Transboundary Protected Areas, Research and Planning

Proceedings of the
Parks Research Forum of Ontario (PRFO)
Annual General Meeting April 2006
Brock University, St Catherines, Ontario

Edited by:
Gordon Nelson and Beth Dempster

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Parks and Protected Areas Research in Ontario

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Overview

The Parks Research Forum of Ontario

The Parks Research Forum of Ontario (PRFO) encourages research applying to parks and protected areas. The objectives of PRFO are to:

- promote research to improve understanding, planning, management and decision making for parks and protected areas;
- encourage related educational and training activities;
- facilitate more cooperation in parks and protected areas research;
- encourage regular exchange of information on parks and protected areas research; and,
- monitor and report on such research.

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Gordon Nelson
for the PRFO Committee

PRFO Publication Policy

As a core operating principle, the Parks Research Forum of Ontario (PRFO) places a high priority on the timely publication of quality proceedings from its annual meetings, state-of-the-art workshops, and other collaborative ventures with which it is involved. By design, the topical scope of PRFO publications is wide ranging and encompasses the natural sciences, cultural and social sciences, economics and all related disciplinary endeavours associated with conserving, planning, managing, and decision-making for parks and other protected areas. This wide sweep derives from the goal and objectives, and the operating principles of PRFO, which recognize that 'conservation science' must be viewed in a very comprehensive fashion to address fully the needs for protected areas planning and management.

Since its inception in 1996, PRFO has published more than 500 papers, many reporting on work in Ontario, and the others being of direct relevance to Ontario's needs for protected areas research, planning and management. Publication standards over this period have evolved, with continual refinement and improvement being an objective of the PRFO Steering Committee. Ongoing improvement has been motivated by principles of accepted standards for scientific reporting, academic excellence and regular feedback from contributors, editors and the larger PRFO audience.

Current style and content standards for PRFO publications are posted on the PRFO website. Adherence to these standards provides consistency in style and reporting, and facilitates the editorial process, which is substantial when dealing with volumes such as this one. Adherence to these standards also establishes a high level of discipline from contributors, especially the many student and agency-based contributors who gain valuable experience in professional reporting. However, in striving for excellence, there is the reality of time and resources coupled with colloquial expression and style, which sometimes necessitate deviations in style and format among a compendium of papers. To the extent possible, within these constraints, PRFO strives to generate a high quality homogeneous product in a timely fashion.

Preparation and submission of readable maps and graphs by authors is a continuing problem for the editors. The clarity of the illustrations in PRFO publications is the responsibility of the authors.

Editors

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Each year the Parks Research Forum of Ontario hosts an annual meeting for all those interested in research and its application to parks and protected areas planning, management and decision-making in Ontario. This meeting normally consists of a theme day followed by a volunteer paper day, including a short workshop on a pertinent topic.

Cross-Border approaches to Protected Areas, Heritage Conservation and Tourism was chosen as the theme for 2006. The reasoning was that with an ecosystem approach more and more in vogue, protected area planning, management and decision-making would necessarily have to consider more frequent crossing of administrative and political borders. The expectation was that most invited and volunteered presentations would deal with lessons learned and research needs for the crossing of major natural or human boundaries, although we hoped that some people would see this as an opportunity to draw attention to challenges and opportunities at the local level.

The response was richer than was anticipated. Excellent overviews were presented on the international experience with cross border protected area initiatives as well as on experience at national and provincial levels. Several presentations focused on experiences and opportunities for cross-border planning and research. The presentation on Northern Ontario was ground-breaking in its description of efforts to date, which involve cooperation across the Manitoba and Ontario border and also across provincial and national initiatives. This presentation also drew attention to the need to address First Nations or cultural boundaries in protected area work. In this respect, several of the presentations stressed the need to understand and work with different institutions on either side of a border or with different agencies and political or governance systems.

Another insufficiently anticipated contribution was the notion of planning cross-border institutions in a broader regional planning context. Cross-border conservation efforts often require formal government protected area initiatives, but to be successful they often require cross-border collaboration among other land use and environmental management agencies as well as non-government organizations. At the heart then, cross-border work is a highly collaborative exercise.

Lessons derived from experience in cross-border protected area planning, management and decision-making are laid out in the papers for the reader to

study. In some cases, the lessons seem at odds among the papers presented. For example, providing a favourable upper level policy framework for protected area personnel operating at the local level was seen as important by some presenters, but as not so important as good working relations among people on the ground by others. Frequent reference was made to the importance of careful cooperation and constant attempts to understand the situation of other partners. In many cases, cooperation, to be effective, was seen as involving sharing of resources at the operational level. Much work can be done through careful use of existing resources; many efforts involved agencies without a large influx of new dollars. In other circumstances, however, explicit budgeting may be necessary to get work done efficiently and effectively.

For some people, the surprise that will come out of this set of studies on cross-border protected areas work is that many of the lessons apply to tasks facing protected areas daily. To work with an ecosystem approach requires, it seems, a cross-border, cross-organizational, cross-cultural, cross-disciplinary sensitivity and approach on an ongoing basis. Those charged explicitly with cross-border work at the provincial and the national levels need to consider the various facets of trans-border issues discussed in the papers in these proceedings

The research needs and opportunities are substantial and challenging. One aspect that requires more research is understanding what actually happens on the ground at various stages in the development of cross border initiatives. What are the critical elements in the middle and long-term as well as the earlier plans? And can we learn more about what differences cross-border initiatives actually make to nature conservation and sustainability on the ground? Some opportunities are shown in presentations made in the volunteered part of the 2006 AGM. Useful results were presented on a range of applicable approaches, including large scale modeling of protected areas as well as other means of identifying issues and concerns for further planning.

Other helpful papers were also presented on topics not central to our 2006 theme but of ongoing interest to protected area researchers and planners. Some papers provide greater understanding of the ecological dynamics of plant or animal communities. Some papers address local policy needs, including the question of how all the various protected areas initiatives by different institutions in Ontario might be linked with one another.

We thank all those who came and participated and offer special thanks for the efforts of those at Brock University and the Niagara Parks Commission.

Gordon Nelson,
2006 PRFO Chair

Transboundary Protected Areas: Experience, Planning, Research Needs

Transboundary Protected Areas, Connections and Conservation

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Abstract

Transboundary parks and protected areas (TBPPAs) have been the focus of increasing attention in recent years. Typologies and inventories are ongoing, but there are many types from peace parks to national and provincial parks to shared conservation areas and heritage designations. Transboundary areas may span international, interprovincial, or regional boundaries, or simply include different types of protected areas. Conservation across boundaries and borders raises a series of challenges and opportunities, among them integrating goals and objectives, management activities, tourism planning and control, education and interpretation, while maintaining separate identity, responsibilities, and unique character. Transboundary management may improve conservation effectiveness, offer opportunities for more participation in management, and improve local benefits and support for conservation, among other political, social and ecological benefits. None of this is easy and a series of principles and best practices have been identified by IUCN The World Conservation Union and others. Fostering cooperation of different kinds is a particular priority and challenge, and illustrated from our experience in the St. Elias region of North America, and elsewhere.

Introduction

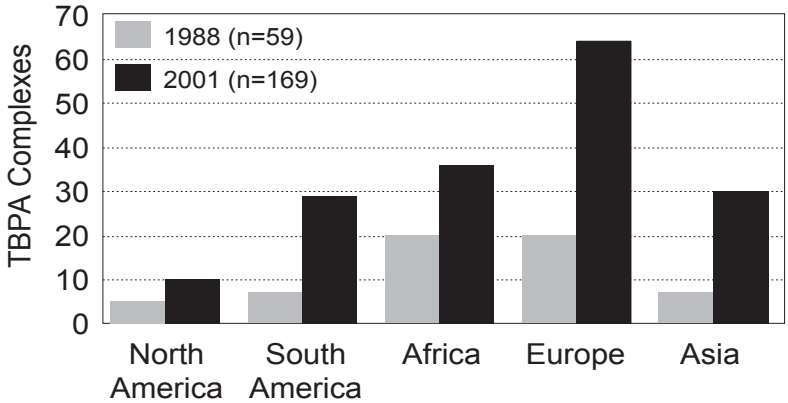
Transboundary protected areas (TBPAs), like other areas of transboundary environmental management and policy, have seen growing conceptual and practical interest in recent decades. Along with this has come increased recognition of the significance of, and interest in the experience with, transboundary protected areas. There are a growing number of published case studies but, until very recently, synthetic/academic treatments of TBPA as a

whole have been less common. We build on the review by Danby (1997) by surveying some of the experience gained over the last 10 years, to provide an overview of definitions, experience with, and lessons from cooperative management of transboundary protected areas.

Transboundary protected areas go back to the early twentieth century. Their origins can be categorized as intentional and simultaneous, intentional but temporally offset, or unintentional (Danby 1997). Waterton (1895) and Glacier (1910) National Parks, in Alberta, Canada and Montana, USA are commonly considered the first international transboundary parks, and were also jointly designated the first international peace park in 1932. European transboundary protected areas followed soon after, while elsewhere in the world most examples are from the1970s and later. Some transboundary protected areas are very well known; others less so, but their numbers have grown steadily in recent decades (see Figure 1) and there are at least 188 spanning 112 countries at present (Zbicz 2001). The inclusion of TBPA actions in the Programme of Work on Protected Areas of the 7th Conference of Parties to the Convention on Biological Diversity has also given additional impetus to their continued development.

Parks and protected areas are the cornerstone of conservation strategies worldwide. The benefits of such areas are well recognized and include natural and cultural heritage preservation, tourism and recreation opportunities, education and interpretation opportunities, and spiritual and aesthetic development. These potential benefits also extend to transboundary protected areas. But there are also emergent benefits specific to TBPAs. Danby (1997) argued that peace and

Figure 1. World-wide growth in transboundary protected areas, 1988-2001, based on data provided in Zbicz, 2001. Numbers will invariably differ slightly depending on the definition used (cf. Zimmerer *et al*. 2004). Regardless, all authorities note the rapid growth in both numbers and total area over the last two decades. NB: Central America included in South America; Oceania included in Asia.



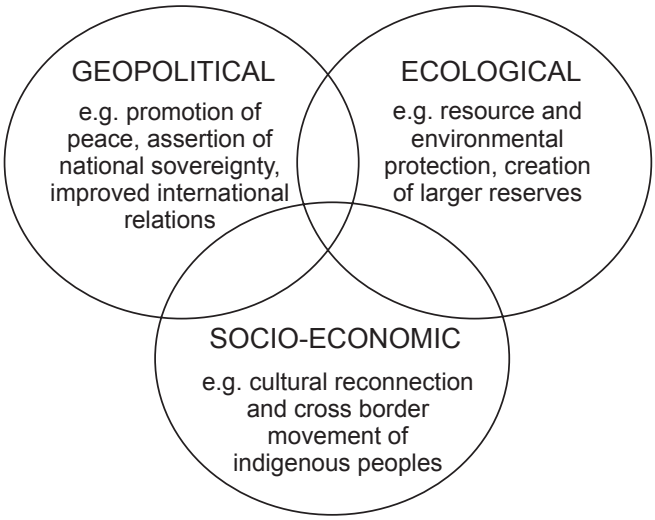
the enlargement of reserves were the two primary emergent benefits. Others include improved effectiveness of protected areas, improved dialogue between protected areas, promotion of cultural connections, and opportunities for mutual learning (see Figure 2).

What are Transboundary Protected Areas?

The conventional definition of a transboundary protected area (TBPA) is typified by the definition adopted by the IUCN as "an area of land and/or sea that straddles one or more borders between states, sub-national units such as provinces and regions, autonomous areas and/or areas beyond the limit of national sovereignty or jurisdiction, whose constituent parts are especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed cooperatively through legal or other effective means" (Sandwith *et al*. 2001: 3). International designations such as *World Heritage Sites* and *Biosphere Reserves* may be superimposed.

A number of other terms are in use, including *transboundary conservation areas*, *parks for peace* or *peace parks*, and *transboundary migratory corridors* (Mittermeier *et al*. 2005). These terms reflect some of the emergent benefits associated with TBPAs but are also indicative of a broader definition of conservation that focuses on border areas in general, not just on adjoining protected areas. Thus, as the benefits of regional-scale conservation become more widely accepted (e.g. Sportza 1999), there has been a slight expansion of the conventional definition of a TBPA to include a wide range of protected area types, as well as proximal, but not necessarily adjoining, protected areas in regions of international conservation concern. IUCN has drafted the following

Figure 2 – The multiple, overlapping benefits of transboundary protected area complexes.

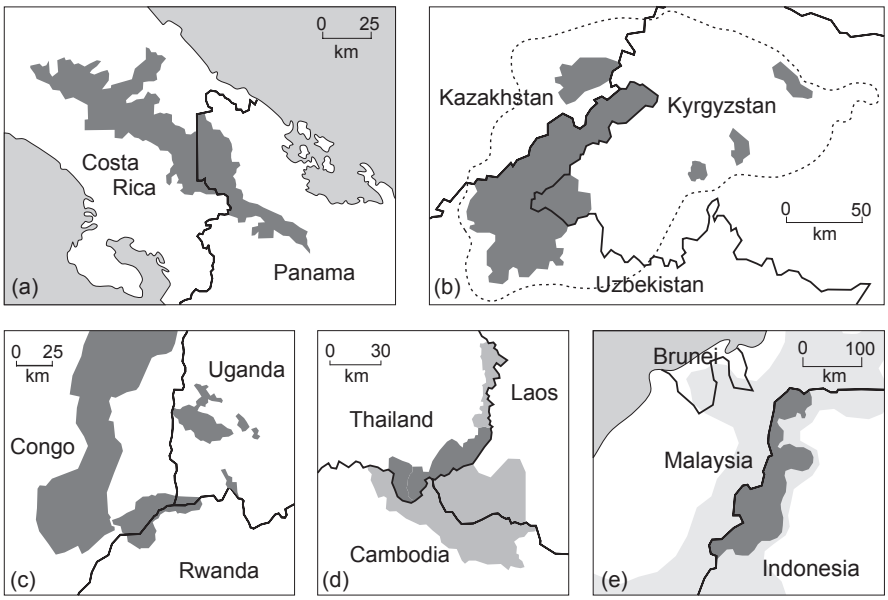


typology of categories to include such areas. Examples of each are illustrated in Figure 3.

a) *Two or more contiguous protected areas across a national boundary*: this is the classic model of a transboundary protected area. A well known example, La Amistad International Park shared by Costa Rica and Panama (Weed 1994) is illustrated in Figure 3a.
b) *A cluster of protected areas and the intervening land*: Combines strict protection with sustainable management in buffer zones and other parts of the landscape. The example in Figure 3b is the West Tien Shan Biodiversity Conservation Project (MacKinnon *et al*. 2005) involving several protected areas and adjoining unprotected lands in Uzbekistan, Kazakhstan and the Krygyz Republic.
c) *A cluster of separated protected areas without intervening land*: Some transboundary initiatives involve protected areas that are geographically separated but share common issues and are part of the same larger ecosystem. The Great Lakes Region of Africa involving Burundi, Democratic Republic of Congo, and Rwanda (Rainer *et al*. 2003) is the example used in Figure 3c.
d) *A trans-border area including proposed protected areas*: some trans-boundary conservation initiatives have been initiated in the hope that formal protection on one side of the border will encourage establishment of an adjoining protected area on other side. For example, the Pha Taem Transborder Initiative includes existing protected areas in Thailand as well as proposals for several others in Laos and Cambodia (MacKinnon 1993, Figure 3d).
e) *Protected area in one country aided by sympathetic land use over the border*: In instances where a protected area exists on one side of a border there may be no potential for establishing an adjoining (or even proximal) protected area on the other. Compatible land and resource management may occur on the unprotected side in these instances without formal protection. Sustainable forest management in an area of Malaysia adjacent to Kayan Mentarang National Park in Indonesia is an example of this type of TBPA (WWF 2005, Figure 3e).

Within this broader context, transboundary initiatives may cover a range of goals including ecosystem or species preservation, peace, or sustainable resource management in general. The goals of such areas may be as diverse as their constituent building blocks. Yet the common feature of all these definitions and typologies is that they focus on conservation across political borders, and are anchored in at least one, but usually more, protected areas. Although much attention is directed to international transboundary protected area complexes, park complexes crossing subnational boundaries such as the Australian Alps National Parks (see Crabb 2003), or more complex mixes of cooperative public and private land management such as the International Sonoran Desert Alliance

Figure 3. Examples of the five draft types of transborder protected areas identified by IUCN. A single TBPA may belong to more than one category. A) Two or more contiguous protected areas across a national boundary, (B) a cluster of protected areas and the intervening land (indicated by dashed line), (C) a cluster of separated protected areas without intervening land, (D) a transborder area including proposed protected areas (in lighter shading), (E) a protected area in one country aided by sympathetic land use over the border (indicated by lighter shading).



or the Yellowstone to Yukon corridor initiative (see Chester 2006) are also significant.

Other interesting examples of unique TBPA initiatives include the Meso-American Biological Corridor and the Korean DMZ. The establishment of frontier protected areas (paired and unpaired) was used to help broker peace in Central America during the 1980s (see Weed 1994). These protected areas are now cornerstones in the Mesoamerican Biological Corridor, which has evolved from the original focus of connectivity through habitat corridors to a broader, more inclusive focus on fostering regional environmental sustainability (Miller *et al*. 2001).

The Korean DMZ is an example of the ongoing use of TBPA to promote peace. The 4 x 250 km DMZ was established by the Korean War armistice agreement of 1953. The DMZ is now highly ecologically significant, undisturbed and uninhabited, rich in biodiversity and rare species (Westing 1998). It is also historically significant, and a living war memorial with many thousands buried

within it. There are ongoing efforts to have North and South Korea formally recognize the area as a peace park, and there has been high profile involvement from the likes of Ted Turner and E.O. Wilson.

Broad Challenges and Approaches

There has been a number of surveys and analyses of transboundary protected areas in the last decade (e.g. Hamilton *et al*. 1996, Zbicz 1999, Sandwith *et al*. 2001, Goodale *et al*. 2003, Mittermeier *et al*. 2005; Ali 2007). Individually and collectively, these treatments illustrate the extraordinary political, social and ecological diversity associated with transboundary protected areas worldwide. Still, a survey of this literature also suggests that there are similarities in the challenges they face and that there are broader lessons that can be learned from experience.

Common challenges include gaining local acceptance; cross-border cooperation and communication; integrating goals and objectives, management activities, tourism planning and control, and education and interpretation; while simultaneously maintaining separate identity, responsibilities, and unique character. All of which adds up to it being a particular challenge to achieve substantive cooperation. Indeed, although more than 80% of all international TBPAs involve some form of transboundary cooperation, most of it occurs at very low levels (Zbicz, 2003). There are also needs to develop more attention and priority on sub-national transboundary protected area complexes, in contrast to international complexes which tend to get much of the attention.

In response to these challenges, the IUCN World Commission on Protected Areas' Best Practice Guidelines (Sandwith, *et al*. 2001) emphasize the need to: identify and promote common values, involve and benefit local people, obtain and maintain support of decision-makers, promote coordinated and co-operative activities, achieve coordinated planning and protected area development, develop cooperative agreements, work toward funding sustainability, monitor and assess progress, and deal with tension or armed conflict.

Somewhat similarly, the EUROPARC Federation (2003) certification guidelines stress several areas for cross-border activity: nature and landscape conservation, education and communication, recreation and sustainable tourism, research and monitoring, and mutual understanding and promotion of peace. Criteria for assessing progress include: development of a common vision for the future of the transboundary area; the creation of official cooperation agreements and joint work plans; organization of cooperation between staff of the protected areas, including regular communications, joint decision-making, joint field work, and the sharing of data and experience; development of joint projects; and secure funding arrangements for transboundary work. Designation of TBPAs as Biosphere Reserves has helped achieve success on many of these in Europe (Fall and Thiry 2003).

Building Cooperation

A central challenge for TBPAs is building cooperation and collaboration (Zbicz 1999). This subject is worth elaborating slightly, and was a key focus of our long-term studies of the St. Elias mountain parks (Danby and Slocombe 2005, Danby and Slocombe 2002, Slocombe & Danby 2005; and cf. Sandwith *et al* 2001; Zbicz 2001). These are large "wilderness" parks, in the northwest of North America where Alaska, Yukon and British Columbia meet. They are international, and physically, biologically and socio-economically complex, including strong First Nation, Territory/State and NGO interests. There are multiple protected area designations, which have seen extensive change in management approach over the thirty year history of the main national parks and protected areas. There are both substantial differences and commonalities between the different parks' and jurisdictions' experience. We identified several levels of cooperation that occur, ranging from simple and informal communication to formal and complex international agreements. Independent of our work, Zbicz (2003) identified similar categories in a group of other TBPAs, indicating that these levels are not unique to the St. Elias Region but are emergent worldwide. The five different levels of managerial cooperation we identified are:

1. Communication

General communication and information sharing between agencies responsible for managing a shared resource is the most common type of management cooperation. Communication varies from simple telephone conversations between peers in different agencies to more formal meetings involving several different agencies. This is also the level at which other, non-managerial, stakeholders are most often involved (e.g. ENGOs).

2. Coordination and Collaboration

This comprises a wide variety of relationships including activity coordination, joint programs, collaborative research and monitoring, infrastructure and resource sharing.

Examples of interpark coordination and collaboration include joint enforcement, search and rescue, and transborder river recreation management. It is often driven by efficiency and operational needs and usually directed by Memorandum of Understandings (MOUs) rather than legislated agreements.

3. Cooperative Management

This usually entails a more formal agreement between two or more resource management agencies. These agreements are often initiated because of a common management issue or shared resource, or due to instances of negative environmental impacts across jurisdictional boundaries. The key difference is that decision making is shared.

4. Joint Management

The most formal and complex level, placing heavy reliance on one or more formal agreements to maintain a specific arrangement. These agreements are usually very detailed, often have independent budgets, and are typically mandated through legislation (e.g. park management boards).

5. International Agreements

Generally these are initiated outside of the region, but directed by formal agreements that the states are signatories to and, therefore, to which management agencies must adhere (e.g. World Heritage Convention, International Migratory Bird Convention).

Beyond this typology, there are a number of core issues and dimensions to fostering greater cooperation. Key steps include building cooperation to get beyond issue-driven cooperation, e.g. on enforcement, search and rescue, and education and interpretation. Overcoming staffing differences, especially by developing some equivalent, lead, staff positions can be a big step forward, and can help TBPAs to build on commonalities (of experience, and of often common biophysical, cultural and historical contexts), within the inevitable context of time and resource constraints. It is also important to recognize the range of possible frameworks of cooperation: from simple, informal MOUs to broad formal alliances and binational conventions and legislation. Start slowly, evaluate where cooperation already occurs and where greater efforts are best focused (don't assume everywhere), do try to involve the managers of unprotected lands, and seek to foster information integration across boundaries as a critical foundation for success.

Conclusions

As the number and extent of protected areas continues to increase worldwide, experience with TBPAs is also increasing. Despite challenges, this is clearly a positive endeavour with benefits extending beyond those associated with the constituent parts. However, just because two or more areas constitute a TBPA doesn't automatically mean that their management should be merged and fully integrated. It is necessary to evaluate where cooperation is best focused. This is important given that there will always be limited resources and decisions must be made about where best to invest these (time, money, expertise). An important step in the assessment of any transboundary initiative is to take stock of shared features and processes (e.g. transboundary wildlife movements, transboundary rivers, common species) and common issues (e.g. increasing tourism pressure, invasive species). This helps identify where cooperation would be most beneficial to all parties, but also where it would be most effective. In addition, it is important to take stock of institutional arrangements such as conflicting and complementary protected area mandates and similar or complementary management strategies and frameworks.

It is also often effective to take small steps toward cooperation, and practical steps, to start. These may address cooperation within, as well as beyond, park boundaries, and projects to address regional, as well as protected areas, concerns. Formalization can aid commitment and recognition at higher institutional levels, up to and including international protected area designations. While formalization of cooperative efforts of various kinds can be contentious, ultimately (although certainly not always initially) there are good reasons to consider it necessary if cooperation is going to move beyond simple levels (e.g. regular communication). The reasons are many, but include regularly changing staff (and therefore a frequent "start-over" period) and the increasing time demands of management (which mean things that don't *have* to get done are made nonpriorities). Essentially, formalization shows commitment to transboundary cooperation, illustrates that it is a high priority, and thus encourages broad, active support of TBPA initiatives.

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Cross Border Partnerships in Protected Areas Management: Northwestern Ontario – Eastern Manitoba

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Abstract

Discussions of cross-border partnerships typically refer to partnerships that cross administrative boundaries such as provincial and international borders and the inside/outside of park borders. Equally important in the planning and management of protected areas in Ontario, however, is the crossing of cultural borders – especially those shared with First Nations. This paper describes three examples – the proposed Manitoba–Ontario Interprovincial Wilderness Area, the proposed UNESCO World Heritage Site Pimachiowin–Aki and the Pikangikum First Nation–Ontario Parks Partnership in Innovation and Opportunity. Each of these involves crossing borders of provinces and of cultures. A range of processes, opportunities, challenges and benefits are discussed in each case. Together, they illustrate the potential for collaboration and respect to facilitate the protection of natural and cultural heritage.

Introduction

When hearing the term *cross border*, one usually pictures an administrative boundary of some kind – one that is easily depicted on a map. Provincial boundaries, regulated protected area boundaries and international boundaries are ones that quickly come to mind. When crossing these borders, one understands that different rules may apply, ranging from permit fees in provincial parks to speed limits on Provincial highways. Another cross border situation that cannot be as easily identified – especially on a map – is that of a cultural border. When crossing cultural borders, different rules or protocols also exist. Learning, respecting and practicing these protocols is integral to furthering a relationship or entering into a partnership.

This paper introduces three cross border protected area partnerships: 1) Manitoba – Ontario Interprovincial Wilderness Area; 2) Pimachiowin – Aki, a proposed UNESCO World Heritage Site; and 3) Partnership in Innovation and Opportunity – Pikangikum First Nation – Ontario Parks.

In these three examples, relationships are formed between Provincial and First Nations Governments resulting in partnerships crossing Provincial and cultural borders.

Manitoba – Ontario Interprovincial Wilderness Area

Manitoba and Ontario share a common border and have contiguous regulated parklands in Atikaki (1985), South Atikaki (2005), Nopiming (1976), and Woodland Caribou Provincial Parks (1983). Along side these protected areas are five additional protected lands, including the four recommended park additions to Woodland Caribou Provincial Park and the Eagle - Snowshoe Conservation Reserve, both in Ontario (Figure 1). In total this area will represent an immense area of natural, cultural and wilderness value encompassing more than one million hectares.

In recognition of the national and international ecological importance of this boreal wilderness area, and with the intent of enhancing park management opportunities, the Ontario Ministry of Natural Resources and Manitoba Conservation propose to establish an interprovincial wilderness area encompassing the aforementioned protected areas with the strong possibility of adding adjacent protected areas in the future. The two provincial government departments are committed to work together to conserve the ecological integrity of the area while respecting and maintaining their separate jurisdictions. In creating and co-operatively managing this cluster of parks and wilderness lands as a single land mass, conservation of an integral part of Canada's central boreal uplands would be strengthened now and in the future.

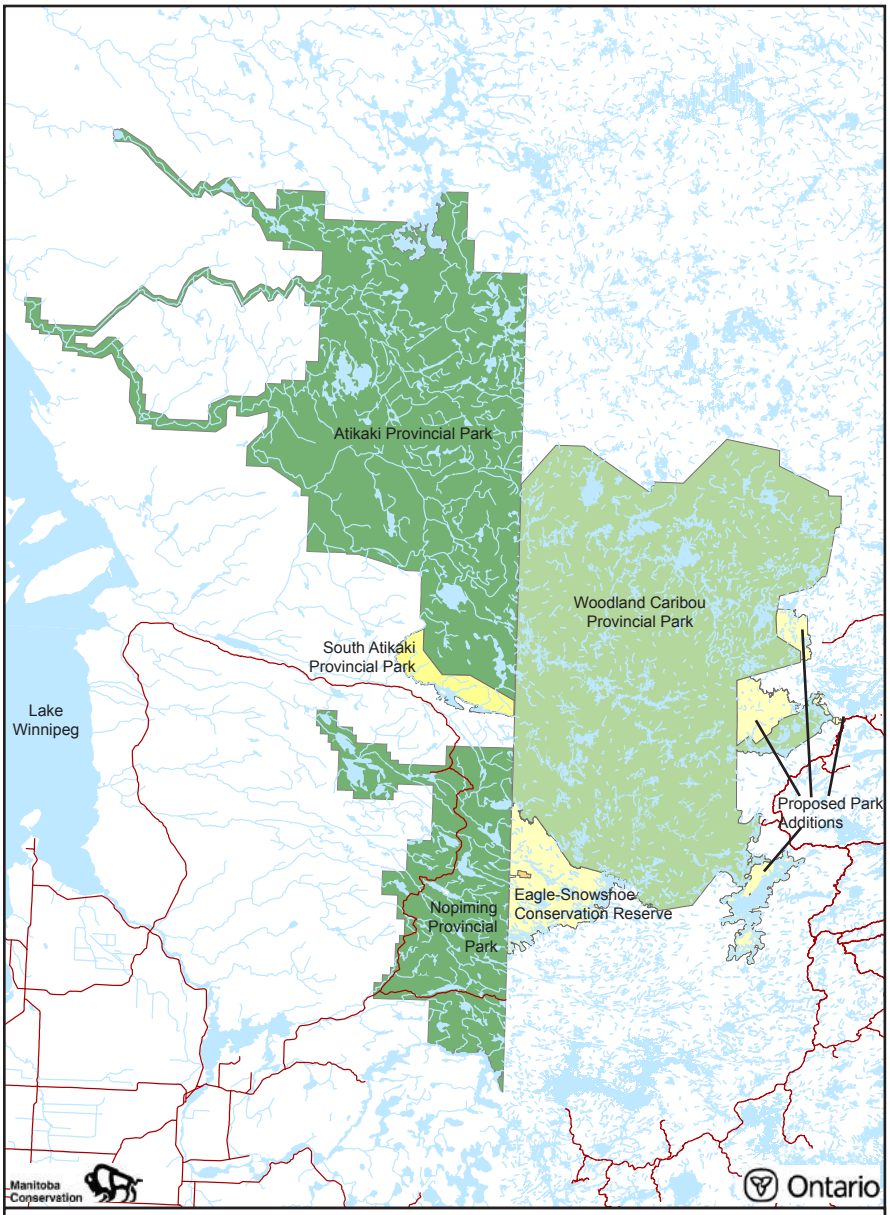
Other protected area initiatives by First Nations in this region may partner with the Interprovincial Wilderness Area in the future. This would further strengthen the possibilities. Both provinces are open to new partnership models.

Manitoba Conservation and the Ontario Ministry of Natural Resources foresee many benefits to be obtained from cooperation in the management of the proposed Interprovincial Wilderness Area. Benefits could include better service to visitors, greater efficiency in the delivery of services, improved conservation efforts, and improved relations with First Nations and with stakeholders and interest groups. At this time, identified areas of co-operation include research, resource management (fire/vegetation management, enforcement, wildlife and fisheries), recreation management (manage for high quality recreational opportunities) and marketing (Bloodvein Canadian Heritage River).

Both governments recognize that the proposed wilderness area is linked with traditional territory and use by First Nations in both provinces. Similarly, many stakeholders such as lodges, outfitters, canoeists, eco-tourists, and others, have various interests in the area. Input and partnerships with First Nations and stakeholders would serve to strengthen decision making and management initiatives.

The following sections sketch out potential benefits that could be realized through the proposed wilderness area.

Figure 1. Proposed Interprovincial Wilderness Area (2003)



Source of Information:
Ontario data is derived from the Natural Resource Values Information System, which is compiled from field survey data, historical records, stakeholder information, reports from public, and from other ministries. Manitoba data and logo were supplied by Manitoba conservation.

Research

Cooperative management of the proposed interprovincial wilderness area would help to realize some of the research potential of the area. The proposed interprovincial wilderness area offers a large pristine wilderness of diverse and impressive flora, fauna, waterways and cultural heritage. This setting could provide a control area for studies wishing to look at how the natural world functions over a landscape unaltered by industrial development.

On-going research is currently being conducted on woodland caribou in both provinces. Inter-jurisdictional research on this nationally threatened species is seen as a key benefit of cooperation in the proposed area. Groups of woodland caribou regularly migrate, unhindered, across this landscape. Opportunities for research beyond provincial borders would be beneficial towards better understanding and protection of this species.

Future research would complement existing initiatives such as Ontario's Woodland Caribou Recovery Strategy and Manitoba's Woodland Caribou Management & Research Strategy.

