Applying the Great Lakes Conservation Blueprint for the Strategic Protection of Biodiversity at Multiple Scales

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Abstract

The Great Lakes Conservation Blueprint *is an analysis of biodiversity features and conservation needs in the Great Lakes region of Ontario. The goal of the Conservation Blueprint is to ensure the long-term survival of species, communities and ecological systems through the systematic selection and conservation of priority sites. This basin-wide assessment of terrestrial and freshwater biodiversity provides a framework to better understand and contextualize biodiversity at multiple scales and facilitates regional assessments of conservation success and needs. Effective implementation of the* Great Lakes Conservation Blueprint *will require mechanisms to prioritize landscapes and conservation targets to focus resources and processes to better engage local knowledge, respond to opportunities, and to adapt to new information. The Nature Conservancy of Canada and partners will use the Conservation Blueprint to develop dynamic partnership-based strategic plans to conserve biodiversity in key areas. The* Great Lakes Conservation Blueprint *also provides important information to better identify and conserve ecosystems at risk.*

Keywords: *biodiversity, Great Lakes region, conservation blueprint, Nature Conservancy of Canada, local knowledge, conservation targets.*

Introduction

Systematic approaches to conservation planning hold the promise of better allocation of often scarce conservation resources. Conservation blueprint projects are increasingly being developed around the world (e.g., Groves, 2003; Malakoff, 2002). Development of regional approaches to conserva-

tion planning has been facilitated by increasing access to powerful Geographical Information Systems (GIS) software, digital land-cover information, and biodiversity data from Conservation Data Centres.

Conservation Blueprints (or ecoregional assessments) are currently being completed for ecoregions throughout North America. These assessments compile and analyze information on biodiversity to set priorities for conservation based on values, existing protection, and threats. Ecoregional assessments of biodiversity values, threats, and conservation needs provide an important perspective on conservation on a continental (e.g., Ricketts *et al.*, 1999) and global basis (e.g., Hoekstra *et al.*, 2005).

Conservation planning does not, however, mean conservation success, and the gap between planning and implementation has been identified as a critical issue. The Nature Conservancy of Canada (NCC) has been developing strategies to utilize the important conservation perspectives derived from the *Great Lakes Conservation Blueprint* with local knowledge and opportunity to develop dynamic implementation strategies.

The Great Lakes Conservation Blueprint for Biodiversity

The Nature Conservancy of Canada and the Ontario Natural Heritage Information Centre recently completed aquatic and terrestrial conservation blueprints for biodiversity in the Great Lakes ecoregion (Henson and Brodribb, 2005; Wichert *et al.*, 2005). The conservation blueprints were designed using automated GIS methods at ecological site district and tertiary watershed scales, using data that were available for the entire ecoregion. Initial steps in the project involved gathering digital data on biodiversity and land-use in the Great Lakes, and establishing a network of scientific peers to participate on the core science teams of the projects. Both the aquatic and terrestrial project focused on mapping the best representative examples of coarse and fine filter biodiversity targets across different spatial scales. In addition to the portfolio of sites generated by the conservation blueprint, the project has resulted in the creation of several new GIS layers, a compilation of existing data on biodiversity and the geography of the Great Lakes, new reporting tools on biodiversity and conservation lands, and the creation of new methods for using GIS to assist with conservation planning.

While the sites in the conservation blueprints outline areas of important biodiversity significance, they do not provide a reliable, precise delineation of the total area that is required to maintain viable occurrences of conservation targets. In order to apply the blueprints toward a successful landscape

conservation strategy, additional work can be done including the validation of key data inputs, incorporation of additional fine-scale data sets, consideration of landscape cores and corridors, and the life history requirements of conservation targets.

From Plan to Action: Using the Conservation Blueprint to Focus Implementation

Disconnects often exist between conservation planning and implementation. While sophisticated regionally-based conservation plans can provide an important context to decision-making, comprehensive conservation blueprints are static and cannot incorporate detailed and dynamic local information on natural heritage, policy, politics, and opportunities needed to make effective and strategic decisions (Pierce *et al.*, 2005; Meir *et al.*, 2004). NCC has been developing strategies to better link the important perspective derived from broad-scale plans, with the critical information base that resides at the local level.

