# Grand River Conservation Action Plan


***Prepared by***

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**&**
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Ontario Federation of Agriculture
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Ontario Invasive Plant Council
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*Thank you to the CAP team and contributors!*

CAROLINIAN CANADA COALITION

*Collaborating for a Healthy Ecoregion*

# Background & Rationale

## Carolinian Canada Coalition's Big Picture Vision

The Grand River Conservation Action Plan (CAP) area is situated in the heart of Ecoregion 7E, an area extending from Toronto to Grand Bend, south to Niagara Falls and the western Lake Erie islands. This ecoregion is colloquially known as Canada's "Carolinian life zone", or simply "Carolinian Canada" because many plants and animals found in the eastern United States as far south as the Carolinas reach their northern limit in this part of Ontario.

Green, healthy landscapes are essential to human quality of life and economic prosperity. Conservation efforts in the past have focused on "islands of green" on landscapes where human uses and activities prevail. In 1984 Carolinian Canada Coalition identified 38 critical natural areas across the ecoregion needing urgent action. But our scientific understanding has evolved and we now know that these "islands of green" cannot remain healthy in isolation. To remain viable they must be connected one to another in a "natural heritage system". Natural heritage systems are critical for maintaining the quality of our water and air, for species movement and genetic exchange, and for adapting to climate change. In 2000, Carolinian Canada's "Big Picture" analysis identified such a natural heritage system of core natural areas and connecting corridors.

The "Big Picture" continues to inform and complement the natural heritage planning being done by municipalities, conservation authorities, and provincial and federal departments. Carolinian Canada is working to update the Big Picture with new information, and find ways to monitor how well we are doing to achieve this vision.

## Conservation Action Planning in Canada's Carolinian Life Zone

The Carolinian life zone occupies less than 0.25% of Canada's landmass, yet it provides habitat for over 40% of Canada's plant species, 67 percent of Canada's terrestrial reptiles, half of the nation's bird species, and equally impressive proportions of other taxonomic groups. At the same time, one quarter of Canada's population lives in the region, our country's agricultural, industrial and economic heartland. As a result, extensive conversion to human land uses has occurred. In southern Ontario, 94% of upland forests were cleared over the past two centuries, while more than 70% of all pre-settlement wetlands have been converted, and up to 99% of prairies and savannahs have been lost.

On a heavily modified working landscape such as this, habitat fragmentation has reduced most natural areas to sizes much smaller than is required to maintain basic ecological functions and diverse, resilient biological communities. Overall, natural cover across the Carolinian life zone now ranges from less than 7% in some areas to below 18% in others. The Grand River Watershed is at the high end of this spectrum as some areas have greater than 35% forest cover (Grand River Conservation Authority, 2014). These high levels of land conversion mean that many of the essential ecological processes needed for healthy soils, clean water and clean air have been severely compromised.

For these reasons, combined with the fact that many of the species found here are near the northern limits of their distribution, the ecoregion has the greatest number and concentration of Species At Risk (SAR) in Canada. At least 65 of them occur in the Grand River CAP area (Table 4). More than 500 additional plant and animal species found in the zone are recognized to be at some level of risk, and many of these are just as threatened as "official" SAR but have not yet gone through the legislative process required to designate them. If historical trends continue, more and more species will end up designated as SAR, resulting in greater costs to protect them and increased regulatory demands on rural landowners.

The Carolinian Woodlands Recovery Team (CWRT), made up of representatives from various levels of government, non-government organizations, the academic research community and the private sector, was established in 2004 to address the recovery needs of the many woodland plant species that are at risk in the ecoregion. The CWRT recognized that many SAR occupy similar habitats and face similar threats. The CWRT also noted that there is an array of organisations, agencies and groups with an interest in conserving and enhancing the ecological health of the landscape of southern Ontario, and that often these organisations are working independently and not in a particularly coordinated or collaborative fashion—a situation that potentially compromises the effective utilization of limited funding and resources.

While some species face threats requiring species-specific actions, taking a broad ecosystem-based approach for Ontario's Carolinian woodlands was considered to be the most efficient and proactive way to improve the chances of recovery of entire suites of species and their habitats. To address the need for large-scale "natural heritage system" planning, since 2000 the Carolinian Canada Coalition (CCC) has been promoting a "Big Picture" vision for the ecoregion, a map-based network of core natural areas and connecting corridors (http://www.carolinian.org/ConservationPrograms_BigPicture.htm). And between 2006 and 2008, a draft *National Recovery Strategy for Carolinian Woodland Ecosystems and Associated Species At Risk* (CWRS) was developed by the CWRT (Jalava and Mansur 2008, Jalava *et al.,* 2009). Recovery goals were set at the ecosystem level in order to address the threats to the ecological processes that support biodiversity "hotspots", SAR and their habitat, significant vegetation communities and natural areas. Restoring natural connectivity to such a network of core areas was deemed essential, as it would allow for genetic exchange between populations, adaptation and migration in response to climate change, and provide corridors for movement of wide-ranging species.

Strategies to address threats, recover habitats, and to monitor and evaluate recovery efforts were outlined in considerable detail. Ecosystem recovery would be directed along the following themes:

- refinement of the map-based template for an ecologically functioning network of core areas and corridors;
- better coordination of recovery efforts, with broad participation from agencies and stakeholders;
- improvements in databases, knowledge and understanding of Carolinian sites, SAR occurrences, and the biological needs of SAR;
- long term monitoring of sites, species and social trends;
- improvements in policy and legislation relating to conservation at all levels of government;
- net increases in overall woodland extent, average core area sizes, extent of forest interior, landscape connectivity, and extent of landscape protected through securement, easements, stewardship agreements and conservation plans;

- measurable reductions in threats to critical sites;
- improvement in population sizes, numbers of extant occurrences and habitat quality for SAR;
- significant increases in landowner participation in stewardship programs and incentives;
- municipalities applying natural heritage system design in official plans;
- enhanced public awareness and support for recovery of Carolinian ecosystems;
- community-based action plans developed for "biodiversity hotspots" to strategically implement ecosystem recovery objectives.

It was determined that The Nature Conservancy (U.S.) Conservation Action Plan (CAP) approach (http://www.conservationgateway.org/topic/conservation-action-planning) would best address these themes strategically and efficiently. The approach has been developed and refined over three decades throughout the world by a remarkable diversity of jurisdictions and organisations, including The Nature Conservancy of Canada (e.g., Southern Norfolk Sand Plain Natural Area Conservation Plan). CAPs are tailored to the specific characteristics and needs of ecologically-important landscapes. By applying this approach to biodiversity "hotspots" in the Carolinian life zone, ultimately a network of linked conservation practitioners and action plans for each target landscape in the Carolinian life zone would be created. This network would:

- Address the urgent needs of priority SAR;
- Prevent increased numbers of species from being listed as SAR;
- Link SAR recovery strategies to watershed plans, official plans and a range of other key land use strategies and planning efforts;
- Heighten awareness, improve attitudes, and garner additional resources towards the recovery of species, communities and ecosystems at risk;
- Enhance community engagement in building a sustainable culture.

In 2007, a sophisticated analysis was undertaken in partnership between Carolinian Canada Coalition (CCC), the Nature Conservancy of Canada (NCC), Environment Canada (EC) and the Department of Fisheries and Oceans (DFO) to identify "biodiversity hotspots" in southern Ontario, based on the best available information on the occurrences and concentrations of rare species and natural communities. A map was developed that identified at least fifteen such areas. This map would serve as the template for targeting efforts on areas within the life zone where the greatest return on investment would be gained.

Two of the fifteen areas (Western Erie Islands and Southern Norfolk Sand Plain) had action plans already being developed or implemented by NCC, while another (Skunks Misery) had an action plan that was being implemented by the Thames Talbot Land Trust in collaboration with the NCC. Between 2008 and 2013, the CCC developed CAPs for ten additional priority areas (Essex Forests and Wetlands; Ausable River -Kettle Point-Pinery; Upper Thames River; Hamilton – Burlington; Short Hills; Niagara River Corridor; Elgin Greenway; Rondeau-Lake Erie Coast; Lake St. Clair Coastal and Sydenham River) with an array of local stakeholder groups, agencies and organisations, including conservation authorities, First Nations, agricultural organisations, provincial and federal government agencies, non-government organisations, naturalist clubs and municipalities.

## The Grand River Conservation Action Plan

The Grand River CAP Steering Committee members, consisting of representatives from Long Point Basin Land Trust, Carolinian Canada, Grand River Conservation Authority, Six Nations of the Grand River, the City of Brantford, Haldimand County, and the Ontario Ministry of Natural Resources, were first contacted in March 2013.

As part of the planning process, Carolinian Canada was invited to participate in discussions for the Southern Grand River Decision Analysis workshops in May and June of 2013. The CAP document is meant to be complementary to this process, not to replicate work already being done, so the CAP focusses on higher priority terrestrial targets and threats, while the SGRDA focuses more on the needs of aquatic ecosystems.

During the Steering Committee meeting on September 30, 2013, the committee was introduced to the mapping and CAP methodologies, and the group discussed mapping options, roles and levels of involvement of the organisations present, and other stakeholders that should be invited to contribute to the process. The team decided that the CAP should focus on the Carolinian portion of the Grand River Watershed. The team acknowledged that while water quality in the southern end of the river is impacted by actions upstream, it would be important to focus our objectives on the southern part of the watershed.

The Science and Technical Team met four times between December 2013 and January 2014, and the Grand River Steering Committee and external advisors reviewed and approved their work in February 2014.

This report represents the results of the one-year planning process, which has drawn from the expertise and knowledge of a large and diverse group of local stakeholders. The long-term benefits of this approach include:

- Mapping tools are available to guide and prioritise site stewardship and ecological restoration activities in the Grand River area
- Resources and funding can be targeted toward the most important projects, activities and sites as identified through a consensus-based multi-stakeholder approach;
- Multiple agencies, organisations and local groups can work collaboratively and efficiently to recover and steward healthy ecosystems, particularly in the highest priority areas;
- Information on Best Management Practices for species and habitats can be widely shared, and community knowledge and capacity will be enhanced.

The Grand River Conservation Action Plan essentially provides a workbook designed to help guide conservation activities and serve the community and stakeholder groups in the following ways:

- Landowner outreach, education, stewardship, restoration and site securement by conservation authorities, Long Point Basin Land Trust, First Nations, and other agencies and groups, can be targeted on the areas where the greatest ecological benefits will be gained;
- Conservation and recovery activities are prioritized based on sound science combined with the best available local knowledge;
- Better coordinated, collaborative project proposals and funding applications, leading to greater likelihood of funding approval;

- Reduced duplication and competition for limited resources amongst the various agencies, groups and organisations;
- Clearly identified tasks and roles (developed on the basis of collaborative expertise) in conservation projects;
- Improved ability to measure progress and monitor results thanks to a mutually agreed-upon set of priorities and tasks;
- Greater transparency in conservation effort and greater buy-in from the community due to the collaborative nature of the approach.

This long-term, multi-faceted, targeted, coordinated approach will result in more vibrant, resilient ecosystems, healthier habitats and enhanced viability of flora and fauna across the Grand River CAP area. Recovery of the ecosystems will not only serve the needs of SAR and other imperiled species, but will contribute to climate change adaptation and enhanced ecosystem services. Healthy ecosystems correlate directly to cleaner water and air, productive soils, sustainable agriculture, and enhanced tourism and recreational opportunities. Ultimately, this initiative aims to build more prosperous communities, healthier citizens, and improved quality of life in the CAP area and across the deep south of Ontario.

## Vision

The Steering Committee developed the following vision for the Grand River CAP.

> The Grand River Conservation Action Plan (CAP) aims to protect critical ecosystems, enrich biodiversity through restoration of habitat and improvement of connectivity of natural areas, enhance ecosystem services such as water quality for local communities, and engage citizens to work together toward a common, mutually-beneficial cause: a healthier environment for all.

## Next Steps

This report and the associated mapping represent a template for conservation action that has been agreed upon by its developers, the Grand River CAP Development Team (listed on page v). Objectives and strategic actions are described in detail in Section 3.

In order for the recommended activities to be undertaken strategically and effectively, and with the support of the collaborating organisations, the Grand River Steering Committee will continue to guide the project.

The Steering Committee will communicate at least twice annually: 1. early in the fiscal year (April/May) when external funding allocations are known (to develop a concrete workplan for the year); 2. in the fall or early winter to review progress, plan for the following year, and apply for

additional funding/support as needed. Additional meetings, conference calls, will be held as needed.

# Acknowledgements

Carolinian Canada and our Ecosystem Recovery Network partners would like to thank all the many organisations and individuals who have contributed many hours of time and expertise to the development of the Grand River Conservation Action Plan. Most of those organisations and individuals are listed in the Plan Authors section of this report.

We also especially wish to thank the remarkable support of the international Conservation Coaches Network (CCNet) and The Nature Conservancy (U.S.) for their inspiration, expertise, training, information and practical support for CAP programs around the world.

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# 1. Conservation Context

## i. Geographic Context

The Grand River Conservation Action Plan (CAP) area covers 203,544 ha (2035.44 km²) of land north of the eastern portion of Lake Erie, encompassing a large part of Haldimand County, part of Brant County and the Six Nations of Grand River (Figure 1). The CAP is part of Ontario's Ecodistrict 7E-5 and a small portion of 7E-2. The CAP area boundaries were developed through GIS analyses of natural areas undertaken by Nature Conservancy of Canada (NCC) using methodology developed collaboratively by Ontario Nature and Carolinian Canada (see appendix A for methodology), with the input of the CAP team and other participating organisations listed above.

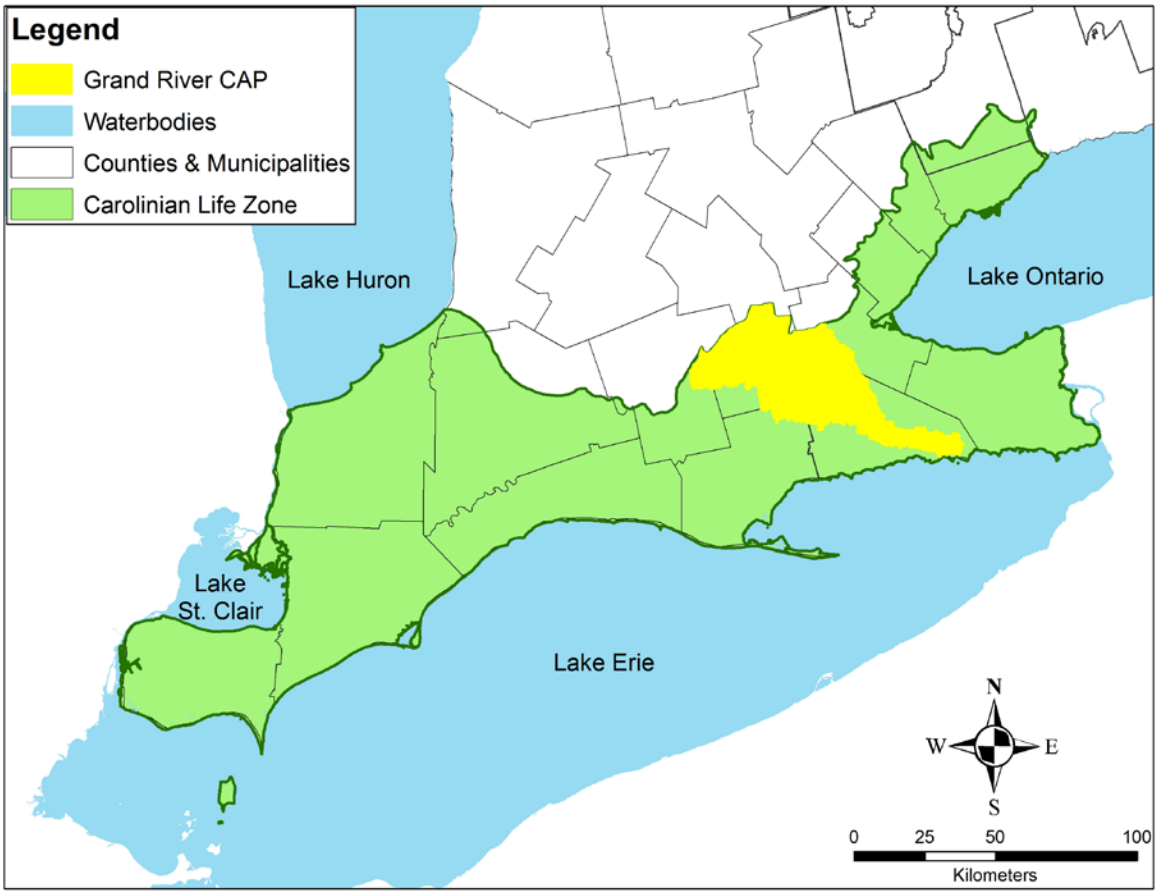


**Figure 1: Location of the Grand River CAP within the Carolinian Life Zone (Ecoregion 7E)**

## ii. Historical, Cultural and Socioeconomic Context

Most of the communities along the Grand River were established along the waterways, which powered mills and other manufacturing industries. There are many heritage buildings along the river from the 19th century that have been converted from their former industrial uses to markets and restaurants (Grand River Conservation Authority, 2014).

The CAP is primarily in Brant and Haldimand counties, but including the 10 km buffer it also covers parts of Niagara, Hamilton, Waterloo, Oxford and Norfolk counties. The largest cities in the area are Cambridge and Brantford, and there are several additional smaller communities (Table 1). The northern half of the Grand River Watershed, not included in the Grand River CAP area, also includes the larger cities of Kitchener, Waterloo and Guelph. Over 80% of the population lives on 7% of the land base, concentrated in the cities (Grand River Conservation Authority, 2003).

*Table 1: Summary of Population Information in the Grand River CAP (Statistics Canada 2012)*

| Name | Population | 2006-2011 Population Change (%) | Population Density (persons/km$^2$) |
|---|---|---|---|
| Cambridge | 126,748 | 5.3 | 1121.7 |
| Brantford | 93,650 | 3.8 | 1292.3 |
| Ayr | 4,380 | 5.3 | 673.8 |
| Paris | 11,763 | 5.2 | 819.8 |
| St. George | 3,124 | 5.7 | 1,098.0 |
| Burford | 1,952 | 0.6 | 251.7 |
| Ohsweken (Six Nations) | 6,213 | - | 39.5 |
| Waterford | 3,119 | -1.7 | 1,000.5 |
| Caledonia | 9,999 | -1.5 | 1,457.7 |
| Hagersville | 2,579 | 2.1 | 820.9 |
| Cayuga | 1,622 | 3.0 | 818.0 |
| Dunnville | 5,789 | 1.0 | 756.3 |

The top four industries in Cambridge and Brantford, as a percentage of the labour force, are (Statistics Canada, 2014):

Cambridge (including Kitchener and Waterloo)

- Manufacturing (23%)
- Retail Trade (11%)
- Health care and social assistance (8%)
- Educational services (8%)

Brantford

- Manufacturing (21%)
- Retail Trade (10%)
- Health care and social assistance (10%)
- Accommodation and food services (6%)

Agriculture is significant outside of the cities. Over 90% of the watershed is classified as agricultural and rural, and growth and intensification are expected to continue (Grand River Conservation Authority, 2003).

The Grand River, including its major tributaries, was designated as a Canadian Heritage River in 1994. This designation recognizes the significant cultural heritage and recreational opportunities found along the river. The river is a popular destination for camping, fishing, boating, picnicking, hiking, swimming, and nature appreciation (Canadian Heritage Rivers System, 2014). The Grand Valley Trail, Hamilton to Brantford Rail Trail, SC Johnson Trail, and Cambridge to Paris Rail Trail are available for hiking and cycling (Grand River Conservation Authority, 2014). Some of these activities contribute to the degradation of conservation targets, however they also present an opportunity for outreach and education.