Research is also being conducted through user surveys of canoeists in both provinces. Blending these efforts would be beneficial, especially in cases where there are shared watercourses.

Research on lake sturgeon has been conducted on the Bloodvein and Pigeon Rivers. The Taiga Biological Station, located in the South Atikaki Park Reserve, is a research field station of the Department of Zoology, University of Manitoba, dedicated to the study of the ecology of the northern boreal forest. Opportunities for cooperative research with outside agencies such as this and with other government departments in both provinces would be further explored.

Resource Management

Cooperating on resource management would be a key benefit of the Interprovincial Wilderness Area. It is recognized that the wildlife of these protected areas know no provincial boundaries, and need to be considered in the context of their entire range.

The opportunity to enhance cooperative fire management regimes in the two provinces is seen as a benefit of this interprovincial partnership. Personnel from each province could more easily communicate with their counterparts on fire management and movement. Each province has different levels of suppression priority where burning is allowed to sustain ecosystems or where fire is fought to protect infrastructure and values. A working understanding of each province's fire suppression practices would also be beneficial in managing habitat requirements for species such as woodland caribou.

A boundary waters agreement currently exists whereby each province's natural resources/conservation officers cooperate on fishing regulations on

specific border lakes. This agreement could be extended to other water bodies and the possibility of transboundary privileges and joint patrols could be further pursued.

Marketing

Realization of an interprovincial wilderness area would help to raise the profile of this environmentally vital boreal region of Canada and its recreational potential. Shared marketing would further the potential for growth in eco-tourism and adventure tourism. Increased economic opportunities associated with heightened interest and visitation in the region would likely occur. New economic opportunities could be managed to directly and indirectly benefit surrounding communities. Joint marketing initiatives tied to establishment of the new interprovincial wilderness area could be considered and, where appropriate, pursued.

Management of Recreational Opportunities

The interprovincial area boasts active and successful fly-in lodge and outfitting operations that bring thousands of visitors to the area each year to pursue outdoor activities. Thousands more come into the region on their own for wilderness canoeing experiences, frequently traveling between the provinces on connecting waterways. Visitors to the region share a common interest in seeking a pristine wilderness environment and an escape from the rigors of their modern lives.

The area is seen as having enormous potential for growth in adventure travel, eco-tourism and eco-cultural tourism. As environmental protection is paramount, great effort must be made through planning initiatives to anticipate growth in protected area use and to manage accordingly.

To ensure visitor expectations of a wilderness experience are met, the possibility of providing compatible management direction in both provinces should be examined. Canoe route designation and maintenance, examination of visitor capacities and quotas, registration fees, no-trace camping regulations and standardized information and mapping are areas that would be explored through a coordinated and consistent interprovincial approach.

Current Management Status and Next Steps

Introduction of the interprovincial initiative occurred at the Canadian Parks Council annual meeting in February 2003. Manitoba and Ontario committed to commence consultation on the initiative through their respective planning processes in Atikaki and Woodland Caribou Provincial Parks. These consultations have been gauging support for the interprovincial concept and will determine which of the park lands and protected areas should be included in the proposed interprovincial wilderness area.

In Manitoba, the Atikaki Provincial Park and Bloodvein Canadian Heritage River Management Plan is currently in its final phase of approvals. Nopiming

Provincial Park is operating under Interim Management Guidelines (1988) and South Atikaki Provincial Park has recently been regulated. In Ontario, the Woodland Caribou Signature Site Strategy is entering its preliminary stage where presentation of the preliminary park management plan for Woodland Caribou Provincial Park and the recommended park additions and the draft resource management plan for the Eagle Snowshoe Conservation Reserve will be released soon.

Boreal wilderness areas of rugged shield and wild rivers are perhaps Canada's greatest and most identifiable natural heritage. Enhanced protection and management of a large pristine wilderness area would provide a living legacy to Canadians and an example to the world of this country's commitment to conservation.

Pimachiowin Aki Proposed World Heritage Site

The second example involves crossing jurisdictional as well as cultural borders. The Pimachiowin Aki proposed World Heritage Site is a partnership between the provinces of Manitoba and Ontario and the Accord First Nations of Pikangikum, Poplar River, Pauingassi, Little Grand Rapids and Bloodvein River. This site has been recognized as internationally significant by the World Conservation Union (IUCN) because of the planned integration of traditional and western ecological knowledge for land management and protection (IUCN 2004).

Translated, Pimachiowin Aki means *the land that sustains us* or *the land that gives us life*. The area will be protected as an Anishinabe cultural landscape. This designation will ensure that the Anishinabe who live there will benefit from sustainable economic activities that support their survival as a people, increase their well-being and maintain the ecological health of the land. It will also benefit Manitoba and northwestern Ontario because it will generate jobs, tourism and suitable developments that will help all Canadians enjoy this area (Alex Peters, Pikangikum, pers. comm.).

In 2002, Pikangikum, Poplar River, Pauingassi, Little Grand Rapids and Bloodvein River First Nations signed the Protected Areas and First Nation Stewardship Accord which committed them to a cooperative effort to protect and manage their traditional lands according to Anishinabe values and land management practices and to seek designation for a series of linked protected areas within their traditional territories as a World Heritage Site. The outstanding value of the area has also been recognized by the governments of Manitoba and Ontario through the creation of two large wilderness parks that straddle the provincial border in the same region – Atikaki Provincial Park in Manitoba and Woodland Caribou Provincial Park in Ontario.

In December 2002 the two provinces and the five Accord First Nations submitted a joint proposal to Parks Canada for inclusion on Canada's tentative list – a list of ten sites that Canada would put forward to UNESCO for World

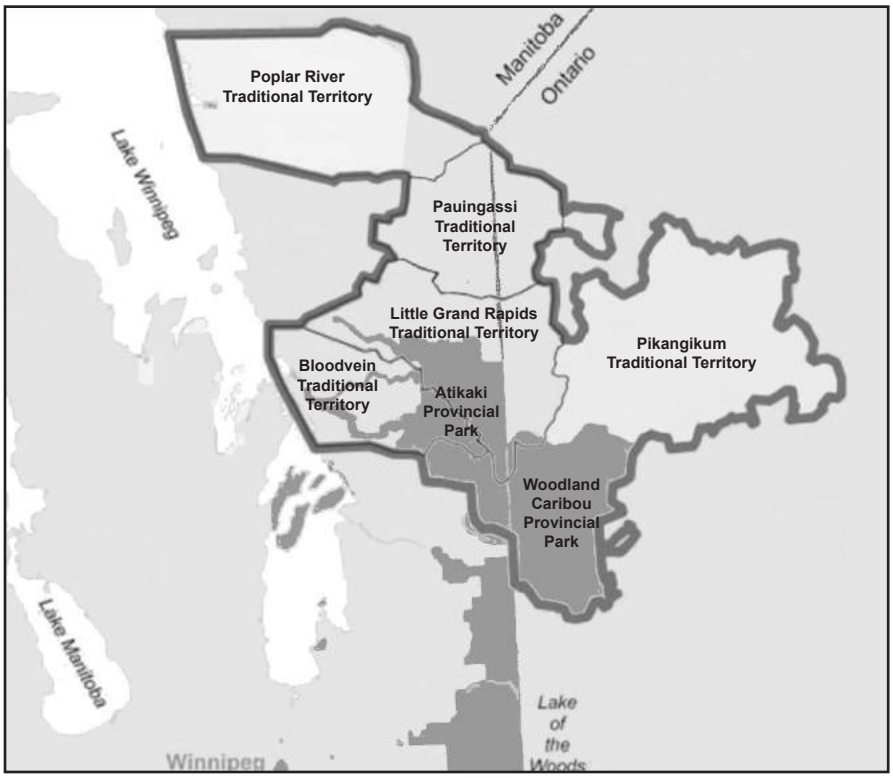
Heritage Site designation over the next decade (Parks Canada 2004). This proposal was one of 125 proposals that Parks Canada had received from provincial and territorial governments.

The area of interest is about 43,000 square kilometres (Figure 2). What is particularly notable is the combination of natural and cultural values that the proposed site will be nominated for. The site represents an outstanding example of traditional lifeways by Aboriginal people and exemplifies a land use that is representative of a culture and human interaction with the environment. It has exceptional natural and scenic values, with wild rivers and extensive undisturbed forests, lakes and wetlands. The region represents critical habitat for several threatened or endangered species including woodland caribou, bald eagles, and wolverines.

The final boundaries of the proposed World Heritage Site will be one of the outcomes of community-based land use planning and public consultations.

The project has already generated considerable international interest as it will fill an identified gap in the World Heritage Site system of protected areas. At the Boreal Zone Workshop in St. Petersburg, Russia in October 2003 the

Figure 2. World Heritage Site Planning Area



IUCN stated:

> *This site is remarkable because of the existence of diverse and significant boreal forest values including woodland caribou and migratory bird populations in an ecologically intact cultural landscape and extensive intact boreal land and water ecosystem with system of lakes, rivers and wetlands. It fills an important gap by representing the Canadian boreal shield ecozone. This site is also internationally significant because of the planned integration of traditional and western ecological knowledge for land management and protection. The agreement between the First Nations in whose traditional territory this site is located is precedent setting (IUCN 2004:6).*

The Partnership

To advance the nomination, the five Accord First Nations and the provinces of Manitoba and Ontario have formed a partnership known as the World Heritage Site Assembly. The partnership acknowledges that although ownership of the land will not change, each jurisdiction will be responsible for planning and management in its area and that aboriginal and treaty rights will remain fully protected.

Since its inception in late 2004, the Assembly has met four times and has established a number of working groups and committees to assist in preparing the nomination. Preparations for the nomination are expected to take five years to complete. This will include significant community-based land use planning to identify and document significant elements of the site (such as sacred sites or archaeological sites of special significance), determine appropriate land uses for different areas, finalize the site boundaries, develop and implement comprehensive land management plans, conduct an international comparative analysis and engage in public participation processes. A name for the site is pending. A challenge that has developed into a benefit has been the hurdle of language – initially perceived as something that would require patience on both sides, which has resulted in the development of increased cross cultural awareness.

Innovation and Opportunity Partnership: Ontario Parks and Pikangikum First Nation

The Innovation and Opportunity partnership between Ontario Parks and Pikangikum First Nation is focused primarily on research, interpretation and education opportunities in the Pikangikum Area of Interest within Woodland Caribou Provincial Park. This agreement has resulted in the birth of a closer and more effective working relationship between the two partners and is another example of cross-cultural, cross-jurisdictional partnership.

Woodland Caribou Provincial Park is located in the heart of Canada's Precambrian Shield. It adjoins the Whitefeather Forest Planning Area where

Pikangikum First Nation people are engaging in community-based land use planning to establish new livelihood opportunities, including those related to protected areas that will be established within the Whitefeather Forest Planning Area (Whitefeather Forest Management Corporation 2003). The Ontario Ministry of Natural Resources is developing a Park Management Plan for Woodland Caribou Provincial Park. A component of the plan will explore opportunities and enable mechanisms to address First Nations interests within Woodland Caribou Provincial Park.

Northern Woodland Caribou Provincial Park (Pikangikum Area of Interest) and the Whitefeather Forest Planning Area encompass an expansive, mostly un-roaded mosaic in the central boreal highlands. The range of biophysical features on this landscape includes extensive river networks and lakes as well as vast forests, muskeg wetlands and fens. The scale of the landscape offers the potential for world-class protected area learning and tourism opportunities that feature the culture, history and Indigenous Knowledge tradition of Pikangikum First Nation people. The region lies in the sub-arctic headlands of the Hudson's Bay watershed.

The northern region of Woodland Caribou Provincial Park (Pikangikum Area of Interest) together with the Whitefeather Forest Planning Area, constitute lands that have been occupied by Pikangikum people since "time immemorial". Pikangikum people still have traplines that extend into Woodland Caribou Provincial Park. Some of the other non-native traplines in the park are lands where at one time Pikangikum people trapped and hunted.

Northern Woodland Caribou Provincial Park (Pikangikum Area of Interest), together with the Whitefeather Forest Planning Area, constitutes an indigenous cultural landscape: a "geographical area that has been modified, influenced, or given special cultural meaning by people" (Parks Canada 1994: 119). The indigenous heritage resources within this landscape, and especially within northern Woodland Caribou Park, are expansive. They represent a vital aspect of the prehistoric, historic and contemporary cultural legacy of Pikangikum First Nation people and their ancestors in the boreal forest and Canadian Shield. The high density of undisturbed archaeological and cultural sites confirms a high level of occupancy by Aboriginal people who have continued to occupy the area for the last 6,000 years. Of particular significance are the numerous high-quality rock art (pictograph) sites. Of additional particular interest are ecologically rich sites such as planted Manomin fields within the landscape. These complement the other heritage resources found there. The Bloodvein and Berens Rivers served as important fur trade routes. Remnant trading post sites still exist in the area.

Much of Woodland Caribou Park and the Whitefeather Forest Planning Area represent what the United Nations calls the "combined works of nature and man".

Not only do the pictographs on the Bloodvein River come from the culture of Pikangikum people but members from the First Nation are buried in the northern reaches of the park and the Whitefeather Forest Planning Area. They made the channels (*dawaapakinigeh*) that allow passage through many locations on rivers and creeks without the necessity of portaging. They made the fish trap sites (*pinjiiboonaagan*) along rivers and streams that allowed them to keep their fish very "fresh" – alive – all through the winter. They have planted Manomin (wild rice) in lakes throughout the landscape, including within Woodland Caribou Park, right up to the 1970's, when they planted Prairie Lake.

Woodland Caribou Provincial Park has been declared a "Signature Site" through Ontario's Living Legacy – Land Use Strategy. Signature Sites have a special significance within Ontario's Living Legacy protected areas initiative. Including contemporary First Nation's people will enhance this vision. To this day, one thing has remained: an indigenous presence of Pikangikum people on the landscape now called Woodland Caribou Provincial Park. A rich potential exists to develop Woodland Caribou Provincial Park as a "world class" landscape through the full partnership of First Nation communities.

This Agreement represents the initiation of a mutually enriching partnership agreement between Pikangikum First Nation and Ontario Parks. It incorporates a vision of renewal, collaboration, partnerships, consensus-based decision-making, respect for people from different cultures and respect for the land. The core of this vision is mutually enriching dialogue and learning between cultures. This dialogue and learning will celebrate the richness and vitality of the Indigenous Knowledge tradition of Pikangikum First Nation. It will be expressed in the form of collaboration and partnership to facilitate the interpretation of the indigenous cultural heritage of Pikangikum people in the area.

Pikangikum people would like to participate in developing the potential of Woodland Caribou Provincial Park by focusing on their aboriginal pre-historic, historic and contemporary culture within their traditional territories. Theirs is a culture that reaches backwards in unbroken continuity to a rich aboriginal history and forward to their future as a First Nation community.

The shared vision of Pikangikum and Ontario Parks is one of partnership to ensure the protection of this landscape. This partnership will be in keeping with the core values and principles of the culture and way of life of Pikangikum people on the land working harmoniously with the responsibilities of Ontario with respect to the land base. This partnership will dramatically enrich the experience of visitors and others wanting to learn about the landscape.

Summary

Partnership and relationship are two words that are used frequently in today's cooperative language. But in order for these words to have true value, another

word lurks in the background and is the cornerstone of any partnership or relationship. That word is respect. Whether the relationship or partnership you are building is with a First Nation government, a First Nation Community, an elder or a Provincial government, respect for those partners past, present and future is integral for the partnership to succeed.

Ontario Parks and Woodland Caribou Provincial Park specifically are involved in three very exciting partnerships where relationships are being carefully built to stand the test of time.

Acknowledgements

I would like to acknowledge all of the partners mentioned in the above illustrations; Pikangikum First Nation, Bloodvein River First Nation, Little Grand Rapids First Nation, Pauingassi First Nation, Poplar River First Nation and Manitoba Conservation, Province of Manitoba for their part in the aforementioned initiatives. I would also like to pay specific attention to the Elders of each First Nation community for their interest in teaching, sharing and learning while these initiatives move along and the partnerships and relationships develop. Specifically to the Elders of Pikangikum whom, as a result of simple geography, I have the most regular contact with, I am very thankful for their hospitality, patience and understanding as we move forward towards our common objective.

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Walking on Water: Meeting challenges on an international waterway

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Abstract

International rivers pose exceptional challenges to resource management that – if approached creatively – can result in effective solutions in conservation, use and development. A simple, low-cost process is applied on the St. Croix International Waterway that separates and yet links the Province of New Brunswick and the State of Maine for over 180 kilometers. Cross-border examples in land protection, heritage conservation, recreational management and tourism will illustrate this approach.

An international setting

The St. Croix watershed is located on the eastern seaboard of North America, draining an area of 4188 km^2 of which 60% lies in the State of Maine (USA) and 40% in the Province of New Brunswick (Canada).

From source to sea, the Canada/US boundary runs the full length of this system, a total of 180 km through some of the region's largest lakes, a river corridor renown for its 'backcountry' canoe experience and a 25 km estuary where tides rise and fall more than 7 meters twice daily. Nationally significant natural, recreational and cultural resources have merited the New Brunswick side of the system's designation as one of the country's 39 Canadian Heritage Rivers. For similar reasons, many of the river and lake waters on the Maine side hold state 'Outstanding' status.

While the St. Croix is an important resource shared by the people and interests of both countries, the international boundary that runs along it sunders perspectives, politics, law, planning, management – even time zone and currency – at mid-channel.

To help to address the management difficulties this creates, in 1986 the Province of New Brunswick and State of Maine entered into an agreement, supported by mutual legislation, to form a small commission to bring together governments, municipalities, landowners and users to create a shared vision for the international waterway, and guide these interests in working together to achieve this plan. The process had to be both local and international, and work at each level.

The St. Croix International Waterway Commission was formed in late 1988 and was given 18 months to produce a cooperative Management Plan for the international corridor. It did so through consultations with 58 government agencies (Canada, United States, Maine and New Brunswick), 25 municipalities and rural advisory councils, over 2100 waterfront landowners and a wide range of recreational and business interests.

The Plan was completed in 1990 and, after a three-year trial, was adopted by the New Brunswick and Maine governments in 1994. Its 22 policies and 68 supporting actions address environmental quality, natural resources, heritage, recreation, economic development and management coordination.

An indication of the Plan's success is that while it is an entirely *voluntary* plan, governments and local interests have worked together across an international border to make significant progress on 21 of its 22 policies. Action on the last – updating the Plan – is scheduled for late 2006.

So how do we do it?

Critical elements of international management

The Commission relies on four key elements of effective transboundary management.

The first is law. The legal and policy frameworks in each jurisdiction – in this case federal (Canada and U.S.), provincial and state – set the ground rules for what is reasonably possible in each sector of a transboundary setting. These regulatory "tool boxes" are very different and must be understood thoroughly, and often used creatively, to achieve common goals by uncommon means.

The second is people. The St. Croix Plan has moved forward, voluntarily, because people want it to. These individuals are in legislatures, government departments, businesses, shorefront homes and boats on the water. People, not entities, make decisions and these have been directly sought out, engaged and appreciated for their efforts.

The third is resources. While money is a logical consideration, there is no direct funding for the St. Croix Plan. The Commission diligently seeks out various sources of direct and in-kind support to 'cobble together' initiatives that have minimal, usually short-term, cost to any single jurisdiction or interest. In doing so it has, to a large extent, cushioned the Plan's implementation from the effects of government budget shifts and recessions. A great deal can be done with very little, when everybody participates.

The fourth is coordination. The Commission's primary role is to bring interests together to achieve mutual goals. Its 'borderless' ability to relate to, and understand, all parties enables it to serve as a key facilitator, translator (oh, the acronyms!) and catalyst, without which the international barriers to communication and action would be difficult to overcome.

Examples: parks, protected areas and heritage tourism

The examples below briefly illustrate the St. Croix process in action. Further details, plus examples in a broader range of fields, are available from the Commission.

Establishing a transboundary protected area

One of the most ambitious policies of the St. Croix Management Plan called for the permanent protection of the forested shores along nearly 90 km of waterway, on Spednic Lake and the upper St. Croix River. These contain the greatest concentration of the St. Croix's rare or threatened natural resources and form an internationally-renown backcountry recreation area.

In 1991, 90% of these shorelands were privately owned and 78% lacked any protection from future development. Over a 14-year period, state and provincial governments, land trusts, conservation groups, foundations and willing sellers collaborated – often in innovative ways on their own sides of the border – to protect this international corridor, one piece at a time.

Now, 93% of this special area – over 284km of shorefront and 270km^2 of backland – is permanently protected through conservation ownership or easement, and these efforts are ongoing. New Brunswick has designated 259km^2 of its acquired lands along Spednic Lake as one of 11 Protected Natural Areas that address the province's longterm commitment to biodiversity.

Elsewhere along the waterway, the Commission has formed partnerships to protect six additional Maine and New Brunswick properties – a total of 1134 hectares – that have prime natural resource and public access value.

Law (property or easement purchase) and people (a remarkably diverse and persistent assemblage of committed individuals inside and outside of government) came into play along national lines to make this protection possible. The funding – nearly $100 million – came in large and small amounts ranging from one-time government appropriations to school kids' pocket change. The common thread was the Plan's vision of permanently protected lands in critical locations, this achieved through efforts that were facilitated by the Commission.

Protecting shoreland

Outside of the Spednic Lake/Upper River segment, residents also made it clear in the Plan that they wanted to see green shores and development co-exist in order to preserve the visual character and environmental quality of the St. Croix region.

Maine already had legislation to ensure this, through statewide shoreland zoning regulations that require building setbacks and the retention of shoreland vegetation, but New Brunswick had no established legal mechanism to do so.

Crafting new, precedent-setting provincial legislation for the St. Croix could be problematic. Instead, New Brunswick made creative use of existing law (its Community Planning Act) to create a special rural planning area for the St. Croix boundary corridor and establish, just for this corridor, a shoreland zoning regulation similar to Maine's. During development, this regulation went through extensive public consultation – itself an unusual step – and received strong landowner support. The two New Brunswick municipalities within the boundary corridor were encouraged to incorporate similar provisions into their municipal plans and one of these did.

As a result, New Brunswick and Maine now have similar protection requirements for their facing St. Croix international shorelines. Compatible requirements for surface water quality will be in place shortly.

Managing park land

While New Brunswick and Maine do not operate formal parks along the boundary corridor, they do have a shared interest in managing outdoor recreation, especially the estimated 7000 canoeists who paddle and often camp along the upper sections of the St. Croix annually.

In the mid 1990s, New Brunswick briefly considered creating a linear park on the St. Croix but chose to forego this concept (it owned little shoreland at the time) in favor of a "virtual park" for which a budget was provided to maintain a series of 40 access sites (remote campsites, drive-in use sites and boat/canoe launches) on land the province either owned or had the landowner's permission to use.

On the Maine side, traditional campsites existed on private land but were not maintained and, as user levels rose, experienced a decline in quality. In the early 1990s, the Commission leased ten key sites from the landowner (a timber company) and solicited contributions and volunteer labor to maintain them for a decade until the State acquired the shorelands and established a small budget for campsite care.

The Commission now delivers both the New Brunswick and Maine "virtual park" programs along the St. Croix's international waters, using a single maintenance crew and a single policy for site design and maintenance, which aligns with and supports the international waterway Plan.

Heritage tourism

An island in the St. Croix estuary was the site of one of the earliest European settlements in North America, established in 1604 by French colonists who named the island and river "Sainte Croix". This colony resulted in the French exploration and settlement of a large part of the continent and a French heritage that remains an integral part of North America's cultural identity today. The island is uniquely honored as the only International Historic Site shared by the

United States and Canada.

The St. Croix's New Brunswick and Maine communities – now entirely English-speaking – were challenged to host the 400th anniversary of this exceptional colony in 2004. To do so, they needed to work across an international border in new ways to commemorate a heritage and a language that were no longer part of their local identity.

The Commission facilitated this process, beginning with a major planning workshop in 1995 and continuing with a decade of support for a transboundary committee of agencies and local interests.

This committee solicited grants and contracts from a variety of sources in both countries to deliver ten days of events in June 2004 that were attended by heads of state, senior government delegations and over 47,000 visitors. The committee also worked with governments to commemorate the anniversary on a wider scale through educational activities, stamps, minted currency and special publications. And it gave overdue recognition to the role of aboriginal people in aiding the French to adapt to a new world, even delivering its programming in three languages: English, French and tribal Passamaquoddy.

This legacy is being preserved. The US and Canadian governments have installed new interpretive facilities facing the island, a permanent exhibit has been opened in a new Downeast Heritage Center, and an educational curriculum has been developed and placed in 200 schools across New Brunswick and Maine. All of these will yield tourism benefits to the area.

The cross-border partnerships and experience gained from this event are now being applied to other economic initiatives.

Into the future

Management collaboration along the international St. Croix is an on-going process, guided by a shared plan and small commission. A wide variety of interests are working together across the border to protect resources, support the local economy, provide recreational opportunities, honor heritage, and develop sustainably with all of these in mind.

Always, this relies on law, resources, people and coordination – and the greatest of these is people.

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Conserving the Natural and Cultural Heritage of the Niagara River

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Abstract

The Niagara Parks Commission (NPC) is an agency of Ontario Ministry of Tourism. Since 1885, NPC has served as guardian over Canadian parklands extending along Niagara River from Lake Erie to Lake Ontario (1,720ha). Our mission then, as now, is to preserve and enhance the natural beauty of the Falls and Niagara River corridor for the enjoyment of visitors, while maintaining financial self-sufficiency. Historically, glaciation left its mark on the area in a major and magnificent manner. These include Niagara Falls and adjacent moraine as well as Queenston portion of Niagara Escarpment (part of World Biosphere) and Niagara Glen (Area of Natural and Scientific Interest). Whether through public nature interpretation and conservation or infrastructure projects (e.g. roads, buildings, attractions) our proximity to these unique and diverse features forms a necessary part of NPC policy and decision-making. Recently, a Natural Heritage Program was developed at NPC which addresses flora and fauna on an eco-system basis. For example, local landscape and other planning must not only be undertaken as a horticultural phenomenon tied to biological constraints such as plants and animals, but also as a physical component of the landscape having height, volume, texture, color and functional ties with soil, water, air and land use practices. NPC has recently undertaken a number of successful "greening" initiatives, together with a number of partners, which reflect this approach. A parallel commitment to Cultural Heritage has been undertaken to guide present and future actions. These cultural resources (including many important sites from the War of 1812), like the natural heritage of the Niagara River, are held in trust and protected so that present and future generations may enjoy, experience and benefit from them. Beyond these NPC activities, cooperative region-based mechanisms are emerging for Canada/US celebration of 200 years of peace following the War of 1812, addressing cross-border issues, conservation and more.

Conserving the Natural and Cultural Heritage of Niagara River

When first established in 1885, by an Act of the Ontario Provincial Legislature, The Niagara Parks Commission (NPC) was comprised of the immediate area surrounding the Falls (on the Canadian side) totaling 62.2 hectares (154 acres). The Commission now maintains approximately 1,720 hectares (4,250 acres) of parkland stretching the length of Niagara River from Fort Erie to Niagara-on-the-Lake, with no cost to the taxpayer.

The Chairman of the NCP reports to the Ontario Minister of Tourism. Commissioners are appointed by the Province and area municipalities to determine policy and direction for the Commission. Because NPC receives no government financing, revenues to support the park resources are acquired through the operation of gift shops, golf courses, restaurants, attractions, parking lots and rentals. In this, we operate in a manner similar to a private business. The resources, including many important sites from the War of 1812, are held in trust and protected so that present and future generations may enjoy, experience and benefit from them.

Beyond NPC activities, cooperative region-based meetings have begun with respect to the coordination and planning of Canada/US celebration of 200 years of peace and prosperity following the War of 1812, addressing cross-border issues, conservation and more.

Economics

In 2005, NPC had an operational profit of approximately $3.1 million, slightly less than that earned in 2004, $3.7 million. Despite some of the best weather conditions in several years, NPC's 2005 tourism season was one of unrealized expectations. This can be partly explained by a large decrease in American visitors. Increased security concerns, the misunderstood need for a passport, a weakened U.S. economy, a strong Canadian dollar, rising fuel costs, and lowered consumer confidence have all had an influence. One bright spot is increased international visitation, from Europe and Japan.

In 2005, NPC spent over $10 million on infrastructure renewal. Projects included updating restaurant and retail areas, a bridge reconstruction, as well as significant Parkway road resurfacing. Locally, consultations continue on what is known as the People Mover Project: a tourist district transportation system. The project is co-chaired by the City of Niagara Falls and The Niagara Parks Commission and is to address traffic and parking concerns in the tourist district in and around the Falls.

Niagara Parks historically has a relationship with power generation, granting franchise for power plants in return for revenue to support the parks. As older stations have been or are soon to be decommissioned and transferred, there is an urgent need to address their future from cultural, environmental and

economic perspectives. Discussions and planning has begun on the pending transfer of these decommissioned facilities to NPC.

Nature

Niagara Parks' environmental commitment includes a comprehensive program of stewardship and environmental accountability founded on the principles of conservation, restoration, preservation, education, innovation and environmental management. Our goal is to improve environmental quality and sustainable development throughout our park system for the benefit of our visitors, employees and our associates. In pursuit of this environmental goal, alliances and partnerships continue to be undertaken as appropriate. It was through such an alliance – with the Ontario Ministry of the Environment – that our environmental mission statement was developed.

Environmental Mission Statement

Niagara Parks has committed to incorporating environmental sensitivity into operations and practices by:

- Partnering with the public and private sector to undertake specific projects that sustain and improve the environmental quality of our lands.
- Implementing plans aimed at greening the park, fostering projects such as *Project Green Initiative*, focused on the preservation and enhancement of existing important natural features
- Complying with applicable environmental laws and regulations
- Developing, implementing and maintaining policies, procedures and systems which assist in managing our operations with a view to protecting the environment and achieving improvements.
- Using, wherever practically and economically viable, best available technology and practices to benefit the environment.
- Actively participating in an integrated waste management system which reuses, reduces and recycles materials.
- Fostering education throughout our parks about our commitment to the environment and sound environmental practices.
- Educating, training and motivating employees to conduct activities in an environmentally responsible manner.
- Ensuring water conservation is a vital component of planning
- Actively participating in the *Green Links* program at our golf facilities (a comprehensive program aimed at improving environmental management practices)
- Providing and promoting leadership in the areas of environmental protection, management and sustainability.

Landscape, preservation and restoration

Glaciation and geology play a major role in the local topography. Elevation differences between the River and surrounding riparian habitats range from a

few metres or feet to more than 100 metres (300 feet) at Queenston on the brink of the Niagara Escarpment. NPC is responsible for 56 kilometres (35 miles) of riparian (shoreline) habitat along the Canadian side of the Niagara River, and other riparian lands along both sides of many smaller rivers, creeks and man-made watercourses that flow into the Niagara River. With over 600 individual properties making up the whole of the Park, it is a challenging responsibility to manage all of these habitats. Our activities must promote clean water, mitigate stream-side soil or bank erosion, and enhance biodiversity of native plant and animal populations, all while trying to maintain the historic cultural integrity co-existing with a large human population and millions of tourists visiting each year. Examples of these activities are described below, illustrating some of the partnership approaches that are applied.

Pilot Programs and Projects

Sometimes the use of pesticides is involved to ensure plants at NPC are kept healthy. For many years, NPC has had a plant health care program using least toxic products and non-chemical alternatives as part of an integrated pest management program (IPM). Niagara Parks Botanical Gardens has also undertaken a trial program of EBPM, Ecological Based Pest Management, which involves balances in systems and no use of pesticides. More research is needed in this area.

Ecological preservation and restoration through multiple community partnerships are aligned with Niagara Parks' Natural Heritage Resources Management Policy. Pilot projects to restore riparian (shoreline) habitat along the entire length of the Niagara River are being undertaken, such as at Paradise Grove in Niagara-on-the-Lake, Ussher's Creek along the Legends Golf Complex, and most recently Memorial Grove in Fort Erie.

Niagara Glen is a spectacular natural landscape and an Area of Natural and Scientific Interest. Increasing human impacts on Niagara Glen have outpaced what information and education can counteract. It suffers further from invasive species and vandals. Additional data, research and resources are needed. However, a trail management program, and partnerships with Species at Risk recovery teams are making positive impacts.

Frenchman's Creek enters the River near a lane where residents have little appreciation for *Branta canadensis,* Canada Geese. Through a creative partnering, a pilot program with Niagara Peninsula Conservation Authority, a goose deterrent was created, otherwise known as a riparian buffer. Consultation was done home by home and has served as a model for other areas of our river shoreline.

Paradise Grove is a vestige of old growth forest which, in certain areas, has been plagued by invasive exotic species and is now subject of another ongoing program of rehabilitation.