A key area of focus for blueprint implementation has been the development of strategies to apply a landscape-based conservation plan to drive effective local actions. Mechanisms to deliver ecoregional assessments have challenged conservation planning. Engagement and building strong support of local partners is critical for the success of landscape-based conservation (Low, 2003). For conservation to occur, planners and researchers need to find better ways to deliver information to local jurisdictions in a form that is not only usable but compelling as well (Groves *et al.*, 2003; Pierce *et al.*, 2005).

NCC has identified the following three sequential steps to better link the Great Lakes Conservation Blueprint with local information:

1. Define priority landscapes (Where do we need to work?).
2. Focus conservation goals (What do we need to do first?).
3. Develop and implement dynamic partnership-based conservation plans (How can conservation success be achieved?).

Step 1: Defining Priority Conservation Landscapes

While conservation needs to occur across all landscapes to ensure effective representation of species and ecosystems, the need for conservation action will vary. Often implementation is based more on political interests and available local resources than a regional perspective on priorities. Prioritizing conservation landscapes is critical to identify which general regions may

require a greater allocation of resources. At a landscape level of conservation planning, the *Great Lakes Conservation Blueprint* can be used as a guide to direct action to areas of most critical need for conservation action and provides a transparent process that allows conservation practitioners to communicate to partners how landscapes are strategically selected to conserve biodiversity based on multiple criteria.

The *Great Lakes Conservation Blueprint* provides a regional baseline on two critical elements for assessing conservation need: a) biodiversity significance (e.g., number of globally rare species, irreplaceable conservation targets) and b) urgency (the area/ number of protected sites) (from Margules and Pressey, 2000).

a. Biodiversity Significance

Biodiversity values are not evenly distributed across the landscape. While some target species and communities are likely to occur throughout the planning region, some elements of biodiversity will be restricted to specific areas.

General regional biodiversity values were assessed in the *Great Lakes Conservation Blueprint* through the application of a Global Biodiversity Index (GBI) to assess the occurrences of globally rare species and communities, and endemic and disjunct species within each ecological site district. The intent of GBI is to provide a comparison between regions of those elements of biodiversity that are restricted or at risk globally, and Ontario is likely to have a high degree of jurisdictional responsibility to ensure their conservation.

Mapping of GBI does provide some new insight into where key regions for protecting biodiversity occur. This analysis shows that ecological site districts along the shores of Lake Erie and Lake Huron have the highest relative global biodiversity values, while the northern shores of Lake Superior also contain a relatively high number of species and communities (Figure 1).

In addition to the diversity of elements of global conservation concern, irreplaceable conservation targets also provide an important decision tool in identifying regions of highest significance (Meir *et al.*, 2004). Irreplaceable conservation targets are species or community types that are only represented in one ecological site district. Information from the *Great Lakes Conservation Blueprint* can be used to identify regions with irreplaceable occurrences of species, communities, and ecological systems (Table 1).

Figure 1. Global biodiversity, Ontario

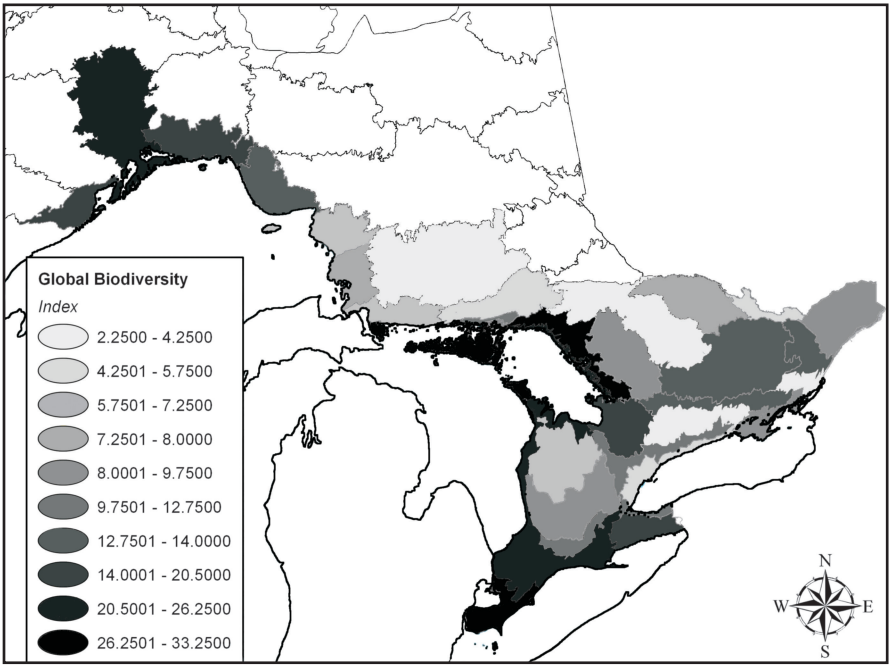


Table 1. Examples of globally rare irreplaceable conservation targets from the Great Lakes Ecoregion (Ontario).