## iii. Ecological Context

## Carolinian Canada

The Grand River CAP area is located in the eastern portion of Ecoregion 7E, colloquially known as the Carolinian life zone of Canada, which falls 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, and though smaller than other Canadian ecological zones (0.25% of Canadian land area), it has greater numbers of species of flora and fauna than any other ecosystem in Canada (Norfolk Environmental Advisory Committee, 2006). This zone is characterized by mainly deciduous-dominated forests including some conifer species [*e.g.*, Eastern Red-cedar (*Juniperus virginiana*), White Pine (*Pinus strobus*)], many southern trees at their northern range limits such as Tulip Tree (*Liriodendron tulipifera*), along with shrubs and herbaceous species not found in other parts of Canada (Lindsay 1984). Over 2,200 plant species, 70 native tree species, and more than half of all Canadian bird species can be found in Carolinian Canada (Solymár et al., 2008).

## Ecodistricts

The majority of the CAP lies within Ecodistrict 7E-5 (Niagara), with smaller portions in the northwest in 7E-2 (St. Thomas) and 7E-6 (South Stratford). Overall, nearly 22% of Ecodistrict 7E-5 remains as natural cover. Clay plain forest complexes represent two-thirds of this, 10% is sand plain deciduous forest complex and 15% is wetland, consisting primarily of treed swamp. Approximately 4% of the Ecodistrict is protected. Conservation authorities have secured over 3,000 ha, over 9,500 ha are identified as provincially significant wetlands, and over 4,400 ha are provincially significant life science ANSIs (Figure 2) (Henson and Brodribb, 2005).

Seven of the 19 significant vegetation communities in 7E-5 are globally rare (limestone talus, limestone cliff, alvar), 15 are provincially rare, and three are considered high-quality representative communities that are important to conservation (Henson and Brodribb, 2005).

Two-thirds of 7E-5 has 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)

Ecodistrict 7E-2 consists predominantly of sand plains, with some kame moraines. Approximately 17% of the ecodistrict remains naturally vegetated, most of this being forest. Sand plain deciduous forest complex comprises 42% of this remaining natural cover, followed by clay plain deciduous forest complexes and till plain forest complexes, each with 14% of the remaining natural cover. Another 12% of the remaining natural cover is wetland, with two-thirds composed of swamp complexes. There are also 2,430 ha of prairies and savannahs remaining in 7E-2, approximately 68% of the total area of all remnants known in southern Ontario. Over 80% of 7E-2 has been converted to agriculture (756,586 ha), with an additional 11,046 ha of residential, industrial and infrastructure development (Henson and Brodribb 2005).

Despite the widespread conversion of natural cover, Ecodistrict 7E-2 remains biologically diverse, with among the highest numbers of globally rare species and communities in Ontario (Henson and Brodribb 2005). More than 60 COSEWIC Species At Risk (SAR) are found in the ecodistrict. Despite its high conservation value, conservation lands make up only 4% of the total area of the Ecodistrict 7E-2 (39,875 ha). Provincially significant life science Areas of Natural and Scientific Interest (ANSIs) account for nearly half of this, with a total of 18,517 hectares (2% of the ecodistrict). Forty-three percent of all documented occurrences of species and vegetation community targets in 7E-2 are within identified conservation lands; more than half of these are within provincially significant life science ANSIs (Henson and Brodribb 2005).

Six of the 27 significant vegetation communities identified within 7E-2 are globally rare (dunes, savannahs and tallgrass prairie), 14 are provincially rare, and 12 are considered to be high-quality representative vegetation communities that are important to conservation (Henson and Brodribb 2005).

*Ecoregion 7E-6*

This ecodistrict occurs in the north-central portion of Ecoregion 7E, along the boundary with Ecoregion 6E. As a result, its vegetation is transitional between the two large ecoregions. Approximately 13% of the Ecodistrict 7E-6 remains under natural cover, primarily forest. Till moraine deciduous forest complex makes up 41% of this remaining natural cover, followed by till plain deciduous forest with 21 percent. Nearly 28% of the remaining natural cover is wetland, largely swamps. Three hectares of a prairie and savannah remnant occurring mostly in adjacent Ecodistrict 7E-2 are within 7E-6. Approximately 79% of Ecodistrict 7E-6 has been converted to developed agricultural lands (177,700 ha), and an additional 2,515 hectares are pastures and abandoned fields. Lands associated with agriculture represent over 80% of the ecodistrict. There are over 3,500 hectares of gravel pits and quarries, and nearly 12,000 hectares of settlement and other associated developed lands, including the city of London. [Henson and Brodribb 2005]

Despite the widespread conversion of natural cover, Ecodistrict 7E-6 remains biologically diverse, providing habitat for at least 27 COSEWIC Species At Risk (SAR). Despite its high conservation value, Conservation lands cover only approximately 4% of the total area in 7E-6 (9,371 ha). Conservation Authorities have secured nearly one-third of these lands (2,939 ha). Over 6,500 hectares have been identified as provincially significant wetlands and 1,838 hectares are designated as provincially significant life science ANSIs. One-third of all documented occurrences of species and vegetation community targets in 7E-6 are within conservation lands, primarily provincially significant life science ANSIs and Conservation Authority lands. [Henson and Brodribb 2005]

Five of the eight vegetation communities identified within 7E-6 are globally rare, five are provincially rare, and one is considered to be a high-quality representative vegetation community that is important to conservation (Henson and Brodribb 2005).

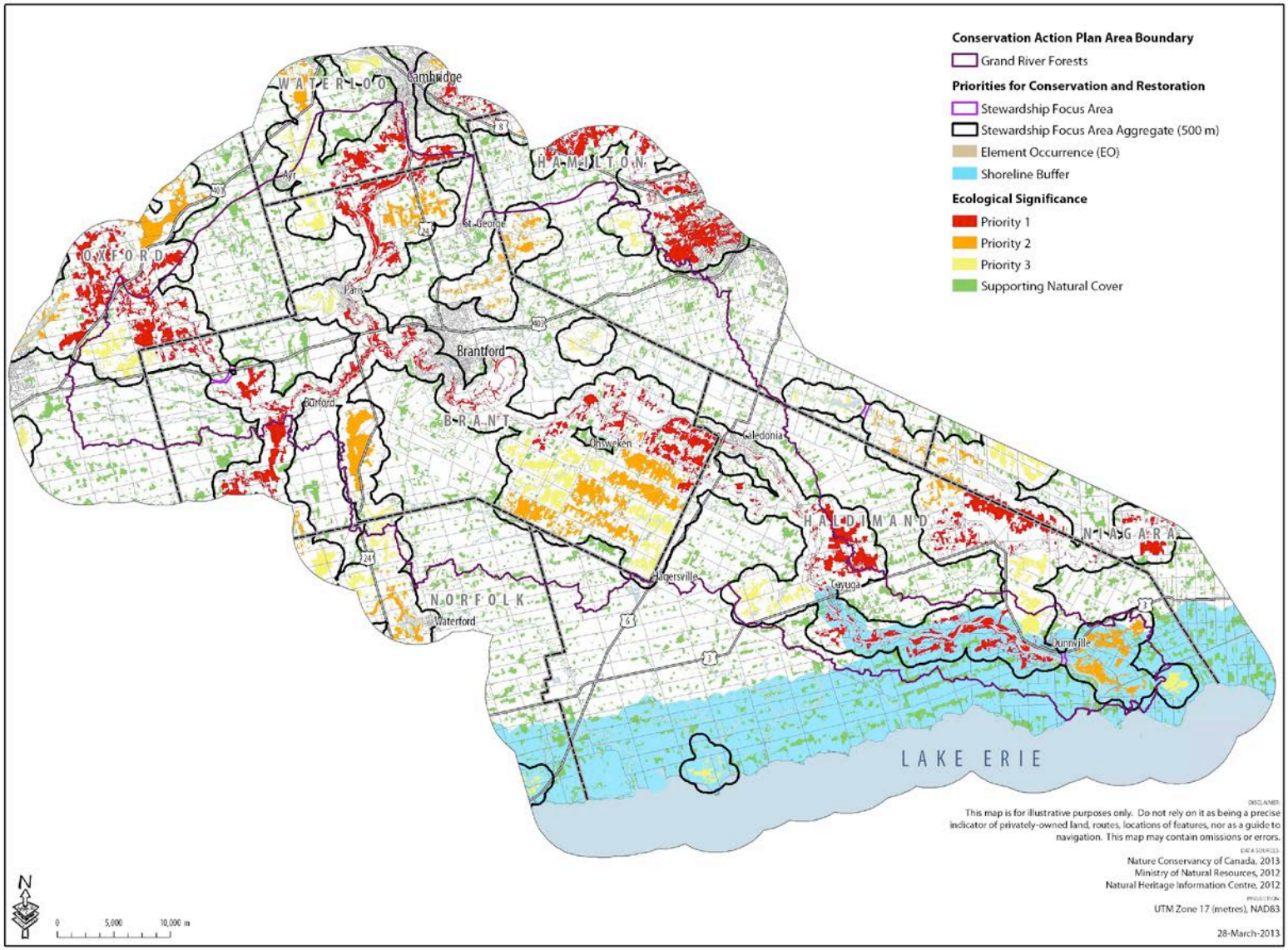


**Figure 2: Boundary, natural areas and priorities for conservation and restoration of the Grand River CAP**

## Grand River CAP Area

The Grand River CAP area extends across the eastern part of Lake Erie's north coast (203,544 ha) (Figure 2). The CAP is primarily in Brant and Haldimand counties, but including the 10 km buffer it also covers parts of Niagara, Hamilton, Waterloo, Oxford and Norfolk counties. The Conestogo River, Eramosa River, Speed River and Nith River are all major tributaries to the Grand, and drain into Lake Erie, which forms its southern boundary. Forests are the dominant ecosystems in the CAP area, but wetland and prairie habitats of high conservation value also occur. The CAP area covers two climate region divisions; The South Slopes and the Lake Erie Counties (Grand River Conservation Authority, 2014).

## Physiography and Glacial History

The Grand River CAP overlaps with four physiographic regions of southern Ontario: the majority of the CAP is within the Haldimand Clay Plain, with strips of Norfolk Sand Plain and Horseshoe Moraines in the middle, and the Mount Elgin Ridges in the western end (Figure 3)(Chapman and Putnam 1984). During the recession of the Wisconsinan glacier, much of the Grand River CAP area was under glacial lakes. As the glacier melted, deposits of gravel, sand and clay were left behind, including the gravel pits near Paris and the clay soils in Haldimand County (Grand River Conservation Authority, 2014). The bedrock found in Ecoregion 7E is Silurian and Devonian limestone, and the predominant substrates include Gray Brown Luvisols and Gelysols (Crins et al., 2009).

Haldimand Clay Plain

The majority of the CAP area lies within the Haldimand Clay Plain. This area was submerged by the glacial Lake Warren. The Grand River has cut a deep valley in the clay and silt below Brantford. The underlying rocks are a succession of Palaeozoic beds that dip under Lake Erie. A scattered group of drumlins are partially buried in dissected clay beds near Caledonia, and there are moronic headlands east of Port Maitland where the Grand River drains into Lake Erie (Chapman and Putnam 1984).

Some areas of the clay plain have heavy soils and poor drainage, and there are numerous wet sloughs. But the Oneida clay loam near Caledonia and the Haldimand clay loam along the Grand River have better natural drainage, and the wet sandy loam near Dunnville has been drained for agriculture (Chapman and Putnam 1984).

Horseshoe Moraines

Morainal ridges are made up of pale brown, hard, calcareous fine-textured till, with a moderate degree of stoniness. The western end is marked by the low gravel beaches of the glacial Lake Warren. The eastern end contains flat sand and gravel terraces and some linear, undrained swampy areas. Large, workable sand and gravel deposits are found in the Grand River valley near Paris (Chapman and Putnam 1984).

Norfolk Sand Plain

The middle of the CAP is in the Norfolk Sand Plain. The sands and silts of this area were deposited by the Grand River as it flowed into glacial Lakes Whittlesey and Warren, resulting in a delta built

from west to east. The topography is generally flat with some steep valleys cut by rivers flowing towards Lake Erie. The well-drained soils drew farmers to the area early but many found that the fine layer of sand on the surface is prone to wind erosion once vegetation was cleared. The finer sediments below the soil hold up the water table and create an abundant supply of well water (Chapman and Putnam 1984).

Mount Elgin Ridges

The western end of the CAP is within the Mount Elgin Ridges, a succession of ridges and vales found between the Thames Valley and the Norfolk Sand Plain (Chapman and Putnam 1984). The ridges are moraines deposited during the recession of the Wisconsin glacier. The ridges are typically clay or silty clay while the vales contain alluvium of gravel, sand or silt (Chapman and Putnam 1984). The ridges are well-drained and well-aerated allowing prosperous agriculture, while the vales are poorly drained. This area forms the divide between the Thames River system and the south flowing rivers that flow into Lake Erie.

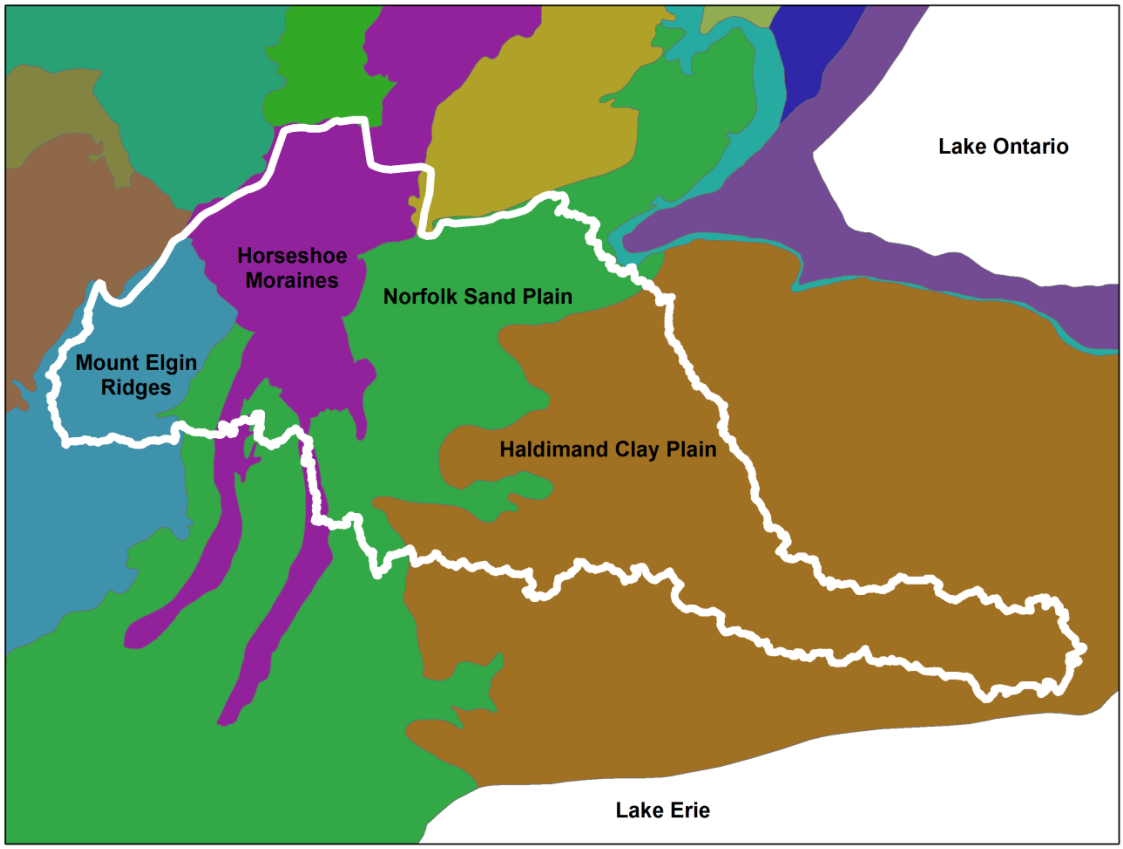


**Figure 3: Physiographic regions of the Grand River CAP**

## Biodiversity

The Grand River CAP is situated in one of the southernmost portions of Canada and is home to a remarkable diversity of southern flora and fauna, many of them at the northern limits of their ranges. Despite the fact that much of the area has undergone conversion to agricultural and urban land uses, a total of at least 151 species of breeding birds (Cadman et al., 2007) 19 reptiles and 18 amphibians (Ontario Nature, 2013), 37 mammals (Atlas of the Mammals of Ontario, 1994), 80 species of fish (Grand River Conservation Authority), and over 48 species of butterflies (Toronto Entomologists' Association, 2013). The area provides habitat for at least 65 terrestrial and aquatic Species at Risk (SAR), with over 110 additional rare species.

Specific habitat types were selected as conservation targets for the Grand River CAP. These targets represent the overall biodiversity of the study area, and the associated Species at Risk are listed as nested targets within the ecosystem (Table 6). The viability of these targets, and their associated threats, have been assessed by the Grand River CAP Development Team, and are listed in Table 7 and Table 8.

Forests

Southern vegetation types in the area include Chinquapin Oak (*Quercus muhlenbergii*), Sugar Maple (*Acer saccharum*) – Red Elm (*Ulmus rubra*), Shagbark Hickory (*Carya ovata*), Black Walnut (*Juglans nigra*) and Eastern Cottonwood (*Populus deltoides*). Southern plant species include trees such as Sassafras (*Sassafras albidum*), Black Oak (*Quercus velutina*), American Chestnut (*Castanea dentata*), Eastern Flowering Dogwood (*Cornus florida*) and Pignut Hickory (*Carya glabra*). Many southern herbaceous plants, sedges and grasses also reach their northern limits in this area.

The forests are also habitat for over 20 Species at Risk including Acadian Flycatcher (*Empidonax virescens*, Endangered), Eastern Flowering Dogwood (Endangered) and Butternut (*Juglans cinerea*, Endangered).

Rivers, Marshes and Wetlands

Wetlands and rivers are major features in the Grand River CAP. The Grand River and riparian habitat support aquatic SAR such as the Black Redhorse (*Moxostoma duquesnei,* Threatened), Eastern Sand Darter (*Ammocrypta pellucida*, Threatened), and several freshwater mussel Species at Risk. Some tributaries also support sensitive native coldwater fish communities that are important indicators of ecosystem health.

Wetlands form a substantial part of the CAP, with 10,316 hectares of the CAP being Provincially Significant Wetland. Most of Southern Ontario wetlands have been drained (Snell 1987), hence the remaining wetlands provide a refuge for many SAR. Reptiles such as snakes and turtles are particularly dependent on wetlands and many reptile SAR are found in the wetlands of the CAP [e.g. Blanding's Turtle (*Emydoidea blandingii*, Threatened), Spotted Turtle (*Clemmys guttata*, Endangered), Snapping Turtle (*Chelydra serpentina*, Special Concern), and Eastern Ribbonsnake (*Thamnophis sauritus sauritus*, Special Concern)].

Prairies and Savannahs

Prairies and savannahs are a rare ecosystem in Southern Ontario, but were formerly much more common and widespread, and only few natural remnants remain (Bakowsky and Riley 1994). The

Grand River CAP has small pockets of prairie and savannah (Figure 4), which support SAR such as the American Columbo (*Frasera caroliniensis,* Endangered), Bird's-foot Violet (*Viola pedata,* Endangered, Figure 4) and Common Hoptree (*Ptelea trifoliate,* Threatened).

