified populations, and accurate GPS coordinates.

Carolinian Woodlands Recovery Strategy

Partners: Carolinian Canada Coalition, OMNR, Environment Canada, and more than 30 other national, provincial, regional and local agencies, organisations and groups

Goals, Timelines, Activities: Conservation Action Plans (Short Hills, Niagara River Corridor) 2009 and onward. CWRT species priorities – Round-leaved Greenbrier, Kentucky Coffee-tree (+ other woodland species, such as American Chestnut, American Columbo, etc.). Refer to Jalava *et al.* (2008, 2009) for more detail.

LandCare Niagara

Partners: OMNR, Canada Ontario Agreement, OMNR Community Fish and Wildlife Improvement Program, OMNR Species at Risk Stewardship program; Environment Canada Habitat Stewardship Program; Provincial Species at Risk Recovery Team members; Niagara Peninsula Conservation Authority; Niagara Parks Commission; Stamford Centre Volunteer Firefighter's Associaton; Haldimand and Area Stewardship Council; Katimavik; Regional Municipality of Niagara; Ontario Power Generation; Eco-Crew; Niagara Eco-inclusion Program

Goals, Timelines, Activities: Since 2001 Land Care Niagara has been providing assistance to the local Ontario Ministry of Natural Resources biologist and her team of technicians to undertake research, habitat restoration and community outreach educational programs on a number of species at risk in Niagara. Among these species are: Spotted Turtle; Fowler's Toad; Dusky Salamander; Eastern Grey Snake; Eastern Massasauga Rattlesnake; Hop Tree and others. In

2008, program objectives were to communicate SAR habitat needs to landowners, decision makers and the general public through an expanded outreach and education program. Monitoring of species to improve our understanding of their ecology and habitat restoration projects continued to be a large part of the 2008 program. The woodworking from nature program has included building nest structures, and salamander and snake cover boards.

NH Ecological Framework 80-90K seedlings planted with partners – would be nice to plant SAR on certain sites. As it stands, LCN is not doing (except for Common Hoptree planting, Swamp Rose-mallow, Eastern Flowering Dogwood, which were all done under MNR SARSF funding in cooperation with OMNR's Niagara Area Office in Vineland). One of major programs has been helping with SAR educational materials and distributing to community in areas where the SAR occur.

Invasive species removal is being undertaken at sites where SAR plantings have been undertaken under MNR Vineland staff supervision. Construction of habitat structures (e.g., turtles, snakes, salamanders, flying-squirrels) has also been an important SAR-related activity of LCN. (Rose pers. comm. 2009)

Carolinian Canada Coalition (CCC) "Caring for Nature" Fact Sheets and Landowner Stewardship Workshops

Partners: CCC and local stakeholders.

Goals, Timelines, Activities: Following the success of the Caring for Nature factsheet series and two Caring for Nature Workshops, held in Essex and Norfolk in 2009, Carolinian Canada will be offering two Caring for Species at Risk Workshops for rural landowners in winter 2010, including one in Vineland on the Niagara Peninsula. These workshops will introduce participants to species at risk in their region and the importance of private landowners practicing good stewardship practices to provide habitat for species at risk on their property. Representatives from local stewardship councils, conservation authorities, naturalist clubs, the Ministry of Natural Resources and Carolinian Canada will be on hand to provide advice on how to manage woodlots, wetlands and grasslands to provide habitat for species at risk and other wildlife. The concepts of Rural Lanowner Stewardship Plans and Conservation Action Plans will also be introduced.

Niagara Parks Commission (NPC)

Partners: The Niagara Parks Commission has many partners including but not limited to the Niagara Peninsula Conservation Authority, Ontario Ministry of Natural Resources, Land Care Niagara, Niagara Restoration Council, Niagara College, Brock University, Environment Canada Habitat Stewardship Program, Bert Miller Nature Club, Peninsula Field Naturalists, Niagara Falls Nature Club, Friends of Niagara Parks-Niagara Glen, Friends of Fort Erie's Creeks.

Goals, Timelines and Activities: The NPC has undertaken many projects particularly in the last 7 years to work towards the mandate of protection of natural spaces within the Park. Currently there is programming to enhance habitat through prescribed burning, invasives removal, and outreach and education initiatives. NPC is in the process of developing the final draft of their Environmental Land Management Plan which lays out

recommendations for the preservation and protection of environmentally sensitive lands and their inhabitants.

Niagara Restoration Council (NRC)

Partners: NRC, NPCA, Ontario Power Generation, local naturalist clubs, Niagara College, as well as funding through Great Lakes Sustainability Fund, Eco-Action, Trillium Foundation, and Environmental Damages.

Goals, Timelines, Activities: According to Burant (pers. comm. 2009), since 2001 the NRC has been involved primarily in habitat improvement projects, and is not involved in land securement. One major project has involved removal of barriers to fish migration, contacting landowners for 210 such barriers; to date approximately 160 have been removed. Watersheds with SAR are specifically being targeted, and Grass Pickerel is one of the SAR benefitting from this program. NPCA hires staff to monitor for rare fish, as does OMNR. Wood Duck nesting boxes have been installed at wetland sites. Outreach has been done in relation to Monarch butterfly and Snapping Turtle conservation, for which NRC has a travelling display, and it is notable that people are often surprised that these two relatively common and well known species are listed as Special Concern.

Ducks Unlimited (DU)

Partners: DU, NPCA

Goals, Timelines, Activities: According to Krete (pers. comm. 2009), DU has completed a conservation planning document for Southern Ontario that will guide implementation across the landscape. DU is almost exclusively focused on waterfowl conservation and has undertaken numerous waterfowl studies. DU has also assessed landowner attitudes and infrastructure, and has evaluated the landscape based on its potential for waterfowl production. The Southern Ontario region was broken down into eight priority habitat areas, of which PHA4 is the Niagara area. Because of the Niagara River RAP, funding is available for restoration work. DU also has a program that focuses on Great Lakes coastal wetlands.

The main DU partner in the Niagara area is NPCA, but DU also works with Habitat Haldimand (HH). HH is directly implementing wetland projects. Initially, a one year program was developed to complete five wetland projects, which extend into the Welland area. The DU objective is a knowledge transfer to partners so they can do wetland projects on their own.

Regional Municipality of Niagara

Partners:

Goals, Timelines, Activities: According to Campbell (pers. comm. 2009), a great deal of work already has been done in relation to environmental stewardship, protection, policies and planning in the Niagara Region including:

- Natural heritage Assessments prepared for the Niagara River RAP;
- Land Care Niagara's Natural Heritage Strategy;
- The Region's environmental policies and Core Natural Heritage mapping;
- NPCA and other watershed plans;
- The NPCA Natural Areas Inventory.

The Regional Policy Plan supports environmental stewardship and environmental restoration. It includes: 1. targets (Policy 7.A.1.1); 2. policies supporting stewardship (e.g., Policy 7.A.1.2; Section 7.C.3); 3. provides for the preparation of Environmental Planning Studies to support Federal and Provincial management and recovery plans for threatened and endangered species (policies 7.C.2.2 and 3). In addition, Environmental Stewardship is one of the six Strategic Objectives set out in Regional Council's current Business Plan. This includes encouraging and participating in the protection of environmentally significant lands.

The Niagara Water Quality Protection Strategy Technical Summary Report is downloadable from from the WaterSmart Niagara website at:
http://www.regional.niagara.on.ca/government/initiatives/nwqps/about-reports.aspx
In particular see Section 4.5 and 4.6 and Chapter 6, which includes an assessment of Local Management Areas (LMAs) within the watershed. Much more detailed reports were produced in the course of developing the Strategy, as well as additional mapping. In the Draft Stage 2 Report, for example, Section 3.4 deals with natural heritage. There also are several maps, including: 1. Land Cover; 2. Forest Extent and Recent Change; 3. Evaluated Wetlands; 4. Natural Areas - Water Related Roles by Subwatershed; 5. Subwatershed Status for RAP Guidelines on Forest and Wetland Extent; 6. Relative Biological Significance by Subwatershed; 7. Water-Related Stressor Severity and Natural Area Sensitivity by Subwatershed; and 8. various other maps not dealing directly with natural heritage (e.g., agriculture, water resources). The Phase 3 Report includes a detailed assessment and mapping for each LMA. Some of this information may have been superseded by subsequent NPCA watershed planning planning.

