Georgian Bay Greater Ecosystem Bioregional Study - A Greater Park Ecosystem Approach to Resource Conservation

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Abstract

Current thinking in conservation biology maintains that it is rarely possible to support indigenous biodiversity within discrete areas such as parks and nature reserves. In recognition of this, Georgian Bay Islands National Park embarked on a program to foster protection of the natural resources in the "Greater Park Ecosystem". As a first step toward achieving bioregional conservation, Georgian Bay Islands National Park sponsored a seminar to introduce the concept of ecosystem management on a bioregional scale to a multi-stakeholder audience consisting of government and non-government groups from the region. Subsequently, a multi-jurisdictional Georgian Bay regional ecosystem working group was formed with a mandate to pursue the means to achieve long term conservation in the Georgian Bay area. The working group commissioned Geomatics International to provide assistance in the identification of a bioregional conservation plan. This information was presented to the working group in the form of a vision map *for the Georgian Bay area. The* vision map *is currently facilitating the incorporation of regional conservation initiatives into municipal planning and this is expected to benefit park ecosystems. Work is also proceeding to refine the corridors as presented in the* vision map *for their incorporation into official plans in the District of Muskoka. The regional study area is 399,466 ha, 16% of which is identified as "core areas", 10% as "corridors", and 6% as a multi-use zone.*

Introduction

The reliance on areas outside park boundaries to sustain biodiversity within parks is common to all Canadian parks. In recognition of this, Parks Canada has embarked on programs to recognise "Greater Park Ecosystems". These can be broadly defined as areas that have the potential to impact the integrity of park ecosystems, and which can contribute to the long-term preservation of within-Park biota. This initiative is consistent with, and supports the notion of bioregional conservation plans being promoted by conservation biologists across North America. The development of a bioregional conservation plan in the Georgian Bay area was initiated by Georgian Bay Islands National Park (Parks Canada) in 1993.

Approach

As a first step toward achieving bioregional conservation, Georgian Bay Islands National Park sponsored a seminar to introduce the concept of ecosystem management on a bioregional scale. An outcome of the seminar was the establishment of a multi-jurisdictional Georgian Bay regional ecosystem working group. Members of the working group included representatives from both government (*e.g.*, Parks Canada, Ontario Ministry of Natural Resources, District of Muskoka,

etc.) and non-government groups (*e.g.*, Couchiching Conservancy, Georgian Bay Association, *etc.*) in the region.

The second step undertaken was to define a general area of co-operation and to map the existing areas of conservation interest. The assumption was made that all existing, designated and candidate protected areas should contribute to the bioregional conservation network, and that the outside boundaries of overlapping areas would be used in the analysis. The resulting areas are referred to as core protected areas or core areas.

The third step was to identify corridor locations and width requirements to connect the core areas. Recent conservation literature was examined to review different approaches to developing bioregional scale conservation plans and to evaluate criteria used for defining conservation corridors elsewhere. Also, as part of this review, characteristics of core areas that were important for maintaining biodiversity were identified to assist in the recognition of the key core areas, *i.e.*, those cores that must be included in the corridor network.

The process of delineating corridors is an iterative and judgmental process. Information on corridor design is scarce and what does exist provides guidance rather than explicit criteria. This is owing to such factors as the lack of rigorous investigation conducted on the movement requirements of various animals and the difficulty in translating known movement patterns into corridor design criteria. There is also the uncertainty of extrapolating corridor requirements from one animal taxon to another or even between different geographical locations for the same species. Notwithstanding this, it is widely accepted that the maintenance of corridors linking protected core areas is important.

Based on our review of the literature the following guidelines were developed for corridor delineation for this study:

1. Roadless areas should be given a high priority in corridor selection.
2. Where roads are present, opportunities to reduce their negative effects should be considered.
3. Corridors should be located away from, or be adequately buffered from, human habitation.
4. Corridors should be wide enough to provide habitat for as many resident species as possible.
5. Corridor width should accommodate the known movement patterns, habitat type requirements and home range size for the more ecologically demanding species.
6. Corridor width should increase as the distance between core areas increases.
7. Corridors should permit movement and genetic flow amongst organisms with limited movement abilities.
8. Corridors should link high quality habitat cores wherever possible while avoiding connection to highly disturbed habitats that could introduce non-native species.
9. Special attention should be given to ensure that the requirements of more demanding, sensitive species are met while weedy and non-native species are actively discouraged.