**Figure 4. Rare tallgrass prairie (top right) and oak savannah (bottom) habitats in Grand River CAP. Top left: The endangered Bird's-foot Violet, a species found in these rare habitats. © G. Buck**

Thickets, Hedgerows, Fencerows, Shelterbelts, Abandoned Fields, Agricultural Areas

Due to the continued intensification of agriculture, many thickets, hedgerows, fencerows (Figure 5), shelterbelts and abandoned fields are being removed to maximize the amount of land available to plant crops. These are important features on the landscape as they provide linkages for wildlife to other natural areas across the landscape. They are important for Species at Risk including American Badger (*Taxidea taxus*, Endangered), Red-headed Woodpecker (*Melanerpes erythrocephalus*, Special Concern) and Short-eared Owl (*Asio flammeus*, Special Concern).

**Figure 5. Example of an effective fencerow in the Grand River CAP area. © L. Davis**

## Natural Areas

The Grand River CAP area contains many natural areas of various sizes and designations that support the remaining natural cover. Most protected areas are small and distributed throughout the CAP area but significant tracts of protected lands are present, often associated with swamps or stream valleys that are unsuitable for agricultural purposes. Various natural heritage designations apply to these natural areas, as summarized in Table 2. For a more complete list of the Natural Heritage sites in the Grand River CAP, please see Appendix B.

*Table 2: Natural Heritage Designations for the CAP area. Some sites can be included in more than one category. Additional natural areas exist which do not have any protection and are not included in this table. See Appendix B for full listing of areas.*

| Designation | IUCN Protected Area Management Category[1] | Area in hectares | Percentage of CAP area | Reference |
|---|---|---|---|---|
| Provincial Parks | II | 187 | 0.09 | Ontario Parks |
| Conservation Authority Area | V | 2,297 | 1.13 | Conservation Authority |
| Provincial Earth Science Area of Natural and Scientific Interest | VI | 1,545 | 0.76 | OMNR |
| Regional Earth Science Area of Natural and Scientific Interest | N/A | 492 | 0.24 | OMNR |
| Provincial Life Science Area of Natural and Scientific Interest | VI | 3,377 | 1.66 | OMNR |
| Regional Life Science Area of Natural and Scientific Interest | N/A | 1,435 | 0.71 | OMNR |
| Provincially Significant Wetland | VI | 10,316 | 5.07 | OMNR |
| Other Significant Wetland | VI | 687 | 0.34 | OMNR |
| Carolinian Canada Site | N/A | 19,053 | 9.36 | CCC |

[1] IUCN Categories (Dudley, 2008): Ia. Strict nature reserve *; Ib. Wilderness area*; II. National/provincial park*; III. Natural monument or feature; IV. Habitat/species management area, V. Protected landscape or seascape, VI. Protected area with sustainable use of natural resources. * Strictly regulated protected areas. Some areas may have more than one IUCN category because of internal zoning.

## iv. Natural Cover / Ecosystem Types

Nineteen vegetation communities have been identified within Ecodistrict 7E-5, seven of which are globally rare (Henson and Brodribb 2005). Of these, nine are forest types, eleven are wetlands (swamps or marshes), and seven are prairies, savannahs, grasslands or open woodlands. Additional rare communities are found within Ecodistricts 7E-2 and 7E-6. Eastern Deciduous Forests are the dominant ecosystem with pockets of other types of communities dispersed throughout where conditions are appropriate. Elements of the more northern Great Lakes – St. Lawrence Forest Region are found in the area as well (e.g. Eastern White Cedar).

Forest cover was reduced to around 5% in the 1800's, but deciduous forests were the dominant ecosystem historically in the Grand River CAP area (Grand River Conservation Authority, 2004). Forest cover in the CAP now ranges from less than 7% (Brantford) to over 36% (Six Nations), but remains severely fragmented (Grand River Conservation Authority, 2014). This fragmentation has numerous negative effects, including the introduction invasive species and pathogens, but these forests still provide habitat for more than 20 Species at Risk. One rare forest type is found in the CAP: Dry Black Oak Deciduous Forest Type (G4?, S3) (Table 3).

Only small remnant prairie and savannah habitats remain in the Grand River CAP representing some of the rarest ecosystems in southern Ontario. Pockets of prairie are scattered throughout the CAP area. Typical species include Big Bluestem, Little Bluestem, Indian Grass, and Butterfly Weed. Two globally and provincially rare grassland ecosystems occur in the CAP area: Dry Tallgrass Prairie Type (G3, S1) and Perched Mineral Prairie Fen Type (G3G4, S1). The rare Dry Black Oak Tallgrass Savannah Type community (G3, S1) is also found in the CAP. In addition, the globally and provincially rare Graminoid Coastal Meadow Marsh Type (G2?, S2) occur along the shores of Lake Erie (Table 3).

*Table 3: Globally and Provincially Rare Vegetation Communities found in the Grand River CAP*

| Ontario Name* | Global Common Name* | Global & Provincial Rank* | Comments** |
|---|---|---|---|
| Dry Tallgrass Prairie Type | *Schizachyrium scoparium - Sorghastrum nutans - Andropogon gerardii - Lespedeza capitata* sand herbaceous vegetation | G3; S1 | Stands occur on flat to moderately sloping sites with sand, loamy sand, or, rarely, sandy loam soils. The deep, well-drained soils formed from eolian sand, glacial outwash, old dunes, alluvium, or sandy glacial lakeplains. Sparse to moderately dense mid and tall grasses dominate the community. Woody species tolerant of dry conditions, such as *Salix humilis, Populus tremuloides*, and *Acer rubrum*, are sometimes found in this community. |
| Dry Black Oak Deciduous Forest Type | *Quercus velutina – Quercus alba / Vaccinium (angustifolium, pallidum) / Carex pensylvanica* Forest | G4?; S3 | Stands occur on sandy, relatively flat, dry-mesic sites. The tree canopy is typically closed, with greater than 80% cover. *Quercus velutina* and *Quercus alba* are the dominant species. The shrub layer contains *Vaccinium angustifolium* and *Vaccinium pallidum* (at least in Ohio). The herbaceous layer can be strongly dominated by *Carex pensylvanica*. |
| Dry Black Oak Tallgrass Savannah Type | *Quercus velutina – (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium – Lupinus perennis* Wooded Herbaceous Vegetation | G3; S1 | Stands occur on sandy outwash or lakeplains. The canopy layer is dominated by *Quercus velutina*, with some *Quercus ellipsoidalis* and *Quercus alba*. A subcanopy layer may be composed of the preceding species or *Prunus serotina, Sassafras albidum*, and *Carya ovata*. The herb layer is dominated by graminoids, such as *Andropogon gerardii, Carex pensylvanica*, and *Schizachyrium scoparium*. |
| Dry Black Oak - White Oak Tallgrass Woodland Type | *Quercus velutina – (Quercus ellipsoidalis) - Quercus alba / Deschampsia flexuosa* Woodland | G?; S1 | Stands occur on excessively well-drained sands of outwash plains. Soil development is minimal, with a thin A horizon (5-10 cm). The canopy is open. Dominant species include *Quercus alba, Quercus ellipsoidalis*, and *Quercus velutina*. *Pinus banksiana* and *Pinus strobus* are common associates. The ground layer consists of a near continuous mat of *Carex pensylvanica* and *Deschampsia flexuosa*. |

| Ontario Name* | Global Common Name* | Global & Provincial Rank* | Comments** |
|---|---|---|---|
| Perched Mineral Prairie Fen Type | *Dasiphora fruticosa ssp. floribunda / Carex sterilis - Andropogon gerardii - Arnoglossum plantagineum* Shrub Herbaceous Vegetation | G3G4; S1 | Stands occur on level to sloping seepage areas. Sites are minerotrophic and alkaline, with groundwater flowing through shallow peats and marls on glacial deposits. Graminoids dominate, though forbs and dwarf-shrubs can be prominent. Shrub swamps or tall-shrub fens often surround the core fen area. Diagnostic species include the prairie grasses *Andropogon gerardii* and *Spartina pectinata*, prairie forbs, such as *Arnoglossum plantagineum (= Cacalia plantaginea), Filipendula rubra, Liatris spicata, Silphium terebinthinaceum* (more eastern), *Oligoneuron ohioense (= Solidago ohioensis)*, and the sedges *Carex aquatilis, Carex haydenii, Carex hystericina, Carex leptalea, Carex sterilis*, and *Carex stricta*. |
| Shrubby Cinquefoil Shrub Fen Type | *Dasiphora fruticosa ssp. floribunda / Carex interior – Carex flava – Sarracenia purpurea* Shrub Herbaceous Vegetation | G3G4; S4 | Stands occur on level to sloping seepage areas. Sites are minerotrophic and alkaline to circumneutral in character, with groundwater flowing through shallow peats and marls on glacial deposits. Graminoids dominate, though forbs and dwarf-shrubs can be prominent. A tall-shrub layer swamp often surrounds the core fen area. Typical graminoids include several species of *Carex* sedges. Shrubs most characteristic of this type include *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)* and *Rhamnus alnifolia*, but *Photinia melanocarpa (= Aronia melanocarpa), Alnus incana, Cornus amomum, Cornus foemina, Salix candida, Salix sericea*, and *Viburnum lentago* can also be found. A moss layer is commonly well-developed, and may or may not contain species of *Sphagnum*. |

* Information from NHIC (2013)
** Community descriptions from NatureServe (2013)

## v. Dominant Environmental Processes

The deciduous forests that historically formed the dominant matrix community throughout southern Ontario, including those in the Grand River CAP, 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.

*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 that 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)].

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 usually an essential component in 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).

*Hydrology*

The Grand River CAP area covers the southern portion of the Grand River watershed, the largest watershed in southern Ontario. The river rises in Dufferin County near Dundalk and flows approximately 300 km before draining into Lake Erie at Port Maitland. Some of the major tributaries include the Conestogo River, the Eramosa River, the Speed River and the Nith River (Grand River Conservation Authority, 2003). From the upstream boundary of the CAP to the City of Brantford the river flows through a well-defined valley with obvious riffle-pool sequences. The gradient is reduced and turbidity increases once the river enters the Haldimand Clay Plain downstream of Brantford. River levels through the lower portion of the Six Nations Reserve are affected by the impoundment created by the Caledonia Dam. From Caledonia to Cayuga the river is free flowing again with gradient pool-riffle sequences, while downstream of Dunnville there is a lake-effect zone (MacDougall and Ryan, 2012). The Dunnville Dam is located within the lake-effect zone and has dramatically degraded the physical and biological processes that link the river and the lake.

The Grand River, along with its major tributaries, was declared a Canadian Heritage River in 1994. It was one of the first highly settled rivers to be awarded this designation. River hydrology and water quality have been heavily modified through deforestation, drainage ,damming and urbanization. The Grand River Conservation Authority owns and operates 29 dams in the watershed, and there are over 100 privately or municipally owned dams (Grand River Conservation Authority, 2014). Several large dams and reservoirs in the upper watershed are managed by the Grand River Conservation Authority to partially mitigate the altered hydroregime caused by land use. Several agencies and organizations have decommissioned and/or removed some obsolete dams, but other structures that serve important water management and ecological functions (flood attenuation, low flow augmentation, barriers to invasive species) are expected to remain on the landscape.

The Grand River watershed lost 65% of wetlands over the last 200 years, and in some areas, this loss exceeds 85% (Grand River Conservation Authority, 2003). This resulted in flooding, drought, and degraded water quality. However, there are still significant wetlands in the CAP area, including inland swamps, marshes and fens, riverine wetlands and coastal swamps and marshes that provide habitat for Species at Risk.

Water quality in the Grand River is affected by a variety of sources. Most cities in the watershed rely on the river or wells for their water supplies, and all of them discharge their treated sewage into the river (Grand River Conservation Authority, 2014). Chloride concentrations continue to increase due to the use of salt for road de-icing and water softening. Fecal coliform levels, from sources including livestock and septic effluent, have exceeded levels deemed hazardous to human health. High nutrient loading from municipal sewage treatment plants in the highly urbanized reach of the river immediately upstream of the CAP area are currently increasing biological oxygen

demand and reducing aquatic diversity within the CAP. Agricultural activities in the watershed have improved from a water quality perspective in recent decades due to agricultural best management practices (BMPs), but still affect the hydroregime and contribute to nutrient loading at approximately the same scale as urban land use. Downstream from Brantford there are high levels of nutrients and suspended solids in the water column (MacDougall and Ryan, 2012). All of these can have negative impacts on both human health and that of the natural ecosystem. Some of the municipalities in the area are working on upgrading their sewage treatment plants (Grand River CAP team).

**Figure 6. Whiteman's Creek (southwest of Paris). © G. Buck**

Groundwater discharge to the Grand River and its tributaries currently plays an important role in maintaining water quality and quantity within acceptable levels for human use and ecosystem function. This is especially important in the "recovery zone" of the river between Cambridge and Brantford where an estimated 30-60 litres/second of clean, cold groundwater enters the river every kilometer and helps the river recover from upstream nutrient loading impacts (G. Swiers, B. Conant, pers. Comm). Water from several groundwater influenced coldwater tributaries also enter this reach of stream and contribute to ecosystem recovery. While not provincial species at risk,

native coldwater species such as brook trout (*Salvelinus fontinalus*) and mottled sculpin (*Cottus bairdi*) found in these tributaries, and to a lesser extent introduced species such as rainbow (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*), are important indicators of ecosystem health because they thrive only at locations that are heavily influenced by groundwater discharge. Groundwater recharge and discharge processes in the Grand River watershed are potentially threatened by future development, so loss of native and naturalized coldwater indicator species at locations with historic abundance could be an early warning of ecosystem dysfunction at adjacent and downstream locations.

## vi. Significant Species

Despite the fact that much of the area has undergone conversion to agricultural and urban land uses, it provides habitat for at least 53 extant terrestrial and aquatic Species at Risk (Table 4), with another 12 SAR having occurred historically.

Unless otherwise indicated, data in Table 4 are from NHIC (2013) but are generally not current to 2013. 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 (Table 5). Records have in some cases not been included for locally extirpated species (indicated with X) occurring at sites considered so modified that they are not recoverable, although 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 4: Provincially and Federally designated species at risk found in the Grand River CAP area. Data from NHIC (2013) plus additional observations of species by CAP team members or other sources of data in parentheses.*

| Element | G-rank[1] | S-rank[1] | COSEWIC[2] | OMNR[2] | EO Rank[3] | Last Observed Date (DD/MM/YYYY) | Associated Conservation Target(s) (see Table 6 for key to codes) |
|---|---|---|---|---|---|---|---|
| Acadian Flycatcher | G5 | S2S3B | END | END | E | 26/07/1990 | UF |
| American Badger | G5 | S2 | END | END | E | 10/06/2009 | PS; TF; AG |
| American Chestnut | G4 | S2 | END | END | D | 2003 (2013) | UF; AG |
| American Columbo | G5 | S2 | END | END | C | 13/07/2002 (2013) | UF; PS |
| American Ginseng | G3G4 | S2 | END | END | D | 28/09/2005 (2012) | UF |
| Bald Eagle | G5 | S2N,S4B | NAR | SC | D | 2007 (2014) | UF; WR; CW |
| Barn Owl | G5 | S1 | END | END | E | 15/09/2007 | TF; AG |
| Barn Swallow | G5 | S4B | THR | THR | E | 2011 (2013) | AG; TF |
| Bird's-foot Violet | G5 | S1 | END | END | A | 21/05/2004 (2007) | PS |
| Black Redhorse | G5 | S2 | THR | THR | E | 02/11/2000 (2012) | WR |
| Black Tern | G4 | S3B | NAR | SC | A | 06/07/1991 | CW; IW |
| Blanding's Turtle | G4 | S3 | THR | THR | E | 07/06/2003 (2013) | CW; IW; WR; AR |
| Bobolink | G5 | S4B | THR | THR | E | 04/07/2005 (2013) | PS; AG; TF |
| Broad Beech Fern | G5 | S3 | SC | SC | E | 18/08/2004 | UF |
| Butternut | G4 | S3? | END | END | E | 26/07/2000 (2013) | UF edges; TF? |
| Canada Warbler | G5 | S4B | THR | SC | | (2013) | IW |
| Cerulean Warbler | G4 | S3B | END | SC | D | 24/06/1990 | UF |
| Chimney Swift | G5 | S4B,S4N | THR | THR | | OBBA 2001-2005 | UF; TF; AG |

| Element | G-rank[1] | S-rank[1] | COSEWIC[2] | OMNR[2] | EO Rank[3] | Last Observed Date (DD/MM/YYYY) | Associated Conservation Target(s) (see Table 6 for key to codes) |
|---|---|---|---|---|---|---|---|
| Common Hoptree | G5 | S3 | THR | THR | D | 18/05/1999 (2013) | PS |
| Common Nighthawk | G5 | S4B | THR | SC | | OBBA 2001-2005 | UF; TF; IW |
| Eastern Flowering Dogwood | G5 | S2? | END | END | E | 06//11/2008 (2013) | UF; TF |
| Eastern Hog-nosed Snake | G5 | S3 | THR | THR | H | 08/1986 | UF; PS; TF; IW; AR |
| Eastern Meadowlark | G5 | S4B | THR | THR | E | 06/08/2011 (2013) | PS; AG; TF |
| Eastern Pondmussel | G4 | S1 | END | END | E | 08/1995 | WR |
| Eastern Ribbonsnake | G5 | S3 | SC | SC | E | 05/06/1990 (2011) | IW; AR |
| Eastern Sand Darter | G3G4 | S2 | THR | END | E | 02/11/2000 | WR |
| Eastern Whip-poor-will | G5 | S4B | THR | THR | | | PS; UF |
| Eastern Wood-Pewee | G5 | S5B | SC | | | OBBA 2001-2005 | UF |
| False Hop Sedge | G4 | S2 | END | END | H | 13/09/1902 | IW |
| Fawnsfoot | G5 | S2 | END | END | | | WR |
| Fowler's Toad | G5 | S2 | END | END | H | 1989 | CW; beaches; AR |
| Gattinger’s Agalinis | G4 | S2 | END | END | X | 01/09/1952 | PS |
| Goldenseal | G3G4 | S2 | THR | THR | A | 19/05/2007 (2013) | UF; IW |
| Golden-winged Warbler | G4 | S4B | THR | SC | | | UF; TF |
| Gray Ratsnake (Carolinian population) | G5T1 | S1 | END | END | C | 20/06/2005 | UF; PS; TF; AR |
| Green Dragon | G5 | S3 | SC | SC | D | 2002 | UF; IW; WR |
| Jefferson Salamander | G4 | S2 | END | THR | C | 31/03/2006 (2013) | IW; UF; AR |
| Kidneyshell | G4G5 | S1 | END | END | H | 07/1988 | WR |
| King Rail | G4 | S2B | END | END | H | 25/05/1952 | CW; IW |

| Element | G-rank[1] | S-rank[1] | COSEWIC[2] | OMNR[2] | EO Rank[3] | Last Observed Date (DD/MM/YYYY) | Associated Conservation Target(s) (see Table 6 for key to codes) |
|---|---|---|---|---|---|---|---|
| Lake Sturgeon (Great Lakes - Upper St. Lawrence River population) | G3G4TNR | S2 | THR | THR | X | 1950 | CW; WR |
| Least Bittern | G5 | S4B | THR | THR | E | 27/06/1998 (2012) | CW; IW |
| Little Brown Myotis | G3 | S4 | END | END | | | UF |
| Louisiana Waterthrush | G5 | S3B | SC | SC | E | 15/06/1990 | WR; UF |
| Mapleleaf Mussel | G5 | S2 | THR | THR | | | WR |
| Massasauga | G3G4 | S3 | THR | THR | X | 1955 | All targets |
| Milksnake | G5 | S3 | SC | SC | E | 01/07/1991 (2013) | PS; TF; AG; AR |
| Northern Brook Lamprey | G4T3T4 | SNR | SC | SC | | | WR |
| Northern Map Turtle | G5 | S3 | SC | SC | H* | 11/08/1988 (2013) | WR; IW; AR |
| Northern Myotis | G2G3 | S3 | | END | H* | 28/08/1985 (2013) | UF; IW |
| Piping Plover | G3 | S1B | END | END | H | 31/07/1938 | beaches |
| Pygmy Pocket Moss | G3G4 | S1 | SC | SC | E | 23/09/1995 | UF |
| Queensnake | G5 | S2 | END | END | C | 13/09/2009 (2013) | WR; AR |
| Rainbow Mussel | G5Q | S2S3 | END | THR | | | WR |
| Rapids Clubtail | G3G4 | S1 | END | END | | | WR |
| Red-headed Woodpecker | G5 | S4B | THR | SC | | | PS; TF |
| River Redhorse | G4 | S2 | SC | SC | E | 23/07/1998 | WR |
| Round Pigtoe | G4G5 | S1 | END | END | E | 26/07/2001 | WR |
| Rusty-patched Bumble Bee | G1 | S1 | END | END | H | 22/08/1951 | PS; TF; IW |
| Short-eared Owl | G5 | S2N,S4B | SC | SC | | | PS; IW; TF |
| Silver Shiner | G5 | S2S3 | SC | SC | E | 25/10/2000 (2013) | WR |

| Element | G-rank[1] | S-rank[1] | COSEWIC[2] | OMNR[2] | EO Rank[3] | Last Observed Date (DD/MM/YYYY) | Associated Conservation Target(s) (see Table 6 for key to codes) |
|---|---|---|---|---|---|---|---|
| Snapping Turtle | G5 | S3 | SC | SC | | | WR; AR |
| Snuffbox | G3 | S1 | END | END | H | 29/10/1966 | WR |
| Spiny Softshell | G5 | S3 | THR | THR | D | 11/06/1997 | WR; CW; AR |
| Spotted Turtle | G5 | S3 | END | END | | (2013) | IW; WR; AR |
| Virginia Mallow | G3 | S1 | END | END | C | 27/09/2008 (2013) | IW |
| Wavy-rayed Lampmussel | G5 | S1 | END | THR | E | 05/12/2005 (2013) | WR |
| Woodland Vole | G5 | S3? | SC | SC | E | 29/07/1991 | UF |
| Wood Thrush | G5 | S4B | THR | | | OBBA 2001-2005 | UF |
| Yellow-breasted Chat | G5 | S2B | SC | SC | H | 09/07/1984 | TF; WR |

[1] Global and Subnational Ranks: Ranks indicate the conservation status of a species and are designated by a number from 1 (critically imperiled) to 5 (secure), preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global, and S = Subnational, in this case referring to Ontario).