One aspect of environmental policies is a landscape approach, not just core areas and connecting lands, but also what is occurring in surrounding landscape. This includes ecological functions and how they interconnect with cores system (developed 6-7 years ago; subsequently could be improved and be even more progressive). One good example is Waterloo Region's example of Environmentally Significant landscapes which involves protecting not just core areas, but the supporting landscape. In summary, municipal policies are generally very supportive of restoration and stewardship, with room to evaluate what that support means and how the municipality can assist and be involved.

Niagara Land Trust (NLT)

Partners: Various local partners.

Goals, Timelines, Activities: From the NLT Mission Statement: "Purpose 1. To acquire, secure and manage lands, and interest in lands, of environmental, heritage or landscape interest related to the Niagara Peninsula….Niagara Land Trust Foundation will identify priority lands and will use a variety of methods to acquire them. These methods will include donation of fee simple title, purchases, and securement of partial interests of land such as leases or conservation easements. This type of activity is conducted by numerous similar "land trusts" across Canada and is supported by a variety of senior government grants, philanthropic organizations and tax incentives for land donors. The Niagara Land Trust Foundation has had discussions with several landowners on the securing of lands. Other contacts in the broader conservation community have offered to assist Niagara Land Trust Foundation in identifying other interested landowners. Niagara Land Trust Foundation monitors significant natural and cultural heritage land sales in the Niagara Peninsula and intends to raise funds to acquire important properties, as funds are available.

"Purpose 2. To identify, conserve and restore the natural environment and heritage sites of the Niagara Peninsula, including sites of ecological, scientific, scenic, open space, historic, architectural or archaeological interest….Niagara Land Trust Foundation has plans to co-develop a database and maps of important and productive natural heritage sites in the Niagara Peninsula. This will take some time to develop and will require the gathering of information from diverse sources. Members of the Niagara Land Trust Foundation have numerous contacts with agencies and organizations in the community to enable Niagara Land Trust Foundation to develop a comprehensive assessment of priority areas for conservation, restoration, agricultural, educational and recreational management. The database would be used to update the Natural Heritage Ecological Framework for the Niagara Region (LCN 1996, 1998). Brock University, Niagara College, the Niagara Parks Commission, the Niagara Peninsula Conservation Authority, the Regional Municipality of Niagara, and numerous conservation organizations have offered to assist in the development and implementation of a process that could involve students and stewardship volunteers in identifying important natural heritage sites in the Niagara Peninsula. The standards and practices for collecting baseline data and producing a property stewardship plan has been initiated. The development of a protocol for sharing data with the Ontario Ministry of Natural Resources and the Niagara Region has also been initiated. Once priority areas are identified, Niagara Land Trust Foundation will work with landowners and organizations to encourage conservation and restoration of specific sites. This will be carried out in partnership with other conservation organizations. The Niagara Land Trust Foundation will recruit membership and active volunteers from the Peninsula Field Naturalists, Niagara Woodlot Association, Niagara Soil and Crop Improvement Association, Bert Miller Nature Club, Niagara Falls Nature Club, Friends of the 12, Friends of Fort Erie Creek, Friends of Shorthill Provincial Park, among others. These organizations seek to inform landowners about means to conserve and restore large woodlands, wetlands, and the wildlife which depend upon them.

"Purpose 3. To identify, conserve and restore working landscapes in the Niagara Peninsula within the framework of careful and sustainable stewardship….The science of landscape ecology has identified the importance of conserving natural areas within a broader landscape matrix, including the protection of connecting wildlife corridors and compatible management areas around core protected areas. The Ontario Ministry of Natural Resources, Ontario Nature, the Nature Conservancy of Canada, Ontario Power Generation, Environment Canada, among others, are encouraging this approach. The development of trails and a signage program are important ways for people to explore and recognize the value of natural areas. The restoration of abandoned farmland to woodlands and wetlands through successful restoration programs, such as the Niagara Woodlands & Fragile Lands Restoration Program will help achieve regional objectives in forest cover, reduction of forest fragmentation, increase of interior forests, and the reduction of non-native species. The community use and restoration of such lands will generally be encouraged. Management of such ecosystems must be undertaken in a careful and sustainable fashion, and thus this principle is enshrined in the objects in order to ensure that activities are compatible with Niagara Land Trust Foundation's larger conservation and restoration goals.

"Purpose 4. To receive, manage and disburse funds, donations and bequests….As a charity, Niagara Land Trust Foundation will receive donations and bequests that will allow it to meet its charitable objects. It will also be necessary to manage and disburse such funds. In order to acquire and manage important lands, Niagara Land Trust Foundation will need to accumulate some funds for future uses. Over time, distinct funds will be identified for specific purposes. This will occur within the constraints of the Income Tax Act and related interpretations.

"Purpose 5. To research and educate about the natural environment, heritage sites and landscapes of the Niagara Peninsula….In order to identify priority lands and manage them responsibly,

Niagara Land Trust Foundation will need to conduct research and carry out education. Currently, Niagara Land Trust Foundation is identifying important areas and compiling data from diverse sources, a role which will be ongoing. This information will be shared with our conservation partners in the Niagara Peninsula, such as the Regional Municipality of Niagara, Niagara Peninsula Conservation Authority, Land Care Niagara, Niagara Woodlot Association, Peninsula Field Naturalists, Niagara Falls Nature Club, Bert Miller Nature Club, Niagara Restoration Council, Ontario government agencies, local municipalities, and other conservation organizations. Niagara Land Trust Foundation is also assisting in the education of students at Brock University and Niagara College through sponsoring such research. Further educational activities will include training students to assist landowners in the development of sound management plans and in the use of cooperative conservation techniques such as tree planting, fencing cattle out of streams to protect water quality, and land donation approaches. Such programs are now under development in cooperation with the Niagara Peninsula Conservation Authority. Niagara Land Trust Foundation will further develop training programs for landowners and their professional advisors in order to enhance the scope and depth of conservation practices in the Niagara Peninsula. Partnerships and collaboration are critical to the success of the Niagara Land Trust Foundation. Niagara Land Trust Foundation already works cooperatively with landowners, municipalities, senior government agencies, institutions and non-profit organizations involved in conserving natural and cultural heritage sites in the Niagara Peninsula. Niagara Land Trust Foundation has developed a set of principles for ensuring that it sustains good relations with regional conservation authority agencies. Ongoing discussions, property donation referrals, site management arrangements, and joint planning, fund-raising, research and education activities will all help achieve this object."

Bruce Trail Conservancy (NCC)
[source: http://brucetrail.org/, accessed 15 January 2010]

Partners: BTC trail clubs and other local partners

Goals, Timelines, Activities: The Bruce Trail Conservancy is a charitable organization committed to establishing a conservation corridor containing a public footpath along the Niagara Escarpment, in order to protect its natural ecosystems and to promote environmentally responsible public access to this UNESCO World Biosphere Reserve. Environment Committee consists of a chair and at least five members with expertise in , ecology, environmental assessment, geography, geology, mapping, pesticides, community planning, site development, and other related fields, and is involved in the following main activities, all of which may have relevance to the Niagara River Corridor CAP program:

- Developing initiatives that promote conservation and restoration of natural resources and wildlife of the BTC conservation corridor and the Niagara Escarpment., e.g. review of property management plans;
- Preparing material to educate trail users in the ecological, historical and cultural features of the Niagara Escarpment, e.g., leading interpretive hikes and preparation of interpretive signs for Bruce Trail properties;
- Submitting articles to the Bruce Trail Magazine;
- Supporting BTC clubs and other committees on environmental issues in their manuals, procedures and practices, e.g., Guide to Non-Native Trees and Shrubs;
- Monitoring government, ENGOs and private development that may impact the environment (e.g., quarry operations; roads).