Priority Targets	**Ecological Site District**
Species/ Global Rank	
Agalinis skinneriana/ G3	7E1
Botrychium campestre/ G3	3W5
Carex wiegandii/ G3	5E13
Sida hermaphrodita/ G3G3Q	7E5
Communities	
Chinquapin Oak - Nodding Onion Treed Alvar Grassland Type/ G1?	7E1
Virginia Chain Fern Open Bog Type/ G3G4	5E7

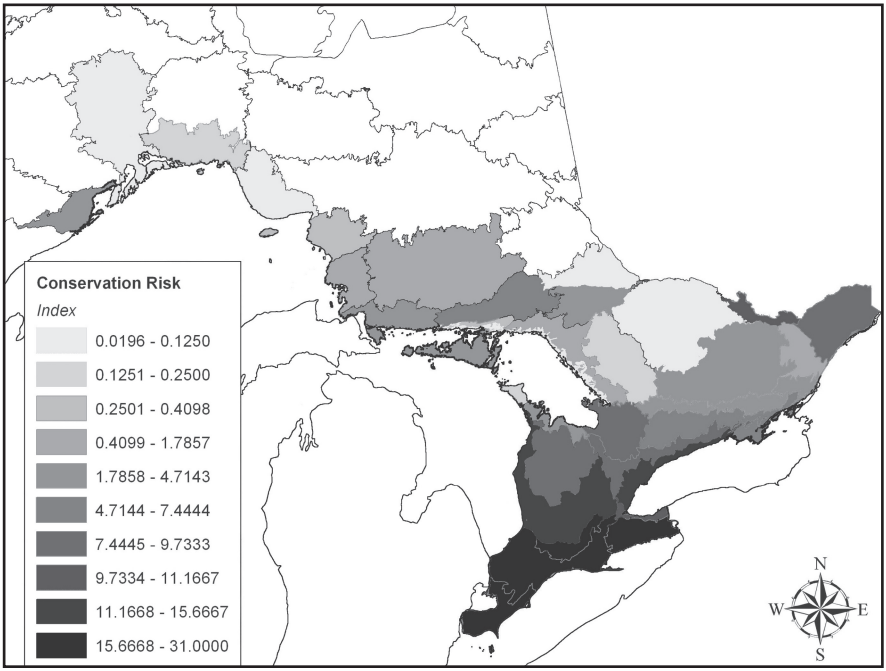
b. Urgency

At an ecoregional scale, urgency can be compared between ecological site districts as a whole by using the Conservation Risk Index (CRI). The CRI is a relatively simple measure of the ratio of land protected to land conserved that has been applied to 847 ecoregions around the globe (Hoekstra *et al.*, 2005). Globally, the CRI for all habitat types is 2.2, meaning that for every 1 ha of habitat protected, 2.2 have been lost. The CRI for temperate broadleaf and mixed forests (the dominant forest region for the *Great Lakes Conservation Blueprint* region with the exception of the north shore of Lake Superior) is 4.7 (Hoekstra *et al.*, 2005).

Several ecological site districts in Ontario are "endangered" and "critically endangered" using this measure (Figure 2). This includes ecological site districts in the south-west, shores of Lake Huron, and the Ottawa Valley. Regions assessed as "vulnerable" using these criteria would include Manitoulin Island and the western portion of Lake Superior.

In addition to regional (i.e., ecological site district) assessments of urgency through the CRI, the *Great Lakes Conservation Blueprint* can also be used to assess the conservation needs of species, communities, and ecological

Figure 2. Conservation risk, Ontario



systems within and between ecological site districts. Comparisons of conservation progress (i.e., areas within protected areas and conservation lands) can be made to the area of the recommended conservation portfolio as a measure of conservation need. For example, within ecological site district 6E7 (Oak Ridges Moraine and central Niagara Escarpment) most of the forest systems included in the *Great Lakes Conservation Blueprint* portfolio are generally in protected areas and conservation lands, while prairie and savanna systems in the portfolio are largely within unprotected lands. This highlights the progress made in protecting key forested areas in this region and the need for increased focus on prairies and savannas.