[2] National and Provincial Status: Status of species listed nationally (COSEWIC) or provincially (OMNR): END = Endangered, THR = Threatened, SC = Special Concern.

[3] EO Rank indicates the viability of the population: A - Excellent predicted viability, B - Good predicted viability, C - Fair predicted viability, D - Probably not viable, E - Verified extant, F - Failed to find, H - Historical, X – Extirpated.

*Table 5: Rare species in Grand River CAP area. Species indicated in bold are included as nested conservation targets.*

| Common Name | Scientific Name | Taxonomic Group | S-rank[1] |
|---|---|---|---|
| A Moss | *Acaulon triquetrum* | Plant | S1 |
| American Gromwell | *Lithospermum latifolium* | Vascular Plant | S3 |
| Appendaged Waterleaf | *Hydrophyllum appendiculatum* | Vascular Plant | S2 |
| Arrow Clubtail | *Stylurus spiniceps* | Insect | S2 |
| Beaked Spike-rush | *Eleocharis rostellata* | Vascular Plant | S3 |
| Biennial Gaura | *Oenothera gaura* | Vascular Plant | S3 |
| Black Cohosh | *Actaea racemosa* | Vascular Plant | S2 |
| **Black Gum** | ***Nyssa sylvatica*** | **Vascular Plant** | **S3** |
| Blue Sedge | *Carex glaucodea* | Vascular Plant | S1 |
| Blunt-lobed Grapefern | *Botrychium oneidense* | Vascular Plant | S3? |
| Bowman's-root | *Gillenia trifoliata* | Vascular Plant | SX |
| Branching Burreed | *Sparganium androcladum* | Vascular Plant | SH |
| Brindled Madtom | *Noturus miurus* | Fish | S2 |
| Bristly Buttercup | *Ranunculus hispidus var. hispidus* | Vascular Plant | S3 |
| Burning Bush | *Euonymus atropurpureus* | Vascular Plant | S3 |
| Bush's Goosefoot | *Chenopodium berlandieri var. bushianum* | Vascular Plant | S1S2 |
| Buttonbush Dodder | *Cuscuta cephalanthi* | Vascular Plant | S2 |
| Carey's Sedge | *Carex careyana* | Vascular Plant | S2 |
| **Carolina Vetch** | ***Vicia caroliniana*** | **Vascular Plant** | **S2** |
| Carolina Whitlow-grass | *Draba reptans* | Vascular Plant | S3 |
| **Chinese Hemlock Parsley** | ***Conioselinum chinense*** | **Vascular Plant** | **S2** |
| Clinton's Clubrush | *Trichophorum clintonii* | Vascular Plant | S2S3 |
| Cluster-stemmed Nailwort | *Paronychia fastigiata* | Vascular Plant | S1 |
| Deer-tongue Panicgrass | *Dichanthelium clandestinum* | Vascular Plant | S2 |
| **Downy Yellow False Foxglove** | ***Aureolaria virginica*** | **Vascular Plant** | **S1** |
| **Downy Trailing Bush-clover** | ***Lespedeza procumbens*** | **Vascular Plant** | **S1** |
| Dusky Dancer | *Argia translata* | Insect | S2 |
| **Dwarf Chinquapin Oak** | ***Quercus prinoides*** | **Vascular Plant** | **S2** |
| Eastern Green-violet | *Hybanthus concolor* | Vascular Plant | S2 |
| Eastern Small-footed Myotis | *Myotis leibii* | Bat | S2S3 |

| Common Name | Scientific Name | Taxonomic Group | S-rank[1] |
|---|---|---|---|
| Erect Knotweed | *Polygonum erectum* | Vascular Plant | SH |
| **Fern-leaved Yellow False Foxglove** | ***Aureolaria pedicularia*** | **Vascular Plant** | **S2?** |
| File Thorn | *Carychium nannodes* | Mollusc | S1S2 |
| Floodplain Thorn | *Carychium riparium* | Mollusc | SNA |
| Forked Panicgrass | *Dichanthelium dichotomum* | Vascular Plant | S2 |
| Greater Redhorse | *Moxostoma valenciennesi* | Fish | S3 |
| **Green Cornet Milkweed** | ***Asclepias viridiflora*** | **Vascular Plant** | **S2** |
| Hairy Bedstraw | *Galium pilosum* | Vascular Plant | S3 |
| Hairy Bugseed | *Corispermum villosum* | Vascular Plant | S2? |
| Hairy Green Sedge | *Carex hirsutella* | Vascular Plant | S3 |
| Hairy Pinweed | *Lechea mucronata* | Vascular Plant | S3 |
| **Hairy Valerian** | ***Valeriana edulis*** | **Vascular Plant** | **S1** |
| Hairy-fruited Sedge | *Carex trichocarpa* | Vascular Plant | S3 |
| Harbinger-of-spring | *Erigenia bulbosa* | Vascular Plant | S3? |
| **Hoary Puccoon** | ***Lithospermum canescens*** | **Vascular Plant** | **S3** |
| Hoary Tick-trefoil | *Desmodium canescens* | Vascular Plant | S2 |
| **Hooded Warbler** | ***Wilsonia citrina*** | **Bird** | **S4B** |
| Jefferson X Blue-spotted Salamander, Jefferson genome dominates | *Ambystoma hybrid pop. 1* | Amphibian | S2 |
| Lilypad Clubtail | *Arigomphus furcifer* | Insect | S3 |
| Long-stlye Canadian Sanicle | *Sanicula canadensis var. grandis* | Vascular Plant | S2 |
| Low Nutrush | *Scleria verticillata* | Vascular Plant | S3 |
| Many-fruit Primrose-willow | *Ludwigia polycarpa* | Vascular Plant | S2S3 |
| Mat Muhly | *Muhlenbergia richardsonis* | Vascular Plant | S3 |
| **Midland Sedge** | ***Carex mesochorea*** | **Vascular Plant** | **S1** |
| Moss Phlox | *Phlox subulata* | Vascular Plant | S1? |
| Northern Hawthorn | *Crataegus pruinosa var. dissona* | Vascular Plant | S3 |
| **Northern Pin Oak** | ***Quercus ellipsoidalis*** | **Vascular Plant** | **S3** |
| Nyman's Cuckoo Flower | *Cardamine nymanii* | Vascular Plant | S2S3 |
| Old-fieldToadflax | *Nuttallanthus canadensis* | Vascular Plant | S1 |
| Pale False Mannagrass | *Torreyochloa pallida var. pallida* | Vascular Plant | S2 |

| Common Name | Scientific Name | Taxonomic Group | S-rank[1] |
|---|---|---|---|
| Palmate-leaved Violet | *Viola palmata* | Vascular Plant | S2S3 |
| Panicled Hawkweed | *Hieracium paniculatum* | Vascular Plant | S2? |
| Pawpaw | *Asimina triloba* | Vascular Plant | S3 |
| Perfoliate Bellwort | *Uvularia perfoliata* | Vascular Plant | S1 |
| **Pignut Hickory** | ***Carya glabra*** | **Vascular Plant** | **S3** |
| Pillose Evening Primrose | *Oenothera pilosella* | Vascular Plant | S2 |
| Prairie Dropseed | *Sporobolus heterolepis* | Vascular Plant | S3 |
| **Prairie Rosinweed (Prairie Dock)** | ***Silphium terebinthinaceum*** | **Vascular Plant** | **S1** |
| **Prairie Violet** | ***Viola pedatifida*** | **Vascular Plant** | **S1** |
| Prostrate Tick-trefoil | *Desmodium rotundifolium* | Vascular Plant | S2 |
| Purplish Copper | *Lycaena helloides* | Insect | S3 |
| Puttyroot | *Aplectrum hyemale* | Vascular Plant | S2 |
| Quill Spike-rush | *Eleocharis nitida* | Vascular Plant | S2S3 |
| Ram's-head Lady's-slipper | *Cypripedium arietinum* | Vascular Plant | S3 |
| Ribbed Sedge | *Carex virescens* | Vascular Plant | S3 |
| Rigid Sedge | *Carex tetanica* | Vascular Plant | S3 |
| River Bluet | *Enallagma anna* | Insect | S2 |
| Rue-anemone | *Thalictrum thalictroides* | Vascular Plant | S3 |
| Rugulose Grapefern | *Botrychium rugulosum* | Vascular Plant | S2 |
| Scarlet Beebalm | *Monarda didyma* | Vascular Plant | S3 |
| Schreber's Aster | *Eurybia schreberi* | Vascular Plant | S2S3 |
| Schweinitz's Sedge | *Carex schweinitzii* | Vascular Plant | S3 |
| Sharp-fruited Rush | *Juncus acuminatus* | Vascular Plant | S3 |
| Sharp-winged Monkeyflower | *Mimulus alatus* | Vascular Plant | S2 |
| Shiny Wedge Grass | *Sphenopholis nitida* | Vascular Plant | S1 |
| Shrubby St. John's-wort | *Hypericum prolificum* | Vascular Plant | S2 |
| **Side-oats Grama** | ***Bouteloua curtipendula*** | **Vascular Plant** | **S2** |
| Silky Vallonia | *Vallonia cyclophorella* | Mollusc | S1 |
| Slim-flowered Muhly | *Muhlenbergia tenuiflora* | Vascular Plant | S2 |
| Smith's Bulrush | *Schoenoplectiella smithii* | Vascular Plant | S3 |
| Smooth Coil | *Helicodiscus singleyanus* | Mollusc | S2? |
| Soft-hairy False Gromwell | *Lithospermum parviflorum* | Vascular Plant | S2 |
| **Spatterdock Darner** | ***Rhionaeschna mutata*** | **Insect** | **S1** |
| Stiff Gentian | *Gentianella quinquefolia* | Vascular Plant | S2 |

| Common Name | Scientific Name | Taxonomic Group | S-rank[1] |
|---|---|---|---|
| Stiff Goldenrod | *Solidago rigida ssp. rigida* | Vascular Plant | S3 |
| Striped Cream Violet | *Viola striata* | Vascular Plant | S3 |
| **Swamp Darner** | ***Epiaeschna heros*** | **Insect** | **S2S3** |
| Taper-leaved Bugleweed | *Lycopus rubellus* | Vascular Plant | S3 |
| Tawny Emperor | *Asterocampa clyton* | Insect | S2S3 |
| Toothed Tick-trefoil | *Desmodium cuspidatum* | Vascular Plant | S3 |
| Torrey's Sedge | *Carex torreyi* | Vascular Plant | S2 |
| Variegated Meadowhawk | *Sympetrum corruptum* | Insect | S3 |
| Virginia Lungwort | *Mertensia virginica* | Vascular Plant | S3 |
| Weak Stellate Sedge | *Carex seorsa* | Vascular Plant | S2 |
| **Willdenow's Sedge** | ***Carex willdenowii*** | **Vascular Plant** | **S1** |
| White-haired Panicgrass | *Dichanthelium praecocius* | Vascular Plant | S3 |
| White-tinged Sedge | *Carex albicans var. albicans* | Vascular Plant | S3 |
| Wild Licorice | *Glycyrrhiza lepidota* | Vascular Plant | S3 |
| Woodland Flax | *Linum virginianum* | Vascular Plant | S2 |
| Woodland Pinedrops | *Pterospora andromedea* | Vascular Plant | S2 |
| **Yellow False Foxglove** | ***Aureolaria flava*** | **Vascular Plant** | **S2?** |
| Yellow Stargrass | *Hypoxis hirsuta* | Vascular Plant | S3 |

[1] Global and Subnational Ranks: Ranks indicate the conservation status of a species and are designated by a number from 1 (critically imperiled) to 5 (secure), preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global, and S = Subnational, in this case referring to Ontario).

# 2. Biodiversity Targets and Associated Threats

## i. Conservation Targets

Conservation Targets are meant to represent the overall biodiversity of the CAP area. Although they may not capture all elements of genes, species and ecological systems, they help to focus conservation efforts (Conservation Measures Partnership, 2013). Targets can be either ecosystems, such as upland forest, or species or species assemblages, such as Reptiles and Amphibians. For the Grand River CAP, Conservation Targets were selected by the Grand River CAP Science and Ecology Team, and all Species at Risk that occur within that ecosystem or species assemblage were included as nested targets (Table 6). The 'health' of these targets was then determined based on Key Ecological Attributes, such as the presence of certain indicator species (Table 7). The size, condition and landscape context of the targets were assessed, which gives an overall rank for the viability of the target. The overall rank was calculated using Miradi v. 4.0 (Foundations of Success, 2013).

*Table 6: Conservation Targets for the Grand River CAP. Species indicated in italics are rare species tracked by NHIC, all others are federal and/or provincial Species at Risk.*

| Conservation Targets | Code | Nested Targets |
|---|---|---|
| **Upland Forests** | UF | Acadian Flycatcher, American Chestnut, American Columbo, American Ginseng, Bald Eagle, Broad Beech Fern, Butternut, Cerulean Warbler, Chimney Swift, Common Nighthawk, *Downy Yellow False Foxglove,* Eastern Flowering Dogwood, Eastern Hog-nosed Snake, Eastern Whip-poor-will, Eastern Wood-Pewee, Goldenseal, Gray Ratsnake, Green Dragon, *Hooded Warbler*, Jefferson Salamander, Little Brown Myotis, Louisiana Waterthrush, Northern Myotis, *Pignut Hickory*, Pygmy Pocket Moss, *Willdenow's Sedge,* Wood Thrush, Woodland Vole |
| **Prairies, Savannahs and Woodlands** | PS | American Badger, American Columbo, Bird's-foot Violet, Bobolink, *Carolina Vetch,* Common Hoptree, *Downy Trailing Bush-clover, Dwarf Chinqupin Oak,* Eastern Hog-nosed Snake, Eastern Meadowlark, Eastern Whip-poor-will, *Fern-leaved Yellow False Foxglove*, Gray Ratsnake, *Green Cornet Milkweed, Hairy Valerian, Hoary Puccoon, Midland Sedge,* Milksnake, *Northern Pin Oak, Prairie Rosinweed* **(***Prairie Dock), Prairie Violet,* Red-headed Woodpecker, Short-eared Owl, *Side-oats Grama, Yellow False Foxglove* |
| **Coastal Wetlands (Swamps and Marshes)** | CW | Bald Eagle, Black Tern, Blanding's Turtle, Lake Sturgeon, Least Bittern, Spiny Softshell |
| **Inland Wetlands (Swamps, Marshes and Fens)** | IW | *Black Gum*, Black Tern, Blanding's Turtle, Canada Warbler, *Chinese Hemlock Parsley,* Common Nighthawk, Eastern Hog-nosed Snake, Eastern Ribbonsnake, Goldenseal, Green Dragon, Jefferson Salamander, Least Bittern, Northern Map Turtle, Short-eared Owl, *Spatterdock Darner,* Spotted Turtle, *Swamp Darner*, Virginia Mallow |
| **Thickets, Hedgerows, Fencerows, Shelterbelts, Abandoned Fields, Agricultural Lands** | TF | American Badger, Barn Owl, Blanding's Turtle, Barn Swallow, Bobolink, Butternut, Chimney Swift, Common Nighthawk, Eastern Flowering Dogwood, Eastern Hog-nosed Snake, Eastern Meadowlark, Golden-winged Warbler, Gray Ratsnake, Milksnake, *Pignut Hickory,* Red-headed Woodpecker, Short-eared Owl, Wood Thrush |
| **Watercourses, Riparian Habitat and Riverine Wetlands** | WR | Bald Eagle, Black Redhorse, Blanding's Turtle, Eastern Pondmussel, Eastern Sand Darter, Fawnsfoot, Green Dragon, Kidneyshell, Louisiana Waterthrush, Mapleleaf Mussel, Northern Brook Lamprey, Northern Map Turtle, Queensnake, Rainbow Mussel, Rapids Clubtail, River Redhorse, Round Pigtoe, Silver Shiner, Snapping Turtle, Snuffbox, Spiny Softshell, Spotted Turtle, Wavy-rayed Lampmussel |
| **Amphibians and Reptiles** | AR | Blanding's Turtle, Eastern Hog-nosed Snake, Eastern Ribbonsnake, Gray Ratsnake, Jefferson Salamander, Milksnake, Northern Map Turtle, Queensnake, Snapping Turtle, Spiny Softshell, Spotted Turtle |
| **Sustainable Agricultural Practices contributing to a healthier environment** | AG | American Badger, American Chestnut, Barn Owl, Barn Swallow, Bobolink, Chimney Swift, Eastern Meadowlark, Milksnake, *Northern Pin Oak* |