- Preparing policy documents (e.g., Position Paper on Wind Turbine Development, 2005; Pesticide Policy for BTC Managed Lands Leased for Agriculture, 2003; Mountain Bike Policy Backgrounder, 2002). Commenting on environmental aspects of BTC policies (e.g., Vegetation Policy, 1999; Non-Pedestrian Activities Policy, 1999). Commenting on trail optimum route strategy to avoid ecologically sensitive areas and rare plants.
- Implementing the Calypso Orchid Environmental Award

Trees Unlimited
[source: http://www.treesunlimited.ca/projects.htm]

Partners: Ontario Power Generation and various other local partners

Goals, Timelines, Activities: Examples of Trees Unlimited projects in the CAP area include:

Trees Unlimited designed and implemented the Niagara Peninsula's Woodland and Fragile Land Restoration Project as part of OPG's Carbon Sequestration Program. The largest project in Ontario, totalling 83,645 seedlings on 93 acres, will expand forest cover, increase forest interior, establish riparian buffers along the Welland River and provide landowner education and recognition.

The Niagara Parks Commission owns some of the oldest and most significant forested lands in Niagara and along the Niagara Escarpment. Trees Unlimited in co-operation with NPC staff have been implementing a forest pest control program since the fall of 1999.

Ontario Power Generation (OPG)
[Source: van Oostrom pers. comm. (2009)]

Partners: NPCA, Niagara Restoration Council, St. Catharines Green Committee, Bruce Trail Conservancy, Niagara Region and others.

Goals, Timelines, Activities: OPG is a major landowner in the Niagara ara and its conservation-related work in the area arises from its Biodiversity Policy and its involvement with the Wildlife Habitat Council (WHC), with which OPG became registered in 2005. WHC creates friendly competition between companies in either restoring or enhancing habitat. The WHC website lists certified programs. At present there are 36 companies and municipalities involved. All of OPG's sites are included. These are companies that own a lot of land that are looking for ways to green themselves. But there is a lot of untapped potential, and a lot of companies who still are unregistered.

Wildlife Habitat Council has a Corporate Lands For Learning program. This is an auditable program that companies like OPG submit to. Corporate Lands For Learning wants to know what you are doing to educate the public and employees about species and SAR.

In addition to the salamander work in Fonthill (see NCC projects, above), OPG has started testing an environmentally-friendly bacteria to eliminate Zebra Mussels from pipes (to reduce the use of chlorine) without harming native mussel species.

OPG also has a botanist updating inventory work, and is taking the lead on American Water Willow and Dusky Salamander recovery work in partnership with OMNR, with OPG represented on the recovery team for the latter species. As a lead on Habitat Stewardship Program initiatives in the area OPG has focused on education, partnering with OMNR to make magnetic stickers,

signs, etc., for Eastern Flowering Dogwood, Dusky Salamander and American Water-willow. Swamp Rose Mallow is also a species of concern. Other relevant OPG activities include donating land to the City of St. Catharines to develop a treatment wetland to improve water quality, and interpretive signage with Bruce Trail Conservancy and Niagara Region (a three-year project).

Ontario Power Generation (OPG), Niagara Plant Group(NPG)
[Source: Van Oostrom pers. comm.. (2010)]

Partners: NPCA, Niagara Restoration Council, St. Catharines Green Committee, Bruce Trail Conservancy, Niagara Region, Niagara College, Niagara Parks, MNR and others.

Goals, Timelines, Activities: OPG is a major landowner with ownership of about 1600 hectares in the Niagara area. Conservation-related work in the NPG is driven by the Corporate Biodiversity Policy, their ISO 14001 Registration and its involvement with the Wildlife Habitat Council (WHC).

The Wildlife Habitat Council has main two auditable programs, Wildlife at Work which the NPG became registered in 2005 and Corporate Lands for Learning which NPG became registered in 2009 WHC creates friendly competition between their member companies in either restoring or enhancing habitat (Wildlife at Work) or biodiversity related enhancement of education and learning (Corporate Lands for Learning) . The WHC website lists certified programs. At present there are 36 companies and municipalities registered to the Wildlife at Work Program in Canada and over 500 internationally. In Canada the number of Corporate Lands for Learning is less than 10, but growing. Internationally there are over 100 registrations. Most of OPG's sites are registered to the Wildlife at Work Program and 4 are registered in the Corporate Lands for Learning program. There is a lot of untapped potential with industry in Canada.

Niagara Plant Group of OPG has had an active Biodiversity program since the 1990's. NPG has carried out botanical investigations of most of their lands through the use of a contractor botanist. This has helped identify restoration opportunities. NPG is working in partnership with OMNR, on American Water-willow and Dusky Salamander recovery work. As a lead on Habitat Stewardship Program initiatives in the area NPG has focused on education, partnering with OMNR to make magnetic stickers, signs, etc., for Eastern Flowering Dogwood, Dusky Salamander and Water-willow. Swamp Rose Mallow is also a species of conservation concern.

Other relevant OPG activities include donating lands for conservation, and participation and support of year long projects with Niagara College Ecosystem Restoration Students for the past few years, as well as working on restoration projects with many local partners in the Niagara Region, with notable recent activities in the Short Hills – Twelve Mile Creek area.

Another important project involves testing environmentally-friendly bacteria to eliminate invasive Zebra and Quagga Mussels from cooling water sytem piping (to reduce the use of chlorine) without harming native mussel species. This project was initiated in 2009 at the DeCew Generating Station, and is being extended for another year in 2010.

2. CONSERVATION VISION AND GOALS

Vision Statement

The Niagara River Corridor area supports a full range of healthy terrestrial and aquatic habitats, including characteristic Niagara Escarpment features, Carolinian deciduous forests, dry oak woodlands, prairies and savannahs, seepage zones, lowland swamp forests, marshes, and riparian and aquatic ecosystems. Species at Risk thrive in a variety of secure habitats, which contribute to the overall connected matrix of natural cover. Natural heritage systems are restored in order to connect fragmented natural areas, and river and stream corridors. Stewardship and site management focuses on further conserving and enhancing the biodiversity values of the area. The local community takes pride in the natural beauty and health of the area, and members from all sectors and backgrounds participate in stewardship and conservation. Relationships between conservation partners are strong and reciprocal, allowing for maximum success in conservation efforts across the interconnected, ecologically functional landscape.

Goals

1. To maintain existing and establish new functional ecological links between core natural areas.
2. To complete securement of core natural areas.
3. To maintain and recover viable populations of Species at Risk and restore their habitats.
4. To improve water quality and aquatic habitats.
5. To manage invasive species populations so no net increase in their extent occurs.
6. To strategically increase natural cover through restoration to reconnect fragmented woodlands, wetlands and riparian corridors.
7. To direct incompatible development and land uses away from natural areas.
8. To enhance community support and understanding of the Niagara River Corridor CAP area.
9. To encourage and support local policies that promote conservation.
10. To enhance information and monitoring of biodiversity values, natural processes and threats.
11. To support and enhance conservation partnerships across the CAP area.

Conservation Objectives	**Conservation Target(s) Addressed**
1. Establish and ensure ongoing public and stakeholder support for the CAP	All
2. Series of natural heritage system map created by 2011 for both CAP areas using existing information compiled from all key sources.	All
3. No net loss of early-successional communities (fields, thickets) from 2009 levels.	5. Edges, thickets and fields; 6. Dry oak woodlands, prairies and savannahs; 8. Ecological services on rural lands
4. Top 10 sources of water pollution identified and appropriate actions relating to each identified by 2012.	1. Marshes and shorelines; 3. Lowland swamp forests; 4. Lakes, rivers, streams and riparian systems
6. Promote and increase land securement for conservation.	All
7. [T.b.d.] ha of private lands owned by corporations within the CAP area have conservation or restoration programs in place by 2015.	All
NR1. Increase the extent of upland and lowland forest cover by realistic quantitative target by 2020.	2. Upland deciduous forests; 3. Lowland swamp forests
NR2. Increase the extent of upland deciduous forest interior by realistic quantitative target by 2020.	2. Upland deciduous forests
NR3. Buffer and restore [realistic quantitative target] of riparian habitat by 2020.	3. Lowland swamp forests; 4. Lakes, rivers, streams and riparian systems

3. CONSERVATION STRATEGIES, ACTIONS AND MEASURES OF SUCCESS

Table 3.1 provides a summary of the priority conservation actions recommended by the CAP Team. These actions are linked to relevant biodiversity targets and impacts, objectives and associated actions. The actions are ranked based on their urgency:

- ***Urgent:*** Conservation actions that without implementation would clearly result in the reduction of viability of a biodiversity target or the increase in magnitude of a critical threat within the next 5-10 years. Also includes research information that is needed before key decisions can be made on the management of biodiversity targets.
- ***Necessary***: Conservation actions that are needed to maintain or enhance the viability of biodiversity targets or reduce critical threats. Also research that will assist in decisions on management of biodiversity targets.
- ***Beneficial***: Conservation actions that will assist in maintaining or enhancing viability of biodiversity targets and reducing threats.