These pilot programs and projects form a platform for the next work to be undertaken. Research and development of a comprehensive land management plan that includes and addresses Niagara Parks' extensive riparian holdings has begun.

Steeply sloped lands immediately adjacent to Niagara Falls at Queen Victoria Park are under increasing pressures from adjacent development. Looking for solutions to the dilemma through a major study and consultation exercise, a management plan and policy were developed and adopted. The priorities include aesthetics and ecological character, slope stability, development setback zones and adjacent development assessment based on land management goals.

Development assessment is based on primary goal satisfaction of ecological diversity, aesthetics and slope stability prior to review of secondary factors of view management, access management, groundwater seepage control and education/interpretation. Given that Niagara Parks does not own nor control the entire slope, it has been through a process of negotiation that such non-NPC lands are being rehabilitated and land management goals being realized.

In 2001, Niagara Parks partnered with the Ontario Ministry of the Environment to launch *Spare the Air* Emissions Reduction Program. This initiative is a positive, voluntary program to reduce idling by encouraging motor coach and truck drivers to turn off their engines when parked. It has resulted in measurable reductions in hazardous air emissions and has been adopted by a number of partners as well as used as a model for other areas.

Using the slogan "*Working in Partnership for a Healthier Environment"*, partners now include: Natural Resources Canada, the City of Niagara Falls, Town of Niagara-on-the-Lake, Town of Fort Erie, The Niagara Falls Bridge Commission, Ontario Power Generation and the Peace Bridge Authority. Endorsed by the Canadian Motor Coach Association, each partner distributes educational flyers and posts signs to remind drivers to "Turn off your engine when parked" rather than implementing by-laws and ticketing.

Growing awareness and participation, combined with support from the Natural Resources Canada - Fleet Smart Program, have resulted in dramatic and positive changes to air quality. In 2004 for example, there were reductions in emissions including less nitrogen oxide, volatile organic compounds and fine particulate matter. The greatest success was achievement of 12,860 less tonnes (14,176 tons) of carbon dioxide. These reductions in emissions were the result of idling periods near the Falls being reduced to less than 5 minutes from an average of 36 minutes for buses and to less than 7 minutes from an average of 19 minutes for trucks.

The recycling and composting programs in our Parks began in the mid-1980's and short-term composting has taken place for even longer. One key initiative is the use of biodegradable plastic and recycling of raincoats at

Journey Behind The Falls, a popular attraction visited by millions of visitors each year. In 2005, 135 metric tonnes (149 tons) of material was recycled. It is believed that further visitor education will be key to expanding our program. Our challenge is to undertake such education with the large number of international and domestic visitors who come to our attractions annually.

At our newest facility, Legends Golf Complex, an environmental plan was developed in keeping with NPC's stewardship mandate. Legends has been certified in environmental planning from the Audubon Cooperative Sanctuary System and our golf staff are now working towards the next level of certification from Audubon.

Pilot projects have been instrumental in showcasing the need for comprehensive land management plans within Niagara Parks. With Brock University's Department of Tourism and Environment just completing a review of these projects, programs and policies, the next step to be completed is a comprehensive land management and riparian habitat plan. Given the level of further support and cooperation with agencies such as Parks Canada and Niagara Peninsula Conservation Authority, next steps will be to meet and consider what exists elsewhere in policy and planning that can be applied to our properties. From there we will identify additional gaps and need for research/ documentation.

Cultural Heritage

In NPC's Heritage Division, inventory, collections management and policy matters are being given priority along with public operations and programming. Much work has been accomplished in the area of policy and in 2005, a needs analysis was undertaken to identify and prioritize requisite maintenance and collections management issues. NPC recognizes that cultural heritage resources are held as a legacy for present and future generations. NPC is committed to protect these cultural resources by law, and endeavours to do so in accordance with the principles of value, public interest, understanding, respect and integrity. NPC properties contain a variety of resources which include such things as buildings, structures, landscapes, monuments and archeological remains associated with history. Interestingly, a major portion of NPC's Heritage Resources is found within its Cultural Landscapes. These landscapes are intimately tied into the public perception of the history and value of NPC's efforts.

In the important area of historic preservation, Niagara Parks has been officially responsible for heritage sites and properties since 1890. It was in that year that NPC's historic stewardship role was initiated, when NPC purchased and agreed to maintain Queenston Heights Park. Queenston is the site where British Commander, General Brock lost his life in battle during the War of 1812. General Brock's Monument (which in 1967 was entrusted to Parks Canada) remains as a testimony to his heroism and marks the site of his interment.

In 1901, Old Fort Erie was the second site added to the heritage inventory and since then several more historic sites and attractions have been obtained, developed and/or maintained by Niagara Parks.

The most recent historical preservation initiative was in 1995, when Niagara Parks assumed control of a War of 1812 battlefield site at Chippawa and its adjoining properties. This was the scene of an historic battle that took place on July 5th, 1814, between about 4000 American, British and Canadian soldiers and their aboriginal allies. By the time the battle was over, more than 800 men lay dead or were wounded in the field now preserved and protected by Niagara Parks. Legends Golf Complex, which is immediately adjacent to the battlefield, provides revenue for this important heritage preservation initiative. The site was otherwise destined for residential development.

Additionally, a number of individuals, organizations, and many levels of government from numerous jurisdictions across Canada and United States have begun planning in preparation for the anniversary of 200 years of peace and prosperity between our two nations. This special War of 1812 Anniversary is truly an opportunity to tell an important North American story through commemoration, celebration and lasting legacies for generations of Canadians, Americans and global visitors for years to come.

With such an opportunity and because so many organizations will be involved from so many jurisdictions, collaborative efforts are being undertaken. The idea is to cooperate in regional efforts, capitalizing on opportunities for coordination, communication and liaison for "a thousand days" of Niagara-based commemoration, celebration and legacy activities within a broader bi-national framework.

There is an old adage, *one step at a time*. Presently Niagara Parks is involved with concurrent development of comprehensive, ongoing planning processes in addition to daily operational matters. Priorities include: ongoing inventories and collections management, as well as refinement of policies, finalization of natural and cultural management plans and additional research to ensure that best practices are employed in all these efforts.

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The Detroit River International Wildlife Refuge: An experience of binational conservation management in the Great Lakes*

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Abstract

The Detroit River International Wildlife Refuge was established as the first international refuge in the US Wildlife Refuge System in 2001. The Refuge includes a range of habitats such as small islands, coastal wetlands, marshes, shoals and riverfront lands along 48 miles of the lower Detroit River and shoreline of the western basin of Lake Erie. The US Fish and Wildlife Service is charged with management responsibilities for the Refuge, to establish partnerships with Canada and local communities and to enter into cooperative land management arrangements with private and public landowners within the Refuge. A Comprehensive Conservation Plan for the Refuge was approved in 2005. Currently over 1200 acres are under management ownership or cooperative arrangements within the Refuge. These efforts are also guided by the shared Conservation Vision for the Lower Detroit River Ecosystem developed by federal, state and provincial agencies in both countries.

Introduction

The Detroit River International Refuge is located along the Lower Detroit River and western shoreline of Lake Erie, in Wayne and Monroe Counties, Michigan (Figure 1). Established by Public Law 107-91 on December 21, 2001, the Refuge is the first international Refuge in North America. The authorized Refuge boundary includes islands, coastal wetlands, marshes, shoals and riverfront lands along 48 miles of the Lower Detroit River and Lake Erie in Michigan. Its location also makes it unique – the Detroit River International Wildlife Refuge is one of only a few Refuges situated in a major metropolitan area.

The Refuge-establishing act designated islands that were once part of Wyandotte National Wildlife Refuge (NWR) – Grassy Island, Mud Island and Mamajuda Island – as part of the new international Refuge. The 18.5-acre Mud Island and 71.5 acres of submerged aquatic shoals were added to

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the Refuge on June 14, 2001. On September 26, 2002, Calf Island, an 11-acre island in the Trenton Channel of the lower Detroit River, was donated for inclusion in the Refuge. The Nature Conservancy purchased the island from

Figure 1. Detroit River International Wildlife Refuge

a private party while several organizations worked in partnership to secure reimbursement funds through a federal North American Wetlands Conservation Act grant. Partners that contributed in-kind matches for this grant included Ducks Unlimited, the Greater Detroit American Heritage River Initiative and Solutia, a chemical industry in Trenton, Michigan. A 152-acre Lake Erie coastal property was purchased from a private landowner on August 18, 2003. This acquisition, using funds from the Migratory Bird Conservation Fund, brings the entire Refuge to 544 acres in size.

On September 25, 2003, the US Fish and Wildlife Service (USFWS) and Detroit Edison Company entered into a cooperative agreement for managing wildlife habitat on over 600 acres of the 1,200-plus acre nuclear facility in Frenchtown Township (Fermi 2). In addition, the U.S. Army Corps of Engineers (Corps) is proposing to transfer a 168-acre parcel of land adjacent to the Pointe Mouillee State Game Area and Estral Beach for inclusion in the Refuge. The Service has accepted a management permit for the site and will be working on the transfer process with the Corps.

On May 19, 2003, Public Law 108-23, the Ottawa National Wildlife Refuge Complex Expansion and Detroit River International Wildlife Refuge Expansion Act, was signed by the President. The Act extends the authorized boundary of the Refuge along the Lake Erie coastline west to I75 and south to the Ohio/ Michigan border. The expansion area encompasses more than 7,500 acres and numerous coastal marshes and sensitive wetlands that would be suitable as part of the Refuge. The Act could eventually result in a string of protected coastal areas extending along the entire Lake Erie Western Basin in Michigan and Ohio. In January 2006 Gard Island in Maumee Bay – at the southern end of the Refuge area – was added to the complex with the signing of a cooperative management agreement with the University of Toledo, Ohio.

The National Wildlife Refuge System

The USFWS manages the National Wildlife Refuge System. The System is a network of more than 500 national wildlife refuges encompassing more than 93 million acres of public land and water. Refuges provide habitat for more than 5,000 species of birds, mammals, fish, and insects. Others were set aside for large mammals such as elk and bison. Most refuges, however, have been created to protect migratory waterfowl. This is a result of the United States' responsibilities under international treaties for migratory bird conservation as well as other legislation, such as the Migratory Bird Conservation Act of 1929. The National Wildlife Refuge System has Refuges along the four major flyways that waterfowl follow from their northern nesting grounds to southern wintering areas.

Refuges also provide unique opportunities for people. When compatible with wildlife and habitat needs, refuges can be used for wildlife-dependent

activities such as hunting, fishing, wildlife observation, photography, environmental education and environmental interpretation. Nationwide, more than 30 million people visited national wildlife refuges in 1997.

Comprehensive Conservation Plan

The comprehensive conservation plan (CCP), identifies the role the Refuge will play in supporting the mission of the National Wildlife Refuge System and provides guidance for Refuge management (Detroit River International Wildlife Refuge, 2005). Several legislative mandates within the National Wildlife Refuge System Improvement Act of 1997 have guided the development of this plan. These mandates include:

- that wildlife has first priority in the management of refuges;
- that wildlife-dependent recreation activities of hunting, fishing, wildlife observation, wildlife photography, environmental education and interpretation are the priority public uses of the National Wildlife Refuge System, these uses will be facilitated when they do not interfere with the ability to fulfill the Refuge's purposes or the mission of the National Wildlife Refuge System; and
- that other uses of the Refuge will only be allowed when they are determined to be appropriate and compatible with the Refuge purposes and mission of the National Wildlife Refuge System.

The CCP will enhance the management of the Detroit River International Wildlife Refuge by several key objectives:

- Providing a clear statement of direction for future management of the Refuge;
- Giving Refuge neighbors, visitors, and the general public an understanding of the Service's management actions on and around the Refuge;
- Ensuring that the Refuge's management actions and programs are consistent with the mandates of the National Wildlife Refuge System;
- Ensuring that Refuge management is consistent with federal, state and county Plans;
- Establishing continuity in Refuge management; and
- Providing a basis for the development of budget requests.

The Detroit River and adjacent portions of the western Lake Erie shoreline have experienced tremendous industrial development within the last 100 years. Widespread pollution, loss of coastal wetlands, and environmental degradation in general became a normal course of events as the Detroit region grew in population and industry. However, along with the coming of a new century, a new attitude toward the river is emerging within local communities.

Beginning in 2000, individuals as well as local, regional, state, and federal agencies in the United States and Canada came together to discuss the future of the Detroit River and its environment. This large-scale effort resulted

in a binational conservation vision for the Lower Detroit River Ecosystem (Metropolitan Affairs Coalition, 2001). A principal element of this vision was to support specific legislation to create an International Wildlife Refuge to be managed in a partnership consistent with the vision statement.

The planning process for this comprehensive conservation plan began in April 2002. Initially, members from various Service programs met in the regional office to identify a list of issues and concerns that were associated with the management of the Refuge. A series of open house events, meetings, and workshops were held in local communities. In total, more than 150 people attended the open houses and meetings. The Planning Team received 35 written comment forms during these events and took numerous pages of notes from small group and individual discussions.

The Detroit River Ecosystem

The U.S. Environmental Protection Agency and Environment Canada have identified the Detroit River as a portion of the Great Lakes shoreline with significant concentrations of coastal wetlands and distinctive characteristics (U.S. Environmental Protection Agency and Environment Canada, 1999). In 1990, Region 3 designated the marshes associated with Lake Erie and the Detroit River as a wetland focus area within the Regional Wetlands Concept Plan. Figure 2 shows the wetlands located within the Humbug Marsh Complex within the Refuge.

The Detroit River consists of a 32-mile-long channel bordered by a poorly drained clay lake plain. The rapidly flowing river is underlain by limestone bedrock. Heavy industrial development dominates the shoreline. The river has 66 miles of Canadian shoreline, 79 miles of U.S. shoreline, five Canadian wetlands with 2,808 acres, and 16 U.S. wetlands with 3,415 acres (Detroit River Canadian Cleanup Committee, 1999).

The Detroit River wetlands provide spawning areas for 26 percent of the fish species in the Great Lakes and nursery areas for 20 percent of the species. Compared with other shoreline reaches in the Great Lakes, the Detroit River is above the 50th percentile for providing spawning and above the 75th percentile for nursery areas (Francis, 2000; Haas *et al*., 1985). One hundred species of breeding birds, approximately 50 percent of the breeding birds of Ontario, use the Detroit River wetlands along the Canadian shoreline. It is expected that an equivalent bird use occurs in the remnant wetlands on the U.S. side.

The Detroit River has been designated a bi-national Area of Concern under the Great Lakes Water Quality Agreement. Based on the Great Lakes Water Quality Agreement, the Michigan Department of Natural Resources and Michigan Department of Environmental Quality (1996) have listed concerns for the Detroit River. They report the following concerns: degradation of benthic populations; fish tumors and other deformities; restrictions on fish and

Figure 2. Humbug Marsh Complex (See location on Figure 1)

wildlife consumption; beach closings due to bacteria in the water; restrictions on dredging; taste and odor in drinking water; degradation of aesthetics; and loss of fish and wildlife habitat.

The Detroit River was designated as an American Heritage River in 1998, one of only 14 rivers nationwide with this distinction. The American Heritage Rivers Initiative is a federal effort to support the local community's goals for the river by providing focused federal support. It is a locally driven program formally chartered as the Greater Detroit American Heritage River Initiative. In Detroit, the private and municipal sectors are the primary forces within the steering committee. Late in 1999, a Federal contact was named for the river and stakeholders held their first major event. In July 2001, the Canadian government designated the river as a Canadian Heritage River, and made the Detroit River the only binationally designated heritage river in the world.

The Detroit River has experienced over a century of heavy contaminant discharges from industry and municipalities. The sources of contaminants vary and include: non-point sources such as stormwater runoff and air deposition, combined sewer overflows, municipal and industrial point sources, tributaries, sediments and upstream inputs (MDNR and MDEQ, 1996). The quality of the Detroit River ecosystem is closely connected to the high water volume flowing from Lake Huron, St. Clair River, and Lake St. Clair. The primary contaminants have been cadmium, copper, lead, mercury, zinc, and polychlorinated biphenyls (PCBs), but other contaminants also have been identified (Froese *et al*., 1997; Hamdy and Post, 1985; Heidtke *et al*., 2003; Kaiser *et al*., 1985; Kreis *et al*., 2001).

Improvements in water and sediment quality have occurred during the past three decades. The long-term trends of lead, copper and zinc concentrations in the water show distinct decreases from 1981 through the present (MDNR and MDEQ 1996). Although the sharpest declines were observed through the mid-1980s, fairly uniform concentrations have been observed since that time. Water quality trend data for concentrations of mercury and PCBs are not continuous or readily available, but appear to show decreases over time.

Recent studies reveal important facts about current mercury distribution in the Detroit River (Kreis *et al*., 2001). The historic pockets of high concentration no longer exist; instead mercury is now distributed quite evenly throughout the river. For PCBs, the situation is similar. Unlike mercury, however, where the major sources were upstream in the St. Clair River, inputs along the shoreline of the Detroit River have dominated PCB loadings. Both PCBs and mercury are persistent chemicals; they bioaccumulate to increasingly higher concentrations in the food web and are recognized to be very toxic (Froese *et al*., 1997; Hamdy and Post, 1985; Kreis *et al*., 2001).

Current Partnership Activities

A wide variety of conservation, environmental education and habitat restoration initiatives are ongoing within the authorized boundary of the Refuge. The Service has been involved in many of these programs including the Greater Detroit American Heritage River Initiative, the Downriver Linked Greenways Initiative, and the bi-national Conservation Vision for the Lower Detroit River Ecosystem, and programs of the Friends of Detroit River and Detroit Audubon. County and local level programs are also important but too numerous to list. Future staff of the Refuge will be involved in a tremendous number of citizen and agency-led conservation programs.

The Downriver Linked Greenways Initiative is a community-based program that seeks to build "green" infrastructure and create outdoor recreational opportunities in Wayne and Monroe counties. A large part of this new program is focused on the Detroit River waterfront and connecting existing recreational trails in Detroit area communities. The project is part of the Greenways Initiative, a 5-year, $75 million private/public partnership for southeast Michigan. More that 200 individuals from 21 communities and seven counties participated in the initial Greenway vision planning process.

Canadian Partnerships

Environment Canada has been working in partnership with the U.S. Fish and Wildlife Service and Canadian agencies to achieve a compatible, mutually shared bi-national focus for fish and wildlife habitat protection, conservation, and rehabilitation on the Canadian side of the Detroit River. This Canadian focus complements the goals of the Detroit River IWR and the Conservation Vision for the Lower Detroit River Ecosystem. In achieving the shared goals of the Conservation Vision and the Refuge, Environment Canada's goal is to promote the establishment of a network of ecologically significant protected areas in the lower Detroit River for the purpose of conserving and protecting remaining fish and wildlife habitat as identified in the Conservation Vision document.

This will be accomplished through:

- Developing conservation/rehabilitation plans for these areas in conjunction with other agencies and landowners on a strictly voluntary basis;
- Linking goals of the Refuge/Vision with existing Canadian/binational programs under the Great Lakes Water Quality Agreement such as the Detroit River Remedial Action Plan, the Lake Erie Lakewide Management Plan, the Detroit River Canadian Cleanup Committee and the Great Lakes Sustainability Fund, as well as the federal Ecological Gifts Program, and the Eastern Habitat Joint Venture under the North American Waterfowl Management Plan; and
- Meeting and partnering with local agencies and interest groups to gain support for Environment Canada's approach to meeting the Refuge/Vision

goals and to discuss how programs can be better coordinated to achieve these goals.

The Conservation Vision document identifies examples of ecologically significant areas that are deemed to be worth protecting and, where need be, rehabilitated. These examples include both federally owned and privately owned properties in the lower Detroit River. Two significant federal properties, White Sands and Crystal Bay/Island, are owned by the Department of Fisheries and Oceans. The Department of Fisheries and Oceans has an agreement with Essex Region Conservation Authority (ERCA) to manage the properties as conservation areas. Since this arrangement has been in effect, ERCA has cleaned up the sites, posted them as conservation areas, patrolled them to prevent overnight camping, and encouraged day use for recreational purposes.

In partnership with ERCA, Environment Canada organized an Ecological Gifts Workshop in 2002 in the Windsor area. The federal Ecological Gifts Program entitles private and corporate landowners who donate land, a conservation easement, or a covenant through the Program to preferential income tax benefits. Ongoing discussions are also under way with agencies/organizations with similar habitat conservation interests to promote the Refuge/Vision goals and Environment Canada's role in partnering to help establish a network of protected areas in the Detroit River. These include the Ontario Ministry of Natural Resources, Ducks Unlimited, and the Nature Conservancy of Canada.

Private Lands Partnerships

Partners for Fish and Wildlife is a voluntary program that focuses on restoring and enhancing wetlands, grasslands, stream corridors and in-stream habitats on private lands to provide wildlife, fisheries, water quality and recreational benefits for private landowners. The Partners Program within the counties surrounding the Refuge is currently administered by Service staff located in the East Lansing Field Office, Ottawa NWR and Shiawassee NWR. When Partners Program staff are added to the Refuge, a Management District will be created which may include Wayne and Monroe counties and surrounding counties that are within the watersheds of the Detroit River, St. Clair River and Lake Erie. Projects are funded by the Service with cost-share assistance provided by conservation organizations, other governmental agencies, and landowners. Project construction is often completed at little or no cost to the landowner. Landowners are required to sign an agreement to leave the project in place on their property a minimum of 10 years.

The USFWS also assists the federal USDA Farm Service Agency in identifying important wetland and floodplain resources on government foreclosed farm properties. Once these resources have been identified, the Farm Services Administration conserves the areas through perpetual easements

and transfers the management responsibility to the Service. When biological and/or enforcement staff are added to the Refuge, a Management District will be created which may include Wayne and Monroe Counties and surrounding counties that are within the watersheds of the Detroit River, St. Clair River and Lake Erie.

Future Management Direction

The USFWS and partners recognize that they face major challenges in providing for fish and wildlife in the Detroit River and Lake Erie Western Basin. Grassy Island and many other sites in the authorized Refuge boundary are contaminated and development has altered most of the natural system. There will be a need to work together with partners to conserve the last remnants of coastal wetlands and undeveloped islands. But beyond the minimum, there is an expectation to restructure areas to benefit wildlife and the aquatic environment. Figure 3 illustrates a conceptual vision for Grassy Island reflecting restoration and remediation planning.

For existing Refuge lands and waters, and lands that could be added in the coming years, there is intent to learn about the waterfowl use of the area. It is known that the Lower Detroit River is important for waterfowl, but there is not sufficient knowledge as to how big a role the Refuge plays in this importance. A better idea of the role the Refuge plays in providing for waterfowl will allow USFWS us to judge how to allocate funds and time among the lands that it manages.

It is felt that fishing and hunting from boats in Refuge-owned waters is compatible with the purposes of the Refuge and in the spirit of facilitating priority uses as specified in the Refuge System Improvement Act of 1997. USFWS plans to amend the Refuge regulations to permit fishing from boats in the Detroit River near existing Refuge islands.

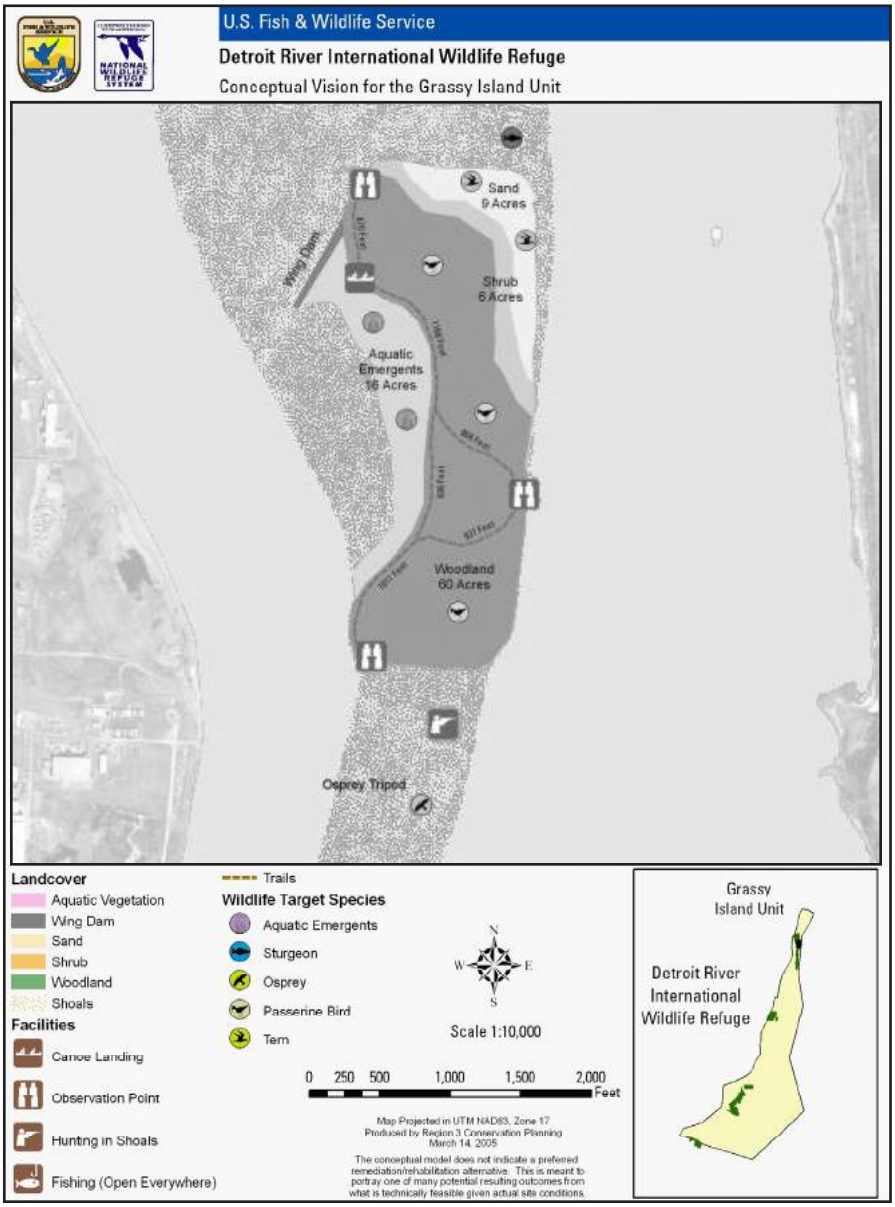
The Refuge will participate as partners in efforts to monitor and restore the lake sturgeon spawning area. The interest is to work with others to conserve the remaining lands in the area for migratory birds, fish, endangered species and other Service Trust resources. By preserving coastal marshes and areas of submerged plant beds, USFWS aims to benefit migrating and wintering waterfowl and spawning and juvenile fish along this international border. Working with the Service's Great Lakes Ecosystem Team and other partners, the Refuge will assess and conserve the important lands in the Detroit River corridor and Western Lake Erie Basin.

Plan Implementation

To achieve the objectives of this plan, the Midwest Region of the Service has requested additional funding from Congress to establish a Refuge office, including staff and equipment, in the vicinity of the Refuge boundary. Figure 4 shows the

area of the Chrysler Tract property, where there are plans to establish a visitor and education center for the Refuge. The cost of remediation and restoration of Grassy Island, and possible cleanup on lands proposed for acquisition in the future, is expected to far exceed any routine Refuge funding request. The work will require special appropriations from Congress or an alternative funding source. Standard surveys of fish and wildlife use and habitat diversity of the

Figure 3. Conceptual Vision for Grassy Island Management Unit



lower Detroit River area are needed to obtain accurate documentation of flora and fauna in the area of the Refuge.

The establishment of a bi-national refuge, and the sheer number of communities and interests along the U.S. and Canadian shoreline, will necessitate involvement with a host of governments, agencies, organizations, and recreational groups. Successful partnerships will be the key element for the future of the Refuge. Such partnership will be actively sought with additional public and private groups as staff and funding increases. Current partnerships of non-profit groups and governments support a wide variety of conservation, environmental education and habitat restoration initiatives within the authorized boundary of the Refuge. The Service has been involved in many of these programs including the Greater Detroit American Heritage River Initiative, the Downriver Linked Greenways Initiative, and the bi-national Conservation Vision for the Lower Detroit River Ecosystem and programs of the Friends of Detroit River and Detroit Audubon. Future staff of the Refuge will be involved in a tremendous number of citizen and agency-led conservation programs.

Conclusions

A number of lessons have been learned from cooperative conservation efforts on the Detroit River. Cooperative conservation initiatives are helping recreate gathering places for wildlife and people along the Detroit River. These unique conservation places are now a key factor in providing the quality of life that is so important in achieving competitive advantage for communities and business.

Figure 4. Chrysler Tract Property

Cooperation is helping provide an exceptional conservation experience to over 5 million people in the Detroit River watershed to help develop the next generation of conservation stewards within the community.

A key factor in the ongoing conservation efforts within the Detroit River International Wildlife Refuge is the ability to rally around existing resources. These resources include the presence of a high profile local champion, ability and means to build strong partnerships, and establishment of a core project delivery team to move projects and initiatives forward. Several key elements need to be place to undertake conservation planning: cooperative learning environments, local ownership, taking a step-wise approach to efforts, focusing on an ecosystem (watershed) approach, developing innovative cooperative solutions (including land stewardship and cooperative management agreements), and sufficient levels of government responsiveness (local, state and federal) to planning.

Ultimately the implementation of the binational conservation undertaken within the Detroit River International Wildlife Refuge will be dependent upon the ability of partners to leverage resources and support cost effectiveness on an ecosystem basis, and the effort taken to publicly celebrate progress, achievements and accomplishments.

Acknowledgements

Appreciation is extended to Dr John Hartig, USFWS, Refuge Manager, Detroit River International Wildlife Service for information provided to assist in the preparation of the conference presentation and this proceedings paper.

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Selection of Protected Areas within the Savegre River Watershed in Costa Rica: Landscape Planning Implications for Transboundary Protection

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Abstract

This paper offers a landscape approach to site selection/expansion of existing protected areas that fall across non-traditional boundaries where a more holistic approach is necessary. In the case study of the Savegre River watershed in Costa Rica, a conservation suitability analysis was applied to examine the feasibility of establishing new protected areas in this watershed through the analyses of available biophysical and socio-economic data. Geographic Information Systems (GIS) was used to determine the suitability of land available for conservation. Three 'themes' were applied to the existing base information – heterogeneity of landforms, ecological integrity and conservation values – and analysed in ArcView 3.2a Spatial Analyst. Weights were applied to each of the landuse planning units to determine areas of highest conservation value. Socio-economic constraints were layered to determine constraints for protection and proposed new protected areas were finally identified using conservation planning principles and reserve design criteria.

Introduction

The conservation planning community recognizes that effectively conserving biodiversity depends on an ecosystems management approach integrating protected areas into wider land and water use planning (IUCN 1994). Natural areas do not adhere to political boundaries. To confine and divide natural ecosystems with arbitrary boundaries and apply different, isolated management styles only damages already fragile systems.

This paper briefly summarizes research within the Savegre River watershed, Costa Rica (Fernandes 2002) in coordination with the joint project between the National Biodiversity Institute (INBio) and the Spanish Development Agency. The results were eventually integrated in the overall land use management plan for the watershed.

The availability of a large amount of existing base information was

essential to the research and was provided mainly as GIS data from INBio. The methodology took a landscape or coarse filter approach to conservation planning for the watershed. It was adapted from a WWF-Canada conservation suitability analysis developed for assessments in Canada. Due to time constraints, no new or raw data was developed for the study area.

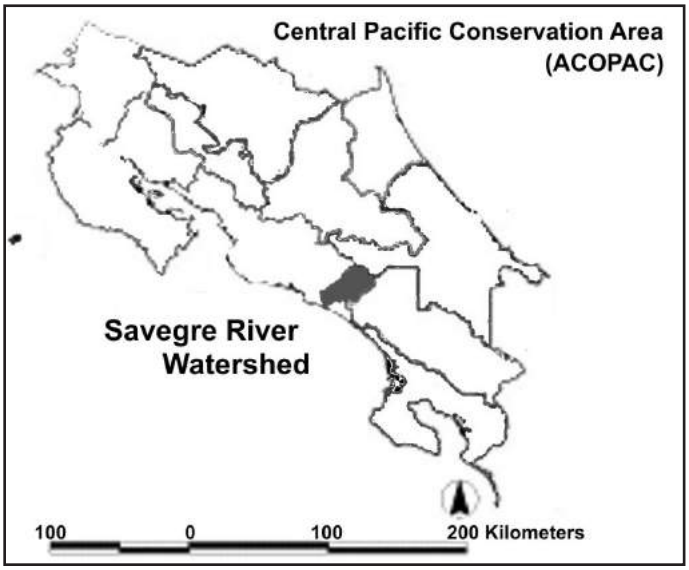
The primary research goal was to develop a methodology that could evaluate the feasibility of establishing viable and stricter protected areas within the Savegre River watershed above the existing Forest Reserve Management. The main objectives were to: 1) Evaluate the conservation value of public and private lands in the Savegre River watershed using available biophysical, social and economic data.; and, 2) Identify options for suitable areas to establish zones of protection and conservation in the watershed. Those interested in more detail on the methodology, analysis and application are referred to Fernandes (2002).