*Table 7: Viability of Conservation Targets in the Grand River CAP. Assessment ranking and colour codes are described below the table. Viability rankings were determined using Miradi software, developed by the Conservation Measures Partnership (2013).*

| Conservation Target | Key Ecological Attributes | Size | Condition | Landscape Context | Overall |
|---|---|---|---|---|---|
| **Upland Forests** | • Forest cover (overall extent, interior habitat)<br>• Quality of forest communities (presence of invasive species, reproducing populations of characteristic forest interior bird species (e.g., Ovenbird, Wood Thrush)<br>• Proximity to nearest patch (landscape connectivity) | Fair | Good | Good | Fair |
| **Prairies, Savannahs and Woodlands** | • Minimum size and shape<br>• Species diversity – presence of key indicator species<br>• Presence of invasive species<br>• Proximity to nearest patch<br>• Disturbance regime | Poor | Fair | Fair | Fair |
| **Tickets, Hedgerows, Fencerows, Shelterbelts, Abandoned Fields, Agricultural Lands** | • Quality of Habitat (Species diversity – should include insect pollinators, snakes, native plant species)<br>• Extent of habitat - Minimum width of 10m<br>• Landscape connectivity (near other hedgerows, thickets or other natural habitats) | Good | Fair | Good | Good |

| Conservation Target | Key Ecological Attributes | Size | Condition | Landscape Context | Overall |
|---|---|---|---|---|---|
| **Watercourses, Riparian Habitat and Riverine Wetlands** | • Extent of naturally-vegetated buffers (% of watercourse having 30 m buffer as measured by GIS)<br>• Water quality (benthic organism composition, temperature, native vs. non-native species diversity, abundance trends for coldwater indicator species)<br>• Intact Hydrology (extent natural watercourse vs. altered watercourse; presence of dams/dykes)<br>• Vegetation Quality (vegetation composition, native vs. non-native invasive species diversity)<br>• Surrounding land use (measured by % of watershed) | Good | Fair | Fair | Fair |
| **Coastal Wetlands (swamps and marshes)** | • Size of patch and extent of cover<br>• Extent of naturally-vegetated buffers (% of watercourse having 30 m buffer as measured by GIS)<br>• Water quality (benthic organism composition, temperature, native vs. non-native species diversity)<br>• Intact Hydrology (extent natural vs. altered watercourse; presence of tile drains)<br>• Vegetation Quality (vegetation composition and native vs. non-native species diversity)<br>• Surrounding land use (measured by % of watershed) | Fair | Poor | Fair | Fair |

| Conservation Target | Key Ecological Attributes | Size | Condition | Landscape Context | Overall |
|---|---|---|---|---|---|
| **Inland Wetlands (swamps and marshes)** | • Size of patch and extent of cover<br>• Extent of naturally-vegetated buffers (% of watercourse having 30 m buffer as measured by GIS)<br>• Water quality (benthic organism composition, temperature, native vs. non-native species diversity)<br>• Intact Hydrology (extent natural vs. altered watercourse; presence of tile drains)<br>• Vegetation Quality (vegetation composition and native vs. non-native species diversity)<br>• Surrounding land use (measured by % of watershed) | Good | Fair | Good | Good |
| **Amphibians & Reptiles** | • Population size<br>• Habitat connectivity (number of reported roadkill)<br>• Quality of habitat (absence of invasive species such as Phragmites, Eurasian Water-milfoil) | Fair | Fair | Fair | Fair |
| **Sustainable Agricultural Practices Contributing to a Healthier Environment** | • Healthy soils (presence of organic matter, bacteria, fungi; minimal compaction)<br>• Agriculture does not depend on synthetic inputs<br>• Healthy water (not nutrient rich; free of toxins; buffered hydrology)<br>• Perennial crops<br>• Pasture management<br>• Crop rotation, less mono-cropping in row crops<br>• Nutrient management (manure, fertilizers)<br>• Cover crops for soil retention, nutrient capture<br>• Increased use of environmental farm plan | NA | NA | NA | NA |
| **Overall rank for Grand River CAP Conservation Targets** | | | | | FAIR |

| | |
|---|---|
| **Very Good** | **Optimal Health**: The biodiversity target is functioning at an ecologically desirable status, and requires little management. |
| **Good** | **Minimum Health**: The biodiversity target is functioning within its range of acceptable variation; it may require some management. |
| **Fair** | **Likely Degradation**: The biodiversity target lies outside of its range of acceptable variation and requires management. If unchecked, the biodiversity target will be vulnerable to serious degradation. |
| **Poor** | **Imminent Loss**: Allowing the biodiversity target to remain in this condition for an extended period will make restoration or preventing extirpation practically impossible. |
| **Unknown** | **Research Need**: The biodiversity target is known to occur, but information on this viability criterion is currently is unknown. |

## ii. Threats

Once the conservation targets were selected for the CAP area, the Science and Ecology Team identified the direct threats to these targets (Table 8). Direct threats can include both human activities that immediately degrade a conservation target (e.g., Unsustainable fishing, construction of roads, introduction of exotic invasive species), or natural phenomena altered by human activity (e.g., increase in extreme storm events due to global climate change) (Conservation Measures Partnership, 2013). Threats are based on the IUCN classification of direct threats (Salafsky *et al.*, 2008). The threats rank is based on the scope, severity and irreversibility, and the results are ranked as follows:

| | |
|---|---|
| **Very High** | The threat is likely to *destroy or eliminate* the biodiversity target. |
| **High** | The threat is likely to *seriously degrade* the biodiversity target. |
| **Medium** | The threat is likely to *moderately degrade* the biodiversity target. |
| **Low** | The threat is likely to *only slightly impair* the biodiversity target. |

*Table 8: Summary of Threats for the Grand River CAP. Threat ranking details can be found below the table. Species specific threats are available in Appendix C.*

| Threats \ Targets | Inland Wetland (swamps & marshes) | Amphibians & Reptiles | Prairies, Savannahs and Woodlands | Sustainable Agricultural Practices contributing to a healthier environment | Thickets, Hedgerows, Fencerows, Shelterbelts, Abandoned Fields, Agricultural Lands | Watercourses, riparian habitat, and riverine wetlands | Upland Forests | Coastal Wetlands (swamps & marshes) | Summary Threat Rating |
|---|---|---|---|---|---|---|---|---|---|
| Climate Change - Droughts | High | Very High | | | | High | High | | Very High |
| Invasive Non-Native Plants | High | | Very High | | Medium | High | High | Medium | Very High |
| Roads | Very High | High | High | | Medium | Very High | Medium | Very High | Very High |
| Housing and Urban Development | Medium | Medium | Medium | Very High | High | High | Medium | Medium | Very High |
| Climate Change - Temperature Extremes | | Very High | | | | High | | | High |
| Agricultural & Forestry Effluents | | | | | | High | | High | High |
| Household Sewage & Urban Waste Water | | High | | | | Medium | | High | High |
| Invasive Fauna | High | | | | | | High | High | High |

| Threats \ Targets | Inland Wetland (swamps & marshes) | Amphibians & Reptiles | Prairies, Savannahs and Woodlands | Sustainable Agricultural Practices contributing to a healthier environment | Thickets, Hedgerows, Fencerows, Shelterbelts, Abandoned Fields, Agricultural Lands | Watercourses, riparian habitat, and riverine wetlands | Upland Forests | Coastal Wetlands (swamps & marshes) | Summary Threat Rating |
|---|---|---|---|---|---|---|---|---|---|
| Dams and Water Management | | | | | | Medium | | Very High | High |
| Disease & Pathogens | High | | | | | | High | | High |
| Commercial & Industrial Development | Medium | Medium | Medium | High | High | High | Medium | Medium | High |
| Mining & Quarrying | Not Specified | Medium | | | Medium | | | | Medium |
| Livestock Farming & Ranching | | | | | | High | | | Medium |
| Non-timber Crops (Agriculture) | | | | | | High | | | Medium |
| Storms and Flooding | Low | High | | | | | | | Medium |
| Tile Drainage & Drains | Medium | | | | | Medium | | | Medium |
| Motorized Vehicles | High | | | | | | Low | | Medium |
| Problematic Native Species | | High | | | | | Low | | Medium |

| Threats \ Targets | Inland Wetland (swamps & marshes) | Amphibians & Reptiles | Prairies, Savannahs and Woodlands | Sustainable Agricultural Practices contributing to a healthier environment | Thickets, Hedgerows, Fencerows, Shelterbelts, Abandoned Fields, Agricultural Lands | Watercourses, riparian habitat, and riverine wetlands | Upland Forests | Coastal Wetlands (swamps & marshes) | Summary Threat Rating |
|---|---|---|---|---|---|---|---|---|---|
| Fire & Fire Suppression | | | High | | | | Medium | | Medium |
| Recreational Activities - Boat traffic | | Medium | | | | Low | | | Low |
| Tourism & Recreational | | Medium | | | | | | | Low |
| Railroads | | | Medium | | | | | | Low |
| Logging & Wood Harvesting | Low | | | | | | Low | | Low |
| Recreational Disturbance - Marina | | | | | | | | Medium | Low |
| Pollution - Garbage & Solid Waste | Low | | | | | | Low | | Low |
| Summary Target Ratings: | Very High | Very High | High | High | High | Very High | High | Very High | Very High |

# 3. Objectives and Strategies

## i. Conservation Objectives:

The objectives for the CAP aim to abate specific threats and improve viability of the conservation targets (Table 9). The objectives can be broadly split into two categories: 1) outreach and education, and 2) restoration and creation of habitat. In many cases restoration projects can be used as demonstration sites for education and outreach so these two broad categories of activities are often linked within each objective. For additional details of strategic actions and action steps for accomplish the objectives see Table 10.

*Table 9: Grand River CAP Conservation Objectives*

| Objectives | Threats Addressed | Targets Addressed |
|---|---|---|
| 1) Establish outreach program to communicate the reasons for the Conservation Action Plan, its goals and objectives to community | All | All |
| 2) Research and promote to municipalities policies for development that minimize negative impacts on biodiversity (Refer to Provincial Policy Statement, Endangered Species Act. | All | All |
| 3) Maintain, restore and enhance conservation targets in the CAP area by 2019 | Housing and Urban Development; Commercial & Industrial Development; Climate Change; Roads | Upland Forests; Prairies, Savannahs and Woodlands; Coastal Wetlands; Inland Wetlands; Thickets, Hedgerows, Fencerows, Shelterbelts, Abandoned Fields, Agricultural Lands; Watercourses, Riparian Habitat, and Riverine Wetlands |
| 4) Research, promote and monitor positive incentive approaches for farmers to conserve biodiversity on their land by 2019 | Non-timber crops (agriculture) | All |

| Objectives | Threats Addressed | Targets Addressed |
|---|---|---|
| 5) Support and endorse *Grand River Water Management Plan* | Non-timber Crops (agriculture); Livestock Farming and Ranching; Dams and Water Management; Household Sewage & Urban Wastewater; Agricultural & Forestry Effluents; Housing & Urban Development; Commercial & Industrial Development; Roads | Watercourses, riparian habitat, coastal wetlands, riverine and inland wetlands primarily |
| 6) Research and promote best management practices regarding problematic native, non-native and domestic animals (eg. Raccoons, red-eared sliders, cats, dogs) to public audiences to protect amphibian and reptile populations in developed areas | Pollution – Garbage and Solid Waste; Invasive Fauna; Problematic Native Species | Amphibian and Reptiles, also benefits birds |
| 7) Promote the Grand River CAP as a mechanism to focus stewardship and rehabilitation of aggregate operations on enhancing biodiversity | Mining & Quarrying; Roads | Thickets, Hedgerows, Fencerows, Shelterbelts, Abandoned Fields, Agricultural Lands; Amphibians and Reptiles, Prairies and Savannahs |
| 8) Prevent and control the spread of new populations of high priority terrestrial and aquatic invasive species at critical sites in the Grand River CAP area (e.g., Dog-strangling Vine, Oriental Bittersweet) | Invasive non-native plants; Pollution – Garbage and Solid Waste; Housing & Urban Development; Commercial & Industrial Development; Roads | All |

## ii. Strategic Actions and Action Steps

The CAP team developed strategic actions and action steps to achieve the objectives set out in Table 9. Details of each strategic action, links to threats and targets, as well as organizations involved in completion of each task are listed in Table 10. Several strategic actions are best achieved through collaboration across the ecoregion with other CAP teams. In particular the CAP team agreed that the following should be addressed at an ecoregional scale: positive incentives for landowners to protect biodiversity and create habitat (e.g. tax relief), approaching Landscape Ontario regarding control of sale of invasive plants at plant nurseries and garden centres.

Many of the strategic actions involve outreach and education to the general public and targeted audiences. The following themes should be incorporated into publications (printed or online), site tours and outreach events for the general public: CAP themes, goals and updates; good news stories about Species at Risk; current and historical best stewardship practices materials (e.g. sustainable forestry practices, stewardship for Species at Risk, benefits of windbreaks, benefits of riparian buffers, roadsides as habitat, using native plants); materials about invasive species (e.g. prevention, early detection, control measures, how to report occurrences).

Acronyms of Partner Organizations for Table 10

| | |
|---|---|
| **ALUS** | Alternative Land Use Services |
| **CCC** | Carolinian Canada Coalition |
| **CO** | Conservation Ontario |
| **CSC** | Cornerstone Standards Council |
| **CWS** | Canadian Wildlife Service |
| **DFO** | Fisheries and Oceans Canada |
| **EC** | Environment Canada |
| **EFP** | Environmental Farm Plan |
| **GRCA** | Grand River Conservation Authority |
| **HNC** | Hamilton Naturalists' Club |
| **HNSC** | Haldimand Norfolk Stewardship Council |
| **HSC** | Haldimand Stewardship Council |
| **HWOA** | Haldimand & Area Woodlot Owners' Association |
| **KWFN** | Kitchener Waterloo Field Naturalists |
| **LGRLT** | Lower Grand River Land Trust |
| **MAH** | Ministry of Municipal Affairs and Housing |
| **MOE** | Ministry of Environment |
| **MTO** | Ontario Ministry of Transportation |

| | |
|---|---|
| **NCC** | Nature Conservancy of Canada |
| **NFU** | National Farmers Union |
| **OFA** | Ontario Federation of Agriculture |
| **OFAH** | Ontario Federation of Anglers and Hunters |
| **OIPC** | Ontario Invasive Plant Council |
| **OLA** | Ontario Landscape Association |
| **OMAF** | Ontario Ministry of Agriculture and Food |
| **OMNR** | Ontario Ministry of Natural Resources |
| **OREG** | Ontario Road Ecology Group |
| **OSCIA** | Ontario Soil and Crop Improvement Association |
| **OSSGA** | Ontario Sand Stone & Gravel |
| **OWOA** | Ontario Woodlot Owners Association |
| **TgO** | Tallgrass Ontario |
| **TOARC** | The Ontario Aggregate Resources Corporation |
| **TUC** | Trout Unlimited Canada |
| **TZ** | Toronto Zoo |
| **UW** | University of Waterloo |
| **WSC** | Waterloo Stewardship Council |

*Table 10: Grand River CAP Objectives, Strategic Actions and Action Steps. Refer to Table 6 for Conservation Targets list.*