Based on the urgency of need, the CAP team has identified the following priorities:

Table 3.1 Summary of Conservation Objectives, Strategic Actions, Action Steps and Timelines

Importance (U/N/B)[7]	Objective	Strategic Action(s)	Action Steps / Timelines	Target(s) Addressed	Threats / Impacts Addressed	Recovery Strategy Links	Agency Lead(s)[8]	Cost Estimate / Funding Source(s)
Urgent	1. Establish and ensure ongoing public and stakeholder support for the CAPs	1.1. Write job spec for outreach / education / social marketing coordinator by 2012.	1.1.1. Secure funding to hire and find office to house staff . 1.1.2. Work with nature clubs and other stakeholders to implement outreach activities (e.g., landowner contact, dissemination of materials, workshops, etc.).	All	All (especially 2, 4 and 5)	All relevant SAR	NLT, CCC, nature clubs (volunteers to implement)	$25K-$50K / year
Urgent	2. Series of natural heritage system map created by 2011 for both CAP areas using existing information compiled from all key sources.	2.1. Synthesize updated NH data and mapping to confirm CAP area boundaries. 2.2. Create publicly-available on-line NH mapping and data access portal. 2.3. Create a restoration and opportunities map to identify conservation targets, priority sites, activities and appropriate methods necessary to enhance SAR recovery and protection by 2013.	2.1. By spring 2011: a) OMNR/LCN to provide SAR mapping data. b) NPCA and Niagara R.M. to provide recent NAI data. c) Consult with local naturalists and groups to verify locations and completeness of data set for mapping. 2.2. By spring 2011: a) Summarize strengths, usefulness and applications of each available mapping source for web site. b) Identify how and where each source can be obtained. c) Upload this information to web site (e.g., NEST). 2.3. By 2011/2012: a) Write job spec for GIS person to create map series that links restoration to SAR needs for both Niagara CAP areas. b) Secure funding and find office / agency to house staff person.	All	1, 3, 4, 6, 7, 8, 9	All relevant SAR	1. NPCA, OMNR, Niagara College, NCC(?). 2. CCC, NLT; 3. Niagara College.	$85K / t.b.d.

[7] - U = Urgent; N = Necessary; B = Beneficial

[8] - ***** It should be noted that the definition of responsibility for the identified "lead agencies" is that these groups will take the leadership role in initiating the implementation of recommended actions. It is anticipated that other agencies and private landowners will also become involved as actions evolve.

Importance (U/N/B)[7]	Objective	Strategic Action(s)	Action Steps / Timelines	Target(s) Addressed	Threats / Impacts Addressed	Recovery Strategy Links	Agency Lead(s)[8]	Cost Estimate / Funding Source(s)
Urgent	3. No net loss of early-successional communities (fields, thickets) from 2009 levels.	3.1. Support existing programs and reprint educational materials 3.2. Research and promote positive incentive approaches for farmers to conserve biodiversity on their land such as Alternative Land Use Services-type initiatives, Ecosystem Goods and Services cost-benefit analyses and Environmental Farm Plan cost-sharing by 2012.	t.b.d.	#5	1, 4, 5, 6, 8, 9	EFDO, RLGB, DWHA, BAOW, COHO, HOSN	t.b.d.	t.b.d.
Necessary	4. Top 10 sources of water pollution identified and appropriate actions relating to each identified by 2012.	4.1. Work through SAR list for CAP areas and identify the key local stresses to each. 4.2. Link these to local sources. 4.3. Develop strategies to reduce these impacts.	4.1-3. a) Write job spec for contractor to undertake project. b) Secure funding and hire contractor by 2011/2012.	#1,3,4,8	All	All aquatic SAR	t.b.d.	t.b.d.
Urgent	5. Control invasive species in natural areas.	5.1. Develop and implement a plan for control of invasive species of concern and key priority areas.	5.1. a) Identify invasive species of concern by 2011. b) Determine measurable goals for control by 2011. c) Identify target areas for control program by 2012. d) Identify appropriate control mechanisms by 2012. e) Secure funding to proceed (2010, ongoing). f) Initiate on-the-ground control programs by 2013 (ongoing). g) Undertake public outreach (aquatic, terrestrial). h) Engage horticultural community. i) Lobby for improvements to federal policies relating to the sale of invasive species. k) Monitor program (develop measurable plan and track initiatives)	All	7, 10	All SAR impacted by invasive species	LCN, Niagara College (?), OFAH (?, re: BMP's)	EC Invasive Species Fund

Importance (U/N/B)[7]	Objective	Strategic Action(s)	Action Steps / Timelines	Target(s) Addressed	Threats / Impacts Addressed	Recovery Strategy Links	Agency Lead(s)[8]	Cost Estimate / Funding Source(s)
Necessary	6. Promote and increase land securement for conservation.	6.1. Engage community and increase awareness of Niagara Land Trust.	6.1. a) Purchase priority conservation lands identified through other objectives and strategic actions of this CAP. b) Secure priority lands through conservation easements. c) Enhance the priority lands through incentive programs through MFTIP and CLTIP.	All	All	All relevant SAR	NLT and other CAP partners	
Necessary	7. [Realistic number of] ha of private lands owned by corporations within the CAP area have conservation or restoration programs in place by 2015.	7.1. Engage corporate and industrial landowners in conservation within CAP area.	By 2011: 7.1.1. Meet with Wildlife Habitat Council, Wildlife Habitat Canada and key corporate and conservation partners to develop strategies for engaging corporate partners in CAP implementation. 7.1.2. Prepare an assessment of: 1) existing corporate partners in conservation projects within the CAP area; 2) key corporate landowners based on extent, locations and ecological characteristics of their lands; 3) develop a prioritized list of potential corporate partners. 7.1.3. Begin implementation of conservation actions on corporate lands by 2012.	All	All	All relevant SAR	CCC, OPG, Wildlife Habitat Canada, Wildlife Habitat Council, and other CAP partners	t.b.d.

Importance (U/N/B)[7]	Objective	Strategic Action(s)	Action Steps / Timelines	Target(s) Addressed	Threats / Impacts Addressed	Recovery Strategy Links	Agency Lead(s)[8]	Cost Estimate / Funding Source(s)
Necessary	NR1. Increase the extent of upland and lowland forest cover by realistic quantitative target by 2020. (e.g., Landowners of at least 500 acres of private lands agree to restoration projects on their properties between 2010 and 2020.)	NR1.1. Determine quantitative targets. NR1.2. Scope existing mapping and work with SAR bios to determine priority upland forest and lowland swamp sites by late 2010; NR1.3. Evaluate need for restoring hydrological functions. NR1.4. Focus on privately-owned upland forests and publicly-owned lowland swamp forests first because private land (PSW) wetlands have legislated protection. NR1.5. Develop landowner contact and incentive program by 2012 (ongoing). NR1.6. Engage agricultural community in swamp forest restoration. NR1.7. Provide funding support to existing landowner programs; NR1.8. Identify a planned timeline for restoration on private lands. NR1.9. Develop adequate conditions for restoration. NR1.10. Acquire and restore sites.	NR1.1.1. Determine historic and current extent of upland and lowland forest types (February 2010) NR1.2.1. Map lowland and upland forest priority areas (Spring 2010). NR1.2.2. Review maps and other resources to identify gaps (i.e., ecological linkages, sites that would increase forest interior, etc.) by 2011. NR1.5.1. Initiate ongoing landowner contact by 2012. NR1.5.2. Investigate opportunities for priority landowners for tax relief on smaller properties of significant value. NR1.5.1. Identify funding opportunities, write funding proposals and secure funding for restoration and securement (2011-ongoing). NR1.8.1. Secure native seed sources for restoration (ongoing), accounting for SAR permit requirements and implications of presence of SAR at restoration sites. NR1.8.2. Engage Ducks Unlimited and drainage superintendents in evaluating hydrology of lowland swamp sites. NR1.9.1. Develop stewardship, restoration and monitoring plans. NR1.9.2. Start restoration in 2011.	#2,3	1, 2, 3, 4, 5, 7, 9	All Carolinian woodland SAR	NPCA, NLT, NRC, OPG, WHC, LCN, NPCA, NLT, NPC, Ducks Unlimited + other groups	Alternative incentives: tree swap; ALUS; public acknowledgement; user fees. >$2,000,000 / OMNR SAR Stewardship Fund, LandCare Niagara (aid), 50 Million Tree Program (Trees Ontario Foundation), Habitat Stewardship Program, Ontario Power Generation, Environment Canada, private foundations, corporate sponsors