Costa Rica and the Savegre River Watershed

Costa Rica accounts for 0.42% of the world's landmass, but contains a 4% representation of all plants in the world. Approximately 250,000 species are found within its borders – with more continually being discovered. Costa Rica maintains its global status at the forefront of biodiversity conservation and management due to continued efforts to preserve its natural heritage and biodiversity by setting aside approximately 25% of its land cover to some form of conservation protection.

The research area falls within the ecological boundaries of the Savegre

Figure 1. Central Pacific Conservation Area (ACOPAC)



River watershed located in the Central Pacific Conservation Area (ACOPAC) on the west coast of Costa Rica (Figure 1). The 58,918 hectare watershed (590 km^2) travels through six different elevation ranges – from ocean level to an alpine elevation of 3,491 meters – and seven life zones (INBio *et al.* 2001). The Los Santos Forest Reserve, the Cerro Vueltas Biological Reserve and the Cerro Narra Protected Zone are the three main protected areas within the watershed (Figure 2).

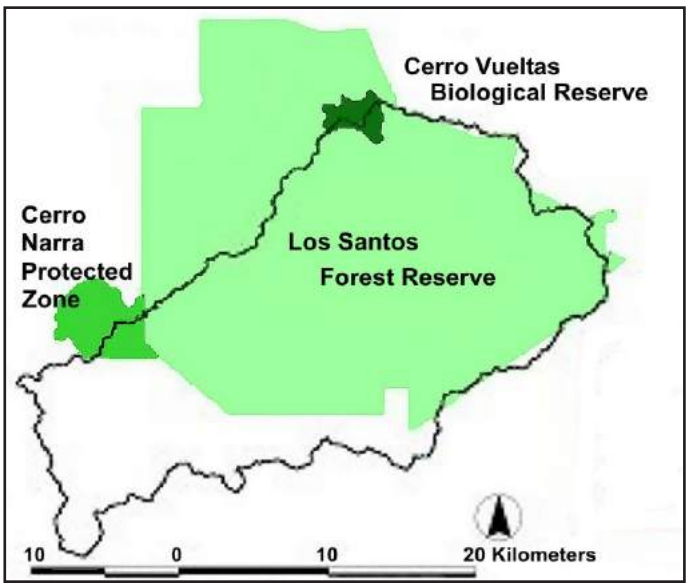
The unique landscape of the watershed – variations in topography, altitudinal gradients, solar exposure, humidity, precipitation and the presence of seven life zones – combine to create an area of high biodiversity and floristic wealth (INBio *et al.* 2001).

In the watershed, 63% of the total land surface is covered in natural ecosystems and of that, 62% is occupied by dense forest.

The Savegre River watershed and its biodiversity have been negatively affected by diverse development pressures, mainly at lower altitudes on the Pacific coast, adjacent to the Transamerican Highway at the watershed's highest reaches to the east, and along the periphery where secondary highways penetrate the watershed. Most of the resource rich interior is protected and contains large tracks of unfragmented landscape due mainly to the legal protection of the forest reserve and rugged landscape that make it difficult to access interior locations.

Within the river basin, 47 of Costa Rica's 88 ecosystems were identified, including 9 natural ecosystems, 15 semi-natural and 23 cultural ones (INBio

Figure 2. Existing Protected Areas in the Savegre River Watershed



et al. 2001). Due to the coarse scale of the research, these ecosystems were reclassified to group those with smaller areas into logical categories. The large number of ecosystems is in part a product of the altitudinal/elevation gradient, which provides a wide variety of natural conditions, and options for the development of human activities. Diverse economic activities in the low altitudinal level have created greater wealth of cultural ecosystems.

Natural ecosystems represent the largest surface area within the river basin occupying approximately 63% of the total area.

Methodology

Since biodiversity occurs at multiple scales and should be considered at the genetic, species, and ecosystems levels of organizations, the most appropriate scale of analysis for this study was taken to be a broad, coarse level. Planning focused on species habitat requirements rather than on specific species is not only economical, but also ensures longevity of habitat and species survival (Margules 1997). A lack of complete field data for fauna (and to an extent flora) excluded methodologies that used species as indicators for more suitable methodologies.

A review of methodologies led to selection of a conservation suitability analysis created by Quebec Lumber Manufacturers' Association AMBSQ-WWF Canada (2001) as most appropriate for this study. It was considered best suited to assess areas for higher conservation protection and assist in the design of the protected areas.

This method is extremely flexible – as more refined information is found, layers can be added to the framework. Additionally, it can be weighted to suit different conservation planning goals and objectives. This methodology also supports and complements a gap analysis and considers biophysical, social and economic variables.

Geographic Information Systems (GIS) have long been used as a mapping method for planning, decision-making and ecosystem monitoring related to ecosystem challenges (Parks Canada 2000). In this case, vector based data was available, but had to be converted to raster based data to perform spatial analysis. A suitability ranking was created using criteria for the map layers to create different outcomes based on the selection of a weighting scheme (Table 1).

Development of Themes and Theme Components

The conservation suitability analysis focused on the three themes: 1) heterogeneity of landforms; 2) ecological integrity; and 3) conservation values (Figure 3). Although the AMBSQ-WWF Canada report (2001) concentrated only on public lands, this research incorporated both public and private lands to assess conservation value. Three main changes were made to the AMBSQ-

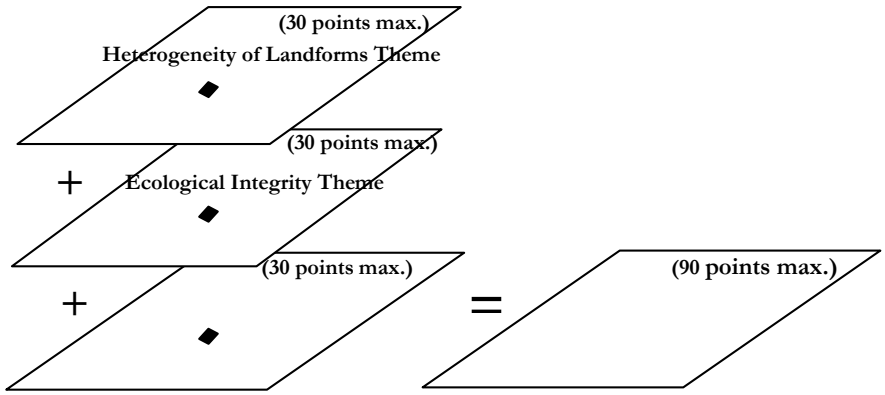
WWF Canada methodology to reflect the specific characteristics of tropical climates, watershed management goals and available GIS information for the region. A comparison of these changes is included in Table 1.

Buffers along rivers are a form of erosion control from adjacent land use sedimentation runoff and can improve the quality of water for both species and

Table 1: Comparison of Methodologies, Scenarios and Associated Weights

Themes	Original AMBSQ-WWF Canada Methodology (2001)	Changes to Methodology (Fernandes 2002)	Scenario 1 Weights	Scenario 2 Weights
heterogeneity of landforms	topography-relief, parent material texture (data unavailable), surficial deposits and slope position	soils composition, geology and slope and aspect of the watershed	30	50
ecological integrity	roads, primary logging roads, railways and hydro-electric transport lines, weighted the buffered zones and areas free of clearcuts	fragmented forest landscapes and road buffers	30	20
conservation value	headwaters, older forests and wetlands	land uses (ecosystems), vegetation coverage, erosion potential and ecological corridors (rivers)	30	20
Totals			**90**	**90**

Figure 3. Illustration of the Three Themes



human use. Rivers are also natural corridors for species movement and the protection of a river's riparian area provides extremely important habitats for species.

For each theme, components were grouped into categories that could be ranked and data was rasterized. Spatial analysis was performed to determine three conservation value ranges (high, medium and low) and two scenarios (Table 1) that weighted the themes differently. Results were converted back into vector data, overlaid and compared with existing protected areas and constraint maps that have been developed.

The analysis was initially tested using 1 ha^2 cell size. Results clearly showed that finer detail was necessary for three reasons: 1) slope and aspect themes were misrepresented; 2) buffers for secondary rivers were not captured; and 3) final map outputs provided greater detail for protected area boundary location, as well as the improved general aesthetics of the final maps.

Heterogeneity of Landforms Theme

Spatial heterogeneity is often linked as a factor that affects biotic diversity (Burnett *et al*. 1998). Other geomorphological elements such as aspect and slope have also been shown to influence vegetation. Burnett *et al*. (1998) found that plots with high geomorphological heterogeneity supported the highest plant diversities among all combinations of plant type and diversity.

A 'neighbourhood statistic' analysis using ArcView 3.2a, Spatial Analyst was performed to identify the most heterogeneous areas by counting the number of different enduring features that fell within a 400 m radius of each cell. Using the 'variety' statistic (ESRI 1996) the number of different heterogeneous landform values within each circle was determined, with the value assigned to the centre cell.

Kavanagh and Iacobelli (1995) suggest that for protected areas to be effective, disturbance regimes need to be considered in defining their size. A small protected area may be drastically impacted or eliminated by disasters such as fire, flood, or landslide. Designing for a larger site ensures that the protected area will have a greater opportunity to survive (Armesto and Pickett 1985; Reice 1994 as cited in Nichols *et al.* 1998).

The resulting map (Figure 4) indicates strong heterogeneity throughout the watershed. Almost the entire watershed was covered by high conservation values.

Ecological Integrity Theme

Ecological integrity was used as the second theme. Non-fragmented ecosystems are more likely to reflect the most attributes such as composition, structure and function. The size and configuration of individual protected areas will influence how well ecological processes and biological diversity are represented

(Kavanagh and Iacobelli 1995).

The two spatial units used to define the ecological integrity theme were island size of fragmented forest ecosystems and road fragmentation. Fragmented dense forest ecosystems were ranked according to island size using existing INBio categories (Table 2) for natural ecosystems – the smallest fragment (<3 hectares) the lowest rank and the largest fragment (>500 hectares) given the highest rank.

Figure 4. Heterogenity of Landforms Theme

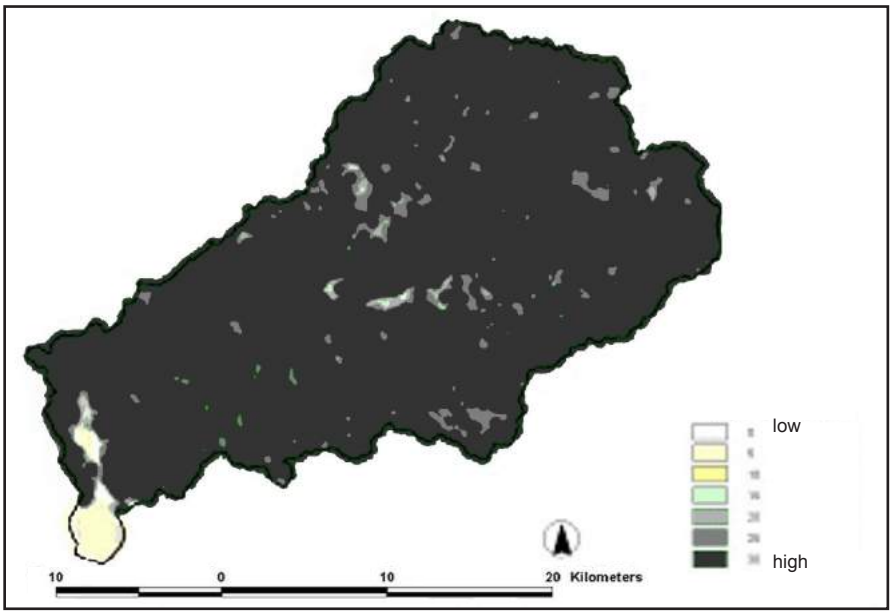


Table 2: Fragmentation of Natural Ecosystems & Associated Weights

Class	Number of Islands	Total Size (Hectares)	% of Total Watershed	Associated Weight
< 3 ha	20	28.08	0.07	5
3 – 50 ha	35	578.21	1.53	10
50 – 100 ha	2	140.79	0.37	15
100 – 150 ha	2	252.00	0.67	20
150 – 500 ha	1	155.73	0.41	25
> 500 ha	3	36,364.12	96.14	30
Total:	**64**	**37,823.08**	**100.00**	

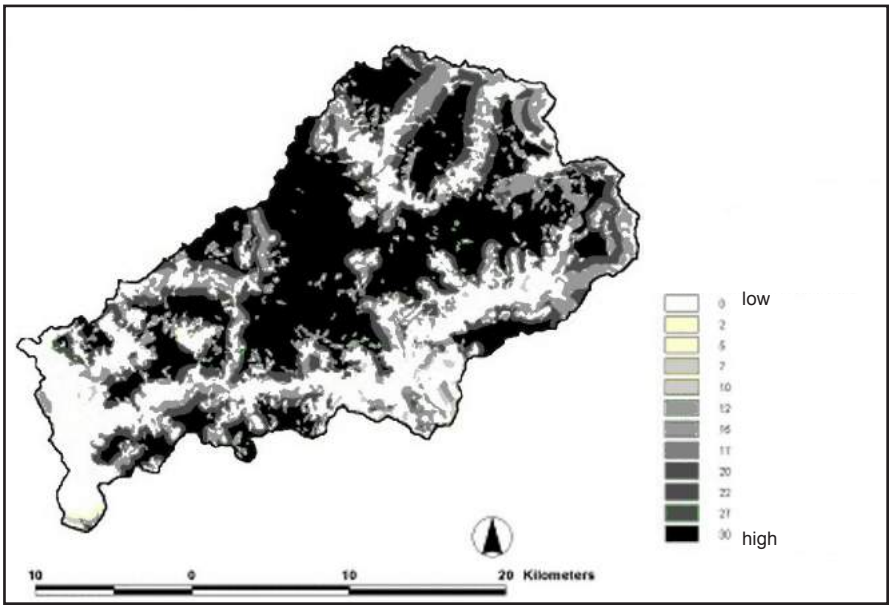
Source: ECOMAPAS (2001), excluding associated weight figures.
Vegetative island ranges do not exist for: 200-300 and 350-500 ha.

Roads have been shown to have devastating effects on ecosystems and wildlife movement, so they were identified and included in this research. Three levels were identified: the Inter-American Highway (fully paved); primary (partially paved); and secondary roads (unpaved, dirt roads). These roads were buffered with two zones and weighted to reflect a lowest to highest conservation value the farther away from the road one moved. The areas outside of the buffer zones were associated with the highest conservation value (Table 3).

Table 3: Road Systems Classification, Buffer Widths and Weight Values

Class	Associated Weight
Class 1: Inter American Highway (paved)	
Buffer 1 (1,000m)	0
Buffer 2 (1,000m)	10
Outside of buffers	30
Class 2: Primary Roads (partially paved)	
Buffer 1 (500m)	0
Buffer 2 (500m)	10
Outside of buffers	30
Class 3: Secondary Roads (not paved—dirt roads)	
Buffer 1 (250m)	0
Buffer 2 (250m)	10
Outside of buffers	30

Figure 5. Ecological Integrity Theme



It is important to note that volumes were not known for the road system in the watershed.

The ecological integrity theme map (Figure 5) indicates (not surprisingly) strong cores of conservation value within unfragmented landscapes and lower values within settlement areas and along road systems. The lower watershed floor also appears to have some of the lowest conservation values that are consistent with the dominant cultural ecosystems.

Conservation Values Theme

The spatial units used to define the conservation values theme consisted of: headwaters conservation; vegetation coverage; ecological connections; and

Table 4: Conservation Values and Associated Weights

Conservation Value Variables	Associated Weight
Headwaters (measured by elevation ranges)	
< 1,000m	0
1,000m to 1,500m	5
1,500m to 2,000m	10
2,000m to 2,500m	15
2,500m to 3,000m	20
3,000m to 3,500m	30
Vegetation Coverage	
Natural Ecosystems: Dense Forest, Dense Mangrove and Dense Chusquea Grassland	30
Semi-Natural Ecosystems: Thin Forest, Dense Wooded Scrub, Dense Scrub, Thin Scrub	20
Cultural Ecosystems: Dense Grassland, Wooded Grassland, Shrub Grassland, Aceite Palm Plantation, Coffee Cultivation, Teak Plantation, Melina Plantation, Rice Cultivation, Pejiballe Plantation and Mora Plantation	0
Ecological Connections	
Primary Rivers	
Buffer 1 (100m)	30
Buffer 2 (200m)	20
Outside of buffers	0
Secondary Rivers	
Buffer 1 (30m)	30
Outside of buffer	0
Erosion Potential	
Category 1: none (no values)	--
Category 2: slight (no values)	--
Category 3: moderate	10
Category 4: severe	20
Category 5: very severe	30

erosion potential (Table 4).

Headwaters are considered to provide important ecological functions and their protection is important for downstream water quality. The greatest number of headwaters are located in the 2,000m to 3,500m ranges and the greatest weight values were given to these elevation ranges.

In Mexico, traditional shaded coffee fields were confirmed to harbour high biodiversity and found to play an important conservation role (Moguel and Toledo 1999). Though it is recognized that some cultural landscapes such as the various tree plantations, the various cultural grasslands and the smaller shrub ecosystems do support biodiversity, these ecosystems were weighted '0' due to their non-permanent nature and management practices that see these areas cleared of vegetation on a rotational basis.

Ecological connections were added to the methodology due to the nature of the study area. Buffers along rivers and streams offer a number of advantages. They are not only an effective way of reducing the velocity of runoff from upland areas and provide natural filtration of runoff from sedimentation and crop fertilizers (Brooks *et al*. 1997), but they are natural corridors for flora and fauna. Slope was not taken into consideration when determining the buffer widths.

Erosion potential was identified as an important variable in tropical areas especially within watersheds with characteristically steep slopes. The vegetation cover that intervenes between the extremely high rainfall for tropical areas and the thin and sensitive soil layer beneath offer a critical control on erosivity (Newsom 1997). The Savegre River watershed is very susceptible to extreme flooding in the lowlands during the rainy season. As a surrogate, this is the weakest variable; however, protection of erosion prone areas is extremely important for environmental and socio-economic reasons.

Findings

The conservation values theme map (Figure 6) indicates the highest conservation values are found in the high elevation ranges in the alpine and sub-alpine floors and along the main river courses. The medium conservation values were concentrated in the mid-elevation ranges.

When the existing protected areas (Cerro Nara Protected Zone and Cerro Vueltas Biological Reserve) were added to the high conservation value layer, a natural extension to the Cerro Vueltas Biological Reserve was apparent. Expansion of the Cerro Nara Protected Zone is also possible, but with greater difficulty as more fragmentation has occurred with the natural vegetation coverage (Figure 7).

A comparison of identified protected areas and high conservation value

Figure 6. Conservation Values Theme

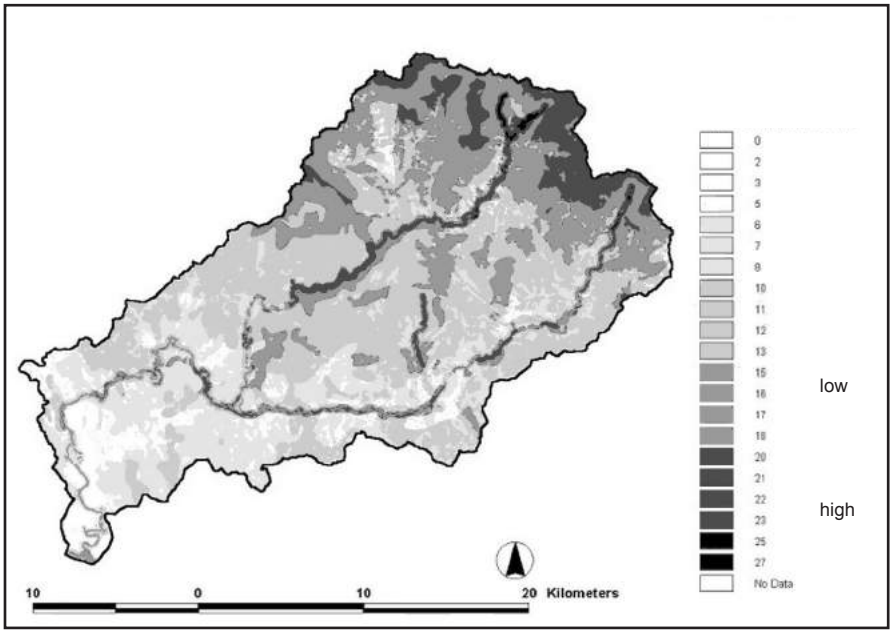
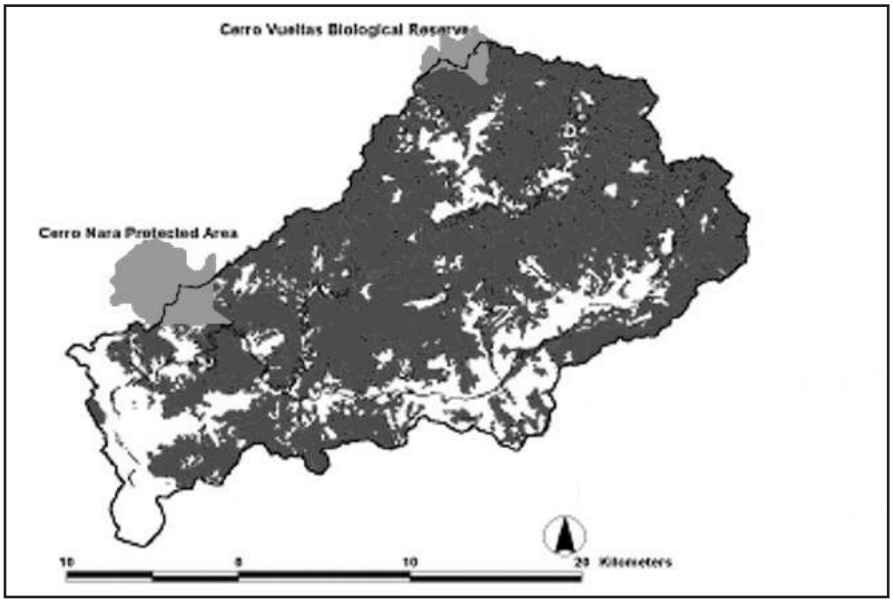


Figure 7. Scenario 2 and Existing Protected Areas Boundaries



layers found that the majority of lands owned by the State fell within high conservation value zones. In addition, these lands formed a natural extension to Cerro Nara and Cerro Vueltas. Conversion of government-owned land is extremely valuable to the existing protected areas.

The final map uses reserve design criteria applied to lands with high conservation value (Figure 8). It identified boundaries for a proposed national park, extensions to the existing Cerro Vueltas Biological Reserve and Cerro Nara Protected Zone, as well as proposed biological corridors. The total area proposed for all new protected areas is summarized as follows:

New National Park: 3,851 hectares

Biological Reserve Extension: 8,178 hectares

Biological Corridor: 5,567 hectares

Biological Runner: 13,543 hectares

TOTAL: 31,139 hectares

The total land proposed for protection is significant and constitutes approximately over half of the watershed's total area. The core proposed protected areas (new national park and biological reserve extension) constitute 12,029 hectares in total or approximately 20% of the watershed.

Conclusions and Implications of Research

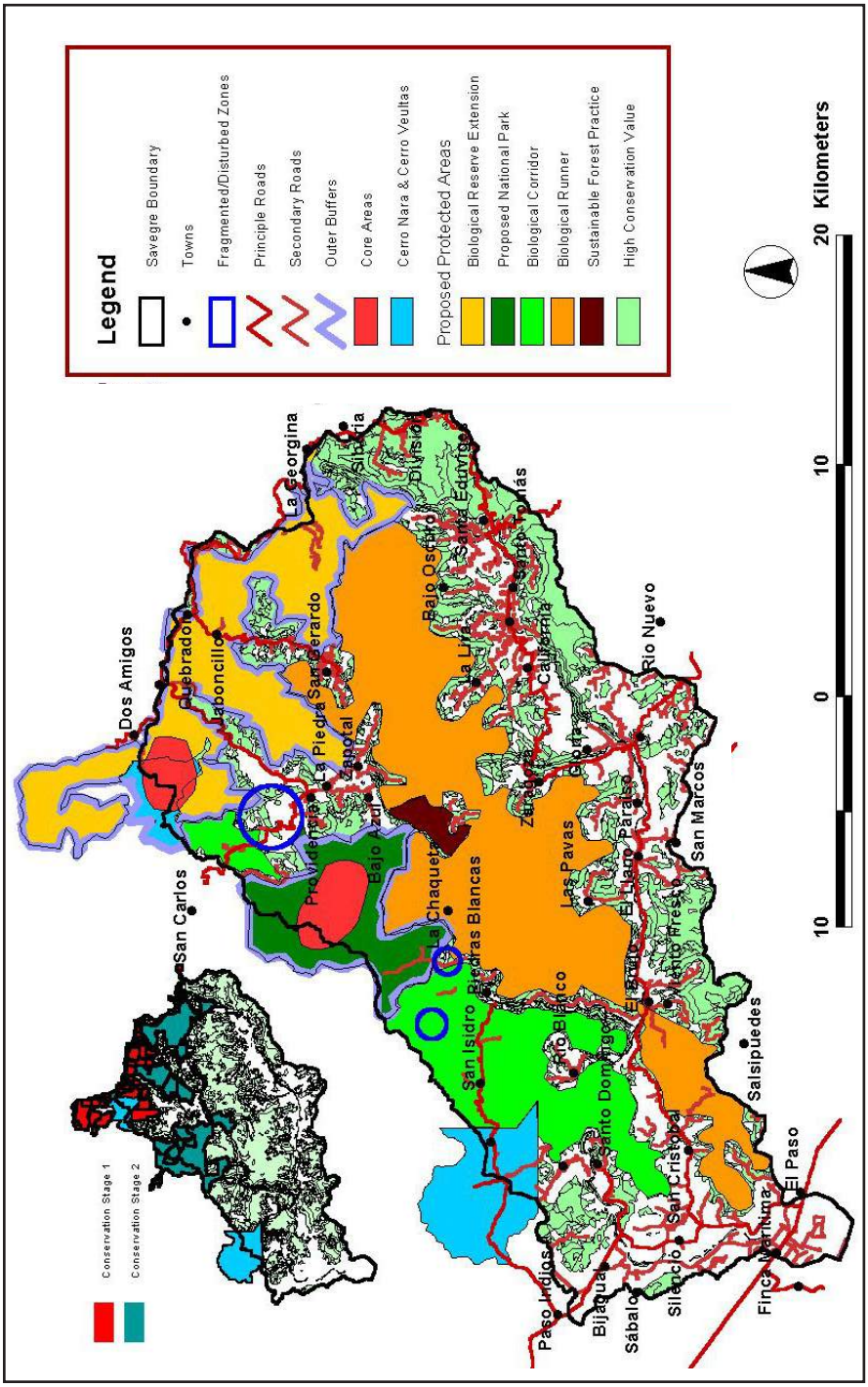
Areas of high conservation value were identified to determine if the watershed contained landscapes that warranted protection. Public lands were identified and found to contain high conservation value that required a protection designation.

Research concluded that it was feasible to establish new protected areas in the Savegre River watershed including extensions to the existing Cerro Vueltas Biological Reserve, the creation of a new national park, identification of protected cores, identification of inner buffers and outer buffers (or zones of transition) that could be used for community-based management projects, and the identification of biological corridors that could link protected zones and provide a biological runner through the important elevation ranges of the watershed.

Implications for Landscape Planning

This methodology offers a multi-disciplinary, landscape approach to site selection and/or expansion of existing protected areas that is flexible and can easily be applied to transboundary sites where the land in question straddles non-traditional boundaries. Landscape planning through the use of a conservation suitability analysis has strong implications for the conservation planning field and can assist protected area planners to plan more holistically, provides a tool to plan proactively and can incorporate vast arrays of data sources for analysis.

Figure 8. Reserve design applied to high conservation values



This is one step in the overall conservation planning process – i.e., the identification of the most suitable land with high conservation value. The establishment of human-nature relationships is essential to conservation planning and this is one of the main strengths of landscape planning that can be applied to transboundary protection. The natural extension to this coarse level analysis is a finer more detailed site-specific analysis at the community level.

Acknowledgements

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Cross-Border Approaches to Protected Areas, Heritage Conservation, and Tourism: A Parks Canada Perspective

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Abstract

Many issues facing individual protected areas agencies transcend park and national boundaries and also affect neighbouring countries. Issues of common concern provide opportunities to work collaboratively on a continental or regional scale to improve protected area management, share best practises and address park management challenges that can only be resolved through mutual cooperation and information exchange. At the global scale, there has been increasing interest in transboundary parks and cross border cooperation and the institutional and governance arrangements that have been put in place for their management. Transboundary protected areas and consideration of benefits beyond boundaries were a major focus of presentations, discussions and recommendations at the 2003 World Parks Congress.

Within this larger global context, this paper provides an overview of Parks Canada's transboundary protected area work, the issues being addressed and some examples of institutional arrangements that have been developed to manage cross border cooperation.

Transboundary protected areas: The Global Context

A recent analysis shows there to be 188 internationally adjoining protected area complexes and other transboundary conservation areas, including at least 818 protected areas in 112 countries (Besançon and Savy, 2005). The total size of all these protected area complexes is more than 3,169,000 square kilometres, representing approximately 16.8% of the global extent of protected areas.

Of relevance to this paper is the finding that nearly half of the total extent of internationally adjoining protected areas is located in North America (Table 1). This is due in large part to the contribution of two complexes, each of about 15 million hectares that lie adjacent to the USA and Canada border. These are the formally designated Kluane/Wrangell-St Elias/Glacier Bay/Tatshenshini-Alsek transboundary World Heritage Site and an unnamed transboundary complex

* The views expressed are those of the author and do not necessarily reflect the views of Parks Canada.

involving Ivvavik National Park (Canada) and the Arctic National Wildlife Refuge (USA). The large size of the Quttinirpaaq National Park (Ellesmere Island)/Greenland transboundary protected area complex (101 million hectares) in the high Arctic also makes a sizeable contribution. The Waterton-Glacier International Peace Park World Heritage Site on the border of Canada and the USA (Alberta and Montana) is another large transboundary protected area complex of about 4600 square kilometres.

Table 1. Internationally adjoining protected area complexes by continent

Region	2005 PA's	2005 Complexes	Size (Hectares)
North America	97	15	145,897,290
Africa	186	33	64,048,168
Central and South America	161	29	52,386,893
Asia	185	46	45,964,411
Europe	189	65	8,618,981

Countries with the greatest number of internationally adjoining protected area complexes on their borders include the Russian Federation (21), China (14) and Canada (12).

The number, extent and location of internationally adjoining protected area complexes shows that such areas are a significant and widely used mechanism to achieve biodiversity conservation at a landscape scale as well as social and economic goals. Fostering new opportunities for sustainable development and engendering a culture of peace and cooperation between and among countries are additional benefits provided by such areas. Creation and effective management of these areas requires governments, NGOs and civil society to work with one another through innovative governance mechanisms. Although there is a growing body of literature related to transboundary parks and protected areas, there has been relatively little research on cross boundary cooperation related to historic sites that interpret shared historical themes.

Parks Canada's Legislative and Policy Mandate for Bilateral Cooperation

Parks Canada's international role is not addressed in any of the substantive provisions of its legislation. The most explicit statement is the Preamble to the Parks Canada Agency Act that states:

> *And whereas it is in the national interest .... to contribute towards the protection of and presentation of the global heritage and biodiversity (Government of Canada 1998).*

Parks Canada's Guiding Principles and Operational Policies (1994) include a number of general provisions regarding an international role for the Agency.

The Vision Statement includes a reference to "helping and cooperating with others to protect and present heritage…through …fostering and advocating heritage protection and presentation, both nationally and internationally." Under the principle of Leadership and Stewardship, Parks Canada is seen as having a "…broader responsibility to the conservation and interpretation community within Canada as well as other countries" (Parks Canada Agency 1994).