10. Wherever possible, linkages should follow existing movement corridors.
11. Stopover habitat used by long range migrants should be viewed in relation to its contribution to the integrity of flight migration corridors.
12. Multiple corridors should be provided to ensure that when one corridor is disturbed or proves inadequate, other corridors are available.
13. Riparian corridor width should include factors such as adjacent land use, size of adjacent areas contributing runoff and the steepness of adjacent slopes.
14. Existing patterns of land ownership and the availability of land for purchase or donation to secure corridors may influence corridor design, but these factors should not compromise the ecological purpose of the corridor.

Development of Criteria for a Bioregional Network

The design process for the bioregional network involved an examination of three key factors: the landscape matrix; size of the core areas; and road density. The information assembled for the three key factors was then considered in regard to the proximity of the key core areas (large, undisturbed and containing indicator species), the distribution of other cores, the location of suitable intervening landscape for corridor location and the guidelines available from the literature on corridor widths. In total, 19 key core areas were considered for connection via corridors and a multi-use buffer zone.

Landscape Matrix Considerations

A useful starting point in corridor planning is consideration of the landscape matrix. The matrix is the background landscape that characterises the area of concern and through which corridors must pass. Not only the size and distribution of existing protected areas should be considered, but also the extent to which the landscape is developed, the distribution of present and possible future development, as well as the earth and life science characteristics of the region. The study area addressed here contains three very dissimilar landscape matrices: 1) lands south of the Precambrian Shield; 2) the Precambrian Shield; and 3) the archipelago of the Georgian Bay shoreline. These disparate landscapes required different approaches when designing a protected system of cores and corridors.

Size of Core Areas

Size is recognized as the single most important attribute of an area for maintaining viable populations (Noss 1992). Size criteria for cores were established by examining the range of core sizes in the study area and dividing them up into three categories: large (>2000 ha), intermediate (500-2000 ha); and small (<500 ha). The importance of the size of the core areas was based, in part, on an understanding of the species that would need to move among core areas. The assumption was made that if those species most sensitive to human presence and those requiring the largest areas to persist are accommodated, the less sensitive species and those with smaller area requirements would be protected. To this end, the following indicator species were selected based on their large home range size and known movement patterns: grey wolf; lynx; fisher; and marten.

Road Density

Road density has also been reported as a good indicator of the isolation and therefore the pristineness of wilderness areas (Noss and Cooperrider 1994). In view of this, the size, length and density of roads within and adjacent to each core area was determined. Road density criteria were identified as follows: roadless areas had densities of less than 100 m/km^2; low density was 100-499 m/km^2; moderate density was 500-1000 m/km^2; and high density was 1000 m/km^2.

Key Core Areas

From the literature review, criteria were developed for determining the "key" cores for establishing connections. For a core area to be considered "key" it needed to be large (>2000 ha) and roadless (<100 m/km^2) or have a low road density (100-499 m/km^2). Only three core areas fulfilled these criteria. By reducing the size criterion to include intermediate sized cores an additional 19 areas were included. The 22 core areas in these two categories were specifically targeted for the establishment of connecting corridors.

Corridors

Potential corridors that best linked the core areas were sketched onto base maps using the best available information about intervening features. These were then refined through examination of topographic maps to avoid areas of high cottage density and to minimise road crossings, especially major highways. Corridor widths of one to two kilometers were used to provide interior habitat and adequate buffering. Corridor widths were frequently wider, however, to accommodate ecological features such as wetland edges or lakes plus an associated corridor of upland habitat.

Multi-use Buffer Zone

A multi-use zone was proposed for the study area to function as a buffer for the core protected areas and corridors. It is based on a concept proposed by Noss (1992, 1993) which lists its function as: 1) ameliorating physical and biotic edge effects; 2) protecting core reserves from harmful human activities; 3) providing supplementary habitat to native species inhabiting core reserves; and 4) providing connectivity for movement of organisms among reserves. In this study, the multi-use zone is primarily being used for the last two functions.

Preparation of a Bioregional Network Map

The approach taken recognizes that designating areas with low densities of development as corridors is the first step in providing, functional ecological linkages, essential to achieving long term regional biodiversity protection in core areas. The detailed level (*i.e.*, species level) of corridor design was not attempted in this study. The boundaries of these regional corridors should therefore be refined during the preparation of land use plans such as secondary plans, plans of subdivision, official plan amendments and applications for zoning changes.

In the landscape matrix south of the Precambrian Shield where there is little remnant habitat left, protected core areas were connected by well-defined corridors where no activity that compromises corridor function is permitted. Since the landscape matrix is primarily cleared for agriculture, corridors are best routed along

watercourses, valleys and other major topographic features that remain undeveloped. Much of the study area south of the Precambrian Shield has already been the subject of a conservation plan: Natural Heritage Action Plan - Couchiching Conservancy (Reid and Peterson 1994, Peterson 1994) that defined corridors. The guidelines used in the Natural Heritage Action Plan were applied to the entire study area south of the Shield to provide consistency in the designation of cores and corridors in this matrix.