Importance (U/N/B)[7]	Objective	Strategic Action(s)	Action Steps / Timelines	Target(s) Addressed	Threats / Impacts Addressed	Recovery Strategy Links	Agency Lead(s)[8]	Cost Estimate / Funding Source(s)
Necessary	NR2. Increase the extent of upland deciduous forest interior by realistic quantitative target by 2020.	See Objective NR1 (above). NR2.1. Identify optimum properties to increase extent of forest interior. NR2.2.Target public lands (e.g., municipal parks Baden Powell Park – Vedaland, Willoughby Marsh CA, Niagara Parks Commission lands such as Paradise Grove) for restoration, and for securement of adjacent lands (by 2013).	See Objective NR1 (above) Timing: 2013 – ongoing. NR2.1.1. Map / Determine (see Lowland Swamp Forest): - historical distribution - SAR habitat needs - Quality of existing habitat - Potential to create quality habitat - Feasibility	#2	1, 4	ACFL / HOWA and all SAR that benefit from undisturbed forest interior habitats	CAP partners + municipal-lities	t.b.d.
Necessary	NR3. Buffer and restore [realistic quantitative target] of riparian habitat by 2020.[9]	See Objective NR1 (above) A) Natural Creeks – work with existing programs and SAR bios to target prioirtity SAR areas and provide supplementary funding. B) Drains – work with local drainage superintendents to ensure ecologically friendly maintenance practices and provide supplementary funding. NR3.1. Continue riparian restoration as identified in watershed plans. NR3.2. Determine # of km appropriate for riparian restoration target by 2011. NR3.3. Reduce erosion (qualitative measure of restoration success). NR3.4. Identify opportunities along municipal drains. NR3.5. Engage agricultural community in riparian restoration (e.g., with help of OSCA)	A) Contact SAR bios to determine prioirity areas. B) Contact SAR bios to dertermine priority areas. NR3.1-4. a) Lobby local government for stronger buffer requirements. b) Lobby local government for ecologically appropriate design in relation to stormwater run-off into coldwater streams. SH3.1-5. a) Secure funding for priority area mapping. b) Determine priority restoration sites along Twelve, Fifteen, Sixteen and Eighteen Mile Creeks by 2011/2012. c) Hold Environmental Farm Plan workshops. d) Identify and create riparian restoration demonstration sites. e) Provide riparian restoration information to landowners (ongoing).	#1, 4, 8	1, 2, 3, 4, 5, 8, 9, 10	All SAR that use riparian, wetland and aquatic habitats	CAP partners + FOFEC NPCA, NRC, LandCare Niagara, OSCA	t.b.d.

[9] - Use NHIC, MNR Guelph District, NPCA NAI, Regional Municipality of Niagara, LandCare Niagara, Nature Conservancy of Canada data/mapping

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APPENDICES

Appendix A
Glossary of Ontario Biodiversity and Conservation Terms

Area of Natural and Scientific Interest (ANSI): means areas of land and water containing natural landscapes or features that have been identified as having life science or earth science values related to protection, scientific study or education (Provincial Policy Statement 2005)

Biodiversity: Biological diversity - or biodiversity - is the term given to the variety of life on Earth and the natural patterns it forms. The biodiversity we see today is the fruit of billions of years of evolution, shaped by natural processes and, increasingly, by the influence of humans. It forms the web of life of which we are an integral part and upon which we so fully depend (Convention on Biological Diversity).

Biodiversity Target: an element of biodiversity selected as a focus for conservation assessment, planning or action. Biodiversity targets most commonly include species, vegetation communities and ecological systems.

Committee on the Status of Endangered Wildlife in Canada (COEWIC): is a national committee of experts that assesses and designates which wild species are in danger of disappearing from Canada. COSEWIC assigns the following status to species:

Extinct (EXT)	A species that no longer exists
Extirpated (EXP)	A species no longer existing in the wild in Canada, but occurring elsewhere in the wild
Endangered (END)	A species facing imminent extirpation or extinction throughout its range
Threatened (THR)	A species likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction
Special Concern (SC)	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events, but does not include an extirpated, endangered or threatened species
Not At Risk (NAR)	A species that has been evaluated and found to be not at risk
Data Deficient (DD)	A species for which there is insufficient information to support a status designation

Committee on the Status of Species at Risk in Ontario (COSSARO): a provincial group of experts whose mandate is to evaluate and recommend a provincial status to candidate species and re-evaluate current species at risk for the Ontario Ministry of Natural Resources. COSSARO employs a uniform, scientifically-based, defensible approach to status evaluations. The committee evaluates species by considering factors such as population size, trends and distribution, habitat trends and known threats. Based on its evaluation, COSSARO recommends the appropriate provincial status category for each candidate species.

Conservation Lands: Lands that are managed or regulated for long-term conservation. The conservation lands identified in the Great Lakes Conservation Blueprint included regulated protected areas (e.g. Provincial Parks), policy areas (e.g. Provincially Significant Wetlands) and lands owned by conservation organizations.

Declining Species: exhibit significant, long-term declines in habitat and/or abundance, are subject to a high degree of threat, or may have unique habitat or behavioural requirements that expose them to a great risk.

Disjunct Species: have populations that are geographically isolated from each other by at least one ecoregion.

Ecodistrict: a subdivision of an ecoregion characterized by distinctive assemblages of relief, geology, landforms and soils, vegetation, water, fauna, and land use.

Ecological Functions: the natural processes, products or services that living and non-living environments provide or perform within or between species, ecosystems and landscapes. These may include biological, physical and socio-economic interactions.

Ecological System: dynamic spatial assemblages of ecological communities characterized by both biotic and

abiotic components that 1) occur together on the landscape; 2) are tied together by similar ecological processes (*e.g.*, fire, hydrology), underlying environmental features (*e.g.*, soils, geology) or environmental gradients (*e.g.*, elevation, hydrologically-related zones); and 3) form a robust, cohesive and distinguishable unit on the ground.

Element Occurrence (EO): an area of land and/or water in which a species or natural community is, or was, present. An EO should have practical conservation value for the element (species or vegetation community) as evidenced by potential continued (or historical) presence and/or regular recurrence at a given location. For species, the EO often corresponds with the local population, but when appropriate may be a portion of a population (*e.g.*, long-distance dispersers) or a group of nearby populations (*e.g.*, metapopulation). For vegetation communities, the EO may represent a stand or patch of a natural community or a cluster of stands or patches of a natural community. The Natural Heritage Information Centre is the central repository for Element Occurrence records.

Endemic: a species or ecological system that is restricted to a region, such as the Great Lakes ecoregion. Many endemic species and systems are generally considered more vulnerable to extinction due to their dependence on a single area for their survival.

Focal Species: have spatial, compositional, and functional requirements that may encompass those of other species in the region and may help address the functionality of ecological systems. Examples include keystone species, wide-ranging species, and cave-dwelling species.

Global Rank (GRANK): the overall status of a species or ecological community is regarded as its "global" status; this range-wide assessment of condition is referred to as its global conservation status rank. Global conservation status assessments are generally carried out by NatureServe scientists with input from relevant natural heritage member programs (such as the NHIC in Ontario) and experts on particular taxonomic groups, and are based on a combination of quantitative and qualitative information. The factors considered in assessing conservation status include the total number and condition of occurrences; population size; range extent and area of occupancy; short- and long-term trends in these previous factors; scope, severity, and immediacy of threats, number of protected and managed occurrences, intrinsic vulnerability and environmental specificity.