National Parks and Historic Sites of Canada: Positioned for cross boundary cooperation

Parks Canada has responsibility on behalf of Canadians for forty-two national parks/reserves totalling 276,000 sq kms and two marine conservation areas totalling 1,283 sq kms. In addition, the agency is responsible under the Historic Sites and Monuments Act for 916 National Historic Sites, 154 of which it administers. Reflecting the historical development of the country and the focus of early park establishment in pursuit of economic and tourism objectives, many national parks and historic sites are located in close proximity to the US border (Figure 1). This generates a need as well as providing an opportunity for cross border cooperation. Ecosystems do not respect political boundaries and cooperation is essential to effectively manage shared ecosystems, address cross border tourism and address other issues of mutual interest.

Institutional Arrangements for Cross-Border Cooperation

In their presentation at the World Parks Congress, Van der Linde and Oglethorpe (2005) concluded that effective transboundary management requires an iterative process and cautioned against a fixed or blueprinted approach. Essentially, cross border cooperation requires institutional arrangements that are suitable to the countries that are working together to manage cross border protected area issues. A variety of types of agreements to accommodate different needs, strong communication amongst individuals and organizations involved in cross border issues, and an enabling environment that promotes transboundary cooperation are essential ingredients for success.

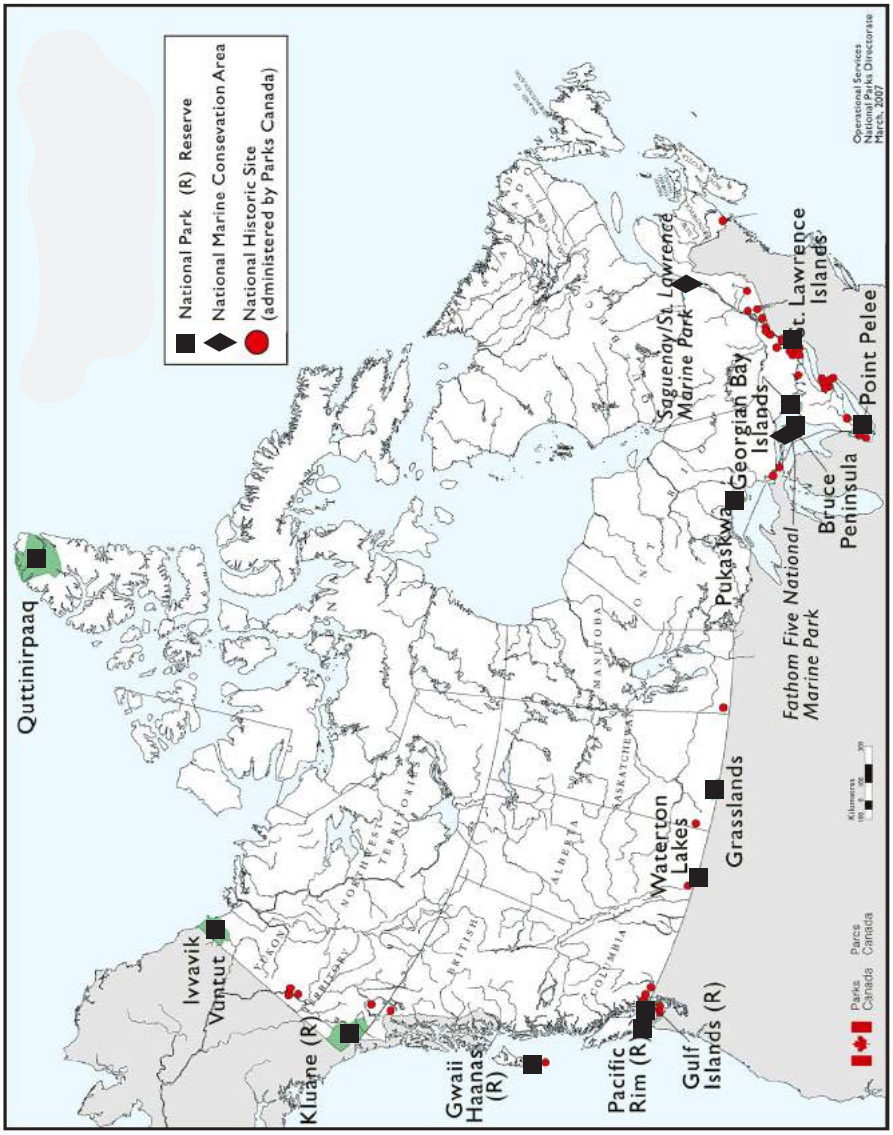
In the case of Parks Canada's strategic arrangements for cross boundary cooperation – two are of particular note. The first, and the most relevant is the Memorandum of Understanding (MOU) on Cooperation in Management, Research, Protection, Conservation and Presentation of National Parks and National Historic Sites between Parks Canada and the US National Parks Service (1999). A second and more general arrangement that has more limited application to cross boundary cooperation is in the form of the protected area provisions associated with the Arctic Council Declaration of 1996 and the Conservation of Arctic Flora and Fauna Program.

The Parks Canada-USNPS MOU was negotiated and signed in 1998 by the Assistant Deputy Minister for Parks Canada and the Director of the National Parks Service of the US Department of the Interior. An annex was added in

1999 identifying priority areas for collaboration. The MOU is an agency-to-agency instrument of understanding and basis for cooperation, signed by senior officers of both organizations, rather than a political accord.

The MOU is focused on enhanced cooperation between the US National Park Service and Parks Canada in the management, planning, development, preservation, research and conservation of national parks, national historic sites, and national cultural heritage resources. It builds on the fact that the United States

Figure 1. Protected Areas Close to or Contiguous with Canada's Border



and Canada are both parties to the World Heritage Convention and that both manage World Heritage Sites including two cross border sites. A stated purpose of the MOU is to strengthen the management and conservation of national parks close to, or contiguous with the border for the purpose of conserving shared ecosystems. Box 1 shows the priority areas for cooperation.

Box 1

Priority areas for possible collaboration between Parks Canada and the U.S. National Park Service pursuant to the Memorandum of Understanding:

- World Heritage Site in the St. Elias Mountains (Kluane National Park, Wrangell-St. Elias National Park and Preserve, Glacier Bay National Park and Preserve, and Tatshenshini- Alsek Provincial Wilderness Park);
- Waterton/Glacier International Peace Park World Heritage Site
- Lake Superior
- St. Croix River and Island
- Roosevelt-Campobello International Park
- Perry's Victory and International Peace Memorial
- Chilkoot Trail
- Pacific coast marine parks
- National Parks in the Yellowstone to Yukon Corridor
- Underground Railroad
- Regional Air-Quality Partnerships
- Guide's Guide
- Market and Visitor Research
- Immigration History Sites Network

A second purpose of the MOU is creation of a framework for cooperation and coordination between the two agencies concerning the commemoration, conservation and presentation of natural and cultural heritage sites. In terms of governance, the agreement calls for a co-chaired Intergovernmental Committee to discuss progress on projects and possible areas for future cooperation that will meet periodically, alternating between the two countries. The co-chairs will designate representatives to oversee, direct, jointly negotiate, approve, implement and monitor the progress of cooperative activities developed to accomplish the objectives of the MOU. Progress reports on projects undertaken under the agreement will be provided to the Intergovernmental Committee for its review.

The MOU provides for a range of cooperative activities: exchanges of technical and professional information; participation in joint seminars, conferences, training courses and workshops; joint planning and research teams; and, exchanges and/or secondment of personnel, specialists and consultants. Areas of mutual interest and benefit for cooperative activities include the following:

- Strengthening participation in the World Heritage Convention, and complementary participation in international membership organizations

such as The World Conservation Union (IUCN) the World Commission on Protected Areas, the International Council on Monuments and Sites (ICOMOS and multilateral conservation initiatives such as UNESCO Biosphere Reserves;

- Research, inventory, documentation and monitoring of natural and cultural heritage resources and sites and related conservation technologies;
- Planning, sustainable design and appropriate development of heritage sites;
- Public information programs and materials to increase understanding of and community support for conservation objectives and heritage;
- Joint identification, conservation, and interpretation of heritage sites and transboundary resources of shared significance to the people of the US and Canada; and
- Development of joint heritage tourism initiatives.

Cooperation under the memorandum is subject to the availability of funds and staff and the agreement does not create a new financial structure. Parks Canada and the USNPS decide upon funding and staff availability before individual projects are undertaken.

The Arctic Council Conservation of Arctic Flora and Fauna Program

The Arctic Council is a high-level intergovernmental forum for circumpolar co-operation on shared environment, socio-economic and cultural issues. It was created in 1996 to address common issues faced by Arctic states: Canada, Denmark (including Greenland), Finland, Iceland, Norway, the Russian Federation, Sweden and the United States. Foreign ministers represent countries. Representatives of the Arctic's indigenous peoples' organisations have a role as Permanent Participants. This enables indigenous peoples organisations to attend meetings of the Council and its programs.

The Conservation of Arctic Flora and Fauna (CAFF), one of five programs established under the Arctic Council, is the biodiversity and habitat conservation arm of the Council. It was created "as a distinct forum for scientists, indigenous peoples and conservation managers" to "co-operate for the conservation of Arctic flora and fauna, their diversity and their habitats" (Arctic Environmental Protection Strategy 1991). In 1991, Arctic Ministers agreed to promote the "development of a network of protected areas." This led to the development of an inventory of arctic protected areas, a listing of proposed arctic parks and conservation areas, and principles and guidelines for establishment and management. A gap analysis and a Circumpolar Protected Areas Strategy and Action Plan were also completed. The latter outlined a concept of a physical network of protected areas that would be coordinated through cooperative action and promote ecological, informational, managerial and inter-jurisdictional linkages.

The resulting network was intended to protect important terrestrial, marine and freshwater areas as well as sites of cultural significance. Sustainable use by Arctic peoples within a management framework of conservation would be encouraged. The Strategy and Action Plan called for 26 action items consisting of measures to be implemented nationally and collectively through circumpolar cooperation, including twinning of arctic protected areas.

From a Canadian perspective, CAFF and CPAN has most relevance as a basis for cooperation with Denmark on protected areas in Greenland and with the USA on national parks and other protected areas in Alaska.

Examples of Cross Border Cooperation

Bilateral or regional instruments provide an essential context for cross border collaboration but what happens on the ground is the true expression of cooperation. Described below are four examples of cross border cooperation involving Parks Canada.

Waterton-Glacier International Peace Park and the Crown of the Continent*

At the centre of the Crown of the Continent are Waterton Lakes and Glacier National Parks straddling the Canada-US border in Alberta and Montana. These parks are internationally recognized as an International Peace Park through legislation in both Canada and the US, a UNESCO World Heritage Site (1995) and a UNESCO Biosphere Reserve. The term 'Crown of the Continent' was first used in the late 1800's to describe the ecoregion that provides the headwaters of three major river systems that drain to Hudson Bay, the Gulf of Mexico, and the Pacific Ocean. This tri-ocean drainage characteristic of the region is one of the outstanding universal values that is associated with the inscription of the international peace park on the World Heritage list.

But the region is not just about parks, conservation and tourism. Logging has been an important industry in the region for more than a century, providing employment and contributing to economic activity. Farming and ranching are also important activities. Rural residential development is an increasingly important land use. Jurisdictional fragmentation is characteristic of the region with multiple entities on both sides of the border exercising a range of mandates addressing multiple interests in the land and its resources.

To better coordinate activities, representatives from over twenty government agencies came together in 2001 to explore ways of collaborating on shared issues in the Crown of the Continent region through an ecosystem based approach. Participants included federal, state/provincial and aboriginal agencies in charge of resource management, land, environment, parks, wildlife,

* Adapted from information provided by Bill Dolan, Waterton Lakes National Park, April 2005.

agriculture, forestry and others. Both Parks Canada and USNPS participated. The Crown manager's partnership seeks to improve the management of a large complex ecoregion containing multiple jurisdictions by working together to build awareness of common interests and issues in the Crown of the Continent Ecosystem and build relationships and opportunities for collaboration across mandates and borders. A third objective is to identify collaborative work already underway and opportunities for further cooperation.

Five issues were identified by the participants at the 2001 meeting that could best be addressed at the larger regional ecosystem scale including:

- Cumulative effects of human activity across the ecosystem;
- Increased public interest in how lands are managed and how decisions are reached;
- Increased recreational demands and increased visitation;
- Collaboration to share data, standardize assessment and monitoring methodologies; and
- The need to address the maintenance and sustainability of shared wildlife populations.

The regional cumulative effects analysis is being treated as the most pressing issue.

In terms of organizational structure, the partnership operates though existing cooperative arrangements between Waterton Lakes National Park and Glacier National Park in the US. A Crown of the Continent Research Learning Centre has been established in Glacier National Park. The most notable feature of the collaboration is the wide range of stakeholders involved – in all more than 20 organizations and agencies, of which only two have national park management responsibilities. Although the USNPS–Parks Canada Memorandum of Understanding lists Waterton/Glacier International Peace Park World Heritage Site and "national parks in the Yellowstone to Yukon Corridor" as priority areas for cooperation, the MOU itself is not a significant factor in the creation or ongoing functioning of the partnership, largely due to the fact that a multilateral approach involving numerous stakeholders is needed to effectively address the issues, rather that a bilateral arrangement as provided for in the Memorandum of Understanding.

In addition, Waterton Lakes and Glacier national parks cooperate in a range of areas related specifically to park management, planning, visitor experience, resource protection as well as visitor awareness and public education. This cooperation is complementary to the multi stakeholder collaboration that occurs through the Crown of the Continent process and is consistent with the Parks Canada-USNPS Memorandum of Cooperation. The status of both parks as part of a World Heritage Site and a UNESCO Biosphere Reserve provides an additional catalyst for cross border cooperation.

Chilkoot Trail National Historic Site*

Chilkoot Trail National Historic Site protects the historic gateway to the Yukon once used by Tlingit First Nation traders and Klondike gold rush prospectors. The Chilkoot Trail was designated a national historic site because of the role it played in the mass movement of people to the Yukon during the Klondike Gold Rush. It has been officially designated by Canada and the United States as a component of the Klondike Gold Rush International Historical Park. A 53 kilometre trip through history, the Chilkoot trail stands as one of North America's most fabled treks. It crosses the international boundary between the United States and Canada and is co-operatively managed by Parks Canada and the US National Parks Service.

The 1999 Memorandum of Understanding between the US National Park Service and Parks Canada provides an enabling environment for the cross border cooperation but the details of the cooperative arrangement have been determined at the site level in response to operational requirements. The fact that the site is a shared responsibility makes cooperation essential for effective management, quality visitor services and public safety. Some tangible examples of cross border cooperation include:

- Shared responsibility for fulfilling trip planning and information requests, including web based trip planning guide and a toll-free reservation line;
- Sale of trail maps and guides by both organizations;
- Provision of administration and management of reservation and fee operations by Parks Canada for the benefit of both agencies. Parks Canada's systems are used to record reservations, cancellations and collect, refund, deposit, and account for revenues generated by fees. Parks Canada collects all reservation fees (including those charged to the US side only) and remits the USNPS fee revenues to the USNPS;
- Joint staffing and operation of the Chilkoot Trail reservation, permitting and fee collection operations in the Trail Centre in Skagway, Alaska. Joint staff training takes place in May of each year;
- Provision of office space and facilities in Skagway Alaska for Parks Canada use at no cost, for joint summer operations. There is a mutually agreed upon division of operational costs;
- NPS designates a location at Dyea (near the Chilkoot Trail head) for Parks Canada seasonal staff housing;
- Application of a blended fee structure where the visitor fee is an amalgam of both agencies fees. Revenue from fees is allocated through a jointly agreed process;
- Both agencies provide reciprocal access to the results of research completed on their respective properties; and

* Adapted from material provided by Robert Lewis, Parks Canada Yukon Field Unit, April 2006.

- Harmonized information provided to visitors to contribute to a greater awareness of the Klondike Gold Rush International Historic Site concept.

What started out over thirty years ago as a shared signage and marking system has expanded to include the co-ordination of public safety measures for hikers, a reservation system and integrated management. Although the cooperation is based on the strategic Memorandum of Understanding between the two agencies, the actual details of cooperation have been determined by field staff working together to address specific needs and operational issues. This cooperation is based on strong personal connections between staff of the two organizations and the geography and configuration of the site that makes cross border cooperation essential for the effective management of both the US and Canadian portions.

Grasslands National Park: The Frenchman River-Bitter Creek Conservation Action Plan*

Grasslands National Park in South-western Saskatchewan preserves a portion of the mixed prairie grasslands. In less than a century this ecosystem has become one of the most endangered habitats in the country. Changes to the prairie due to settlement have brought about the extirpation of the bison, prairie wolf, plains grizzly, elk, wolverine, swift fox, and black-footed ferret. The park plays a major role in promoting habitat restoration and species preservation and reintroduction.

The park has 15 listed species at risk. Recovery of these species depends on a landscape scale, multi-jurisdictional plan. The challenge is to develop a conservation plan at a landscape scale including cross border cooperation that is relevant for the conservation requirements of these species and to work with partners to implement the plan. The large areas required by some of these species and the contradictory requirements of others means that species-by-species planning will not achieve the desired conservation outcomes.

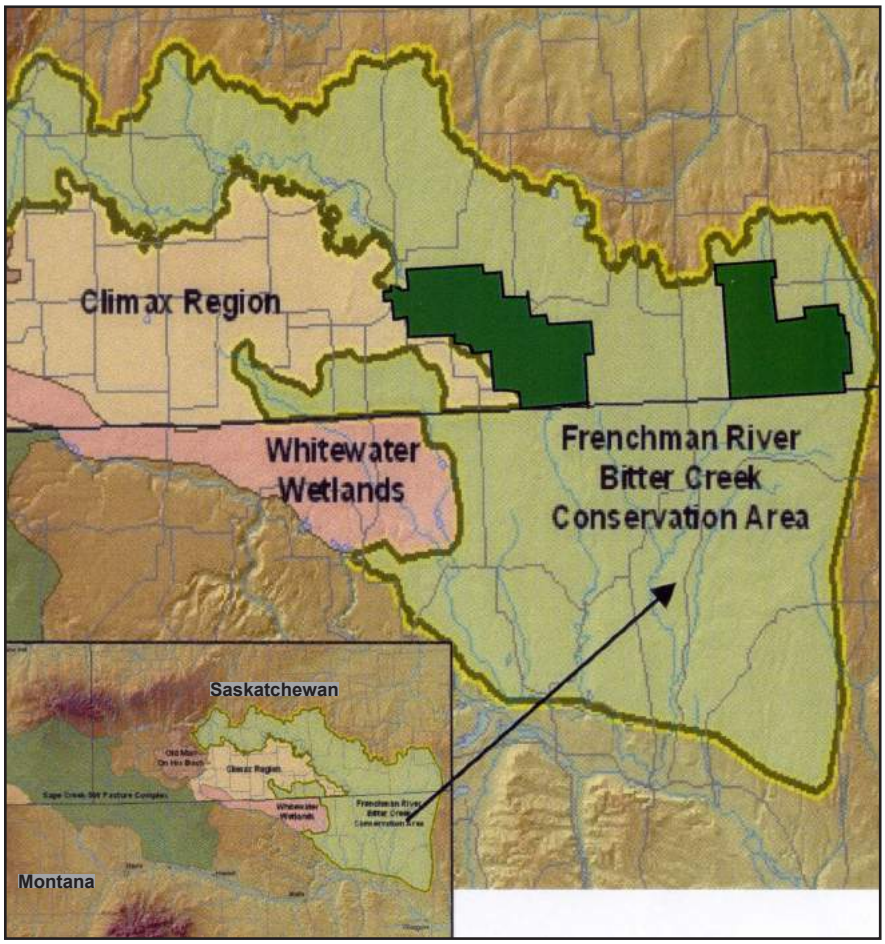
With species recovery planning as the catalyst, Grasslands National Park helped initiate, fund, and participated in a conservation planning workshop series based on The Nature Conservancy's Site Conservation Planning process. Over 17 different agencies and non-government organizations from Saskatchewan, Alberta and Montana participated. The workshop partners produced draft site conservation action plans for a 24,908 km^2 transboundary region (Figure 2), compiled GIS databases, produced a presentation on the planning process and developed an electronic book detailing the process and results of the collaboration. The approach was a powerful recognition of the utility of integrating species at risk recovery into conservation programming at broader multi-jurisdictional scales. The planning partners have remained committed to

* Adapted from material provided by Cheryl Penny and Pat Fargey, Grasslands National Park of Canada, April 2006.

transboundary prairie conservation planning and have agreed to cooperate in formalizing and implementing the plan.

The planning area that includes Grasslands National Park is called the "Frenchman River-Bitter Creek Area." All park species-at-risk are addressed in the plan, which focuses on securing habitat, stewardship, inventory, and restoration. The plan identifies 36 high-level strategies/actions to recover the highest priority species in the region. In addition, the plan addresses many of the high-ranking State of the Park stressors such as exotic invasive plant species, grazing management, and revegetation of cultivated lands. The Frenchman River-Bitter Creek plan is regional in focus and provides the park with a platform to begin working more with regional/transboundary partners. The outcomes

Figure 2. The Frenchman River-Bitter Creek region. Grasslands National Park is shown in black.



Source: Parks Canada, Crossing the Medicine Line: The Frenchman River-Bitter Creek Conservation Action Plan. 2005-06 / 2007-08

associated with the project also are consistent with Parks Canada efforts to move from stakeholder consultation to effective involvement of stakeholders, to demonstrate that humans are an integral part of heritage areas and to foster an organizational culture that embraces internal and external engagement.

This example of cross border cooperation, premised on species-at-risk recovery, demonstrates the benefit of working with partners at spatial scales that extend beyond the park boundaries, including working across political boundaries with partners from the United States. Most of the work to date has been agency-to-agency cooperation. Further work to engage regional stakeholders and communities will serve to raise awareness and provide recognition of the important biodiversity values in the region and develop collaborative forums in which local knowledge can be accessed and local interests incorporated into conservation program delivery. As in the case of the Crown of the Continent cooperation, this example demonstrates the value of a multilateral approach involving numerous stakeholders as a means to address the issues rather than a bilateral arrangement as provided for in the Memorandum of Understanding.

Other examples of Cross Border Approaches to Conservation and Tourism

A number of other examples of cross border cooperation can be found in locations such as Kluane National Park/Reserve where agreed upon policies and approaches have been developed for the joint coordination of rafting trips on the Alsek-Tatshenshini River system. At the St Croix Island International Historic Site in New Brunswick, a Memorandum of Understanding has been developed, formally recognizing the international significance of the site and outlining a cooperative program to commemorate the island's history. In Point Pelee National Park, park staff are increasingly cooperating with state and national parks in the US and with Mexican protected area managers to focus on protecting habitat of the monarch butterfly along the length of its migration route.

Issues and Challenges

Although cross border cooperation is increasingly important as protected area agencies adopt new approaches to managing parks in a broader park landscape and addressing species of common conservation concern, a number of challenges exist that can complicate cooperation or reduce its effectiveness.

In some situations, cross border cooperation can be a lower priority than taking care of business within their own system or jurisdiction, where park managers are more conversant with legislation, policy and procedures, and where networks already exist and where funding may be more readily available for project work. Restrictions on travel outside the country may also limit opportunities to meet with cross border colleagues or take part in cross border initiatives. With regard to transboundary or adjoining protected areas

in the Arctic, long travel distances and language differences can serve as an impediment to effective collaboration.

In Arctic protected areas, many of which are managed cooperatively with indigenous groups, domestic laws regarding rights and privileges of indigenous and local communities in protected areas vary from country to country. These differences can complicate cross boundary collaboration by Park agencies, since management arrangements that are effective in one country, based on case law of that country, may not be applicable or be able to replicated in the adjacent country, limiting opportunities for sharing of best practises.

No less a source that the Economist magazine (2006) has noted the increasing setbacks experienced by transboundary protected areas as nations mount new programs to deal with border security. Focused on Big Bend National Park on the US-Mexican border, the article also references North Cascades National Park and Glacier National Park on the US-Canada border and notes the challenges facing transboundary cooperation in an age of heightened border security.

One of these transboundary challenges is cross border tourism, an important activity and revenue source for many national parks located close to the international boundary. Starting in 2007, the Western Hemisphere Travel Initiative will require passports for travel between the US and Canada. This is expected to have significant negative impact on cross border tourism, including travellers to parks and historic sites on both sides of the border. Many potential visitors will not possess passports and will not be able to make cross border trips to visit parks and sites.

Although less of an issue, increased security requirements also may make cross border travel by protected areas staff more complicated, which, in turn, can negatively affect cross border cooperation.

In the last several decades, there has been a significant growth in multi-lateral and regional environmental agreements that increasingly require protected area organizations to work at a regional or global scale (e.g. Scanlon and Burhenne-Guilmin 2004). The most recent of these is the Convention on Biological Diversity (1992) that includes an Article on protected areas (Article 8, In-situ Conservation). In 2004, the Parties to the Convention adopted a global Program of Work on Protected Areas. These instruments have an overall positive effect on global action and cooperation on protected areas as a means to conserve biological diversity. However, this new imperative for international cooperation and efforts by national park agencies on a country by country basis to contribute to the implementation of a global program of work, can result in a lower priority for bilateral or cross border cooperation.

Future opportunities

Although challenges face cross border cooperation related to protected areas and their management, new opportunities are also emerging.

Although not directly related to the Parks Canada–USNPS MOU, the Chief Executive officer of Parks Canada and the Director of the USNPS have met in both 2005 and 2006 to discuss issues of mutual interest and identify new areas of cooperation. In addition, Parks Canada is developing a new strategy to consolidate and advance its international agenda that will better define priorities for international work, including cross border cooperation. New resources to be dedicated to international work as part of this strategy will provide the agency with additional capacity to address cross border cooperation. Increasingly Parks Canada staff and staff of the USNPS are working cooperatively in a variety of areas to address species of common conservation concern such as the monarch butterfly and to share information and best practices in areas such as managing for ecological integrity, monitoring and remote sensing. Another example of cross border cooperation, related to cultural resource management, is the use of the US Secretary of the Interior's Standards for Historic Properties as a basis for Standards and Guidelines for the Conservation of Historic Places in Canada. A number of national historic sites commemorate themes and historic resources that are of significance to both Canada and the United States.

In the Arctic, the designation of International Polar Year (2007-08) may serve as a catalyst for renewed circumpolar cooperation on arctic protected areas. International Polar Year activities in Canada will be linked with activities in other polar regions through partnerships and collaborative activities some of which involve or have implications for parks and protected areas.

Parks Canada recently established a new External Relations and Visitor Experience Directorate to focus on memorable visitor experiences that will better enable the agency to address cross border tourism challenges, carry out and share social science research and better engage partners and stakeholders.

Analysis and Conclusions

Research presented at the World Parks Congress concluded that effective management of transboundary parks requires institutional arrangements that are suitable to the countries that are working together. In the case of cross border cooperation between Canada and its neighbours, the most successful arrangements seem to be those that have been developed at the park and site level to address specific issues and needs. The high level strategic instruments such as the Parks Canada-USNPS Memorandum of Understanding or the CAFF Circumpolar Protected Area Network Strategy and Action Plan provide a useful context and symbolize goodwill and cooperation but appear to have a modest benefit in terms of actual on the ground cooperation.

Ongoing management of the USNPS-Parks Canada MOU has received less

attention than the actual negotiation of the agreement. The Intergovernmental Committee to review and discuss projects and possible areas for future cooperation and receive summaries of activities undertaken under the MOU has not been implemented. Although the MOU provides an enabling context for cross border cooperation, it does not appear to be used in this way by park managers on either side of the border when developing agreements to address specific cross border management projects. As illustrated by the Crown of the Continent and the cross-border cooperation associated with species recovery in Grasslands National Park, many transboundary management issues require cooperation with a wide range of partners and stakeholders and a bilateral agency-to-agency memorandum of understanding has limited application in these situations.

With respect to CAFF and circumpolar cooperation on protected areas, a recent paper (Pagnan 2005) concluded that significant progress and cooperation had been achieved in the early planning work where a number of important documents were prepared through strong collaboration, but that subsequent project work has been disappointing. On the ground implementation of the Circumpolar Protected Area Strategy and Action Plan, despite its early promise, has stalled. This is in contrast to the some of the examples of cross border cooperation cited earlier where like-minded professionals have come together, primarily at the park or site level, to address an issue or park operational requirement and put in place successful cross border cooperation.

It may be that both types of agreements are becoming necessary for effective park management to address the range of issues that park managers increasingly need to address and will face in the future such as climate change, the spread of invasive alien species and development pressures from adjacent lands and activities on both sides of the border. Essentially national parks have moved from being managed as islands of nature, to parts of regional networks, to key elements of continental conservation initiatives and management challenges have evolved accordingly. Strategic country-to-country cooperative agreements at the political level have value as a means to provide an enabling environment for bilateral collaboration, whereas informal or formal cooperation at the level of individual parks, to address shared management and operational issues, are emerging as the key mechanism to achieve tangible cross border cooperation, often in conjunction with other stakeholders.

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Addressing Transboundary Issues at Parks Canada

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Abstract

The Panel on Ecological Integrity of Canada's National Parks revealed that national parks are suffering from stresses internal and external to their boundaries. When a project or other activity occurs outside of the park boundary it may threaten the ecological integrity of the park, or at a minimum, be an additional stressor on the park's ecosystem. In such cases, Parks Canada is faced with a 'transboundary' issue that typically requires attention. In some instances, the transboundary issue may be of such significance that an environmental assessment in accordance with the Canadian Environmental Assessment Act is warranted. Parks Canada has determined that the development of a consistent approach to evaluating and managing potential transboundary issues affecting national parks is important to ensure that Parks Canada is effectively applying its available resources, particularly when the issue may warrant the application of the Canadian Environmental Assessment Act. To this end, Gartner Lee Limited was retained by Parks Canada to review the circumstances in which potential transboundary issues have been identified and addressed by Parks Canada. The review of this experience informed the development of a consistent approach to the identification, evaluation and management of potential transboundary issues affecting national parks. This review also documented lessons learned, including what has worked well and what hasn't worked for Parks Canada.

Background

While the *Canada National Parks Act* mandates that ecological integrity (EI) is to be given the highest priority in park management decisions, the federal government generally does not have jurisdiction over activities outside of park boundaries. When a project or other activity occurs outside of the park boundary it may threaten the EI of the park, or at a minimum, be an additional stressor on the park's ecosystem. In such cases, Parks Canada is faced with a 'transboundary' issue that may require attention.

Sections 46 to 53 of the renewed *Canadian Environmental Assessment Act* (CEAA) provide for the assessment of "transboundary and related environmental effects", by panel review or mediation, when there is a project that may cause significant adverse environmental effects that will cross an international, inter-provincial or federal-provincial boundary. Of particular interest to Parks Canada is the opportunity for the Minister of the Environment to use section 48(1) of CEAA to establish a panel review or mediation process for a project which may cause significant adverse environmental effects on a) the EI of a gazetted national park or park reserve, or b) federal land (i.e., a non-gazetted park or national historic site).

The Canadian Environmental Assessment Agency (CEA Agency) investigates and provides advice to the Minister of the Environment with respect to petitions or requests asking that projects be referred to a review panel or mediator under the provision of CEAA. Recent amendments to CEAA have removed a legal impediment to the use of the provisions and the expectation has been created that requests to use the provisions will increase significantly. The Agency has developed a set of internal procedures to help it manage the investigation process in a consistent and timely manner.

Parks Canada has been involved in the investigation and review of a number of transboundary issues involving such projects as new logging plans and roads, new residential and commercial developments, mines, waste facilities, and others. These projects and their associated transboundary issues have affected numerous National Parks and commemorative sites across Canada. While none of the transboundary issues that have emerged over the years have resulted in the establishment of a review panel or mediation in accordance with the requirements of CEAA, all have involved the expenditure of considerable effort and resources. The development of a consistent approach to evaluating and managing potential transboundary issues affecting national parks will be important to ensure that Parks Canada is effectively applying its available resources and that it is responding in a manner consistent with its mandate.

Key Characteristics of Transboundary Issues

No two transboundary issues are alike. Nevertheless, it is important to understand their key characteristics and how they emerge and are identified in order to best develop ways they could be investigated, analyzed, managed and resolved.

Transboundary issues, by definition, are inter-jurisdictional conflicts that can involve Provincial, Territorial, municipal or First Nation planning and decision-making processes. Often the federal government does not have any decision-making authority over a specific project proposal.

- Transboundary issues are not necessarily only of interest to Parks Canada.