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **Objective 1** | **Establish outreach program to communicate the reasons for the Conservation Action Plan, its goals and objectives to community** | 2014 and beyond | All | All | CCC , GRCA, MNR, Six Nations, HNC, KWFN, TgO, Haldimand County, Brant County, City of Brantford, OFA (target branches in the CAP area), OSSGA, HSC, TUC, OSCIA, OMAF | TD FEF, MNR SARSF, HSP, OTF, EcoAction |
| **1.1 Strategic Action** | **Inform area residents and stakeholders of the CAP, its goals and objectives** | 2014 and beyond | as above | as above | as above | as above |
| 1.1.1 Action Step | Work with steering committee to identify and collaborate with existing relevant outreach programs (e.g. GRCA, EFP, Woodlot Owners Association) by 2015 | 2014-2015 | as above | as above | as above | as above |
| 1.1.2 Action Step | Identify and/or make available best stewardship practice materials for landowners via websites (cross-linked), publications and outreach events by 2015 | 2014-2015 | as above | as above | CCC, GRCA, OSCIA, Woodlot Owners Associations, TgO, OMAF, OFA | as above |
| 1.1.3 Action Step | Prepare annual report/ newsletter on CAP and make available to the community through websites, publications, newspapers (e.g. Expositor, St. George Lands, Burford Times), GRCA newspaper inserts/columns, and outreach events | 2015 and beyond | as above | as above | CCC (with input from all CAP partners) | as above |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **Objective 2** | **Research and promote to municipalities policies for development that minimize negative impacts on biodiversity (Hamilton, Brant, Brantford, Cambridge, Haldimand, Norfolk, Oxford, Regional Municipality of Waterloo). Refer to Provincial Policy Statement, Endangered Species Act.** | **2014 and beyond** | **All** | **All** | **GRCA, CCC, MNR, MTO, DFO,** | |
| **2.1 Strategic Action** | **Support the development of a natural heritage systems plan in the Grand River CAP area to inform municipal planning** | 2014 and beyond | as above | as above | GRCA, CCC, MNR | |
| 2.1.1 Action Step | Compile existing literature and data sources (e.g., subwatershed studies, CAPs, Big Picture mapping, Recovery Strategies, Management Plans) by 2019 | 2014-2019 | as above | as above | GRCA, MNR | |
| 2.1.2 Action Step | Disseminate relevant mapping and data products to municipalities to encourage planning that minimizes adverse or negative impacts on biodiversity by 2019 | 2019 | as above | as above | GRCA, MNR | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **2.2 Strategic Action** | **Research, promote, and apply policies that avoid or minimize adverse or negative impacts of urban and commercial development on biodiversity** | 2014-2019 | Housing and Urban Development; Commercial & Industrial Development; Roads; Pollution – Garbage and Solid Waste | All | MAH, CO, GRCA | |
| 2.2.1 Action Step | Promote natural heritage systems planning (see 2.1).<br><br>Ensure compliance with existing provincial and municipal natural heritage policies by developing minimum standards for Comprehensive Environmental Impact Studies (e.g. Subwatershed Studies, Area Studies, etc) that promote better protection of natural heritage systems through restoration and enhancement of core natural areas, buffers, and linkages. | 2014-2019 | | All | MNR, GRCA, municipalities | |
| 2.2.2 Action Step | Ensure more effective compliance with GRCA natural hazard policies issued under Ontario Regulation 150/06 by developing hydrologic impact study guidelines, buffer guidelines, and related BMPs to protect, restore, and enhance hydrologic functions sustaining wetlands and watercourses. | 2014-2019 | | Regulated wetlands and watercourses | GRCA (OMAF) | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| 2.2.3 Action Step | Identify where each municipality is in the Official Plan update cycle by 2015 | 2014-2015 | as above | as above | GRCA | |
| 2.2.4 Action Step | Meet with two municipalities (e.g. City of Brantford, Waterloo Region) to discuss how natural heritage systems plans and CAP objectives can be integrated into Official Plan updates by 2019 | 2014-2019 | as above | as above | GRCA, CCC, MNR, local municipalities | |
| 2.2.5 Action Step | Develop and implement one workshop for planners about natural heritage systems plans, CAPs, ecopassages, and BMPs more generally by 2019 | 2014-2019 | as above | as above | as above | |
| 2.2.6 Action Step | Complete a decision-making, best management practices and technical specifications document relating to road development based on best available research, technical information, and case studies by 2019 | 2014-2019 | | AR, American Badger | MTO, Municipalities, OREG, Ontario Good Roads Association, OMNR | |
| 2.2.7 Action Step | Encourage and support municipal planning initiatives to identify and map significant wildlife habitat and significant woodland features for inclusion within Official Plans | 2014 and beyond | | | Municipalities, consultants | |
| 2.2.8 Action Step | Support the use of the MNR's EcoRegional Criteria for Significant Wildlife Habitat, and review, and if necessary update, the Decision Support System for wildlife | 2014-2019 | | AR, birds, habitat targets | OMNR, GRCA, Municipalities | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **Objective 3** | **Maintain, restore and enhance conservation targets in the CAP area by 2019** | 2014-2019 | Housing and Urban Development; Commercial & Industrial Development; Climate Change; Roads | UF; PS; CW; IW; TF; WR | GRCA, CCC, WSC, TgO, LGRLT | MNR, Region of Waterloo |
| **3.1 Strategic Action** | **Compile relevant mapping and data sets to assess and better understand baseline ecological conditions and to prioritize potential sites for protection, restoration, enhancement, and securement, including buffers and linkages, based on ecological values and opportunities for collaboration, by 2017** | 2014-2017 | as above | as above | GRCA, municipalities (acquisition would target areas within or adjacent to Dunnville Marsh, Beverly Swamp, Roseville Swamp. lands within the Galt Paris Moraine, remnant tallgrass prairie sites and large/intact Carolinian forest tracts) | as above |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| 3.1.1 Action Step | Compile all relevant mapping and data sets to understand baseline conditions (e.g. Grand River CAP, CCC Big Picture, GRCA Watershed Forest Plan and subwatershed plans, OP mapping, Tallgrass Ontario's prairie-savanna GIS layer, MNR aggregates map, SAR and rare species occurrences) by 2016 | 2014-2016 | as above | as above | GRCA, municipalities, OMAF | as above |
| 3.1.2 Action Step | Identify and prioritize public land, utility corridor, roadsides and rail lines for stewardship and restoration by 2017 | 2016-2017 | as above | as above | GRCA, municipalities | as above |
| 3.1.3 Action Step | Identify and prioritize private land sites for stewardship, ecological restoration and securement by 2017 | 2016-2017 | as above | as above | GRCA, CCC Landowner Leaders, WSC landowners, TgO landowners, aggregate companies, OSSGA, EFP participants, rural water quality participants, Trees for the Grand, OFA, municipalities | as above |
| 3.1.4 Action Step | Based on 3.1.2 and 3.1.3, develop quantitative targets by 2018 for amount of land to be restored and secured within CAP area for next 5 years | 2017-2018 | | | | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **3.2 Strategic Action** | **Using estimates of forest cover in the GRCA's Watershed Forest Plan as a baseline and the 30% target established by Environment Canada, restore forests in Grand River CAP by 2029**<br>Projects that increase extent of existing forest and make linkages among forest patches should be given priority. Projects should use ecologically appropriate species of native trees and shrubs. | 2014-2029 | Development, Logging & Wood Harvesting; Roads; Invasive Non-native plants | UF; PS; CW; IW; TF; WR, AR | GRCA, Ontario Woodlot Owners Association, local municipalities (they have jurisdiction under the Planning Act); MNR (they may have jurisdiction under the ESA) | |
| 3.2.1 Action Step | Engage 3 landowners in priority areas identified in 3.1 in forest restoration by 2019 | 2014-2019 | as above | as above | GRCA, CCC, Woodlot Owners Associations, OFA, OSCIA | |
| 3.2.2 Action Step | Restore 30 hectares (75 acres) of forest on priority (identified in 3.1) public and private land by 2029 | 2014-2029 | as above | as above | GRCA, municipalities, Woodlot Owners Associations | SARFIP, Trees Ontario, LSHRP, HSP |
| **3.3 Strategic Action** | **Enhance forests in Grand River CAP through improved stewardship by 2019** | 2014-2019 | as above | as above | | |
| 3.3.1 Action Step | Identify priority forest species and communities to target for landowner stewardship by 2015 | 2014-2015 | as above | as above | | |
| 3.3.2 Action Step | Identify woodlot owners with priority species and communities on their lands (using data from 3.1) by 2016 | 2015-2016 | as above | as above | | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| 3.3.3 Action Step | Send relevant stewardship materials (information from recovery strategies, BMPs) to landowners identified in 3.2.x by 2017 | 2016-2017 | as above | as above | | |
| 3.3.4 Action Step | Promote SAR best management practices (e.g. leaving snags for bats, etc) to woodlot owners through BMPs on website and publications, and relevant outreach events annually | 2014 and beyond | as above | as above | GRCA, CCC, MNR, Ontario Woodlot Owners Association and local chapters | |
| 3.3.5 Action Step | Encourage more woodlot landowners to participate in relevant forest management programs (e.g., MFTIP), and join woodlot owners associations at 2 outreach events (e.g. fairs, farm shows) by 2019 | 2014-2019 | as above | as above | CCC, GRCA, Woodlot Owners Associations, OSSGA | |
| 3.3.6 Action Step | Link to CCC's Landowner Leaders program by creating 2 demonstration sites showcasing good stewardship by 2019 | 2014-2019 | as above | as above | CCC, GRCA, potentially UW | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **3.4 Strategic Action** | **Restore and manage prairie remnants within the CAP area** | 2014-2019 | Fire & Fire Suppression; Housing & Urban Development; Commercial Industrial Development; Mining & Quarrying; Invasive Non-native Plants; Roads | PS; AR | MNR, TgO, GRCA, municipalities | SARSF, HSP, Stewardship Councils |
| 3.4.1 Action Step | Identify the 10 best remnant prairie/savannah sites (contiguous or nearly contiguous) within the CAP area by 2014 by evaluating Floristic Quality Index, patch size and connectivity.<br>Identify all populations and sub populations of nested species targets. | 2014 | as above | as above | MNR, TgO, academic community | as above |
| 3.4.2 Action Step | Identify all landowners with prairie/savannah habitats identified in step 3.4.1 by 2015 | 2014-2015 | as above | as above | GRCA, City of Brantford, WSC, CCC, MNR, TgO, OSSGA | as above |
| 3.4.3 Action Step | Contact all landowners identified in step 3.4.2 to develop landowner agreements, management plans, and/or securement by 2016 | 2015-2016 | as above | as above | GRCA, City of Brantford, WSC, CCC, TgO, OSSGA, NCC, HNC | as above |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| 3.4.4 Action Step | Implement management plans with all landowners identified in step 3.4.3. | 2017-2025 | as above | as above | GRCA, City of Brantford, WSC, CCC, TgO, OSSGA, MNR | as above |
| 3.4.5 Action Step | Raise public awareness regarding historic prairie/savannah ecosystems and fire management techniques through education and outreach annually. | 2014 and beyond | as above | as above | GRCA, TgO, OSSGA, WSC, MNR | as above |
| 3.4.6 Action Step | Monitor the status of all tallgrass prairie/savannah ecosystems with management plans (3.4.4) and nested species against baseline inventory in 3.4.1. Update management plans to reflect monitoring (adaptive management). | 2018 and beyond | as above | as above | GRCA, TgO, MNR | |
| 3.4.7 Action Step | Restore 72 hectares (178 acres) of prairie at priority sites (identified in 3.1) on public and private land by 2019. Projects that increase extent of existing prairie and make linkages among prairie patches should be given priority. Projects should use ecologically appropriate native species. | 2014-2019 | as above | as above | OSSGA, GRCA, TgO, MNR | |
| **3.5 Strategic Action** | **Promote the value of native-multi-species windbreaks and engage two landowners per year in planting by 2019** | 2014-2019 | Roads; Non-timber crops (agriculture) | TF | GRCA, Agricultural organizations, CCC, WSC, OSSGA, OMAF, OSCIA | |
| 3.5.1 Action Step | Develop programs to raise awareness of the advantages and importance of windbreaks by 2016 | 2014-2016 | as above | as above | as above | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| 3.5.2 Action Step | Develop one demonstration site to educate landowners (use signage, promote via websites) by 2019 | 2014-2019 | as above | as above | as above | |
| 3.5.1 Action Step | Engage two new landowners per year in creating new windbreaks or enhancing existing windbreaks by 2019. Recruit landowners through CCC's Landowner Leaders program. | 2014-2019 | as above | as above | as above | |
| **3.6 Strategic Action** | **Improve riparian habitat and water quality by establishing buffers of native vegetation to reduce erosion and nutrient inputs by 2019. Refer to GRCA Subwatershed Plans and Water Management Plan** | 2014-2019 | Non-timber crops (agriculture), Agricultural & Forestry Effluents, Livestock Farming & Ranching | WR | GRCA Rural Water Quality Program, Great Lakes Water Quality Programs (multiple) | |
| 3.6.1 Action Step | Work with municipalities of Haldimand and Brant to identify all possible restoration opportunities along municipal drains by 2016 and work with relevant landowners by 2018 | 2014-2018 | as above | as above | Drainage superintendents, municipalities, OMAF, Drainage Investment Group | |
| 3.6.2 Action Step | Compile existing data for baseline fish, turbidity and benthic invertebrate samples as an indicator of water quality by 2015 | 2014-2015 | as above | as above | MNR, DFO in the lower Grand, GRCA | |
| 3.6.3 Action Step | Collect fish, turbidity and benthic invertebrate samples as an indicator of water quality post restoration to monitor success annually | 2018 and beyond | as above | as above | MNR, DFO in the lower Grand, GRCA | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| 3.6.4 Action Step | Establish new buffers of native tallgrass prairie grasses >1 m or non-native vegetation > 2 m wide on 50 km of watercourses by 2019; the buffer guidelines suggest 15 m for warm water creeks and 30 m for cold water creeks | 2014-2019 | as above | as above | GRCA rural water quality program, municipalities | |
| 3.6.5 Action Step | Hold on-site 'best practices' demonstration events hosted by local landowners (one annually, working with local agricultural organizations and drainage superintendents) | 2014 and beyond | as above | as above | CCC, GRCA | |
| 3.6.6 Action Step | Make video of 'best practices' demonstration event and promote online by 2017 | 2014-2017 | as above | as above | CCC, GRCA, municipalities | |
| **Objective 4** | **Research, promote and monitor positive incentive approaches for farmers to conserve biodiversity on their land by 2019** | 2014-2019 | Tile Drainage & Drains; Non-timber crops (agriculture); Livestock Farming & Ranching; Agricultural & Forestry Effluents; Invasive Non-native Species | All | Universities, Ruthven Charitable Trust | SARFIP, Corporations (Novartis, Syngenta, Pfizer, Bayer, grocery stores, banks?) |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **4.1 Strategic Action** | **Research positive incentive approaches for farmers to conserve biodiversity on their land by 2017** | 2014-2016 | as above | as above | ALUS program; OMAF; OSCIA; OFA; National Farmers Union; Christian Farmers; Ecological Farmers of Ontario, Canadian Organic Growers, Beef Farmers of Ontario, Dairy Farmers of Ontario, Grain Farmers of Ontario, Sheep Farmers of Ontario, Ontario Vegetable and Fruit Growers Association; Ginseng Growers Association; Ontario Potato Growers; Farm and Food Care; Stewardship Councils | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| 4.1.1 Action Step | Research types of programs available to farmers in other regions (eg. Alternative Land Use Service-type initiative, Ecosystem Goods and Services cost-benefit analyses, Environmental Farm Plan cost sharing, leasing farmland for native habitat). Refer to Environmental Farm Plan, Nutrient Management Act, Rural Water Quality Program | 2014-2016 | | | | |
| 4.1.2 Action Step | Disseminate results of research to target audiences (e.g. conference, workshops, presentations, meetings) | 2016-2017 | as above | as above | as above | as above |
| 4.1.3 Action Step | Work with partners to identify and secure funding sources for incentive programs | Ongoing | as above | as above | as above | as above |
| **4.2 Strategic Action** | **Monitor and assess the efficacy of BMPs and various incentive programs once implemented** | 2019 and beyond | as above | as above | Universities, OMAF, GRCA, MOE | |
| 4.2.1 Action Step | Develop partnerships with relevant organizations interested in monitoring and analysing results by 2019 | 2014-2019 | as above | as above | Universities, OMAF, GRCA | |
| 4.2.2 Action Step | Develop and run monitoring program once implemented | 2019 and beyond | as above | as above | Universities, OMAF, GRCA | |
| 4.2.3 Action Step | Disseminate findings from monitoring to target audiences | 2019 and beyond | as above | as above | Universities, OMAF, GRCA | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **Objective 5** | **Support and endorse *Grand River Water Management Plan*** | 2014-2015 | Non-timber Crops (agriculture); Livestock Farming and Ranching; Dams and Water Management; Household Sewage & Urban Wastewater; Agricultural & Forestry Effluents; Housing & Urban Development; Commercial & Industrial Development; Roads | WR, CW, IW | GRCA, CCC, MNR, DFO, MOE, OMAF, Six Nations, municipalities | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **5.1 Strategic Action** | **Maintain a framework for water management and undertake research and monitoring to better understand the linkages between groundwater recharge and discharge areas, point and non-point sources of pollution, water quality, and the aquatic ecosystem** | 2014-2019 | as above | WR, CW, IW | GRCA, MOE, MNR, EC, OMAF, municipalities, | |
| **5.2 Strategic Action** | **Conduct a water budget study and develop water management plans for Whitemans, Mount Pleasant, and McKenzie Creeks (Norfolk Sand Plain area of Brant and Oxford Counties) and support farmers dealing with water management issues in these areas** | 2014-2019 | as above | WR | GRCA, MNR, OMAF, MOE | |
| **5.3 Strategic Action** | **Oversee and support research, monitoring, and management approaches that address the role of altered hydrology on water quality and fish communities in the Dunnville Marshes; identify a comprehensive remediation plan for the southern Grand River; and undertake a feasibility study for modifying the Dunnville Dam** | 2014-2019 | as above | WR; CW | GRCA, MNR, EC, Southern Grand River Ecosystem Rehabilitation Working Group | |
| **5.4 Strategic Action** | **Work with research partners to design (2015) and implement (2016) a biomonitoring program to assess the efficacy of management actions and aquatic ecosystem health and trends.** | 2014-2016 | as above | WR; CW | GRCA, MOE, Regional Municipality of Waterloo | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **Objective 6** | **Research and promote best management practices regarding problematic native, non-native and domestic animals (eg. Raccoons, red-eared sliders, cats, dogs) to public audiences to protect amphibian and reptile populations in developed areas** | 2014 and beyond | Pollution – Garbage and Solid Waste; Invasive Fauna; Problematic Native Species | AR, also benefits birds | Environmental education centres, GRCA, Municipalities, Neighbourhood Associations, Agricultural Associations (OFA, OSCIA) | |
| **6.1 Strategic Action** | **Identify, map, and monitor turtle nesting areas by 2019 to assess the impact of nest predation, road mortality, other management efforts to protect turtles** | 2014-2019 | as above | as above | GRCA (Brant Park in particular) | |
| 6.1.1 Action Step | Identify and map turtle nesting areas in urban and suburban centres by 2017 | 2014-2017 | as above | as above | GRCA (Brant Park in particular) | |
| 6.1.2 Action Step | Develop monitoring program for turtle nesting areas identified in 6.1.1 by 2018 to assess the impact of nest predation, road mortality, other management efforts | 2017-2018 | as above | as above | GRCA, Toronto Zoo, CWS, Turtle Recovery Teams | |
| 6.1.3 Action Step | Continue monitoring program for turtle nesting areas identified in 6.1.1 on an ongoing basis | 2018 and beyond | as above | as above | GRCA, local groups, local schools | |
| **6.2 Strategic Action** | **Compile data on the effectiveness of various management techniques, including nest covers, captive breeding, signage, and public education programs by 2016** | 2014-2016 | as above | as above | MNR, CCC, GRCA, Toronto Zoo, CWS, Turtle Recovery Teams | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **6.3 Strategic Action** | **Educate members of the public about proper waste management to limit garbage as a food source for problematic native species** | 2014 and beyond | as above | as above | CCC, GRCA, municipalities | |
| 6.3.1 Action Step | Disseminate relevant BMP materials on websites, through publications, neighbourhood associations by 2016 and at outreach events on an ongoing basis | 2014 and beyond | as above | as above | CCC, GRCA, municipalities | |
| 6.3.2 Action Step | Erect two signs discussing BMPs at public parks (e.g. Brant Park) and nature centres by 2017 | 2014-2017 | as above | as above | GRCA, municipalities | |
| **Objective 7** | **Promote the Grand River CAP as a mechanism to focus stewardship and rehabilitation of aggregate operations on enhancing biodiversity** | 2014-2019 | Mining & Quarrying; Roads | TF; AR; PS | GRCA; WSC, Municipalities; OSSGA; The Ontario Aggregate Resource Corporation; restoration consulting firms (eg. NRSI, MHBC); Aggregate Companies (eg. Holcim (Dufferin), LaFarge, Nelson (Wainco), CBM, TCA (James Dick Construction) | Management of Abandoned Aggregate Properties Program, SARSF |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **7.1 Strategic Action** | **Engage aggregate producers to facilitate an improved understanding of how stewardship and rehabilitation of aggregate pits can enhance biodiversity** | 2014-2019 | as above | as above | as above | as above |
| 7.1.1 Action Step | Identify key contacts to develop workshops for CAP partners and aggregate producers to share information by 2015 | 2014-2015 | as above | as above | OSSGA, CCC, MNR, GRCA, Cornerstone Standards Council, TOARC | |
| 7.1.2 Action Step | Hold one workshop for CAP partners and aggregate pit operators by 2016 | 2015-2016 | as above | as above | OSSGA, CCC, MNR, GRCA, Cornerstone Standards Council | |
| 7.1.3 Action Step | Identify one demonstration site of pit and quarry rehabilitation by 2019 | 2014-2019 | as above | as above | OSSGA, CCC, GRCA, TOARC | |
| 7.1.4 Action Step | Develop and hold one tour of rehabilitation sites showcasing biodiversity by 2019 | 2014-2019 | as above | as above | as above | |
| 7.1.5 Action Step | Develop initiatives to engage smaller aggregate operators in biodiversity restoration by 2019 | 2014-2019 | as above | as above | as above | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **Objective 8** | **Prevent and control the spread of new populations of high priority terrestrial and aquatic invasive species at critical sites in the Grand River CAP area (e.g., Dog-strangling Vine, Oriental Bittersweet)** | 2014-2019 | Invasive non-native plants; Pollution – Garbage and Solid Waste; Housing & Urban Development; Commercial & Industrial Development; Roads | All | OIPC, OMNR, CCC, GRCA, OFAH, EC, municipalities, HNSC; Habitat Haldimand; WSC; DFO | HSP, SARSF, municipalities, stewardship councils, OTF, EcoAction |
| **8.1 Strategic Action** | **Identify high priority invasive species in the CAP and compile existing literature and data sources about extent and control methods by 2015** | 2014-2015 | as above | as above | MNR, OFAH, OIPC, CCC | as above |
| 8.1.1 Action Step | Meet and coordinate with provincial and other groups/agencies by 2015 | 2014-2015 | as above | as above | as above | as above |
| 8.1.2 Action Step | Develop list of high priority invasive species in the CAP by 2015 | 2014-2015 | as above | as above | as above | as above |
| 8.1.3 Action Step | Compile existing literature and data sources about extent and control methods of identified high priority invasive species by 2015 | 2014-2015 | as above | as above | as above | as above |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| **8.2 Strategic Action** | **Collaborate with relevant partners to provide education to target audiences about invasive species and promote reporting of invasive species in the CAP area** | 2014 and beyond | as above | as above | CCC, GRCA, OIPC, OFAH, stewardship councils, woodlot owners associations, municipalities | |
| 8.2.1 Action Step | Provide educational materials re: problematic invasive species to the general public and target audiences (e.g. Woodlot Owners Association, agricultural organizations, OSSGA, garden plant purchasers, local garden centres) at relevant events (e.g. OIPC Grow Me Instead, newspaper articles about critical invasive species). | 2014 and beyond | as above | as above | as above | |
| 8.2.2 Action Step | Encourage citizen reporting of invasive species using existing methods such as hotline, apps on an ongoing basis | 2014 and beyond | as above | as above | as above | |
| 8.2.3 Action Step | Develop and implement one bus tour or visit to demonstration site of plant nurseries selling native plants to educate garden plant purchasers and local garden centre operators by 2019 | 2014-2019 | as above | as above | CCC, Ontario Landscape Association, local nurseries | |
| 8.2.4 Action Step | Promote SERO list of nurseries and garden centres | 2014 and beyond | as above | as above | CCC, GRCA | |
| 8.2.5 Action Step | Approach Landscape Ontario by 2016 regarding sale of invasive plants at plant nurseries and garden centres | 2014-2016 | as above | as above | CCC (support from CAP partners) | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| 8.2.6 Action Step | Review all municipal planting species lists and provide suggestions regarding removal of invasive species by 2019 | 2014-2019 | as above | as above | CCC, GRCA | |
| **8.3 Strategic Action** | **Control invasive species at five priority natural areas (eg. GRCA: Prairies – Black Locust control at Dickson Wilderness Area; Dunnville – remove European Alder and Phragmites at pit and mound restoration site; Pinehurst – invasive tree/shrub in restored prairies (Morton) and Autumn Olive management; Apps – invasive shrub control in savannah)** | 2014-2019 | as above | as above | GRCA, TgO, municipalities | HSP, SARSF, municipalities, stewardship councils, OTF, EcoAction |
| 8.3.1 Action Step | Prioritize natural areas for focal invasive species control efforts using mapping from 3.1 | 2014-2017 | as above | as above | GRCA, TgO, municipalities | as above |
| 8.3.2 Action Step | Control invasive species at five priority natural areas by 2019 | 2014-2019 | as above | as above | GRCA, TgO, municipalities | as above |
| **8.4 Strategic Action** | **Approach municipalities, counties, MTO in CAP area to develop best practices for roadside habitat, utility corridors, etc. (e.g. using native plants) by 2017** | 2014-2017 | as above | as above | GRCA, CCC | |
| 8.4.1 Action Step | Identify municipalities that could serve as a model for CAP area municipalities (e.g. West Elgin) by 2015 | 2014-2015 | as above | as above | as above | |
| 8.4.2 Action Step | Identify and approach relevant local partners interested in supporting proposal to municipalities by 2015 | 2014-2015 | as above | as above | as above | |

| # | Objective & Strategic Actions | Timeline | Threats Addressed | Targets Addressed / Recovery Strategy links | Potential Leads (Collaborators) | Costs / Funding Sources |
|---|---|---|---|---|---|---|
| 8.4.3 Action Step | Prepare relevant materials and approach CAP area municipalities to adopt best practices for roadside habitat, utility corridors, etc. by 2017 | 2015-2017 | as above | as above | as above | |
| **8.5 Strategic Action** | **Engage in public education and outreach about road sides as habitat** | 2014 and beyond | as above | as above | as above | |
| 8.5.1 Action Step | Promote native plants along roads by developing one visible road side demonstration site in the CAP area by 2017 | 2014-2019 | as above | as above | as above | |

## iii. Evaluation and Monitoring

An important component of the CAP process is monitoring. Are the CAP's strategic actions and action steps being implemented as planned? Are the strategic actions achieving the objectives they were designed to achieve? And are they resulting in the improved viability of the conservation targets and enhanced overall ecosystem health? Are target audiences receiving the appropriate information and educational materials? Is the community actively engaged and supportive of the CAP objectives and strategies? Are public policy changes occurring that support the vision and long term goals of the CAP?