Rank	Definition
GX	**Presumed Extinct** (species): Not located despite intensive searches and virtually no likelihood of rediscovery. **Eliminated** (ecological communities): Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.
GH	**Possibly Extinct** (species): Missing; known from only historical occurrences but still some hope of rediscovery. **Presumed Eliminated**: Historic, ecological communities)-Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration, for example, American Chestnut Forest.
G1	**Critically Imperilled**: At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	**Imperilled**: At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	**Vulnerable**: At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	**Apparently Secure**: Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	**Secure**: Common; widespread and abundant.

Variant Ranks

Rank	Definition
G#G#	**Range Rank**—A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community. A G2G3 rank would indicate that there is a roughly equal chance of G2 or G3 and other ranks are much less likely. Ranges cannot skip more than one rank (e.g., GU should be used rather than G1G4).
GU	**Unrankable**—-Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. Whenever possible, the most likely rank is assigned and a question mark qualifier may be added (e.g., G2?) to express minor uncertainty, or a range rank (e.g., G2G3) may be used to delineate the limits (range) of uncertainty.

GNR	**Unranked**—Global rank not yet assessed.
GNA	**Not Applicable**—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

Rank Qualifiers

Rank	Definition
?	**Inexact Numeric Rank**—Denotes some uncertainty about the numeric rank (e.g. G3? - Believed most likely a G3, but some chance of either G2 or G4).
Q	**Questionable taxonomy**—Taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority conservation priority.
C	**Captive or Cultivated Only**—At present extant only in captivity or cultivation, or as a reintroduced population not yet established.

Infraspecific Taxon Conservation Status Ranks

Infraspecific taxa refer to subspecies, varieties and other designations below the level of the species. Infraspecific taxon status ranks (T-ranks) apply to plants and animal species only; these T-ranks do not apply to ecological communities.

Rank	Definition
T#	**Infraspecific Taxon** (trinomial)—The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above for global conservation status ranks. For example, the global rank of a critically imperilled subspecies of an otherwise widespread and common species would be G5T1. A T-rank cannot imply the subspecies or variety is more abundant than the species as a whole-for example, a G1T2 cannot occur. A vertebrate animal population, such as those listed as distinct population segments under the U.S. Endangered Species Act, may be considered an infraspecific taxon and assigned a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status. At this time, the T rank is not used for ecological communities.

Limited Species: are nearly restricted to the Great Lakes ecoregion. These are species that are not "true" endemics because there may be populations outside the ecoregion. However, the core part of the species range is in the Great Lakes ecoregion.

Natural heritage system: means a system made up of natural heritage features and areas, linked by natural corridors which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species and ecosystems. These systems can include lands that have been restored and areas with the potential to be restored to a natural state (Provincial Policy Statement).

Peripheral: species or ecological systems that are located closer to the outer boundaries of an ecoregion than to the centre and are not widespread throughout the ecoregion (*e.g.*, where the Great Lakes ecoregion is the extreme edge of the species' range).

Protected Areas: natural area designation that is regulated under legislation such as the National Parks Act, Provincial Parks Act or the Public Lands Act. Protected areas identified in the Great Lakes Conservation Blueprint include National Parks, National Wildlife Areas, Migratory Bird Sanctuaries, Provincial Parks and Conservation Reserves.

Provincially Significant: in regard to wetlands, coastal wetlands and areas of natural and scientific interest, an area identified as provincially significant by the Ontario Ministry of Natural Resources using evaluation procedures established by the Province, as amended from time to time (Provincial Policy Statement).

Species at Risk (SAR): species designated as Endangered, Threatened or Special Concern by either the Ontario Ministry of Natural Resources (OMNR) or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Secondary Target: an element of biodiversity (species or vegetation community) that is of some conservation concern in the Ontario portion of the Great Lakes. Occurrences of secondary biodiversity targets were included in

the Conservation Blueprint portfolio where their occurrence coincided with a primary target occurrence, a protected area or conservation land.

Sub-national (Provincial) Rank: provincial ranks are used by the Ontario Natural Heritage Information Centre to set conservation priorities for rare species and vegetation communities. These ranks are not legal designations. Provincial ranks are assigned in a manner similar to that described for global ranks, but consider only those factors within the political boundaries of Ontario. Comparison of global and provincial ranks, gives an indication of the status and rarity of an element in Ontario in relation to its overall conservation status, therefore providing insight into the urgency of conservation action for it in the province. The NHIC evaluates provincial ranks on a continuous basis and produces updated lists annually.

Subnational (S) and National (N) Conservation Status Ranks

Status	Definition
NX **SX**	**Presumed Extirpated**—Species or community is believed to be extirpated from the nation or state/province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
NH **SH**	**Possibly Extirpated** (Historical)—Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.
N1 **S1**	**Critically Imperilled**—Critically imperilled 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.
N2 **S2**	**Imperilled**—Imperilled 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.
N3 **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.
N4 **S4**	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
N5 **S5**	**Secure**—Common, widespread, and abundant in the nation or state/province.
NNR **SNR**	**Unranked**—Nation or state/province conservation status not yet assessed.
NU **SU**	**Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
NNA **SNA**	**Not Applicable** —A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
N#N# **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).
Not Provided	Species is known to occur in this nation or state/province. Contact the relevant natural heritage program for assigned conservation status.

Threats Assessment: The threat ranking method assigns Severity, Scope, and Irreversibility directly to the sources of stress. The following two matrices show how Severity and Scope are combined to create a Threat Magnitude rank, which is then combined with the Irreversibility Rank to deliver an Overall Threat Rank.

		Scope			
		4-Very High	3-High	2-Medium	1-Low
Severity	4-Very High	4-Very High	3-High	2-Medium	1-Low
	3-High	3-High	3-High	2-Medium	1-Low
	2-Medium	2-Medium	2-Medium	2-Medium	1-Low
	1-Low	1-Low	1-Low	1-Low	1-Low

The **Overall Threat Rank** is calculated by integrating **Threat Magnitude** and a third rating variable (in this case **Reversibility**):

		Irreversibility			
		4-Very High	3-High	2-Medium	1-Low
Magnitude	4-Very High	4-Very High	4-Very High	4-Very High	3-High
	3-High	4-Very High	3-High	3-High	2-Medium
	2-Medium	3-High	2-Medium	2-Medium	1-Low
	1-Low	2-Medium	1-Low	1-Low	1-Low

Viability: the status or health of a species population or vegetation community occurrence. Viability indicates the ability of the biodiversity target to withstand or recover from natural and anthropogenic disturbances and probability of persistence of long periods of time. The viability rank provides a measure on the quality of occurrence which can be useful in determining probability of conservation success (i.e. will the target likely persist) and restoration/ management needs. The more viable a species or community is, the higher its EO rank and the higher its conservation value (see Table). Viability ranks are based solely on factors that reflect present quality. There are three viability rank factors, each reflecting what is currently known about a species or community:
Size + Condition + Landscape Context = Viability

Rank	**Definition**
A	Excellent estimated viability
B	Good estimated viability
C	Fair estimated viability
D	Poor estimated viability
E	Verified Extant (viability not assessed)
H	Historical
F	Failed to find
X	Extirpated

Wetlands: means lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. In either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic plants or water tolerant plants. The four major types of wetlands are swamps, marshes, bogs and fens.

Wide-ranging Species: are highly mobile species that require large tracts of habitat for their survival. These include top-level predators, migratory mammals, birds and insects. The design of fully functioning networks of conservation sites needs to take into account the habitat requirements of such species, including factors such as linkages, natural corridors, interior habitats and roadless areas.