Step 2: Focus Conservation Goals

As the biodiversity values and urgency for landscapes are identified, additional conservation planning information must be integrated into the Conservation Blueprint, particularly for sites of the highest action priority. This will include updating element occurrence data from the Natural Heritage Information Centre, ensuring protected areas and conservation lands boundaries are current, and integrating information from the aquatic and terrestrial portfolios.

Additional information, not included in the original Conservation Blueprint analysis, should be integrated wherever possible. This information could include:

- county forests;
- other provincial/ federal/ municipal lands;
- other non-governmental organization (NGO) lands;
- Natural Heritage strategies;
- municipal zoning; and,
- First Nations lands.

Within each priority landscape, conservation goals will then be focussed based on the suite of biodiversity targets identified in both the terrestrial and aquatic Conservation Blueprints. Not all biodiversity targets identified in the blueprints will be a priority – good landscape-scale conservation planning begins with an understanding of the priority conservation targets. Each landscape (priority ecological site district) having one or more *prima facie* reasons, is important for conservation (Low, 2003). This process will identify the key elements of biodiversity on which NCC should focus resources. These priority targets may include ecological systems, vegetation communities, species, and other important natural resources. Priority targets for each ecological site district will be established based on:

- target status (priority to globally rare species and communities);
- matrix systems (often acting as an umbrella for species and communities of conservation concern);
- ecological systems and communities with multiple, nested targets;
- viability (assessing the habitat requirements to maintain or enhance the viability of biodiversity targets – priority given to extremely high quality examples of biodiversity targets);
- irreplaceable targets and systems (only occurrence in the Great Lakes study area or Site Region (i.e., 7E); and,
- threats (i.e., is the target already protected?).

The initial catalogue of priority targets will be shared with local partners for their review, input, and revision. This local review is critical to conservation success. While landscape-scale projects are very strong at providing the context of conservation targets (i.e., how important is it and why?), specific information on target viability and threat often resides with local experts and partners and needs to be included in decisions on conservation.

An example of focal conservation targets and selection rationale for 7E5 (Niagara Peninsula) is provided in Table 2. In this example, one of the focal conservation targets selected is Clay Plain Forest complex, an ecological system. This system is selected because it represents the dominant land cover in the ecological site district, and because clay plain forests in this region are often characterized by wet oak associations.

The Blueprint data offers the flexibility to re-analyze the portfolio outputs. In the previous example of Clay Plain Forests on the Niagara Peninsula, the baseline ecological system goal in the *Great Lakes Conservation Blueprint* of the two highest scoring examples of each clay plain forest type (deciduous, coniferous, mixed) was increased to expand the potential number of sites for consideration. The underlying scores layer of the Conservation Blueprint were re-opened and queried to provide additional information on higher scoring ecological systems. In this case, the top 10% of the systems were extracted and additional local information applied (such as agricultural drainage) to define a broader range of priority sites.

Step 3: Develop and implement dynamic partnership-based strategies and action steps.

While nature reserve networks and natural heritage systems may be best designed at regional levels, successful implementation requires integration of a “bottom-up approach”. Local stakeholder and municipal input is im-

Table 2. Focal Conservation Targets for Ecological Site District 7E5 Niagara Peninsula.

Priority Targets	Selection Criteria	Comments
Species		
Bromus nottowayanus	GRANK/ irreplaceable	7E5 only
Sida hermaphrodita	GRANK/ irreplaceable	7E5 only
Crataegus formosa	GRANK/ irreplaceable	7E5 only
Communities		
Pin Oak Mineral Deciduous Swamp Type	GRANK/ irreplaceable	7E5 and 7E1
See Clay Plain Deciduous Swamp Complex		
Shagbark Hickory – Prickly Ash – Philadelphia Panic Grass Treed Alvar Grassland Type	GRANK/ irreplaceable	7E5 and 6E1
Ecological Systems		
Beach and Shorecliff Forest Complex	Umbrella system	Includes many GRANK communities.
Clay Plain Deciduous Forest Complex, including swamp complex	Umbrella/ Matrix System	> 60% of remaining natural cover. The largest concentration of clay plain systems in Ontario. Includes wet oak associations (many GRANK).
Limestone Plain Deciduous Forest Complex	Umbrella system	Multiple species targets.
Fen & Bog complexes	Umbrella system	Multiple species targets.