Having answers to questions such as these during the ongoing implementation of the CAP will allow for 'adaptive management' in what is meant to be a flexible, long-term program for positive change on the landscape. Objectives, quantitative targets, timelines, strategic actions and other aspects of the CAP may need adjustment based on unforeseen factors that either impede or prevent progress on a specific objective or target, or at least make it unrealistic to achieve that target within a given timeframe. The CAP is therefore a 'living document' that will be reviewed at least annually, and periodically revised as necessary, based on evaluation of monitoring results.

As long as adequate funding is available, Carolinian Canada Coalition (CC) is committed to monitoring the actual implementation of the CAP (i.e., are the strategic actions being undertaken as planned?). The Grand River CAP will be included in CC's annual CAP monitoring report, which is normally submitted to the key funders of the CAP program as well as to all local CAP implementation partners. CC is also exploring ways in which landscape-level monitoring can be undertaken on a regular basis in order to document changes and trends in land cover and land use in CAP areas as well as across the entire Carolinian life zone in Canada. Such high-level monitoring using remotely-sensed data will help determine if goals such as extent of forest cover, forest interior, prairie, wetland and natural connectivity are being achieved by the CAP. For finer-scale monitoring, such as would be required at individual sites and to determine how target species populations are faring, the support of CAP partner agencies and groups will be essential.

Table 7 includes a column that lists "key ecological attributes" or KEAs for each major conservation target. KEA are critical components of a target's life history, habitat, physical processes, or community interaction that, if degraded or lost would seriously jeopardize the target's integrity. Tracking change in the KEAs will thus be an excellent measure of the success of the CAP's strategic actions. In many cases, relatively straightforward, efficient, low-cost measures were identified by the CAP science team for each conservation target, and are included in the KEA column in Table 7. Wherever appropriate and feasible, CAP implementation partners should consider monitoring KEA in their project work plans. CC will strive to assist partners in developing methods to undertake such monitoring.

A comprehensive array of excellent conservation planning resource materials, including guidance on CAP monitoring methods, are also available on-line at The Nature Conservancy (U.S.) web site (www.conserveonline.org).

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# Appendix A: Grand River Mapping Methodology

**Scope**

The CAP is centred on the Grand River including the counties of Haldimand and Brant and the Six Nations of the Grand River. A 10km buffer was used in order to avoid exclusion of natural features falling just outside of the CAP boundary. Any individual land use polygon with a centroid falling within the CAP area or its 10km buffer was included in the mapping analysis. Using this approach, entire polygons were either included or excluded; none were divided.

**Data Layers**

The data layer SOLRIS v1.2 was the primary component used to create the Grand River CAP Mapping. The Southern Ontario Land Resource Information System, or SOLRIS, was developed by the Ontario Ministry on Natural Resources (see document entitled Southern Ontario Land Resource Information System (SOLRIS) - Phase 2 - Data Specifications, Version 1.2, April, 2008) for details about this data layer.

Grand River CAP Mapping consists of two maps: 1) Priorities for Conservation and Restoration; and 2) Land Use Policy. Both are described in more detail below.

**Map 1: Priorities for Conservation and Restoration**

*Goal of Map*

The goal of the Priorities for Conservation and Restoration map is to provide a tool to guide restoration, stewardship and land securement in the Grand River CAP area.

Identification of Core Habitats

Areas of natural cover shown on the CAP maps have been placed into one of the following categories: Priority 1 Core, Priority 2 Core, Priority 3 Core, or Supporting Natural Cover. The category indicates that area's ecological importance as part of the Grand River CAP. Areas categorized as Priority 1 Core are greater than 1500 hectares in size and represent the largest and most intact areas of natural cover in the Grand River CAP. Areas categorized as Priority 2 Core are between 501 and 1500 hectares in size. Areas categorized as Priority 3 Core are between 200 and 500 hectares and, although smaller than Priority 1 and 2 Cores, nonetheless are an important part of the Greenway system, especially when they are located in areas without much overall natural cover. Areas categorized as Supporting Natural Cover are important as stepping stones between core areas.

The categorization of areas of natural cover was based on the overall size of each area. The assessment ignored all fragmenting features with a width of 25 metres or less (e.g., minor roads, trails, power lines). In other words, two or more areas of natural cover separated by a road 25 metres or less in width were considered to be one area. Also, adjacent areas of natural cover (e.g., an area of forest adjacent to an area of marsh) were treated as one area. The criteria are shown in Table A1.

**Table A1: Criteria for Identification of Core Habitats**

| Category | Size (ha) | Fragmenting features |
|---|---|---|
| Priority 1 | Core >1500 | <25m |
| Priority 2 | Core 501 - 1500 | <25m |
| Priority 3 | Core 200 - 500 | <25m |
| Supporting Nature Cover | < 200 | <25m |

*Stewardship Focus Areas*

Stewardship Focus Areas were created by placing a 750 metre[1] buffer around all areas identified as Priority 1, Priority 2 and Priority 3 Cores. The intention of the Stewardship Focus Areas is to recognize the value of Cores that are in close proximity to one another, and to highlight areas between and surrounding core areas where opportunities to enlarge or connect core areas through restoration may exist.

*Shoreline Buffer*

The Shoreline Buffer is intended to emphasize the importance of the Lake Erie shoreline as an important corridor for migrating birds and other animals. The Shoreline Buffer was created by identifying all areas of natural cover within 0.6 km of the Lake Erie shoreline, then buffering these areas with a 1 km buffer[2].

**Map 2: Land Use Policy**

*Goal of Map*

The goal of the Land Use Policy map is to provide a tool to highlight priorities for land use policy in the Grand River CAP.

*Identification of Natural Heritage Features*

The map indicates the locations of evaluated wetlands (PSW and non-PSW), Areas of Natural and Scientific Interest (Life Science and Earth Science ANSIs) and freshwater streams.

In addition, an analysis was conducted using the SOLRIS data layer to identify areas of forest and other natural cover that are likely to meet the suggested criteria for the identification of Significant Woodlands[3] in planning areas with 15-30% natural cover. All areas of natural cover > 20ha in size were identified, as were areas > 10ha in size that occur within 50 metres of a watercourse.

**Footnotes and References**

1. We used the definition of a wetland complex from the Ontario Wetland Evaluation System Manual (May 1994 revised).
2. Evaluation by The Nature Conservancy of stopover sites for migratory birds in the western Lake Erie basin ranked undeveloped cover within 1.6km of the Lake Erie shoreline as high or very high for landbirds and raptors (Ewert, et al., 2006).
3. We used the size and water protection criteria from the Natural Heritage Reference Manual for

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# Appendix B: Natural Heritage Designations of the Grand River CAP Area

| Natural Area Name | Natural Heritage Designation* |
|---|---|
| Alps Woods | Provincial Life Science ANSI |
| Ancaster Prairie | Regional Life Science ANSI |
| Ancaster Prairie | Environmentally Sensitive Area |
| Apps Mill | Conservation Authority Lands |
| Ayr Flood Plain | Conservation Authority Lands |
| B02 (3) | PS Wetland |
| Banister and Wrigley Lakes | Regional Life Science ANSI |
| Bannister - Wrigley - Sudden Tract Complex | PS Wetland |
| Bannister Lake | Conservation Authority Lands |
| Beake Pond | Regional Life Science ANSI |
| Bealton Wetland (BO 7) | Unevaluated Wetland |
| Bertie Formation (I) | Regional Earth Science ANSI |
| Bertie Formation (II) | Regional Earth ScienceANSI |
| Big Creek Headwaters Complex | PS Wetland |
| Bleinheim Bends | Conservation Authority Lands |
| Blenheim Flood Plain | Conservation Authority Lands |
| Blue Lake | Conservation Authority Lands |
| Blue Lake Railway | Environmentally Sensitive Area |
| BO1 (6) | Unevaluated Wetland |
| BO3 (6) | Unevaluated Wetland |
| BO4 (6) | Unevaluated Wetland |
| BO5 (7) | Unevaluated Wetland |
| BO6 (3) | Unevaluated Wetland |
| Bois Blanc Formation | Regional Earth Science ANSI |
| Boston and Mckenzie Creeks | Unevaluated Wetland |
| Boston Creek 2 | Unevaluated Wetland |
| Branchton Prairie | Environmentally Sensitive Area |
| Branchton Swamp | PS Wetland |
| Brant Conservation Area | Conservation Authority Lands |
| Brantford Golf and Country Club Oak Savannah | Environmentally Sensitive Area |
| Brantford Kiwanis Camp | Conservation Authority Lands |
| Brantford North West (Davidsville Swamp) | PS Wetland |
| Brantford Perched Fens | PS Wetland |
| Brantford Perched Prairie Fen | Environmentally Sensitive Area |
| Brantford Railway Prairie | Environmentally Sensitive Area |
| Brantford Savannah | Environmentally Sensitive Area |
| Brantford Tufa Mounds | Provincial Earth Science ANSI |

| Natural Area Name | Natural Heritage Designation* |
|---|---|
| Brantford Twp Flood Plain | Conservation Authority Lands |
| Brooks | Conservation Authority Lands |
| Burford Nursery | Conservation Authority Lands |
| Burgess Lake Swamp (GR 14) | PS Wetland |
| Byng Creek | Unevaluated Wetland |
| Byng Island Conservation Area | Conservation Authority Lands |
| Caithness | Conservation Authority Lands |
| Cambridge to Paris Rail Trail | Conservation Authority Lands |
| Cambridge/Dumfries Dyke System | Conservation Authority Lands |
| Canning Swamp | Unevaluated Wetland |
| Central Whiteman's/Horner Creek Complex (GR 4) | PS Wetland |
| Central Whitemans Creek Complex | PS Wetland |
| Chestnut Tree Easement | Conservation Authority Lands |
| Clanbrassil | Provincial Earth Science ANSI |
| Clanbrassil Woodlot | PS Wetland |
| Clements Tract Wetland Complex | PS Wetland |
| Copetown Bog | PS Wetland |
| Cottrel Lake Esker | Regional Earth Science ANSI |
| Cranberry Bog | Provincial Life ANSI |
| D'Aubigny Creek Swamp | PS Wetland |
| Dean's Lake | Regional Life Science ANSI |
| Dean's Lake County Forest | Other |
| Deans Lake - Cowan Lake Complex | PS Wetland |
| Drumbo Tract County Forest | Other |
| Dry Lake | PS Wetland |
| Dryden Tract | Conservation Authority Lands |
| Drynan Regional Forest County Forest | Other |
| Dumfries Crown Game Preserve | Other |
| Dundas Valley | Provincial Earth Science ANSI |
| Dundas Valley Forests | Provincial Life Science ANSI |
| Dunmark Lake - Currans Swamp | Unevaluated Wetland |
| Dunnville Grand River Alluvial Marshes | Provincial Life Science ANSI |
| Dunnville Marsh | Conservation Authority Lands |
| Dunnville North Swamp Wetland Complex | PS Wetland |
| Dunnville Woodlots | PS Wetland |
| Eagle Ave | Conservation Authority Lands |
| Eagle Nest Tract | Conservation Authority Lands |
| East Oakland Swamp | Unevaluated Wetland |
| East of Dunnville Woodlots | PS Wetland |
| Eastwood Wetland (UT 55) | Unevaluated Wetland |

| Natural Area Name | Natural Heritage Designation* |
|---|---|
| Erco Wetlands | PS Wetland |
| F.W.R. Dickson Wilderness Area | Conservation Authority Lands |
| Fairchild Creek Complex | PS Wetland |
| Fairlake | Conservation Authority Lands |
| Farley Tract | Conservation Authority Lands |
| Forfar | Conservation Authority Lands |
| Foulds Tract | Conservation Authority Lands |
| Frandenburg Tract | PS Wetland |
| FWR Dickson C.A. Prairie | Environmentally Sensitive Area |
| Galt Ridge - Sudden Bog | PS Wetland |
| Gilbert Creek Wetland | PS Wetland |
| Glen Morris Ridge Wetland Complex | PS Wetland |
| Glen Morris Valley Wetland Complex | PS Wetland |
| Glennie | Conservation Authority Lands |
| Grand River Forests | Provincial Life Science ANSI |
| Grand River Marshes | PS Wetland |
| Grass Lake | Conservation Authority Lands |
| Greenfield Swamp | PS Wetland |
| Griffin East | Conservation Authority Lands |
| Griffin West | Conservation Authority Lands |
| Hagersville | Provincial Earth Science ANSI |
| Hamilton to Brantford Rail Trail | Conservation Authority Lands |
| Hatchley - Big Creek Headwaters Wetland Complex | PS Wetland |
| Hayesland - Christie Wetland Complex | PS Wetland |
| Hillside ParK | Conservation Authority Lands |
| Hosack Tract | Conservation Authority Lands |
| Hungry Hill | Regional Life Science ANSI |
| INGERSOLL MORAINE | Provincial Earth Science ANSI |
| Jenkins Road Swamp (MC 2) | Unevaluated Wetland |
| K2A | Unevaluated Wetland |
| K3A COMPLEX (GR 3) | Unevaluated Wetland |
| K5A | Unevaluated Wetland |
| K5B | Unevaluated Wetland |
| Kerby Island | Conservation Authority Lands |
| LaFortune Tower Easement | Conservation Authority Lands |
| Levy Lake - Mud Creek Wetland | PS Wetland |
| Link | Conservation Authority Lands |
| Little Turnbull Lake | Regional Life Science ANSI |
| Little Turnbull Lake Wetland | PS Wetland |
| Lower Oakland Swamp | PS Wetland |

| Natural Area Name | Natural Heritage Designation* |
|---|---|
| MC1 (7) | Unevaluated Wetland |
| McCrone Lake | Regional Life Science ANSI |
| McKindrick Tract | Conservation Authority Lands |
| McPherson | Conservation Authority Lands |
| McRea | Conservation Authority Lands |
| Millers Pond | Conservation Authority Lands |
| Milroy Lake Wetland | PS Wetland |
| Mohawk | Conservation Authority Lands |
| Mohawk Lake and Oxbow Wetlands | Unevaluated Wetland |
| Morton Property | Conservation Authority Lands |
| Moulton West Wetland Complex | PS Wetland |
| Mount Healy Riparian Islands | Provincial Life Science ANSI |
| Nelles Tract Wetland Complex | PS Wetland |
| Nelson Aggregates | Conservation Authority Lands |
| Nith River Forests | Regional Life Science ANSI |
| North Cayuga Slough Forests | Provincial Life Science ANSI |
| North Cayuga Swamp Wetland Complex | PS Wetland |
| North Seneca Swamp | Unevaluated Wetland |
| Oak Park Prairie | Environmentally Sensitive Area |
| Oakland Swamp | PS Wetland |
| Oakland Swamp | Regional Life  Science ANSI |
| Oakland Swamp | Conservation Authority Lands |
| Old Welland Feeder Canal Wetland Complex | PS Wetland |
| Oneida | Conservation Authority Lands |
| Onondaga - Colborne St. | Conservation Authority Lands |
| Onondaga - S Hwy 54 | Conservation Authority Lands |
| Oriskany | Conservation Authority Lands |
| Oriskany Sandstone | Provincial Earth Science ANSI |
| Oriskany Sandstone and Woodlands | Provincial Life  Science ANSI |
| Ouse | Conservation Authority Lands |
| Paris Bluff Savannah and Prairie | Environmentally Sensitive Area |
| Paris Property | Conservation Authority Lands |
| Parkin Source Area | Conservation Authority Lands |
| Pine Pond | Conservation Authority Lands |
| Pinehurst Lake Conservation Area | Conservation Authority Lands |
| Pinehurst Lake Kettles | Provincial Earth  Science ANSI |
| Piper | Conservation Authority Lands |
| Princeton Wetland | Unevaluated Wetland |
| Prothonotary Pond | Unevaluated Wetland |
| Rear Land | Conservation Authority Lands |

| Natural Area Name | Natural Heritage Designation* |
|---|---|
| Reinhart Property | Conservation Authority Lands |
| Riches | Conservation Authority Lands |
| Rock Point Provincial Park | Provincial Park |
| Roger's Creek Tributary | Unevaluated Wetland |
| Roseville Swamp - Cedar Creek Wetland | PS Wetland |
| Salem-Rockford Rocklands | Regional Earth Science ANSI |
| SC Johnson Trail | Conservation Authority Lands |
| Sheffield - Rockton Complex | PS Wetland |
| SHOUPS FARM QUARRY | Provincial Earth Science ANSI |
| South of Glen Morris Prairie | Environmentally Sensitive Area |
| Spottiswood - Pinehurst Lake Complex | PS Wetland |
| Spottiswood Lakes | Provincial Life Science ANSI |
| Stockdale | Conservation Authority Lands |
| Sudden Bog | Provincial Life Science ANSI |
| Sudden Regional Forest County Forest | Other |
| Sudden Tract | Regional Life Science ANSI |
| Summit Bog | Provincial Life Science ANSI |
| Tanquanyah Conservation Area | Unevaluated Wetland |
| Taquanyah | Conservation Authority Lands |
| Taylor's Lake Wetland | PS Wetland |
| TCG Railway Prairie and Oak Woods | Environmentally Sensitive Area |
| Troy Swamp | PS Wetland |
| Turnbull Lake - Charlie Creek Wetland | PS Wetland |
| Tutela Heights | Conservation Authority Lands |
| Upper Buckhorn Creek Wetland Complex | PS Wetland |
| Upper Mill Pond | Conservation Authority Lands |
| Upper Quarry | Provincial Earth Science ANSI |
| Victoria Mills | Conservation Authority Lands |
| West Paris River Swamp | Unevaluated Wetland |
| White Property | Conservation Authority Lands |
| Whitemans Creek - Kenny Creek Wetland Complex | PS Wetland |
| Wilks Dam | Conservation Authority Lands |
| Wolverton Wetland Complex | PS Wetland |