- Transboundary issues are essentially land use conflicts (e.g. "conservation" vs. "development")
- While Parks Canada's mandate is centred upon the concepts of EI and Sustainability, the mandates of external stakeholders (e.g., Provincial authorities) are often more focused on regulatory approvals and enforcement issues, than planning, conservation or stewardship.
- Transboundary issues are most often associated with a specific project that is proposed adjacent to or nearby a national park.
- Transboundary issues can also be associated with a policy, plan or program of another jurisdiction (e.g., provincial or territorial government, municipal government or First Nation).
- Private sector projects that have potential to generate a transboundary issue are difficult to anticipate or identify early in their planning phase.
- Transboundary issues typically involve a wide range of stakeholders that have an interest in the land, as owners, managers, regulators, stewards or users.
- Transboundary issues are often controversial, generating a high public profile with substantial media attention.

Not all transboundary issues result in a petition for the application of the *Canadian Environmental Assessment Act*. However those that do, become very politically sensitive within the federal government, as they involve issues of jurisdiction.

Lessons Learned

Through a number of interviews with Parks Canada staff and other stakeholders involved in nine transboundary issues across Canada, Gartner Lee reviewed and documented the experience to date in dealing with transboundary issues and identified approaches and actions that would enable an effective and consistent approach for the future evaluation and management of potential transboundary environmental effects affecting national parks (Gartner Lee 2005). Based on these interviews several key lessons learned were identified:

- The time to identify potential transboundary issues and develop management responses is before a specific project is proposed, approved or constructed.
- Identify and take advantage of all opportunities to participate within external review and approval processes.
- A champion with authority and credibility is critical to the success of any effort to resolve transboundary issues.
- The potential for the use of a third party (e.g., mediation expert, the CEA Agency) to convene and co-ordinate a conflict resolution process should be considered as part of a strategic plan for issue management/resolution.
- Parks Canada's activities to resolve an issue are likely to be ineffective without active and timely support from senior management.

- Any formal request by Parks Canada to invoke Section 48 provisions of the CEAA and any successful issue-management effort must have credible sources of information, credible analysis and definitive conclusions regarding the effects on EI.
- Attention needs to be given to communications and collaboration with the broader community on specific transboundary issues.
- Attention needs to be given to the media.
- Attention needs to be given to ongoing public education, not only regarding the larger value of parks in the ecosystem, but also their economic and social value to local communities.
- Creation and/or participation in formal, collaborative planning and decision-making processes are the best mechanism to keep informed about regional issues of concern, avoid projects with transboundary implications, identify new projects and subsequently manage issues that arise.
- Issues are resolved more easily when there is trust and open and honest communications. Trust among stakeholders does not need to exist for a successful collaborative process to be initiated.

Towards a More Structured Approach to Transboundary Issue Management

Based on the lessons learned from previous cases, it became clear that Parks Canada could benefit from a more formalized and restructured process to the management of transboundary issues. Gartner Lee's research and experience suggested that Parks Canada move toward a more formalized and strategic approach to transboundary issue management. A restructured approach to transboundary issue management would involve:

- strategic planning to guide external stakeholder liaison, operational monitoring, research and data management activities at individual parks to support transboundary issue management;
- ongoing issue scanning to assist in issue identification;
- creating an explicit decision-making step early in the process to determine whether or not an issue warrants Parks Canada's action or response;
- a more formal, team approach to issue investigation/analysis;
- creating an explicit decision-making step early in the process to determine the merits of a petition and/or a Section 48 recommendation to the Minister of Environment;
- integrating a requirement for the development and approval of a "strategic plan" for implementing issue management/resolution activities on a case by case basis;
- conducting an internal evaluation of each transboundary issue following its resolution, whether the issue was successfully resolved or not;
- applying a set of tools to assist in the issue investigation/analysis and issue management/resolution steps in the process; and
- providing staff with training and guidance regarding issue management

tools and approaches and to enhance skills in the areas of alternative dispute resolution and media relations.

Figure 1 illustrates a restructured approach to transboundary issue management. The following sections describe the key elements of this restructured approach.

Strategic Planning

Some form of strategic planning is required at each park that would include a review of the various operational activities undertaken by Parks Canada that could provide useful data/information to determine whether or not a transboundary issue is likely to have a significant adverse effect on the park's EI. The goal of this review would be to identify gaps in scientific knowledge and ways in which operational activities could be undertaken to ensure that data/information is available to support decision-making concerning EI, if and when a transboundary issue arises.

Issue Scanning

Issue scanning is an anticipatory or foresight activity. Issue scanning would involve periodic and systematic identification and assessment of the environmental, social, political/regulatory, technological and economic issues, trends and activities that have the potential to affect a park's EI. The results of the issue scanning process could be formally documented either through a regular "watching brief" or a specific issue review/briefing note that would be provided to the park's Superintendent and other senior management. Within the context of a watching brief, issues would be analyzed, classified, prioritized for management review and action.

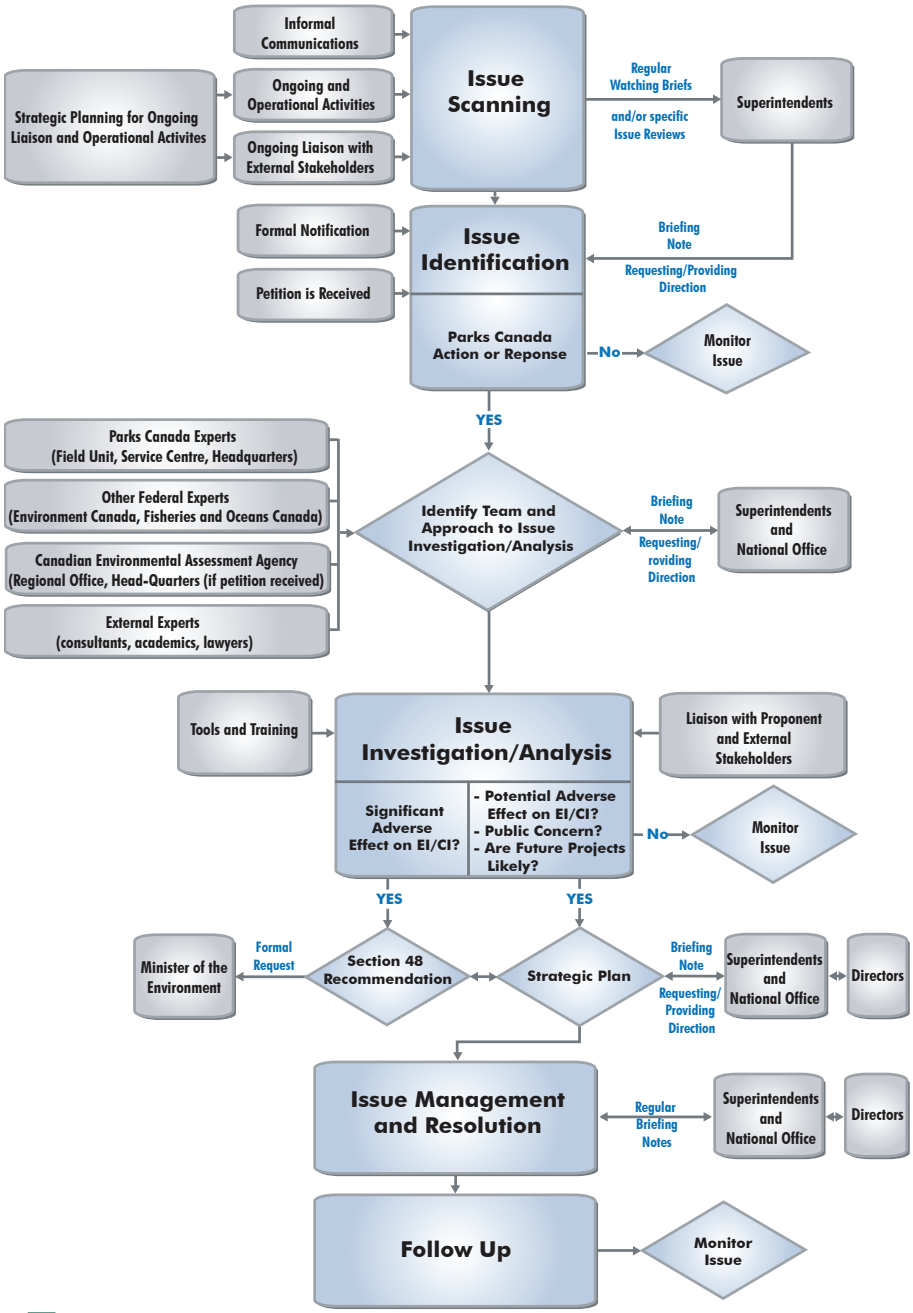
Issue Identification

Issue identification is the stage in the overall issue management process when a Park Superintendent or other senior management official decides that some sort of action or response from Parks Canada is required. Issues for which a Parks Canada action or response is desirable could be identified from the "watching brief" or briefing notes prepared by staff on a regular basis. Receipt of a formal notification or petition would automatically trigger action by Parks Canada. In both cases, formal documentation of the issues that require action is desirable.

Issue Investigation/Analysis

Once a transboundary issue has been identified for which some sort of action or response is desired, Parks Canada would initiate the issue investigation/analysis step. A team comprised of Parks Canada experts (i.e., Field Units, Service Centres and National Office staff) and other federal government experts (other federal authorities and the CEA Agency as required) would be assigned the responsibility to investigate and analyze the issue in detail. Decisions regarding

Figure 1. Restructured Approach to Transboundary Issue Management Process



the need for external expertise (e.g., consultants, academics and/or lawyers) would be made at this time. The issue investigation/analysis step should be guided by a formal work plan to ensure that the most relevant and up to date information regarding the issue is obtained in a timely manner. Ultimately, the result of the issue investigation/analysis step would be an answer to the question of whether or not the transboundary issue (i.e., a project, plan, program or policy) is likely to cause a significant adverse effect on the park's EI or commemorative integrity (CI). Consideration would also be given to whether there is significant public concern regarding the transboundary issue and whether there is potential for adverse cumulative effects from future projects.

Section 48 Decision-making

If the issue investigation/analysis step determines that there may be a significant adverse effect on the park's EI, this should be documented in a briefing note with a clear recommendation regarding the need to invoke Section 48 of the CEAA. In making a Section 48 decision, consideration would need to be given to the likelihood that a panel or mediator would be able to complete its work and contribute to resolving the transboundary issue (e.g., are people willing to participate, is negotiation a possibility, are there enough time and resources for such a process?).

Strategic Planning for Issue Management/Resolution

If the issue investigation/analysis step determines that a significant adverse effect on the park's EI or CI is not likely, a strategic plan would nevertheless be developed to either collect more information to make a firm determination of effect, and/or to determine the course of action that should be taken by Parks Canada and others to manage and/or resolve the issue.

Issue Management/Resolution

Issue management/resolution involves putting into action the strategic plan and applying to the extent possible the various approaches available to resolve the transboundary issue in the short term or otherwise manage the issue over the longer term. Some of the approaches that are available to Parks Canada staff include:

- participation in consultation processes (e.g. liaison committees and working groups, public/town hall meetings etc.);
- joint planning agreements;
- mediated solutions using negotiations;
- regulatory negotiations;
- policy dialogues;
- regional studies and cumulative effects assessments;
- proactive coalition building;
- speaking engagements and park tours; and
- proactive communications/media programs.

Evaluation and Follow-up

Parks Canada's success in managing a transboundary issue needs to be evaluated. Measures of success will vary depending upon the purpose and objectives of Parks Canada, however some of the measures of success offered by those interviewed included:

- degree to which the Parks Canada's objectives were achieved;
- degree to which the objectives of other parties involved in the issue were achieved;
- degree of broader community support/buy-in to Parks Canada's position;
- degree of collaboration among stakeholders that was achieved;
- number or degree to which specific commitments by stakeholders were obtained;
- number of 'agreements' achieved or issues 'resolved' within the framework of the agreement;
- number of issues requiring the application of formal conflict resolution procedures; and
- number of, or willingness to consider extensions or supplementary agreements.

Acknowledgement

The authors wish to acknowledge the contribution of Parks Canada staff at the National Office in Ottawa, the various park's Superintendents, staff at Parks Canada's Service Centres and the CEA Agency for their insight and assistance to Gartner Lee in completing this project.

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Urban to Rural to Hinterland: Planning for Protected Areas

The Regional Integration of Canada's National Parks: A framework for analysis

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Abstract

It has long been recognized in the literature that protected areas do not exist in isolation from their surrounding regions. The term 'regional integration' broadly means the integration of a protected area into its surrounding region in order to address the challenges that exist in the context of its interaction with its surrounding region. This paper introduces the concept of regional integration, presents a conceptual framework for examining regional integration, and gives a brief description of an ongoing Ph.D. research project that is examining the regional integration of Canada's national parks.

Introduction

It has long been recognized in the literature that protected areas do not exist in isolation from their surrounding regions (Garratt, 1984; Hough, 1988; Janzen, 1983; Zube, 1995). Early research on protected areas and their surrounding regions examined issues such as the management of conflicts between national parks and surrounding human communities (Hough, 1988) and the effects of national parks on surrounding communities (West and Brechin, 1991; Zube and Busch, 1990). This research tended to focus on the establishment of national parks in developing countries and the negative outcomes (such as physical displacement or the loss of traditional uses of natural resources) that were a result of the 'mismatch' of a Western model of protected area management and local circumstances.

Today, a vast literature details the many challenges that relate to protected areas and their surrounding regions, in both developing and developed-country contexts. From the perspective of protected areas in developed countries, some of the more common challenges include a lack of trust between protected area managers and local residents (Bissix *et al.*, 1998; McCleave *et al.*, 2004); a low level of communication, cooperation and coordination between government agencies within a protected area's surrounding region (Danby, 2002; Wright, 2002; Parks Canada, 2000; Beresford and Phillips, 2000); external pressures on protected areas' ecological integrity due to land development, habitat fragmentation, resource extraction, toxics and pollutants and exotic species (Walton, 1998; Francis, 2003; Parks Canada, 2000, 2000; Beresford and Phillips, 2000); and overuse from recreation and tourism (Nepal, 2000; Parks

Canada, 2000a, 2000b).

The regional integration of protected areas

The term 'regional integration' broadly means the integration of a protected area into its surrounding region in order to address the challenges that exist in the context of its interaction with its surrounding region. Examples of regional integration initiatives are:

- Building partnerships, collaborating, and cooperating with actors within a protected area's surrounding region;
- Developing, participating in, and/or increasing support for local institutions;
- Increased public participation in protected area management and planning;
- The coordination of regional plans and policies; and
- Resolving conflicts and improving relations with local people.

Regional integration can have varied or multiple goals. They might include addressing specific management problems, improving a protected area's ecological integrity, or moving towards economic or ecological sustainability in the protected area's surrounding region.

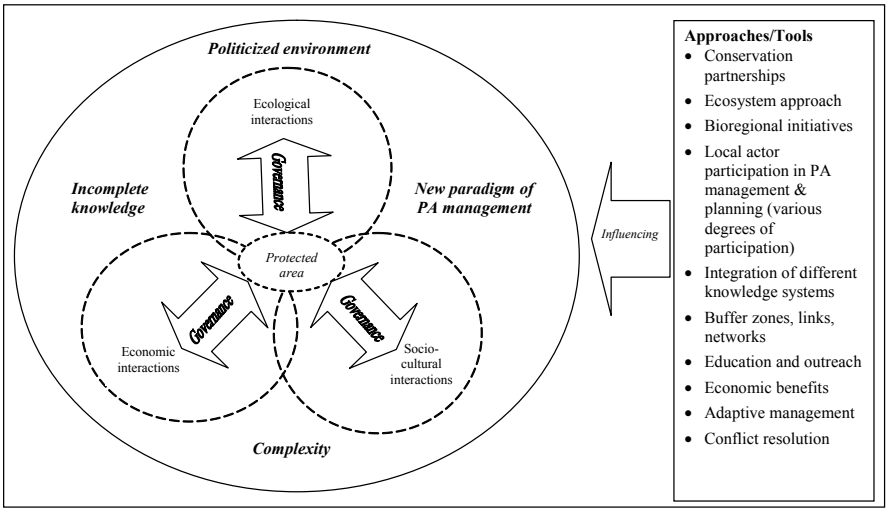
Despite efforts at implementing the types of regional integration initiatives described above, regional integration problems still remain for protected areas around the world (McCleave *et al.*, 2004; Brandon *et al.*, 1998; West and Brechin, 1991; Wells and Brandon, 1992). Four preliminary 'scoping' trips to national park regions in Canada indicate that the national parks of Canada are no exception. However, in depth research that focuses specifically on regional integration is sparse with most research addressing various components of regional integration such as partnerships in conservation (e.g., Stolton and Dudley, 1999; Brown *et al.*, 2003; McNeely, 1995), or developing larger scale 'bioregional' institutions for conservation (e.g., Miller, 1999; Gatewood, 1999; Brunckhorst, 2000). There is a notable lack of research which explores how regional integration is being carried out within the context of national parks in Canada or how the integration of national parks into their surrounding regions could be improved. Furthermore, regional integration as a concept remains unclear, under-studied, and undefined.

Conceptual framework for examining regional integration

A preliminary conceptual framework for examining the concept of the regional integration of protected areas has been developed (Figure 1). The framework will be constantly reviewed throughout the research process and therefore the framework as presented in this paper should be considered to be preliminary.

The conceptual framework has two main components. On the left, the interactions between a protected area and its surrounding region are represented,

Figure 1. Conceptual framework for examining regional integration



along with the context in which these interactions occur. On the right, are listed the main approaches and tools for addressing the challenges arising from the interactions on the left.

There are ecological, economic, and socio-cultural interactions between a protected area and its surrounding region. The use of dashed lines denotes that the boundaries between these systems and between the protected area and these systems are fluid and ever changing. All of the interactions transpire through the governance arrangements that are in place in the protected area's surrounding region. Furthermore, all of the above interactions occur within the context of a politicized environment, incomplete knowledge, complexity, and a new paradigm of protected area planning and management.*

Several protected area management frameworks have the potential to address the challenges that arise from the interaction between protected areas and their surrounding regions. The most commonly cited and used management frameworks are integrated natural resource management (Cairns and Crawford, 1991; Born and Sonzogni, 1995; Hooper *et al.*, 1999; Lang, 1986); ecosystem-based management (Agee and Johnson, 1988; Francis, 1993; Grumbine, 1994; Slocombe, 1993); and non-traditional 'governance types' such as community-based natural resource management (Agrawal and Gibson, 2001, 1999; Kellert *et al.*, 2000; Worah, 2002) and co-management (Berkes, 1994, 1997; Notzke, 1995). Other common management tools include the implementation of buffer zones and education and outreach programs.

* From the point of view of the manager of a government-managed protected area in the developed world, this means that a more regional, multi-stakeholder, and co-operative approach to protected area management is needed (Phillips, 2003).

Current study

The current study is examining the interactions between national parks in Canada and their surrounding regions, how these interactions have been addressed by national park managers and other actors, and how the concept of regional integration is currently defined and practiced. Five national parks and their surrounding regions have been selected as case studies for this research: Kejimkujik National Park, Nova Scotia; Gros Morne National Park, Newfoundland; Waterton Lakes National Park, Alberta; Mount Revelstoke National Park, British Columbia and Glacier National Park, British Columbia.* Semi-structured interviews are currently being conducted with Parks Canada employees and actors within the national parks' surrounding regions.

Anticipated outcomes of this study include the development of theory related to regional integration; an external perspective on the regional integration of Canada's national parks; and suggestions on how the regional integration of Canada's national parks could be improved. Preliminary results indicate that although many of the case study national parks are faced with similar regional challenges and contexts, there are quite different regional integration approaches in place across the country.

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* Mount Revelstoke and Glacier National Parks will be treated as a single case study since they are located very close to each other and managed by the same Parks Canada office in Revelstoke, BC.

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Moving Toward a Viable, Representative Protected Area Network in the Great Lakes Basin of Ontario

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Abstract

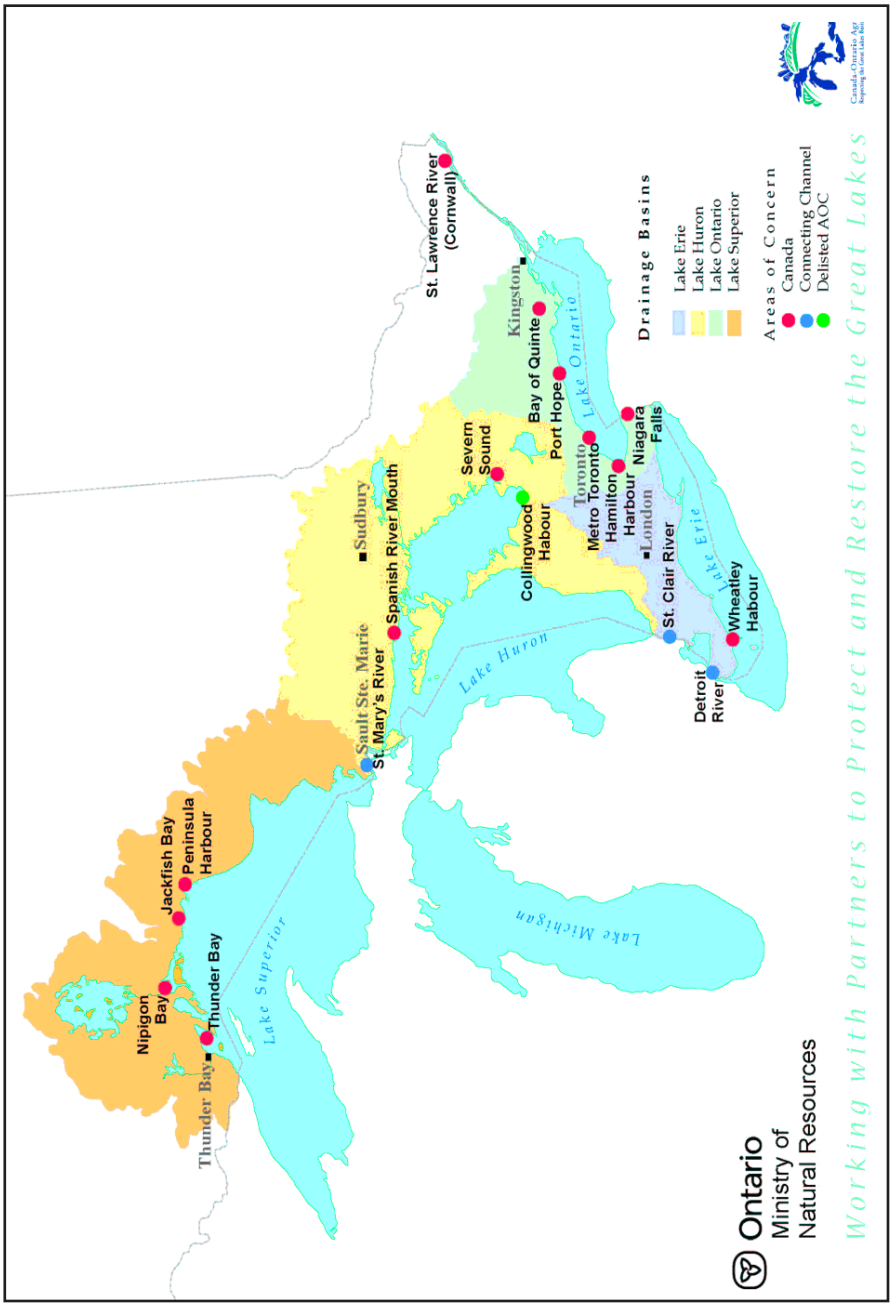
Over the past decade, several hypothetical ecological networks (e.g. lands of conservation importance) and systems of protected areas have been proposed within all or part of Ontario's Great Lakes Basin. Many of these systems provide visions of ecologically healthier landscapes within the Basin, as well as focal points for future conservation efforts, including securement and restoration. A key priority of The Canada – Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA) is improving the health of the ecosystems feeding into this drainage basin. Toward that end, it is necessary to know to what extent the current protected area system in the basin is a network, and to provide additional recommendations for its enhancement and development. Taking a broad view of protection, we have assembled the relevant spatial data on protected areas, and overlaid these data on the hypothetical systems proposed by others (Big Picture 2002, Great Lakes Terrestrial and Aquatic Conservation Blueprints). Areas of coincidence between the actual protected area system and the hypothetical systems were identified. Nearest-neighbour analysis was conducted between core unconnected blocks of conservation lands under two scenarios (blocks ≥ 20 ha and blocks ≥50 ha), and nearest-neighbour vectors were underlain with stream segments, where these existed, to determine whether potential ecological connections exist between the protected, but unconnected cores. All ecodistricts falling wholly or partly within the basin were analyzed. It is recommended that these results, along with those of the hypothetical systems, be used to assist in the prioritization of conservation efforts in the Great Lakes Basin.

Introduction

The Ontario portion of the Great Lakes drainage basin (Figure 1) is a large, diverse area of land and water that includes all or part of 34 ecodistricts, within 7 ecoregions and 2 ecozones (Crins, 2002). Thus, a very large range in climatic, geological, physiographic, and biotic variation exists within this huge area. The

southern portion of the Great Lakes Basin (within Ecoregions 7E and 6E) is heavily developed and settled, with most of the former natural cover having been converted for human use and settlement. In sharp contrast, the land on the

Figure 1. Ontario's portion of the Great Lakes Basin



Precambrian Shield (Ecoregions 5E, 4E, 3E, 3W, and 4W) is largely forested, with patches that have been converted for agriculture and settlement, and with industrial activities, particularly forestry, occurring within the forested landscape. The amounts and types of water bodies vary considerably between these two broad landscapes as well. This variation is generated partly by climatic and geological parameters, resulting in different water chemistries and buffering capacities, and different tolerances to eutrophication and acidification processes.

The need to establish a viable, representative network of protected areas in the Great Lakes Basin must be placed into this diverse ecological context. Within the *Lakewide Management Annex* of the *Canada – Ontario Agreement Respecting the Great Lakes Basin Ecosystem* (COA) (Environment Canada and Ontario Ministry of the Environment, 2002), Result 2 focuses on "*Rehabilitated, conserved and protected fish and wildlife habitats and protected areas*". One of the commitments under this desired outcome (result) is that "*Canada and Ontario will begin to establish a viable and representative Great Lakes protected areas network*".

This paper describes an analytical approach that should provide a useful tool in moving toward a viable, representative network of protected areas in the Great Lakes Basin. It takes advantage of the existing protected area system and provides suggestions on areas that would provide efficient, but ecologically meaningful, connections between existing protected areas through the use of nearest-neighbour analysis and overlays with previously created visions for natural heritage systems and water courses.

Current Protected Area System

There are many mechanisms in place in the Great Lakes Basin that afford varying degrees of protection for natural cover and natural heritage values (Crins and Janetos, 2006). In the southern portion of the Basin (much of the Lakes Huron, Erie, and Ontario watersheds), substantial portions of the landscape are in private ownership. Thus, reliance on the traditional, regulated forms of protection (national parks, provincial parks, conservation reserves) is inadequate. Other mechanisms of full and partial protection are required to ensure that natural heritage features are represented and that ecological functions can continue to operate, or be restored. In order to meet the commitment to begin to establish a viable, representative protected area network in the Basin, it is necessary to take account of, and utilize to the fullest extent possible, all of the protection mechanisms that are available. On the Precambrian Shield, the traditional regulatory protection mechanisms contribute a larger proportion to the network than do private ownership, conservation easements, policy mechanisms, and planning mechanisms. However, even there, policy-based protection mechanisms are important (for example, forest management planning

designations such as Areas of Concern* contribute substantially to connectivity among more formally regulated protected areas).

For the purposes of the approach being described here, all forms of full and partial protection are considered to be integral parts of the existing protected area system, and are treated equally in the analytical procedure. However, a potential enhancement, once the current state of the protected area system is known, would be to factor in the level of protection, in terms of determining priorities for securement and restoration. A classification system for protected areas, based on their management direction and conservation goals, has been developed by the IUCN (International Union for the Conservation of Nature and Natural Resources, now called the World Conservation Union; Phillips and Harrison, 1997). In Ontario, protection mechanisms have been classified using this system, and an approach to classifying partial protection mechanisms has been added (Gray *et al.*, 2007).

COA has provided the context in which the analytical approach described here was developed. To expand on the commitment made in COA, a vision for the protected area network is necessary, to provide a broader philosophical context. We propose the following vision:

The protected area network within the Great Lakes Basin is to be fully connected and ecologically viable, providing a full range of ecological services, including the protection of high-quality, representative terrestrial and aquatic ecosystems, hydrological functions, and suitable habitat for the native biota of the Basin.

Analytical Approach

The approach taken in this study involved:

- compiling all available digital information on protected areas (in the broad sense discussed above) within the Great Lakes Basin;
- overlaying these protected areas on proposed natural heritage visions and systems found in the Big Picture, 2002 (Nature Conservancy of Canada and Natural Heritage Information Centre, 2003) and the Great Lakes Conservation Blueprint (both terrestrial and aquatic components) (Henson and Brodribb, 2005; Wichert *et al.*, 2005);
- examining the degree of coincidence between existing and proposed or hypothetical protected areas and connections; and,
- assessing the distances between existing protected areas that are nearest neighbours to obtain a measure of the potential ease or difficulty of establishing connections between them.

*Areas of Concern in forest management should not be confused with Areas of Concern designated under the Great Lakes Water Quality Agreement. In forest management planning, Areas of Concern include numerous natural heritage and cultural values, some of which are related to water body protection.

Water courses were intersected with the nearest neighbour vectors to determine if there are natural landscape connections with which these vectors might coincide, to assist in increasing connectivity (functionality, viability) through focused securement and restoration efforts. This approach was tested with several pilot ecodistricts in southern Ontario to ensure its feasibility. When the pilot study was completed, and the methods for overlay and analysis refined, all ecodistricts coinciding, in whole or in part, with the Great Lakes basin were analyzed. Cartographic, digital, and tabular results were generated for each ecodistrict in the study area.

Data assembly and analysis were conducted using the Lambert Conformal Conic projection (NAD 83). The resolution of the raster data was 30 m. Forty-three input data layers were used in the compilation and analysis. Nearest neighbour analysis was conducted using the 'Nearest Features V.3.8' extension in vLATE 1.0 (Jenness Enterprises). During the application of the nearest neighbour analysis, a size constraint of 20 ha was placed on protected areas to be connected, to minimize the influence of small fragments on the analysis. The nearest neighbour analysis was conducted on an ecodistrict by ecodistrict basis. However, to ensure that nearest neighbours were found, the boundary of each ecodistrict was buffered by 10 km and any protected area that intersected the boundary was used as part of the nearest neighbour analysis for that ecodistrict. When nearest neighbour vectors were intersected with water features (lakes and rivers), the water features were buffered by 100 m on each side, and then intersected with the vectors.

Basic Technical Methodology for Creation and Analysis of Protected Areas Network Layer

1. Project all input data to Lambert Conformal Conic projection (NAD 83)
2. Convert first two sets of input data to grids (scores of 1 and 2 and background value of 0)
3. Add them together
4. Draw newly created grid
5. Based on score of output, determine the next number in sequence (Score of 1 + Score of 2 = Overlap score of 3; therefore the next input grid receives a score of 4)
6. Keep track of land types and overlapping areas in spread sheet
7. Repeat this process until all input grids are added to the Protected Areas Network grid
8. Transfer attributes from spreadsheet to grid (export to DBF and join in ArcView)
9. Reclassify all non-zero grid cells to 1

10. Overlay Protected Areas Network with Big Picture (delete islands and non-natural features, retain only cores and corridors)
11. Overlay Protected Areas Network with Aquatic and Terrestrial components of Great Lakes Conservation Blueprint, separately
12. Overlay Protected Areas Network with all 3 (Big Picture, Aquatic and Terrestrial components of Great Lakes Conservation Blueprint) together
13. On the Protected Areas Network, reclassify all non-zero grid cells to 1 and reclassify 0 to No Data
14. Run 'gridpoly' on reclassified Protected Areas Network on ArcInfo workstation to create polygon coverage
15. In ArcView, reselect all Grid Values = 1 from polygon coverage and convert to shape file
16. To dissolve adjacent polygons, add shapefile to an ArcMap project, make the shape file editable, and run vLate 1.0
17. Select polygons >20 ha and create shapefile
18. Add the Nearest Features V3.8 extension to the ArcView project and run on the >20 ha shapefile
19. Save resulting shapefiles and tables and run summary statistics
20. Buffer all streams and lakes/double line rivers by 100m for the entire study area
21. Intersect buffered water polygons with Protected Areas Network and convert to shape file
22. Intersect buffered streams with the nearest neighbour vectors for areas >20 ha
23. Create spread sheet of all summary statistics

Results and Discussion

Each ecodistrict within Ontario's portion of the Great Lakes Basin contains a partial (not fully connected) network of protected areas at the present time. On the Precambrian Shield, the present system is comprised largely of regulated protected areas on Crown land, although other protection mechanisms contribute to a small degree. In the south, the existing system is comprised of numerous protection mechanisms, providing variable degrees of partial to full protection. Maps illustrating the application of the approach described here, including the existing protected area system, overlays with two different hypothetical protected area systems based on different approaches and visions (Big Picture, Great Lakes Conservation Blueprint), and nearest neighbour vectors between protected areas over 20 ha in size, are presented in Figures 2-9, using Ecodistricts 5E-13, 7E-4, and 7E-5 as examples.