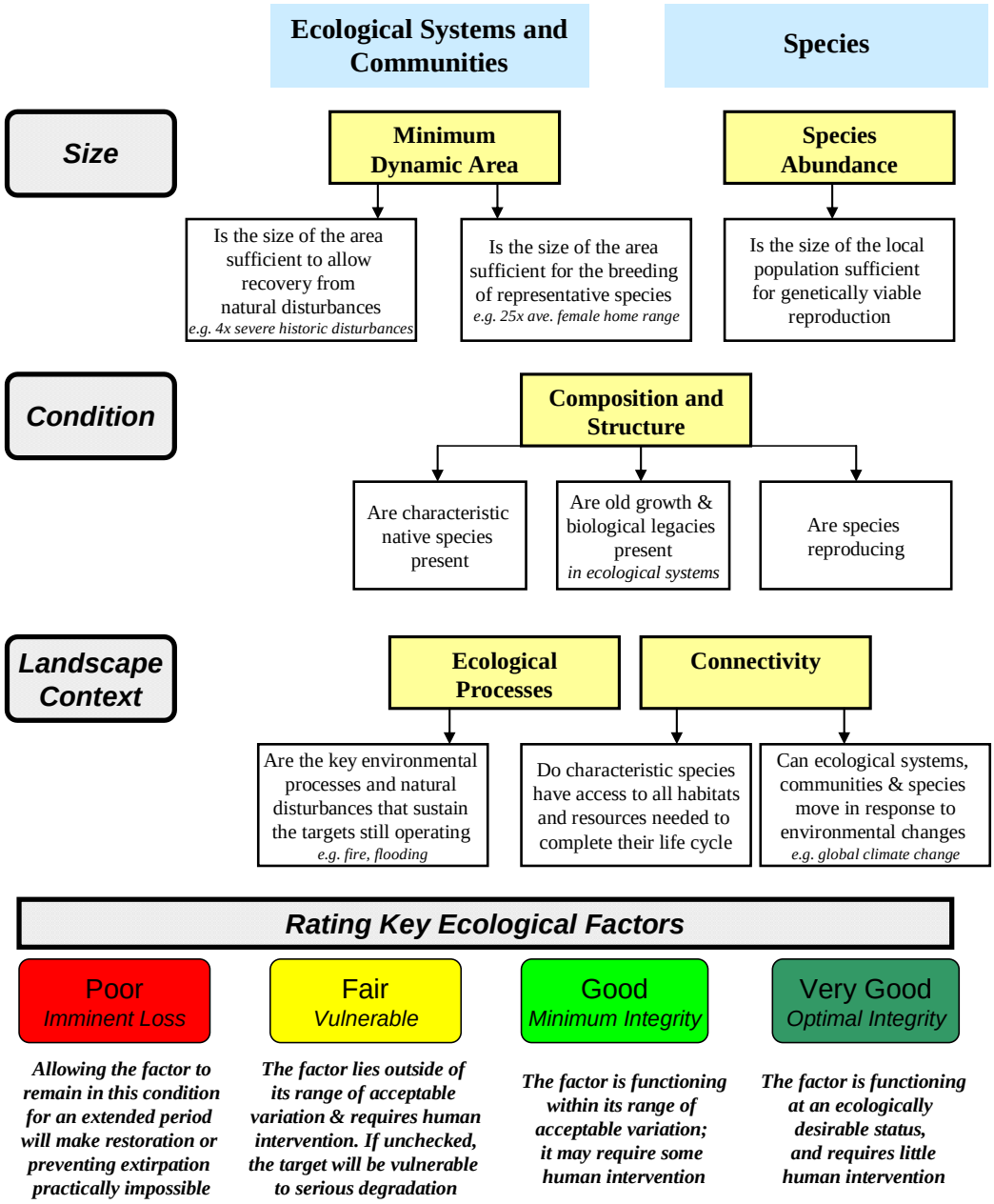
Widespread: species or ecological systems occurring naturally throughout the Great Lakes ecoregion and considerably beyond the ecoregion.

APPENDIX B.
CONSERVATION TARGET VIABILITY AND THREATS EVALUATION CRITERIA

[source: The Nature Conservancy, www.conservonline.org]

Viability Assessment Tool

Representative Key Ecological Attributes



Note: The ecological factors cited are common to many targets, but are not inclusive. Not all factors will apply to a given target.

Stress Ranking Guidelines

Severity of Damage *-- what level of damage can reasonably be expected within 10 years under current circumstances (given the continuation of the existing management/conservation situation)*	
Very High	The stress is likely to *destroy or eliminate* the conservation target over some portion of the target's occurrence at the site
High	The stress is likely to *seriously degrade* the conservation target over some portion of the target's occurrence at the site
Medium	The stress is likely to *moderately degrade* the conservation target over some portion of the target's occurrence at the site
Low	The stress is likely to *only slightly impair* the conservation target over some portion of the target's occurrence at the site

Scope of Damage *– what is the geographic scope of impact on the conservation target at the site that can reasonably be expected within 10 years under current circumstances (given the continuation of the existing situation)*	
Very High	The stress is likely to be *very widespread or pervasive in its scope*, and affect the conservation target *throughout the target's occurrences the site*
High	The stress is likely to be *widespread in its scope*, and affect the conservation target at *many of its locations* at the site
Medium	The stress is likely to be *localized in its scope*, and affect the conservation target at *some of the target's locations* at the site
Low	The stress is likely to be *very localized in its scope*, and affect the conservation target at a *limited portion of the target's location* at the site

Stress Ranking Chart

↓ ***Scope***	***---------- Severity ----------***			
	Very High	**High**	**Medium**	**Low**
Very High	*Very High*	*High*	*Medium*	*Low*
High	*High*	*High*	*Medium*	*Low*
Medium	*Medium*	*Medium*	*Medium*	*Low*
Low	*Low*	*Low*	*Low*	-

Source-of-Stress Ranking Guidelines

Contribution *– Expected contribution of the source, acting alone, to the full expression of a stress (as determined in the stress assessment) under current circumstances (i.e., given the continuation of the existing management/conservation situation)*

Very High	The source is a *very large* contributor of the particular stress
High	The source is a *large* contributor of the particular stress
Medium	The source is a *moderate* contributor of the particular stress
Low	The source is a *low* contributor of the particular stress

Irreversibility *– Reversibility of the stress caused by the source of stress*

Very High	The source produces a stress that is not reversible, for all intents and purposes (e.g. wetland converted to shopping center)
High	The source produces a stress that is reversible, but not practically affordable (e.g. wetland converted to agriculture)
Medium	The source produces a stress that is reversible with a reasonable commitment of additional resources (e.g. ditching and draining of wetland)
Low	The source produces a stress that is easily reversible at relatively low cost (e.g. ORVs trespassing in wetland)

Source Ranking Chart

↓ ***Irreversibility***	***---------- Contribution ----------***			
	Very High	**High**	**Medium**	**Low**
Very High	*Very High*	*High*	*High*	*Medium*
High	*Very High*	*High*	*Medium*	*Medium*
Medium	*High*	*Medium*	*Medium*	*Low*
Low	*High*	*Medium*	*Low*	*Low*

APPENDIX C. RECOMMENDED ACTIVITIES IN AVAILABLE RECOVERY STRATEGIES FOR SELECTED SAR OF THE NIAGARA RIVER CORRIDOR CAP AREA

Priority of recommended strategies: H = High (urgent); M = Medium (necessary); L = Low (beneficial); X = no priority indicated in RS
Conservation Target Key: MS = Marshes & shorelines; UDF = Upland deciduous forest; LSF = Lowland swamp forests; PS = Prairies, savannahs & oak woodlands; ETF = Edges, thickets and fields; LRS = Lakes, rivers & streams

Bolded strategies are addressed wholly or partly by this CAP.