*ANSI = Area of Natural and Scientific Interest, PS = Provincially Significant

# Appendix C: Species-specific Threats to Grand River CAP Species At Risk

**O=Ontario-wide threats, OE=Ontario-wide threats also documented in Grand River CAP.**

| ELEMENT | Associated Conservation Target(s) (see Table 6 for key to codes) | Habitat Fragmentation | Habitat Loss | Degradation of Habitat | Incompatible Forest Management | Changes to natural succession | Disease | Changes to Hydrology | Disturbance (Recreation, Construction or Maintenance) | Accidental Mortality | Discriminate Killing, Collection, Harvesting | Pollution | Road Mortality | Excessive Predation, Parasitism or Herbivory | Competition with Introduced Species | Hybridization with Introduced Species | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acadian Flycatcher | UF | O C | O C | O C | O C | | O? | O | O C | | | | | O C | | | Limited by availability of suitable habitat; Incompatible Forestry: diameter-limit harvesting, canopy opening; Brown-headed Cowbird nest parasitism; Predators? |
| American Badger | PS; TF; AG | O C | O C | | | | O | | | O C? | O C? | | O C | O C? | | | Limited by low population density and large home ranges, low reproductive capacity, presence of deep sandy soils suitable for dens; reduced prey availability; predation by coyotes and domestic dogs; incidental trapping; canine distemper and tularemia |
| American Chestnut | UF; AG | | O C | O C | O | | O C | | O | | | O | | | | O | Main threat is **Chestnut blight (*C. parasitica*)**; Limited by self-incompatible breeding system and low seed dispersal |
| American Columbo | UF; PS | | O | | | | | | | | | | | | O | | Habitat loss; invasive exotic species (Garlic Mustard, Common Buckthorn, Dame's Rocket, Japanese Barberry, Multiflora Rose, Pale Swallowwort, White Sweet Clover, Tatarian Honeysuckle). Habitat on private land has no long term protection if a current landowners sells property. |
| American Ginseng | UF | | O | O | O | | | | | | O | | | C | | | Main threats are small population size, harvesting, and habitat loss and degradation from clearing and logging. Browsing from large populations of White-tailed Deer may be a problem locally. |
| Bald Eagle | UF; WR; CW | | O | | | | O? C? | | O C | | O C | O C | | | | | Limited by availability of nest sites (large tall trees) and naturally low reproductive output; Pollution (mercury, lead, pesticides); disturbance during nesting; disease (botulism?) |

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| Barn Owl | TF; AG | O | O | | | | | | | | | | O | | | | Limited by availability of suitable habitat (grasslands) and nesting sites (wooden farm buildings torn down and replaced by more modern “bird proof” barns); loss of habitat for prey (rodents such as voles); road mortality |
| Barn Swallow | AG; TF | | O | O | | | | | O | | | | | | | | Limited by availability of suitable nesting sites (wooden farm buildings torn down and replaced by more modern “bird proof” barns) and foraging habitat in open agricultural areas; loss of food (pesticide spraying reduces the insect population) |
| Bird's-foot Violet | PS | | O | O | | O C | | | | | | | | | | | Limited by lack of suitable habitat. Single known population of this species in the CAP is imperilled due to lack of habitat management and lack of accessibility. |
| Black Redhorse | WR | | | O | | | | O | | O | O | O | | O | O | | Limited by specialized habitat requirements; bank alteration; run-off; drainage pattern/rate changes; sewage disposal; chemicals/pollution; dams and impoundments (may not use fishways); incidental harvest; introduction of sport fish (predators or competitors) |
| Black Tern (No reports available) | CW; IW | | O | O | | | | O | | O | | O | | | | | Main threats include wetland drainage and alteration, water pollution, human disturbance at nesting colonies (particularly boat traffic which can swamp floating nests)* from ROM SAR website |
| Black Tern | WE | | O | O | | | | O | | O | | O | | | | | Main threats include wetland drainage and alteration, water pollution, human disturbance at nesting colonies (particularly boat traffic which can swamp floating nests)* from ROM SAR website |
| Blanding’s Turtle | CW; IW; WR; AR | O C | O C | O C | | | O? C? | | | | O C | O C | O C | O C | | | Limited by naturally low recruitment, low dispersal, long generation time; road mortality (female-biased); availability of nesting habitat; unusually high levels of predation (esp. nests); fragmentation and isolation of populations (roads/urbanization)?; sarcophagid fly infestation of nests? |

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| Bobolink | PS; AG; TF | | O | O | | | | | O | O | | | | | | | Limited by availability of suitable habitat; disturbance of nests during hay mowing; possible threats along migration route |
| Broad Beech Fern | UF | | O C | | O C | | | O C | O | | | | | | | | Trampling during maple sugar operations; damage to plants and habitat during forestry operations; Limited by low tolerance to environmental changes. |
| Butternut | UF edges; TF? | O | O C | | O C | | O C | | | | O | | | O C | | O | Main threat is **butternut canker**; Limited by short life-span, short dispersal distance, low genetic diversity, specific conditions for regeneration; incompatible forest management: intentional harvesting (in anticipation of disease), indiscriminate removal of trees that have canker (prevents natural development of resistance), indiscriminate silvicultural practices; diseases and pests; excessive seed predation; hybridization with exotic Juglans species |
| Canada Warbler | IW | | O | | | | | | | | | | | | | | Habitat loss (breeding and wintering grounds) |
| Cerulean Warbler | UF | O C | O C | | O C | | | | | | | O | | O C? | | | Limited by high breeding site fidelity and threats in wintering grounds; acid rain; stream pollution, Forestry practices: remove most mature trees and open canopy (diameter-limit /diameter-cut, maintaining young, even-aged stands through short rotations); brown-headed cowbird brood-parasitism; light pollution, Forest pests? (emerald ash borer? Tent caterpillar? Gypsy moth?) disease? (oak wilt) |
| Chimney Swift | AG; UF; TF | | O | O | | | O? | | O | O | | O | O | O | O | | Loss or degradation of nesting and roosting sites (changes to chimneys, loss of large-diameter hollow trees); reduced abundance and quality of prey; bioaccumulation of pesticides; disturbance during breeding period (nest removal, chimney sweeping); competition with European Starlings for nest sites; accidental mortality (asphyxiation or burns in chimney); road mortality; predation; West Nile Virus (tested positive in US) |

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| Common Hoptree | PS | | O | | | O? | | O | | | | | | O | O | | Dioecious, requires cross-pollination, sex ratio skewed towards males; cottage development; beach grooming; deer browsing; Double Crested Cormorant nesting colonies (may also benefit hoptree by opening canopy to create more habitat); twig boring beetle; fire suppression or beach stabilization?.*Risk of habitat destruction by residential development (Brantford)* |
| Common Nighthawk | UF; TF; IW | | O | O | | | | | | | | | O | O | | | Habitat loss and degradation; loss of food (pesticide spraying reduces the insect population); road mortality; excessive predation in urban areas; climate change |
| Eastern Flowering Dogwood | PS; UF; TF | O C | O C | O C | O C | O C | O C | | | | | | | O C | | | Main threat is **dogwood anthracnose fungus**; fire suppression and forest succession (closed canopy results in reduced EFD vigour and encourages fungal growth); reduced probability of seed dispersal; restricted gene flow (possibly reducing ability to develop natural resistance to anthracnose); insects and pests |
| Eastern Hog-nosed Snake | UF; PS; TF; IW; AR | O C | O C | O C | | | | | | | O C | O C | O C | C? | | | Limited by prey specialization, climate, low population densities; roads; pesticides (reduced fitness and reproductive success, prey abundance) |
| Eastern Meadowlark | PS; AG; TF | O | O | O | | | | | | | | | | O | | | Habitat loss, degradation and fragmentation; reforestation; loss of food (pesticide spraying reduces the insect population); excessive predation |
| Eastern Pondmussel | WR | | | O | | | | O | | | | O | | O? | O | | Main threats include invasive dreissenid mussels, decline in water quality, climate change, changes in hydrology. Possibly limited by excessive predation by muskrats, lack of host fish (unknown). |
| Eastern Ribbonsnake | IW; AR | | O C | O C | | | | O C | | O C? | O C | | O C | O C | | | Limited by habitat (ponds/wetlands bordered by dense vegetation) and prey specialization (amphibians); declines in prey abundance; boat mortality?; subsidized predators |

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| Eastern Sand Darter | WR | | | O | | | | O | | O | | O | | | O | | Limited by strong preference for sandy substrates (not silt or cobble); increased siltation; impoundments; stream channel and flow modifications; excessive nutrient enrichment and turbidity; round goby; incidental harvest in commercial bait fisheries; aquatic insecticides (reduce prey abundance) |
| Eastern Whip-poor-will | PS; UF | O | O | O | | | | | | | | | O | O | | | Habitat loss and degradation; road mortality; loss of food (pesticide spraying reduces the insect population); excessive predation |
| Eastern Wood-Pewee (no reports available) | UF | | | O | | | | | | | | | | | | | Habitat loss or degradation on its wintering grounds in South America; loss of food (pesticide spraying reduces the insect population) |
| False Hop Sedge | IW | | O C | O C | O C | | | O C | | | | O C | | | | | Limited by availability of sunlight and climate; drains; dams; agricultural runoff |
| Fawnsfoot | WR | | | O | | | | O | | | | O | | | O | | Main threats include invasive dreissenid mussels, decline in water quality, climate change, changes in hydrology. |
| Fowler's Toad | CW; beaches; AR | O | O C | O C | | | O | | O C | O C | | O C | O | O? | O | | Limited by amount of available suitable habitat, naturally high mortality, short life span, low genetic variability; artificial shoreline stabilization; removal of beach sand (fill); beach compaction; invasive plant species (Common Reed, Silver Poplar, Crown Vetch, Kentucky Bluegrass); accumulation of Zebra mussel shells; draining or filling of wetlands; mortality due to beach cleaning activities; botulism; pesticides and industrial contaminants; subsidized predators; potential hybridization with American Toad |
| Gattinger's Agalinis | PS | | O | O | | | | | | | | | | | | | Habitat loss and degradation |

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| Goldenseal | UF; IW | O | O | O | | O | | O | O | O | O | | | | | | Main threats include habitat loss and degradation (logging, urban development, drainage/ditches), changes to natural disturbance regimes, harvesting. Limited by slow regeneration vegetatively and by seed, lack of natural disturbance (flood), lack of appropriate seed dispersing fauna. |
| Golden-winged Warbler | UF; TF | | O | | | | | | | | | | | O | | O* | Loss of habitat; hybridization with *native Blue-winged Warblers; nest parasitism by Brown-headed Cowbirds |
| Gray Ratsnake | UF; PS; TF; AR | O C | O C | O C | | | | | | O C | O C | | O C | C? | | | Limited by fidelity to hibernacula, communal use of hibernacula, number of suitable hibernacula available, life history features; loss and change in configuration of habitat mosaic; road density; accidental mortality (due to agricultural and construction machinery, lawnmowers, off-road vehicles, boats); disturbance or destruction of hibernacula (aggregate extraction, road construction, high density residential development); collection for pet trade |
| Green Dragon | UF; IW; WR | | O | | | | | C | | | O | | | | C | | Limited by climate; collection; changes in hydrological regime; garlic mustard |
| Jefferson Salamander | IW; UF; AR | O | O | O | | | | O | | | | | O | | O | | Habitat loss, fragmentation and degradation/alteration; road mortality; impairment of wetland/hydrologic function; introduction of fish to breeding ponds |
| Kidneyshell | RS; FM | | O C | O C | | | | O C | | | | O C | | | O C | | Main threats include non-native dreissenid mussels, siltation, water quality (nutrients and contaminants), water quantity, decline of host fish?, urbanization?, impoundments?, predation?. Limited by complex reproductive cycle and limited dispersal. |
| King Rail | CW; IW | | O | O | | | | O | | O | O? | O? | O | | | | Main threats include wetland loss and degradation, changes in water levels, invasive species degrading habitat, collisions with artificial structures, toxic pollutants?, decreasing crayfish populations?, West Nile virus?, incidental trapping? and targeted hunting? |

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| Lake Sturgeon | CW; WR | O | (O) | | | | | | | | (O) | (O) | | | | | Habitat fragmentation (dams and other river barriers); Historical: harvesting, habitat loss, and poor water quality |
| Least Bittern | CW; IW | O | O | O | | O | O | O | O | O | | O | O | O | | | Draining/filling of wetlands; Biomagnifications of agricultural and industrial chemicals (eggshell thinning); invasive species replace cattails (used as nesting material); succession to drier habitat; natural succession from wetland to upland; disease, parasites (semi-colonial); vehicular collisions; wake from boats floods nests, degrades foraging habitat |
| Little Brown Myotis | UF | | | | | | O | | | | | | | | | | Main threat is fungal disease: white nose syndrome |
| Louisiana Waterthrush | WR; UF | O | O | | | | | O | | | | O | | O | | | Limited by availability of suitable habitat; Swamp drainage; Reservoir development; Fluctuating water levels; Siltation; Brown-headed Cowbird nest parasitism |
| Mapleleaf Mussel | WR | | O | O | | | | | | | | O | | | O | | Habitat loss and degradation; pollution; non-native dreissenid mussels; threats to host fish |
| Massasauga | All targets (extirpated) | O | O | | | | | | | | O | | O | | | | Low population numbers; isolation |
| Milksnake | PS; TF; AG; AR | | O | O | | | | | | | O | | O | O | | | Persecution |
| Northern Brook Lamprey | WR | | | | | | | O | | O | | O | | | | | Use of lampricide for the control of the invasive Sea Lamprey; pollution; changes in water levels and temperature |
| Northern Map Turtle | RS; WE; RP | | O C | | | | | O C | O C | O C | O C | O C | | | | | Development, shoreline hardening; dams, control of water levels (submerge nest sites, alter habitat); Heavy metals and other toxins |
| Northern Myotis | UF; IW | | | | | | O | | | | | | | | | | Main threat is fungal disease: white nose syndrome |

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| Piping Plover | beeches | | | | | | | | | | | | | | | | Currently extirpated from historical range of the north shore of Lake Erie. Main threats in other parts of the range include excessive predation, habitat loss and degradation (including succession), human disturbance, livestock grazing (trampling, pollution), West Nile virus?, pollution?, threats on wintering grounds. |
| Pygmy Pocket Moss | UF | O | O | O | | | | | O | O | | O | | | | | Main threats include air and water pollution; habitat loss, degradation and fragmentation; human disturbance. Limited by cool climate at northern range limit. |
| Queensnake | WR; AR | | O | O | | | | | O | O | O | O? | | | O | | Main threats include habitat loss, fragmentation and degradation (including invasive species), persecution, disturbance by humans (recreational activities), water pollution? (may also affect prey), invasive species. Limited by prey specialization (crayfish), narrow habitat preference (shorelines), viviparity, limited dispersal, isolation between populations, availability of overwintering features. |
| Rainbow Mussel | WR | | O | O | | | | | | | | O | | | O | | Habitat loss and degradation; pollution; non-native dreissenid mussels |
| Rapid's Clubtail | WR | | | O | | | | O | | | | O | | | | | Habitat degradation; changes to hydrology; pollution |
| Red-headed Woodpecker | PS; TF | | O C | | O C | | | | | | | O C | O C | | | | Limited by availability of preferred habitat (mature, open oak and beech forests); loss of nesting and roosting sites (dead trees); Beech-bark disease (reduces food supply); Pesticides and industrial chemicals; lack of suitable habitat? |
| River Redhorse | WR | O | | O | | | | | | | | | | | | | Habitat degradation (siltation and turbidity); dams |
| Round Pigtoe | RS; FM | | O | O C | | | | | | | | O | | | O C | | Main threats include siltation, nutrient loads, contaminants, increased water temperatures, exotic species especially dreissenid mussels. Limited by low dispersal ability. |
| Rusty-patched Bumble Bee | PS; TF; IW | | O? | O? | | | O? | | | | | | | | | | Cause of decline unknown. Possibly: pesticides, spread of disease from bumble bees used to pollinate greenhouse vegetable crops, habitat loss, climate change |

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| Short-eared Owl | PS; IW; TF | | O | | | | | | | | | | | | | | Habitat loss (grasslands, marshes) |
| Silver Shiner | WR | O | O | O | | | | | | O | | O | | | O | | Habitat loss, degradation and fragmentation (dams); pollution; sportfish stocking; bait fish harvesting. Limited by temperature as southern Ontario represents the northern limit for the species. |
| Snapping Turtle | WR; AR | | | | | | | | | | O | | O | O | | | Limited by long generation time; road mortality; persecution; excessive predation of eggs (especially in urban and agricultural areas) |
| Snuffbox | WR | O | | O | | | | O | | | | O | | O | | | Main threats include degradation of habitat (impoundments, siltation, channel modification, pollution), invasive dreissenid mussels, excessive predation. |
| Spiny Softshell | WR; CW; AR | O C | O C | O C | | | O C | O C? | O C | O C | O C | O C | | O C | | | Limited by prey specialization (crayfish and molluscs); main threat is habitat degradation (alteration of nest sites by/for human recreation, shoreline hardening, disturbance from construction projects; disturbance during nesting; fragmentation by dams; decline in crayfish and mollusc (mussel?) populations; subsidized predators; sarcophagid fly infestation of nests; environment contamination; high numbers of infertile eggs at some Ontario sites; accidental mortality (angling and hunting activities, collisions with watercraft); egg poaching |
| Spotted Turtle | IW; WR; AR | | O C | O C | | O C | | | | | O C | | O C | O C | | | Limited by slow growth rates, delayed maturity, naturally low nest and juvenile survivorship, relatively small clutch sizes; Hibernate communally (susceptible to collection and mortality of large # of individuals); natural succession; Phragmites; overgrazing by livestock |
| Virginia Mallow | IW | | O | O | | | | | O | | | | | | O | | Habitat loss; site disturbance (mowing, pipeline maintenance); invasive exotic species (Common Reed, Purple Loosestrife) |
| Wavy-rayed Lampmussel | WR | | | O | | | | | | | | O | | O? | O | | Main threats include invasive dreissenid mussels, decline in water quality; small populations possibly limited by excessive predation by muskrats, threats to host fish |

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| Woodland Vole | UF | O | O | | | | | | | | | | O? | O | | | Limited by climate and short life span; low population densities; road mortality? (fossorial, may not be a significant threat) |
| Wood Thrush (no reports available) | UF | O | O | | | O | | | | | | O | | | | | Habitat loss and fragmentation on both its breeding grounds its Central American wintering grounds; forest succession; acid rain (negatively affects reproduction) |
| Yellow-breasted Chat | TF; WR | | O<br>C | | | O<br>C | | | | | | | | O<br>C | | | Limited by lack of available suitable habitat; Brown-headed Cowbird nest parasitism (low) |