On the Precambrian Shield, where a large portion of the landscape matrix is undeveloped, a different approach was taken. Here, the major obstacles to faunal movement are the heavily cottaged shorelines and major highways. Future development will however result in a greater fragmentation of the landscape. Therefore, there is a need to identify corridors that over the long term will be preserved and provide for the movement of fauna and flora. In the Precambrian Shield matrix, a multi-use zone of low development was proposed along with conventional "no development" corridors.

In the Georgian Bay landscape matrix, there is regular movement and colonization of offshore islands by plants and animals from the mainland and between islands. Radio-tracking studies have confirmed that at least two species of snakes (massasauga and fox) disperse among islands from hibernacula in the Beausoleil Island area. The heavily developed shoreline and the dense boat traffic in this area likely inhibit plant and animal movement among islands and between islands and the mainland. The concept of a corridor across water has not been addressed in the literature and it is difficult to define areas to accommodate this need. However, this study recognized that it is important to provide protection of some shoreline areas that can provide sites from which dispersal to islands can occur. Optimally, boat traffic should be excluded from some designated aquatic corridors.

The *Vision Map*

The accompanying map (Figure 1) illustrates a vision for connected core areas in the Georgian Bay area. The key to the vision is that multiple agencies involved in land management have agreed upon a common bioregional framework for the protection of the core areas that represent the range of habitats and the best remaining examples of the life science features in the study area. It has also been recognized that the corridors and protection of the core areas alone will not be sufficient to protect the regional biodiversity in the long-term; core areas must be linked to facilitate the dispersal of flora and fauna. The vision therefore relies on both corridors and a wide multi-use buffer zone that extends from Massasauga Provincial Park in the north, sweeps south along the Georgian Bay shoreline and then east, taking in a band of land that extends from the Trent Severn Waterway to the edge of the Precambrian Shield. The corridors and multi-use zone are intended to provide for the dispersal of a broad array of flora and fauna by controlling human intrusion.

Within the constraints of the study area, developed areas were avoided in locating corridors wherever possible. In places however, it was impossible to avoid highways and roads and consequently implementation of the *vision map* could include the provision for functional wildlife road crossings. The corridors have been posi-