The landscape context (matrix) for each of these two broad regions (Precambrian Shield, south of the Shield) is entirely different. This is an important consideration in terms of the assessment of the viability of the network. In the

Figure 2. Ecodistrict 5E-13, with existing protected areas (mid-gray), important aquatic areas from Great Lakes Conservation Blueprint (Wichert *et al*., 2005) (pale gray), areas of overlap between them (dark gray), and nearest neighbour vectors (line segments of varying width and darkness).

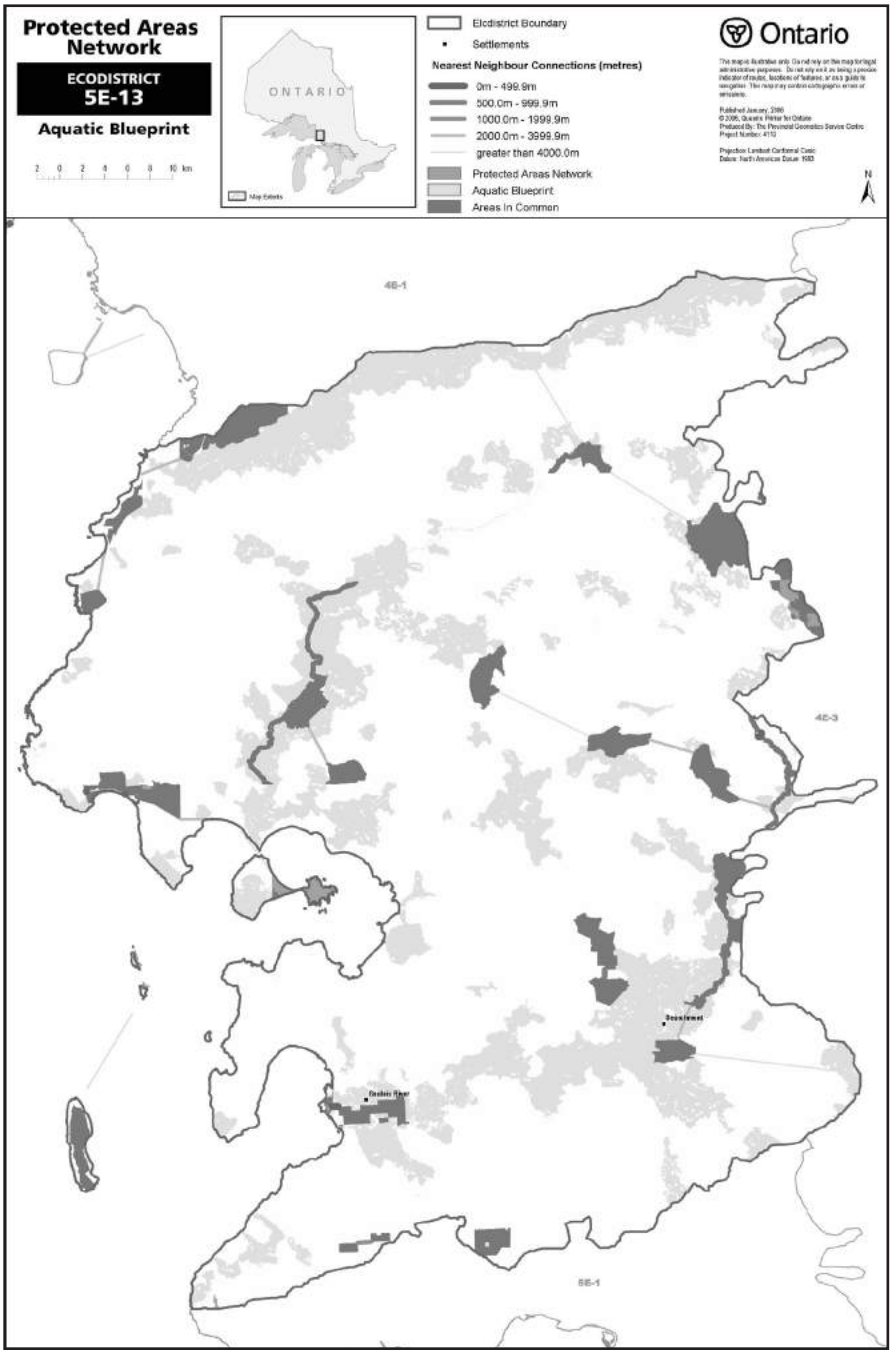


Figure 3. Ecodistrict 5E-13, showing existing protected areas (dark gray), nearest neighbour vectors (line segments of varying width and darkness), and water courses (dendritic mid-gray lines) that intersect nearest neighbour vectors.

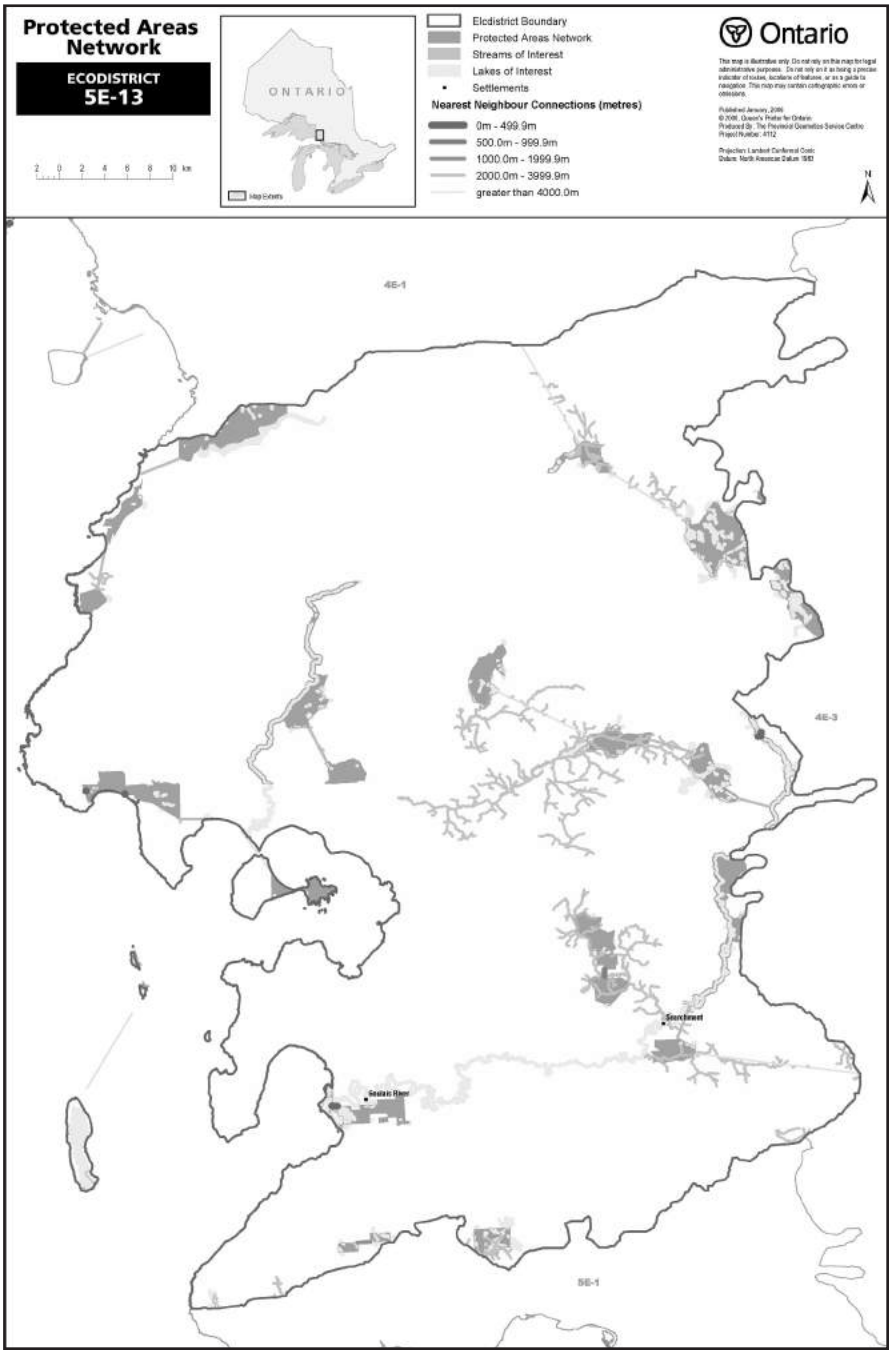


Figure 4. Ecodistrict 7E-4, with existing protected areas (mid-gray), important terrestrial areas from Great Lakes Conservation Blueprint (Henson and Brodribb, 2005) (pale gray), areas of overlap between them (dark gray), and nearest neighbour vectors (line segments of varying width and darkness).

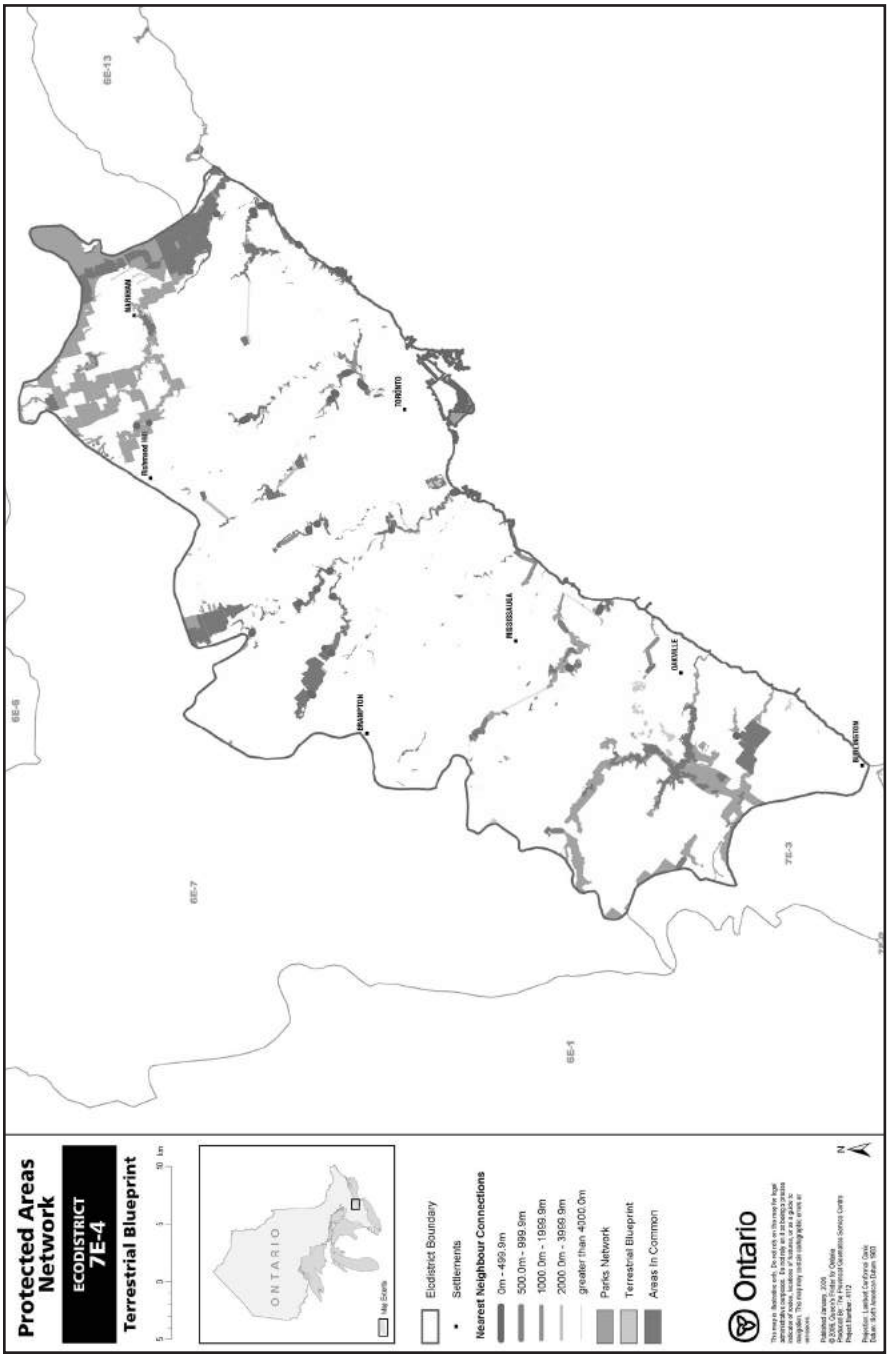


Figure 5. Ecodistrict 7E-4, with existing protected areas (mid-gray), important aquatic areas from Great lakes Conservation Blueprint (Wichert *et al*., 2005) (pale gray), areas of overlap between them (dark gray), and nearest neighbour vectors (line segments of variable width and darkness).

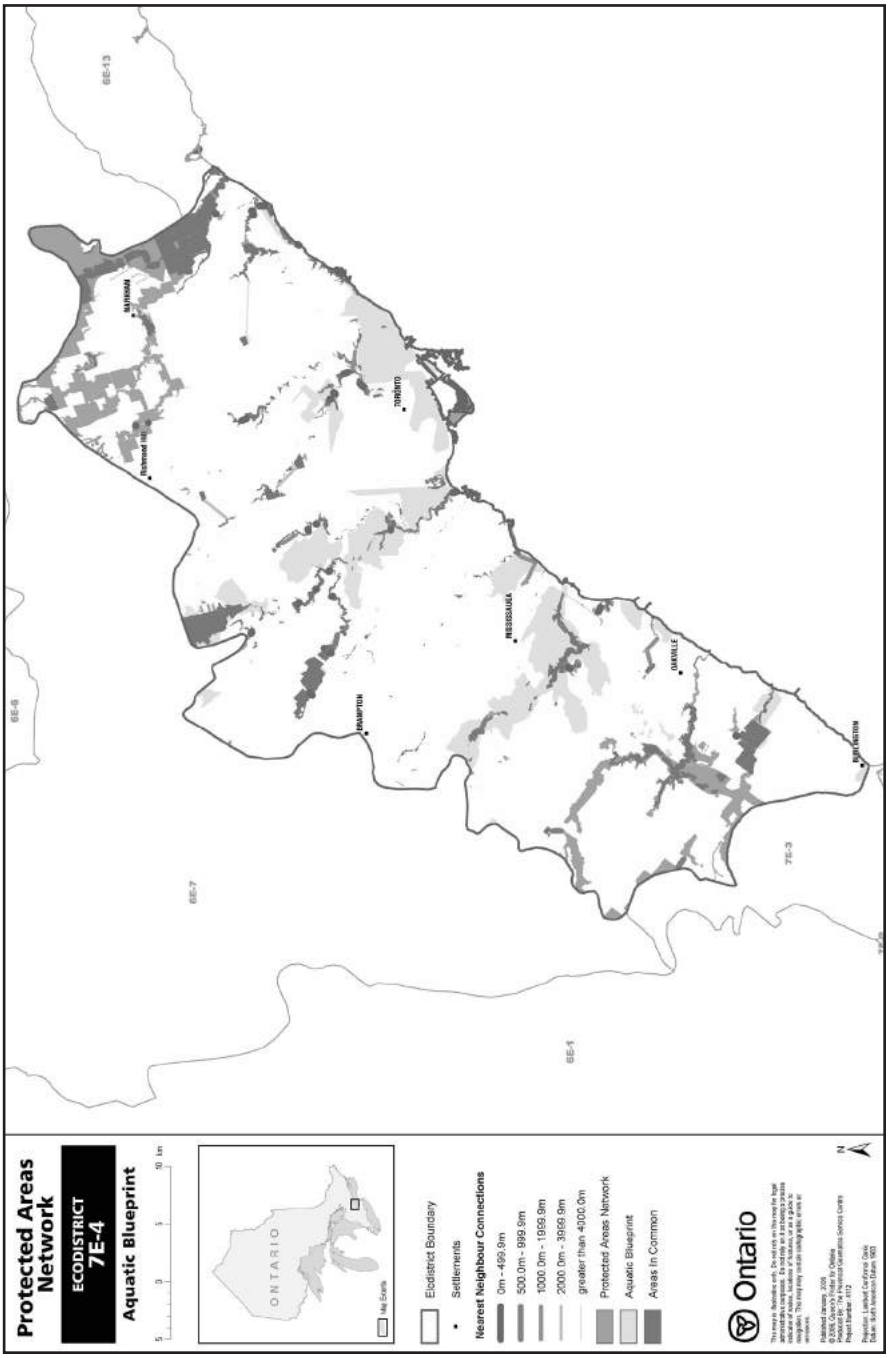


Figure 6. Ecodistrict 7E-4, with existing protected areas (mid-gray), Big Picture network (pale gray) (NCC and NHIC, 2003), overlap between them (dark gray), and nearest neighbour vectors (line segments of variable width and darkness).

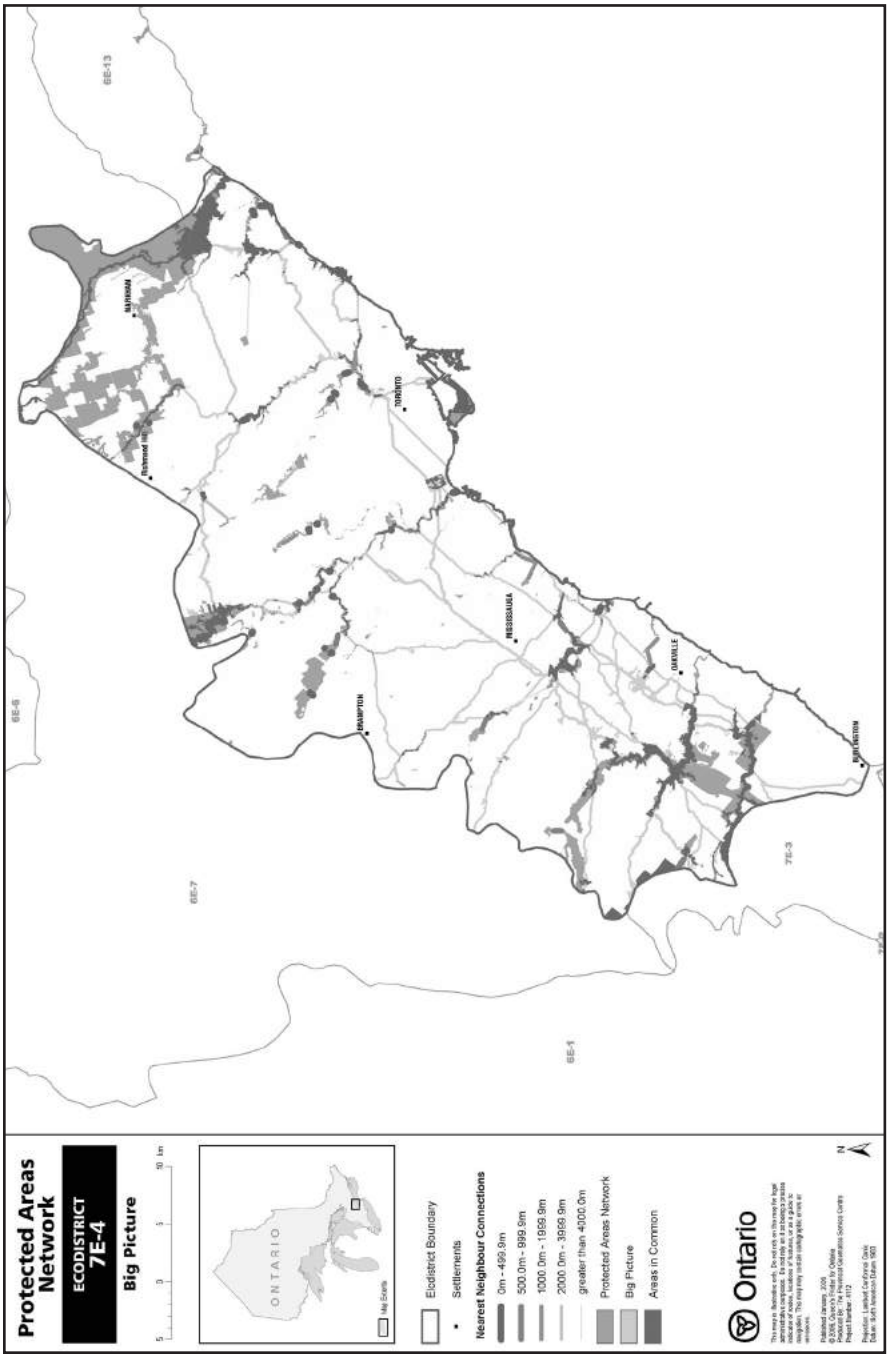


Figure 7. Ecodistrict 7E-4, with existing protected areas (mid-gray), nearest neighbour vectors (line segments of variable width and darkness), and intersecting water courses (dendritic pale gray lines).

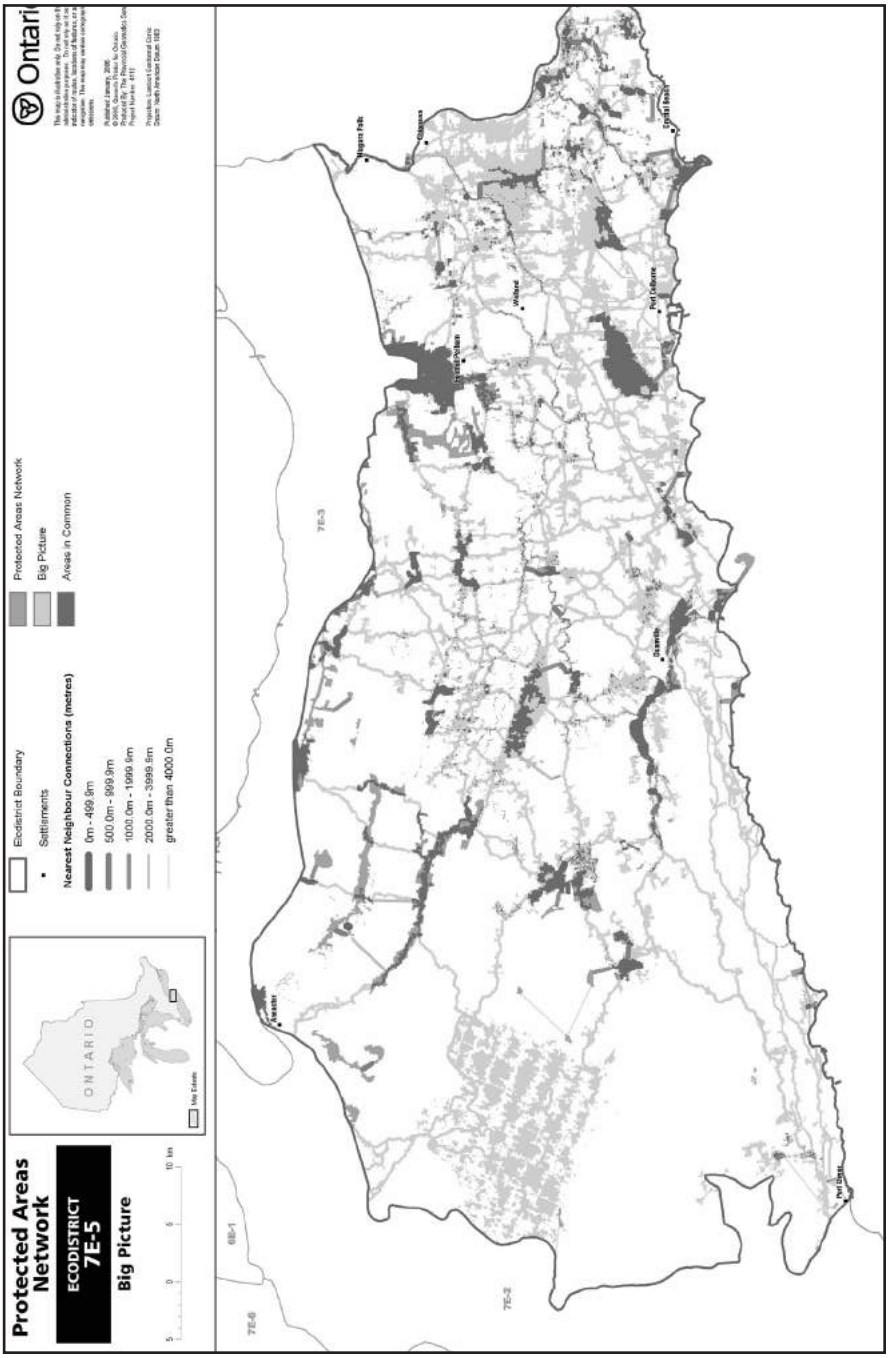


Figure 8. Ecodistrict 7E-5, showing existing protected areas (mid-gray), Big Picture network (pale gray) (NCC and NHIC, 2003), overlap between them (dark gray), and nearest neighbour vectors (line segments of variable width and darkness).

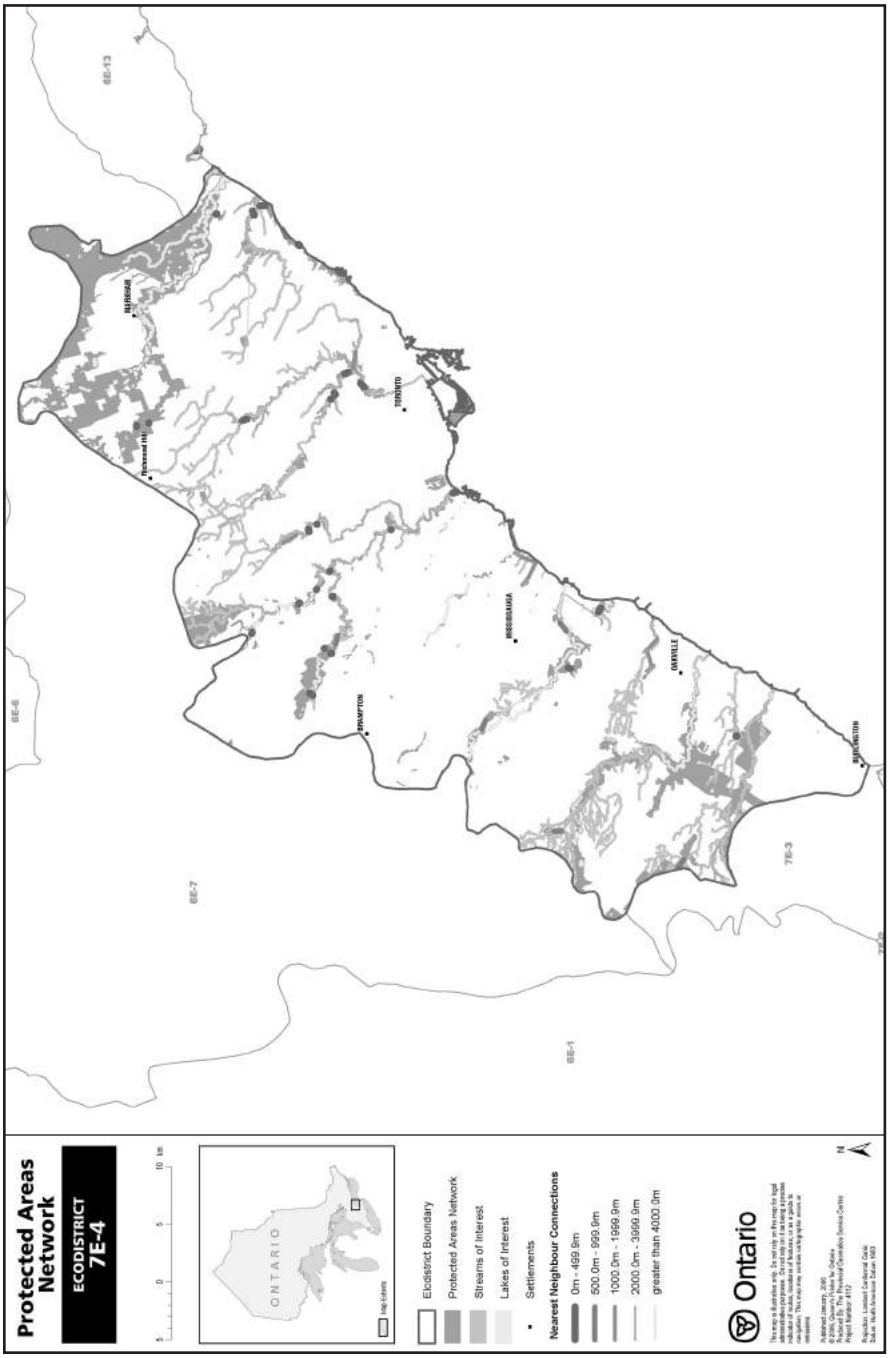
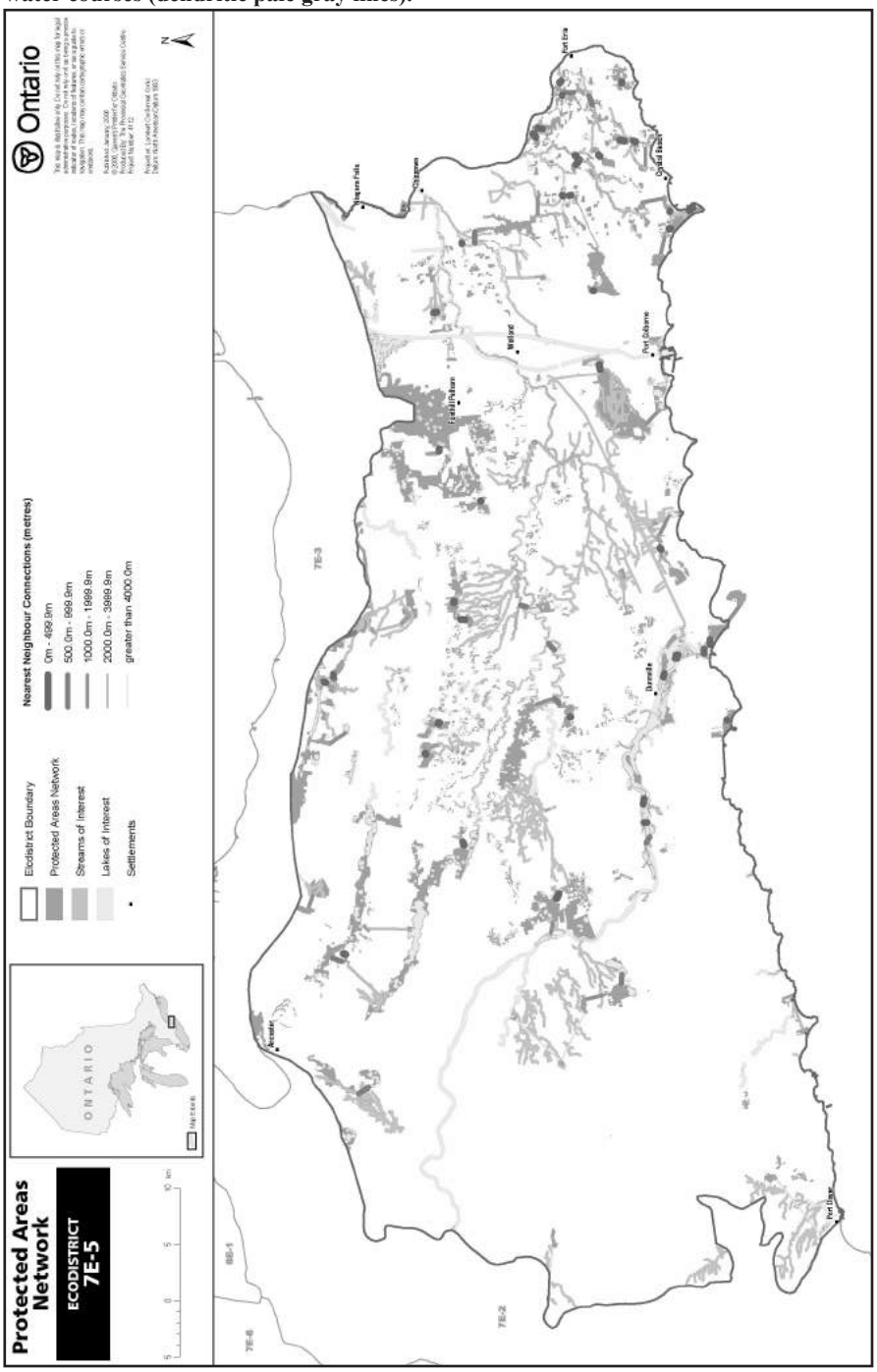


Figure 9. Ecodistrict 7E-5, showing existing protected areas (mid-gray), nearest neighbour vectors (line segments of variable width and darkness), and intersecting water courses (dendritic pale gray lines).



south, where the landscape largely has been converted away from natural cover to land uses supporting settlement and agriculture, the matrix provides limited support for biodiversity conservation. Therefore, the sum of all protected areas does not provide a well connected network. In order to increase the level of functionality or viability of the system, efforts will be required to secure and/or restore lands and waters to build the level of connectivity in the system, and to build the existing blocks of core natural heritage values so that their long-term viability is increased.