	Carolinian Woodlands	**Acadian Flycatcher / Hooded**	**American Chestnut**	**Butternut**	**Deerberry**	**Eastern Hog-nosed Snake**	**Freshwater Mussels**	**Hooded Warbler**	**Red Mulberry**	**Redside Dace**	**Spoon-leaved Moss**	**Lake Chubsucker**	**Common Hoptree**	**Round-leaved Greenbrier**	**Barn Owl**	**Bird's-foot Violet**
Habitat	UDF, LSF	UDF	UDF	UDF, ETF	PSO	PSO, ETF	LRS	UDF	UDF	LRS	LSF	LRS	ETF	UDF, ETF	ETF, PSO	PSO
Recovery Strategy Status	D	A	A	A	A	A	A	A	A	A	A	AP	D	D	A	AP
Habitat Threats / Viablity Assessment	**H**				**H**	**H**	**M**		**H**		**H**				**H**	
Update NHIC & central databases				**H**		**H**					**H**					**X**
Inventory			H	H	M	H			M			H		H	H	X
Standardized habitat classification & mapping				**M**		**H**	**H**		**H**		**H**				**H**	
Identify priority sites & landowners	**H**													**H**	**H**	**X**
Review historic distribution					**H**									**H**		
Review land uses														H		
Ecosystem modeling					**L**											
PVA / MVP				M					M		H			M		
Investigate Road Impacts																

	Carolinian Woodlands	**Acadian Flycatcher / Hooded**	**American Chestnut**	**Butternut**	**Deerberry**	**Eastern Hog-nosed Snake**	**Freshwater Mussels**	**Hooded Warbler**	**Red Mulberry**	**Redside Dace**	**Spoon-leaved Moss**	**Lake Chubsucker**	**Common Hoptree**	**Round-leaved Greenbrier**	**Barn Owl**	**Bird's-foot Violet**
Investigate recreational impacts	H												X			
Investigate role of fire					M								X			
Investigate shoreline modification impacts / coastal processes													X			
Investigate Invasive plant Impacts	**H**			**L**									**X**			
Locate & monitor disease-resistant plants			L	H												
Research mechanisms to control disease			H	M												
Investigate deer impacts	H				H								X			
Investigate Wild Turkey Impacts					H											
Investigate invasive insect impacts	H				H											
Investigate impacts of alterations to drainage	**H**															
Investigate soil chemistry													X			
Survey with other SAR						H										
Gather TEK / ATK				M												
Investigate commercial Supply & Demand						L										
Demographic, genetic studies, dispersal, pop`n modeling				M	H	H	H		M		H			M		
Investigate impacts of contaminants						L										

	Carolinian Woodlands	Acadian Flycatcher / Hooded	American Chestnut	Butternut	Deerberry	Eastern Hog-nosed Snake	Freshwater Mussels	Hooded Warbler	Red Mulberry	Redside Dace	Spoon-leaved Moss	Lake Chubsucker	Common Hoptree	Round-leaved Greenbrier	Barn Owl	Bird's-foot Violet
Investigate Common Carp control												H				
Investigate conservation tillage, sustainable agriculture, soil restoration																X
Investigate reintroduction opportunities							**H**		**M**		**H**			**L**		
Investigate Best Management Techniques	H															X
Investigate existing management at sites													X			
Monitor Management Techniques		X														
Initiate Public Reporting Program				H		H							X			
Manage for habitat mosaics																
Develop & Apply Monitoring protocol	H		H	H	H	H	M		M		H	H	X	M	H	X
Monitor slumping impacts																
Develop & Distribute BMPs	**H**	**X**	**M**			**H**							**X**	**H**		**X**
Input into Official Plans, etc.	**H**				**H**	**H**	**N**		**H**							**X**
Develop appropriate EIS guidelines	H															
Identify key restoration sites	**H**				**M**				**M**					**L**		**X**

	Carolinian Woodlands	Acadian Flycatcher / Hooded	American Chestnut	Butternut	Deerberry	Eastern Hog-nosed Snake	Freshwater Mussels	Hooded Warbler	Red Mulberry	Redside Dace	Spoon-leaved Moss	Lake Chubsucker	Common Hoptree	Round-leaved Greenbrier	Barn Owl	Bird's-foot Violet
Restore sites using appropriate techniques	**H**	**X**			**H**								**X**	**L**	**H**	**X**
Restore historic sites													**X**			**X**
Restore Habitat linkages	**H**								**M**							**X**
Create vegetated buffers along waterways							**H**									
Work with farmers to mitigate tile drain impacts							**H**									
Establish adequate manure collection & storage							**H**									
Improve faulty septic systems							H									
Encourage cover crops	**M**															
Restrict livestock access	**M**						**H**									
Encourage low tillage	**M**															
Identify / demonstrate / promote sustainable grassland management															**H**	
Support habitat improvement projects															**H**	**X**
Support development of EFPs	**M**						**H**								**H**	
Nest box program															**L**	
Expand / Enhance Forest Interior	**H**	**X**														

	Carolinian Woodlands	**Acadian Flycatcher / Hooded**	**American Chestnut**	**Butternut**	**Deerberry**	**Eastern Hog-nosed Snake**	**Freshwater Mussels**	**Hooded Warbler**	**Red Mulberry**	**Redside Dace**	**Spoon-leaved Moss**	**Lake Chubsucker**	**Common Hoptree**	**Round-leaved Greenbrier**	**Barn Owl**	**Bird's-foot Violet**
Identify / Increase Older Growth Forests	M	X														
Develop & Distribute Appropriate Forest / Woodlot Management Guidelines	**H**	**X**		**H**												
Reduce Forestry Impacts	H	X														
Develop Guidelines for Managing Succession in Conifer Plantations		X														
Develop & implement management plans	**H**								**H**		**H**					**X**
Signage						H										
Reduce invasive species impacts	**H**								**H**				**X**			
Discourage use of exotic bait species							M					M				
Reduce trail / off-trail impacts	H															
Encourage natural shoreline processes													X			
Collect seed and propagate plants			**M**	**H**	**M**				**M**							
Introduce opposite gender plants													X			
(Re-)introduce to enhance populations			**L**						**M**					**L**		
Reduce beach grooming													X			
Liaise with First Nations						X										X

	Carolinian Woodlands	Acadian Flycatcher / Hooded	American Chestnut	Butternut	Deerberry	Eastern Hog-nosed Snake	Freshwater Mussels	Hooded Warbler	Red Mulberry	Redside Dace	Spoon-leaved Moss	Lake Chubsucker	Common Hoptree	Round-leaved Greenbrier	Barn Owl	Bird's-foot Violet
Collaborate with other conservation initiatives (e.g. CWRS)	**H**				**M**		**H**		**M**		**H**			**M**	**H**	**X**
Integrate SAR communications	**H**				**L**	**X**			**H**		**H**		**X**			**X**
Integrate SAR enforcement				H		X										
Apply / Promote Property Tax Incentives	**H**	**X**					**H**								**H**	**X**
"Soft" Incentives to Protect Forest Habitat		X													H	
Secure Key Sites through Easements and Acquisition		**X**				**X**									**H**	**X**
Use Carbon Offset Programs to Increase Habitat		X														
Forest Certification		X														
Prepare & Distribute Educational Materials	**H**	**X**	**L**	**H**	**H**		**H**						**X**	**H**	**M**	**X**
Educate Commercial interests (pet trade, nurseries, horticulturalists, landscapers)	**H**					**X**			**H**							
Conduct Information Sessions	**H**	**X**														
Cormorant population control													X			
Deer population control	H												X			

	Carolinian Woodlands	Acadian Flycatcher / Hooded	American Chestnut	Butternut	Deerberry	Eastern Hog-nosed Snake	Freshwater Mussels	Hooded Warbler	Red Mulberry	Redside Dace	Spoon-leaved Moss	Lake Chubsucker	Common Hoptree	Round-leaved Greenbrier	Barn Owl	Bird's-foot Violet
Support development of protective legislation	**H**															**X**
Support CO's in prosecution							M									
Recognize good stewards																X
Develop communications strategy		?		H					H				?			X
Rank / evaluate conservation methods	H															
Develop / improve protective policies (e.g., Drainage Act)	**H**			**M**			**M**									
Restrict movement of plants	M		L													
Wastewater treatment upgrades							**M**									
Nutrient & manure management plans							**H**									
Establish Tallgrass Institute, maintain Tallgrass Ontario																X
Partnerships with academia	H															
Training program for conservation practioners	H						H									
Update Big Picture / NH mapping	H															
Determine effective invasive spp. controls	**H**															

	Carolinian Woodlands	Acadian Flycatcher / Hooded	American Chestnut	Butternut	Deerberry	Eastern Hog-nosed Snake	Freshwater Mussels	Hooded Warbler	Red Mulberry	Redside Dace	Spoon-leaved Moss	Lake Chubsucker	Common Hoptree	Round-leaved Greenbrier	Barn Owl	Bird's-foot Violet
Community-based CAPs	**H**															
Evaluate & improve protected area management activities	M															
Educate public re: introducing exotic species							**H**									
Promote better controls at border crossings	M															
Support environmental lobbying	M															