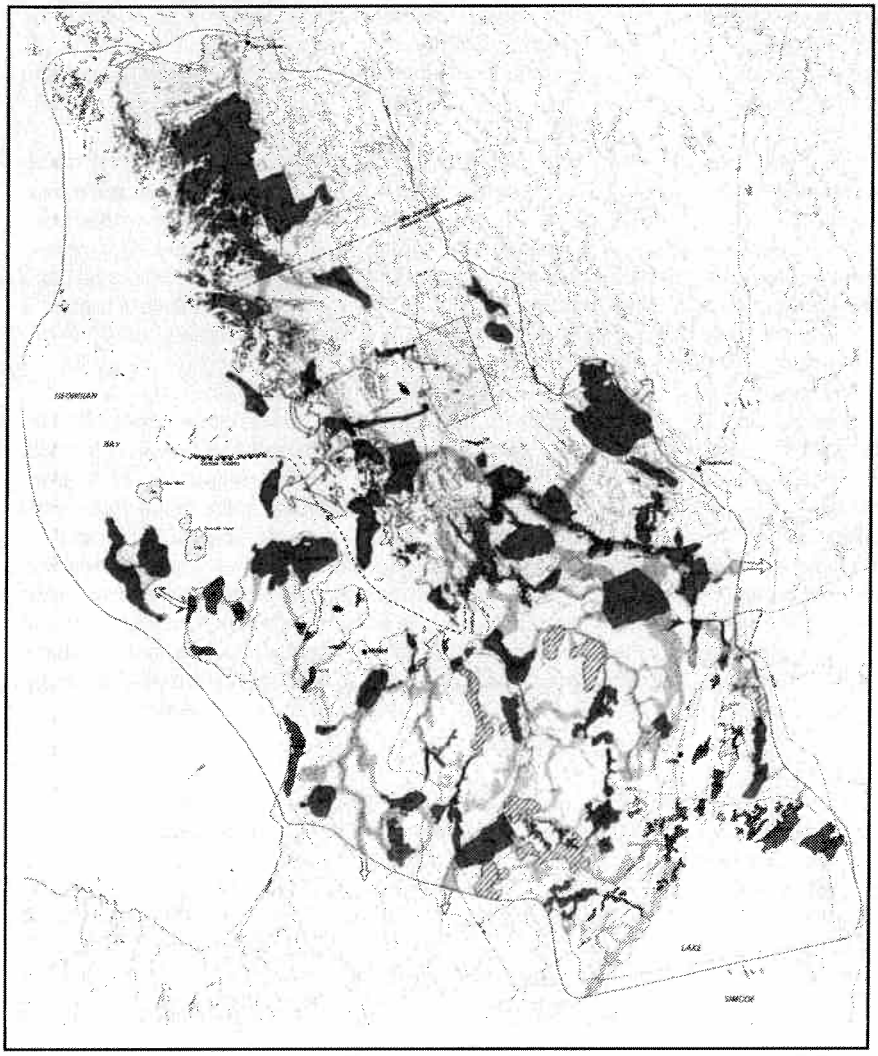

Figure 1: Vision Map of Potential Core and Corridors in the Georgian Bay Regional Ecosystem. In general the figure shows cores areas in dark tones and additional core areas as hatched. Corridors are shown in lighter tones. Broad arrows between the shoreline and islands in Georgian Bay show potential corridors over water. Broad arrows at the periphery of the study area show potential connections beyond the regional ecosystem. Approximate scale in this figure is 1:1 250 000. (This figure did not reproduce well as it was originally designed for a larger and colour format. Contact the author for more information on this map. Eds.)

tioned back from the Georgian Bay shoreline out of recognition that the shoreline is densely cottaged in many places, although there are links to off-shore islands through some core areas. Within the corridors, human disturbance should be kept to a minimum and where feasible eliminated if it already exists.

Fifteen of the twenty-two core areas identified as intermediate or large in size and with low road densities were connected with corridors. Six of the remaining unconnected core areas were islands, making the designation of corridors difficult. The seventh unconnected core area was too distant from any other core to easily connect with a corridor. Out of the total 134 core areas identified, only twenty (excluding islands), remain unconnected by either a corridor or the multi-use buffer zone. These unconnected cores are generally small, relatively isolated areas that are difficult to connect owing to the lack of suitable intervening landscape or their remoteness from other cores. Some are wetland areas along the shores of Severn Sound, Lake Simcoe and Lake Couchiching that may be better served by the existing, functional water and shoreline connections.

If indigenous biodiversity is to be maintained, Noss (1993) suggests that between 25% and 75% of a region needs to be set aside in a system of connected reserves consisting of approximately 50% cores and 50% corridors and buffers. Other estimates of area required to preserve biodiversity include 12% (Hummel 1989), 40% (Odum 1970, as cited in Noss 1992) and 50% (Odum and Odum 1972, as cited in Noss 1992). The figures provided in Table 1 for the study area show that the *vision map* falls well within these estimates.

Conclusion

Traditionally, provincial and federal governments working independently have taken the lead in natural areas protection through the establishment of parks. This study recognizes the need for a bioregional ecosystem approach, requiring much greater

	Areas by Municipality (ha)			Areas by Geographic Regions (ha)		Totals (ha)
	Simcoe	Muskoka	Parry Sound	On Precambrian Shield	Off Precambrian Shield	
Study Area	232,972	111,258	55,236	206,428	193,038	399,466
Core Areas	33,069 14%	18,029 16%	12,815 23%	39,323 19%	24,590 13%	16%
Corridors	14%	7%	0 0%	8%	12%	10%
Multi-use zone	6,257 3%	17,288 16%	2,077 4%	25,622 12%	0 0%	25,622
Total of Cores+Corridors-Multi-use zone	72,051 31%	43,180 39%	14,892 27%	81,552 39%	48,571 25%	130,123 32%

Table 1: Areas of cores, corridors and multi-use zone in the study area (note: open water areas of Georgian Bay have been excluded from core, corridor and multi-use zone areas)

communication and involvement amongst the lead stakeholders and regional governments as well as private individuals to achieve protection of core natural areas and corridors. The *vision map* provides guidance for long-term biodiversity protection in the Georgian Bay region. The success of achieving biodiversity protection through implementation of the vision map will rely on partnerships between planners, biologists and a wide variety of public and private land managers.

The *vision map* is currently facilitating the incorporation of bioregional conservation objectives into local municipal planning. Work is proceeding to refine the linkage corridors as presented in the *vision map* for their incorporation into regional official plans. A more detailed map (1:50,000) based on refined criteria that define local core and corridor boundaries has been produced for a smaller area centred on Parks Canada Beausoleil Island holdings to act as an example of the next step for incorporating the *vision map* into municipal land use planning (North-South Environmental 1999).

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