"GRANK" refers to "Global Rank," which is based on the range-wide status of species, subspecies or variety

portant for gathering site-specific information and gaining support and participation for voluntary implementation mechanisms. Broad-scale planning provides consistent approaches – local scale allows the "master plan" to be translated into concrete projects (Bolck *et al.*, 2004).

With revisions from partner review, focal conservation targets will be

mapped in each ecological site district. It is at this stage that NCC will delineate key natural areas to focus action within each ecological site district based on conservation blueprint information, ancillary data, and collaboration with local partners. This will include the examination and incorporation of the many Natural Heritage and Greenlands strategies that have been prepared by municipalities and Conservation Authorities.

Within these landscapes, key areas for protecting biodiversity will occur. The Nature Conservancy of Canada and local partners will identify these project areas based on biodiversity mapping and socio-economic information. Action sites will include a core area identified in the Conservation Blueprint, or subsequent landscape planning, and other lands based on an assessment of viability needs. This could include areas of high biodiversity and/or ecological integrity identified during field studies, or areas that are needed to enhance the viability of conservation targets by expanding the habitat or creating linkages to other areas. NCC and partners have prepared plans for a number of key areas identified in the Great Lakes Conservation Blueprint including the Carden Alvar, Western Lake Superior Coast, and Rice Lake Plains. These plans are dynamic and responsive to changes in opportunity, land-use planning, new biodiversity information, and conservation success.

Application of the Great Lakes Conservation Blueprint to Species-at-Risk Recovery

Much of the focus of conservation biology has been on the crisis of species loss (Wilson, 1991) and biodiversity of species-rich "hot-spots" (Myers *et al.*, 2000), such as the tropical rainforests. As a result, both public awareness and policy has been aimed at halting the loss of species.

Recovery of "species at risk" in Ontario will be a tremendous challenge in terms of political support and finding the conservation resources needed to implement recovery plans. Currently, over 165 species at risk have been identified in Ontario. In addition to these, over 300 species in Ontario are globally rare which have not been formally designated as "at risk" (NatureServe, 2005).

While species conservation is often necessary, good conservation planning and effective conservation require approaches that include both species and ecosystems (Noss *et al.*, 1997). An ecosystem-based approach to conservation does not necessarily mean protecting the habitats that harbour the most species of conservation concern. Globally, the biomes at greatest risk are

temperate grasslands and Mediterranean forests and scrub. The temperate deciduous forests of southern and central Great Lakes are at higher risk than tropical rainforests (Hoekstra *et al.*, 2005). Protecting these ecosystems at risk is critical for maintaining ecological services and functions.

Conservation blueprints provide a tool to better understand and measure ecosystems in different areas. Within the Great Lakes, the conservation risk index can be assessed by comparing the amount of natural habitat lost to habitat protected from different ecological site districts to track conservation success and needs.

The conservation needs of ecological systems can also be assessed by examining the area protected and area converted. This is particularly useful for systems that are (or were) matrix forests. For example, in the Niagara Peninsula, less than 0.3% of the Deciduous Clay Plain Forests are within regulated protected areas, and <1% are within other conservation lands. Given that clay plain forest is the dominant remaining ecological system in the region (over 13% of the land cover), this ecosystem should be a focus for conservation efforts.

Understanding the conservation needs of ecosystems is critical for effective conservation. We may succeed in protecting examples of species at risk and their habitats, but fail to maintain ecosystem functions that ultimately sustain those species and provide the ecological services we require (Hoekstra *et al.*, 2005).

Conclusions

Good conservation plans need to result not in a product but in a process. Top-down, landscape approaches to conservation planning have many advantages. They provide important context for goal setting in land-use decisions and create a framework for the design of natural heritage systems. By providing a clear understanding of what local natural heritage features are most important from a global or ecoregional perspective, broad-scale conservation plans can also inspire conservation, focus resource allocation and support good land-use management decisions. Bottom-up, local approaches to conservation planning often have better, more current data and local knowledge, both ecological and political, that is critical for making sound decisions. Good conservation planning needs to integrate both approaches. While the *Great Lakes Conservation Blueprint* provides good context and is a useful tool in goal setting and rationalization, the successful execution and long-term success of those goals ultimately relies on bottom-up input and local partnerships.

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