In the north, the matrix provides a supportive landscape for connectivity between protected areas. Since much of the land base still supports natural cover, the land base does not provide significant barriers to movement of terrestrial organisms, either through the matrix or between protected areas, but there are exceptions. In the vicinity of settled areas, and perhaps also in heavily cottaged areas, more barriers will exist to the movement of organisms. Also, aquatic ecosystems may be more compromised than terrestrial ecosystems, in terms of natural flows and movement of organisms. This would be true on heavily developed lakes, as well as on all dammed systems, of which there are many.

When interpreting the maps, each of the overlays and analyses should be examined, along with supplementary information regarding land use, built infrastructure, zoning, etc., in order to assess opportunities for enhancing the system and moving toward a connected network. The maps may assist in setting priorities for securement or ecosystem restoration. Each map provides a different perspective on the protected area system and its connectivity in a given ecodistrict. The nearest neighbour vectors may be short, giving the impression that enhancing connectivity may be relatively simple, but supplementary information may determine the actual feasibility of creating such connections. Likewise, long vectors do not necessarily imply difficulty in building the network. Once again, the landscape context, including existing uses and land tenure will be important considerations. Coincidence of the nearest neighbour vectors with natural features on the landscape, such as riparian systems, will enhance the ecological value of any securement or ecological restoration projects undertaken to build the network. All of the maps generated by the approach will serve as guides in building the protected area network, when supplemented by other information.

The analyses conducted using the approach described here should be used for prioritization for network-building projects (securement, restoration) at the ecodistrict scale. Once this has been done, we recommend that finer scale analyses be conducted at the local level (municipality, CA watershed, etc.), to focus in on particular tracts of land and water courses that will provide the highest value in building the network.

Acknowledgements

We thank Bill Thompson, biologist intern with Ontario Parks, for early work in obtaining data and beginning to build the protected area layer, Jason Henson, GIS analyst, for completing the assembly of the data layers and conducting the GIS analyses, Greg Sikma, cartographer, for creating the cartographic products, and Taylor Pattinson, GIS project manager, for managing the analytical part of the project. The latter three people work in OMNR's Geomatics Service Centre in Peterborough. We appreciate their efficiency and skill in conducting these components of the work. Over the course of the project, we have had productive discussions on the concepts related to this project with our partners from Parks Canada, Angus MacLeod and Paul Zorn. Also, the project has benefited from numerous discussions with other colleagues throughout OMNR and other conservation agencies who are conducting conservation planning exercises in various parts of the Great Lakes basin (e.g., Natural Spaces, Great Lakes Conservation Blueprint, the Island Biodiversity Project, etc.).

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Assessment of the Biodiversity and Conservation Status of Great Lakes Islands: A Progress Report

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Abstract

The more than thirty thousand islands of the Great Lakes form the world's largest collection of freshwater islands and their ecological significance is of provincial and global importance. They make a unique contribution to the biodiversity of North America and include a high proportion of Ontario's endemic species, rare communities, specialized biological functions and unique ecological phenomena. Many islands are under threat from incompatible development, invasive species and intensive recreation. Conservation of Great Lakes islands is important for maintaining the biodiversity of Ontario. Over 3100 large islands and island complexes in the Ontario portion of the Great Lakes have been organized by coastal environment and scored for 20 biodiversity criteria that include: rare species and communities, physical diversity, shape complexity, isolation and distinctiveness. Large islands and island complexes were also assigned scores based on threats and existing land protection and conservation policy. Results from this work can be used to better identify islands and island complexes that have exceptional biodiversity values and may require a more urgent conservation focus. This work is being integrated with a similar study in the U.S., and will enhance our understanding of the biodiversity and conservation needs of islands within the entire Great Lakes basin.

Introduction

Islands of the Great Lakes present an important opportunity for the conservation of freshwater coastal ecosystems. The more than thirty thousand islands of the Great Lakes, most of which occur in Ontario, form the world's largest collection of freshwater islands. Some of the recognized outstanding features of Great Lakes islands include the alvars of Manitoulin Island; the dune communities of

Lake Huron, Lake Ontario and Lake Erie; the tallgrass prairies and savannahs of the Walpole Island complex; and the harsh Precambrian coastline environments of Lake Superior. Islands also provide key nesting areas for colonial waterbirds, stop-over sites for migratory landbirds and habitat for Great Lakes fishes. In many areas of the Great Lakes, most of the coastal habitats occur on islands. They make a unique contribution to global biodiversity and include a high proportion of Ontario's endemic and disjunct species, rare communities, specialized biological functions and unique ecological phenomena. There are 459 different occurrences of provincially rare or tracked species and plant communities from the Natural Heritage Information Centre (NHIC) database that occur on Great Lakes islands.

The biodiversity on many larger islands has been well documented - Pelee Island and Manitoulin Island for example - but we know less about the more remote and less settled islands. Information is needed on the characteristics of the full spectrum of islands across the Great Lakes basin to inform and focus conservation. This information will benefit both governmental and non-governmental organizations working to conserve biodiversity on private and public lands.

A methodology was developed to take advantage of the availability of digital spatial data on the biological and physical features of islands and potential stressors. This is the first time that a comprehensive analysis of the biodiversity of Great Lakes islands has been completed and it is coordinated with complementary efforts in the United States.

This paper is a progress report on the analysis and preliminary results. A comprehensive report of our findings in Ontario will be released in 2007, in addition to the bi-national assessment.

Methodology

Coastal Environments

In order to create manageable units for the analysis, we grouped islands according to their Great Lakes coastal environment (Owens, 1979). Coastal environments are based on relief, geology, fetch, wave exposure, ice conditions, and availability and transport of sediment. This report splits some larger islands (e.g. Manitoulin) into different zones to reflect distinctive coastal characteristics. The Great Lakes shoreline on the Canadian side was divided into 33 coastal environments (Figure 1).

Large Islands and Island Complexes

Portions of the Great Lakes (e.g. eastern Georgian Bay) contain thousands of islands, many of which are very small and have similar characteristics. These complexes of small islands function as a landscape unit. Within each coastal environment large islands and island complexes were identified. Large islands

were extracted based on the range of sizes and maintained as a single unit of analysis. Clusters of small islands were grouped into island complexes based on proximity (within 200 m of each other and without any intervening land) and similar geology. The analysis was then done on the island complex, rather than small individual islands.

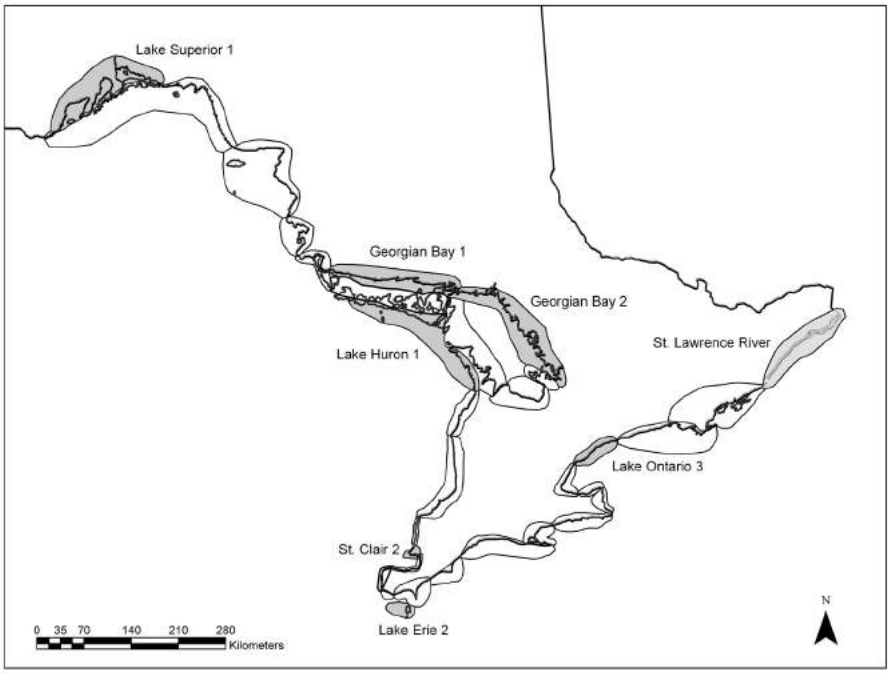
Scoring Criteria

Islands and island complexes were assigned scores based on three categories: 1) biodiversity values, 2) potential threats, and 3) existing conservation progress.

A bi-national working group established the following biological criteria to rank the relative importance of islands for conservation (Ewert *et al*. 2004):

- Presence of Nesting Colonial Waterbirds
- Presence of Roosting or Foraging Shorebirds
- Presence of Roosting or Foraging Waterfowl
- Stopover Sites for Landbirds
- Occurrence of Nursery/Spawning Areas for Native Inter-jurisdictional Fishes
- Number of State/Provincial Endangered and Threatened Species
- Number of Federally Endangered and Threatened Species

Figure 1. Coastal environments of the Great Lakes (Owens 1979) identified in this paper.



- Species and Communities Identified in the Conservation Blueprint for the Great Lakes
- High Quality Sites for a Species or a Community

The criteria from Ewert *et al*. (2004) were modified and used as a basis to build an enhanced scoring method that could use an automatic approach to assess the biodiversity of islands in the Ontario portion of the Great Lakes. Biodiversity criteria used included criteria for biological diversity, physical diversity, size and distinctiveness (Table 1). Data sources included Environmental Sensitivity atlases (e.g. Environment Canada 1993), shoreline data from Environment Canada, colonial nesting waterbird data from Canadian Wildlife Service, data on rare species and community occurrences from the Ontario Natural Heritage Information Centre and vegetation data from the Great Lakes Conservation Blueprint for Biodiversity.

Table 1. Biodiversity Scoring Criteria for Great Lakes Islands

Biological Diversity

Species
- Diversity of Tracked Species (extant element occurrences)
- Colonial Nesting Waterbirds (known breeding sites)
- Global Biodiversity Values (G1-G3 species and Great Lakes endemic/ disjunct/declining species)
- Species at Risk (Endangered, Threatened, Special Concern)

Vegetation Communities
- Extant community element occurrences and G1-G3 communities

Ecological Systems
- Diversity of natural terrestrial ecological system types
- Presence of key aquatic and terrestrial ecological systems
- Presence of key shoreline combination types
- Presence of rivers/streams, wetlands, inland lakes

Ecological Functions
- Degree of isolation from other islands, island complexes or the mainland
- Presence of roosting and foraging shorebirds, waterfowl and landbirds
- Known occurrences and suitable habitat of interjurisdictional fish

Physical Diversity

Shape complexity
- Area weighted mean path fractal dimension

Geological diversity
- Presence of key geology types and diversity of types

Shoreline diversity

Size
- Based on 10 natural breaks within a coastal environment (thresholds will vary)

Distinctiveness

Similarity Index
- Compares ecological complexity, geology and shorelines of each island or island complex to the average for the coastal environment
- Measures which islands are representative and which are unique within their coastal environment

The analysis of threats considered direct potential threats, such as boat launches, anchorages, residences, cottages, building density, invasive species, pits, quarries and lighthouses. Indirect potential threats considered included distance to mining claims, road density and percent of the island occupied by cropland.

The numerical scores assigned to each island and island complex according to the criteria above is described in another paper (Henson *et al*. 2006).

Conservation progress was also assessed for each island and island complex. Spatial data on parks and protected areas, Areas of Natural and Scientific Interest, OMNR evaluated wetlands, lands owned by NCC and other organizations for conservation purposes agencies, and islands recognized as top-scoring aquatic and terrestrial sites from the Great Lakes Conservation Blueprint for Biodiversity were compiled as part of this project. Parks, protected areas, conservation lands and existing recognition of biodiversity values were assigned into four categories to reflect the general type of associated conservation. Existing conservation progress scores did not directly contribute to the biodiversity or threat scores, but the proportion of these conservation lands on each island and island complex were assessed to provide further insight into island values and identify potential conservation gaps and needs.

Highest scoring islands for biodiversity and threats within each coastal environment were identified based on the natural breaks, (Jenks) method provided in ArcGIS software (ESRI 2002). Along with the protection gap analysis, potential priority islands and island complexes for conservation can be identified.

Preliminary Results

Ontario's Great Lakes islands contain an abundance of provincially and globally significant biodiversity values that vary across the basin. There is also a wide range in threat scores across the islands within and among the coastal environments (Table 2). The highest mean biodiversity score was found in the Georgian Bay 2 coastal environment followed by Lake Erie 2.

This analysis confirms the importance of several islands that are already well known for their biodiversity. For example, the southern portion of Manitoulin Island had the highest overall score for biodiversity (Table 3) (Note: Manitoulin Island occurs in three different coastal environments and has an associated score for each portion). Manitoulin Island is known as the largest freshwater island in the world. Larger islands, like Manitoulin, tended to score higher for biodiversity because of their size and because they typically support a greater range of habitats than do smaller islands. Manitoulin Island was separated into subsections that fell within different coastal environments (Figure 1) and would have scored higher if included in one coastal environment. It scored high for species at risk, the diversity of globally rare vegetation communities,

the presence of wetlands, lakes and rivers, and fish habitat, as well as, size. Manitoulin supports habitat for many globally rare species including itcher's thistle (*Cirsium pitcheri*), lakeside daisy (*Tetraneuris herbacea*) and dwarf lake iris (*Iris lacustris*). The large and globally rare alvar communities are also particularly significant.

Table 2. Total biodiversity score and threat scores for eight of the 33 coastal environments on the Canadian side of the Great Lakes.

Coastal Environment	No. Individual Islands	No. Islands/ Complexes	Biodiversity Score		Threats Score	
			Mean	Range	Mean	Range
Georgian Bay 1	3992	595	85.2	0-345	1.3	0-65
Georgian Bay 2	17615	848	90.2	0-290	11.8	0-52
Lake Erie 2	15	15	151.7	87-385	11.2	1-88
Lake Huron 1	887	173	103.4	39-490	8.2	1-179
Lake Ontario 3	34	13	127.0	86-190	7.0	1-27
Lake Superior 1	167	117	84.6	39-290	2.2	1-25
St. Clair 2	234	25	162.2	92-336	9.2	1-68
St. Lawrence 1	337	111	92.4	44-211	19.5	1-81

Table 3. Islands in top-scoring biodiversity class from eight coastal environments in the Great Lakes in Ontario.

Coastal Environment	Islands in Top-Scoring Class (total biodiversity score)
Georgian Bay 1	Great La Cloche Island (345); Clapperton Island (259)
Georgian Bay 2	Parry Island (290); Philip Edward Island (271); Beausoleil Island (270)
Lake Erie 2	Pelee Island (388)
Lake Huron 1	Manitoulin Island (490); Cockburn Island (318); Fitzwilliam Island (240)
Lake Ontario 3	Toronto Island (190), Algonquin Island (186), LO3-13 (157)
Lake Superior 1	Pie Island (290); St. Ignace Island (259)
St. Clair 2	Squirrel Island (Portion of Walpole Island) (336)
St. Lawrence River	Ault Island (211); Grenadier Island (196); Tar Island (174); Cornwall Island (168)

Figure 2. A provincially rare plant found in a globally rare community type. Nodding onion *(Allium cernuum,* S2) in Stone Road Alvar. Photo by G.M. Allen, NHIC Archives.

Pelee Island was the second highest scoring individual island and the highest within its coastal environment (Lake Erie 2) (Table 3). Pelee Island also supports a high diversity of globally rare, endemic and disjunct species and species at risk as well as rare plant communities. It had high scores for key ecological systems and wetland, stopover sites for land birds, colonial nesting birds, fish habitat and size. Per unit area, it is one of the richest sites in the entire province, supporting dozens of rare species such as blue racer (*Coluber constrictor foxii*), Lake Erie watersnake (*Nerodia sipedon insularum*), Eastern foxsnake (*Elaphe gloydi*), yellow-breasted chat (*Icteria virens*) and Miami mist (*Phacelia purshii)*.

Patterson Island, the largest of the Slate Islands in Lake Superior at 2,776 hectares, was notable for its disjunct species, key ecological systems, streams, shoreline diversity, fish habitat, isolation and size. As well as arctic-alpine vegetation communities, this island supports woodland caribou (*Rangifer tarandus*), yellow dryas (*Dryas drummondii*), smooth woodsia (*Woodsia glabella*), northern woodsia (*Woodsia alpina*), mountain bladder fern (*Cystopteris montana*) and large-leaved sandwort (*Moehringia macrophylla*). It is adjacent to spawning shoals of lake trout (*Salvelinus namaycush*) and lake herring (*Coregonus artedi*).

Lesser known islands in other coastal environments that scored highly include: Great La Cloche Island in Georgian Bay 1, Parry Island and Philip Edward Island in Georgian Bay 2 and Pie Island and St. Ignace Island in Lake Superior 1. Squirrel Island, a part of the Walpole Island complex in St. Clair 2

scored highly and would score even higher if the entire complex were within the study area (a portion is on the U.S. side).

In addition to assigning priority to islands based on the total biodiversity score, islands were also assessed based on key attributes that are unique to island systems. The diversity of ecological systems and physical environments were also assessed separately as surrogates for biodiversity.

Key island attributes include habitat for colonial nesting waterbirds. Islands with a relatively low total biodiversity score can nevertheless be critical for nesting waterbirds. Wallis Rocks, a complex of 12 small islands contains nesting habitat for colonial nesting birds: herring gull (*Larus argentatus*), Caspian tern (*Sterna caspia*), ring-billed gull (*Larus delawarensis*) and great black-backed gull (*Larus marinus*). Despite the abundance of these species, there are relatively few nesting sites on the Great Lakes.

Priority islands were also identified based on the score for the diversity of ecological systems and physical environments. These measures can be less biased than some of the species and community measures, which are based on field data. Often, sites with high scores for their diversity of ecological systems and physical environments also had the highest overall biodiversity scores.

Figure 3. Northern anemone (*Anemone parviflora*, S5), an Arctic disjunct plant found on Lake Superior islands. Photo by M.J. Oldham, NHIC Archives.

Potential Threats

There are many potential threats to the biodiversity of Great Lakes islands. Extensive residential and cottage development occurs on the islands of the lower Great Lakes as well as development related to tourism and recreation,

such as marinas, resorts and roads. Large aggregate operations are located on some islands. Larger islands support permanent residential development, roads and agriculture. The aquatic ecosystems adjacent to islands can be impacted by over-harvesting (not scored) and by the array of non-native species.

Many islands scoring high in biodiversity also scored high for threats (Table 4), partly because the larger islands that support greater biodiversity also support more human activities. There is a significant but low positive correlation between total biodiversity score and threat score (Pearson correlation coefficient=0.343, $P \leq 0.01$).

Table 4. Islands in top-scoring threat class in eight coastal environments of the Great Lakes in Ontario.

Coastal Environment	Islands in Top-Scoring Class (total threat score)
Georgian Bay 1	St. Joseph Island (65)
Georgian Bay 2	Island-GB2-278 (52); Island-GB2-681 (52); Island-GB2-1283 (50) Note: there are 21 islands in the top threats class in GB2, none of which have names
Lake Erie 2	Pelee Island (88)
Lake Huron 1	Manitoulin Island (179)
Lake Ontario 3	East Island (Ontario Place) (27)
Lake Superior 1	St. Ignace Island (25)
St. Clair 2	Squirrel Island (68)
St. Lawrence River	Cornwall Island (81)

In general the level of threat is higher in the lower Great Lakes, as a result of the greater human population and its impacts. However, many islands, due to their isolation or small size, have been relatively free of human impacts and represent excellent opportunities for conserving representative or unique ecological systems.

Applications

The urgency for conservation actions concerning islands, or any natural area, will be a combination of the importance of the biodiversity values, the threats to those values and any existing conservation progress. Our first attention should be towards irreplaceable biodiversity values, especially those under impending threat (*sensu* Margules and Pressey 2000). When assessing priority for conservation, the level of threat can be an incentive to take actions quickly,

but if the threat is too great, it may be more practical to conserve areas with similar values but less immediate threat. However, such choices are not always available to be made. Figure 5 presents an example from the Lake Erie 2 coastal environment of how plotting biodiversity scores against threat scores can be useful for identifying islands that may be a priority for conservation action.

Next Steps

The work reported here will form part of a binational report on the biodiversity of islands across the entire Great Lakes. Another report in progress (Henson *et al*. 2006) will describe the methodology and present detailed results for coastal environments within Ontario. This information should make a useful contribution towards identifying the most important islands for future conservation initiatives.

Figure 4. Caspian tern and ring-billed gull nesting colony, South Watcher Island. Photo by D.A. Sutherland, NHIC Archives.

Acknowledgements

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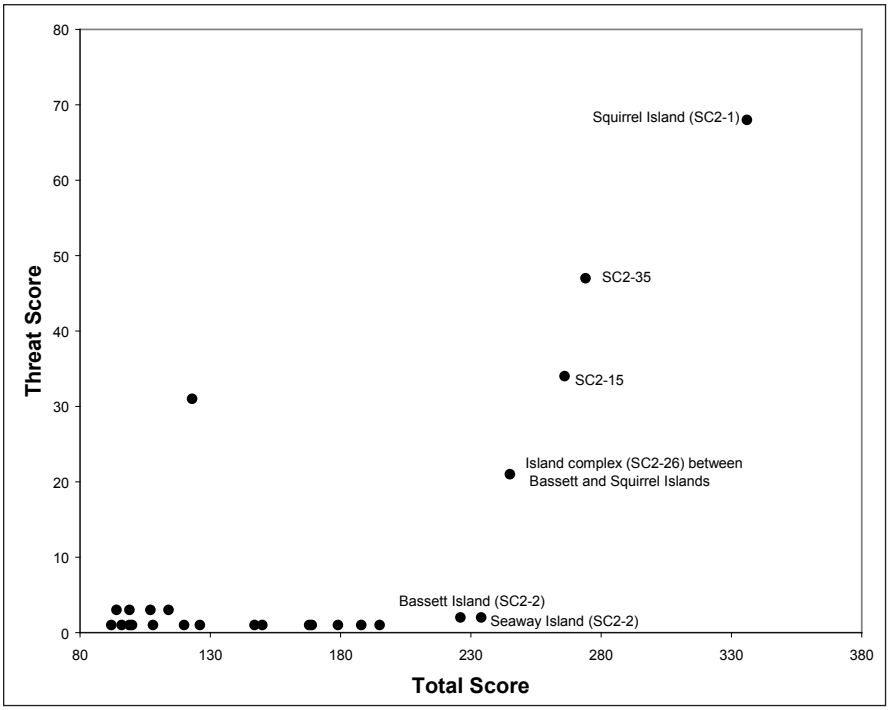
Figure 5. Total biodiversity score versus threat score for islands in the St. Clair 2 coastal environment. Islands in the upper right quadrant may be a higher priority for conservation (i.e. higher biodiversity and threats scores relative to other islands in the coastal environment).



data summaries and the preparation of figures for this paper. Wasyl Bakowsky (NHIC) and Bill Crins (Ontario Parks) provided valuable input in discussions on the methodology and preliminary results. Jim Mackenzie facilitated and supported the partnership between NCC and the NHIC. The U.S. partners co-leading the bi-national assessment of Great Lakes islands are The Nature Conservancy (U.S.), U.S. Fish and Wildlife Service, University of Minnesota and the Northeast Midwest Institute.

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GapTool: An Analytical Tool for Ecological Monitoring and Conservation Planning

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Abstract

GapTool is an analytical tool that is used to prepare information on ecological representation. It is based on a framework for terrestrial life science representation developed by the Ontario Ministry of Natural Resources (OMNR). This framework helps to ensure that the full range of Ontario's natural diversity is systematically identified and protected. OMNR has chosen to use naturally occurring landform/vegetation associations as surrogates to represent the range of biodiversity in terrestrial ecosystems. Landform/vegetation associations that are not adequately represented within protected areas in an ecodistrict are known as gaps in representation. Ontario Parks has improved the provincial GIS data sets used to assess ecological representation; these include ecodistricts, protected areas, and landform/vegetation associations. GapTool enhances monitoring and reporting by helping to produce up-to-date tabular reports and maps on ecological representation for all of Ontario's 71 ecodistricts and over 600 protected areas. GapTool also serves as a decision support tool for assessing candidate protected areas during systematic conservation planning.

Ecological representation and gap analysis

The concept of ecological representation has developed worldwide over the past quarter century as a method to help conserve biological diversity. Ecological representation is based on the principle that the full range of a region's natural diversity should be systematically identified and protected.

Fundamentally, protected area systems should include representative examples of the known biodiversity within ecologically defined regions. Examples of biodiversity that are not adequately represented within protected areas are known as gaps in representation.

Gap analyses are efforts to identify features that are not sufficiently represented within protected areas. Gap analyses are used to evaluate the degree of protection already in place for aspects of biodiversity, so that conservation efforts can be focused on species or communities with the greatest need.

Elements of biodiversity with lower levels of existing protection generally merit higher priority for conservation efforts.

Varying approaches to gap analysis have been used in different jurisdictions, but the underlying premise is common to all approaches: natural heritage features are assessed to determine whether or not some of those features require conservation.

GapTool is an analytical tool to help prepare information on ecological representation, including gaps in representation. It is based on a framework for terrestrial life science representation developed by the Ontario Ministry of Natural Resources (OMNR).

Criteria for Selecting and Designing Protected Areas

As outlined in *Nature's Best* (OMNR, 1997), it is an MNR natural heritage objective "to identify, evaluate and select areas that embody the provincially significant geological, aquatic and terrestrial diversity of the Province." OMNR seeks to include the "best" examples that represent the diversity of its natural and cultural features within its system of protected areas.

For more than 30 years, OMNR has used these five criteria to identify, select, design, and assess proposed protected areas:

1. Representation of terrestrial life science, aquatic life science, and earth science features;
2. Condition, in terms of freedom from anthropogenic modifications;
3. Diversity, or heterogeneity of landscape components and species within a proposed site. Sites with greater variety of physical habitats tend to support a wider array of biodiversity because of the range of habitat conditions they provide;
4. Ecological functions, in regard to the ecological role of a proposed site within the broader context of the surrounding landscape and watershed. This is assessed primarily in terms of hydrological functions, size, shape, connectivity with other protected areas, ecologically defined boundaries, limiting habitat components for species not at risk, and successional processes as indicated through features such as old growth forest; and,
5. Special features, primarily populations of species and vegetation communities known to be rare in Ontario, and localized features important to their persistence.

The first criterion, representation, is the backbone of the approach. The other four criteria are used to help identify the "best" examples of representative features, and help design functional protected area systems that promote the persistence of biodiversity (such as through well designed protected area boundaries). The best examples of representative natural features in Ontario are considered to be provincially significant, and many are also nationally or internationally significant (OMNR, 1997). The next best examples are

considered to be regionally significant.

These five selection criteria were developed for the purposes of protected area systems planning in the 1970s. They were applied in the preparation of Site District Reports, in which many of Ontario's Areas of Natural and Scientific Interest (ANSIs) were identified. They were also used in establishing priority areas for protection in District Land Use Guidelines. During the 1980s and 1990s, the approach was used in identifying protection priorities for old growth red and white pine forest, and in the Megisan Lake Environmental Assessment. In the 1990s, the selection criteria were used in Lands for Life, a major Crown land use planning initiative that included the identification of 379 protected areas encompassing some 2.4 million hectares across much of central and northern Ontario. Most of these sites have since been regulated as provincial parks and conservation reserves.

Although the five selection criteria are long established, their application is quite flexible and has continually evolved to reflect changes in available information and technologies.

Ontario's Approach to Ecological Representation

As noted, representation is foremost among the five selection criteria used to identify possible additions to Ontario's system of protected areas.

OMNR has prepared individual frameworks to help identify representative examples of earth science, life science, and cultural heritage features. Each of these frameworks forms a distinct, but complementary stream with unique representation requirements. They do not necessarily capture the same features (Davis and McCalden, 2004).

Geological (earth science) representation provides the basis for protecting selected examples of Ontario's geological history and its physical expression on the landscape. Cultural heritage representation provides the basis for evaluating and protecting archaeological and historical features of Ontario's human history. Ecological (life science) representation provides the basis for protecting a range of examples of Ontario's biological diversity.

These frameworks have been developed through the provincial parks program, and are also applied to conservation reserves. Like national and provincial parks, some conservation reserves contain natural heritage values that are of provincial, national, and international significance.

Since no jurisdiction has completely catalogued its biological diversity, various surrogates are used to represent the range of biodiversity. Depending on the purpose of the analysis, the jurisdiction involved, and the information available, these surrogates can include: physiographic features such as waterbodies, soil types and landforms; biotic features such as vegetation communities and rare species occurrences; or some combination. Some approaches also incorporate

protected area design considerations such as size and connectivity.

Prior to the 1990s, OMNR used landforms as broad surrogates for biodiversity. In the 1990s, OMNR expanded the concept by incorporating vegetation variability on landforms as a more complete basis for assessing terrestrial diversity on the landscape (OMNR, 1997). Thus naturally occurring landform/vegetation associations serve as surrogates to represent the range of biodiversity in terrestrial ecosystems. This concept incorporates surficial geology landforms as coarse elements of the physical environment, local biotic elements (vegetation associations) as finer filters.

OMNR's minimum requirements are to represent at least 1% or 50 hectares of each naturally-occurring landform/vegetation association within each of Ontario's 71 ecodistricts. These are minimum requirements, and do not imply adequacy of representation (Crins and Kor, 2000). Landform/vegetation (L/V) associations that are not protected to these minimum requirements are considered representation gaps.

The GIS process used to identify life science representation gaps and assess potential new protected areas has been automated with the development of an application called *GapTool*.

The *GapTool* application

Prior to the mid 1990s, OMNR conducted life science gap analysis using hard copy maps, reports, and aerial photographs. With the advent of geographic information systems (GIS) and the landform/vegetation approach, MNR began using GIS functions and digital data sets to assess ecological representation. Even with GIS tools, however, the process of preparing suitable data sets and conducting a gap analysis was a time-consuming procedure. An analysis for a single ecodistrict could easily take a week to complete, and consistency of approach was often an issue.

The need for timely gap analyses continued to increase, primarily to support land use planning initiatives that involve potential protected areas, and to assess Ontario Parks' progress in establishing protected areas to help represent and conserve biodiversity. In 2004, Ontario Parks decided to develop tools to help automate the procedure.

A needs analysis was conducted to define what users would require in an analytical gap analysis tool, and identify technical options to building such a tool. Based on this needs analysis, the tool was developed during 2005.

From a technical perspective, *GapTool* is an ArcGIS extension programmed in *ArcObjects* and *Visual Basic*. The application is launched from a button within *ArcMap*, and has a graphical user interface with dialogue boxes that help guide users through a gap analysis. A users guide has been prepared (Davis, 2006) and training workshops are sometimes provided.

GapTool produces formatted tabular reports and maps at two levels: the ecodistrict level, and the individual protected area level. The maps are produced in PDF and GIS shapefile format.

Three representation maps are produced at the ecodistrict level. All three of these maps show the locations of L/V associations for which the minimum representation requirements have not been met, whether they occur within or outside of protected areas. The three maps differ in one respect: the shading of these under-represented L/V associations.

The landform/vegetation representation map is the simplest "gap map". Figure 1 provides an example. This map shows the locations of under-represented landform/vegetation features (representation gaps) for Ecodistrict 3W-2 (Savanne) in Northwestern Ontario.

The other two ecodistrict-level maps highlight the same under-represented features, but colour them according to certain criteria. In the "achievement" map, under-represented L/V associations are shaded to signify the degree to which the minimum representation requirements are met for that feature. In the "rarity" map, under-represented L/V associations are shaded to signify the relative rarity of that feature within the ecodistrict. These two maps are useful in focusing conservation efforts. For example, under-represented features that are relatively rare and are poorly represented in protected areas should generally be a focus of conservation planning efforts if opportunities arise.

When viewing a representation map, it is important to recognize that only a portion of the under-represented L/V associations need to be protected in order to meet the minimum representation requirements. Under-represented natural features may be used as building blocks to guide the placement of any potential new protected areas.

Associated data sets

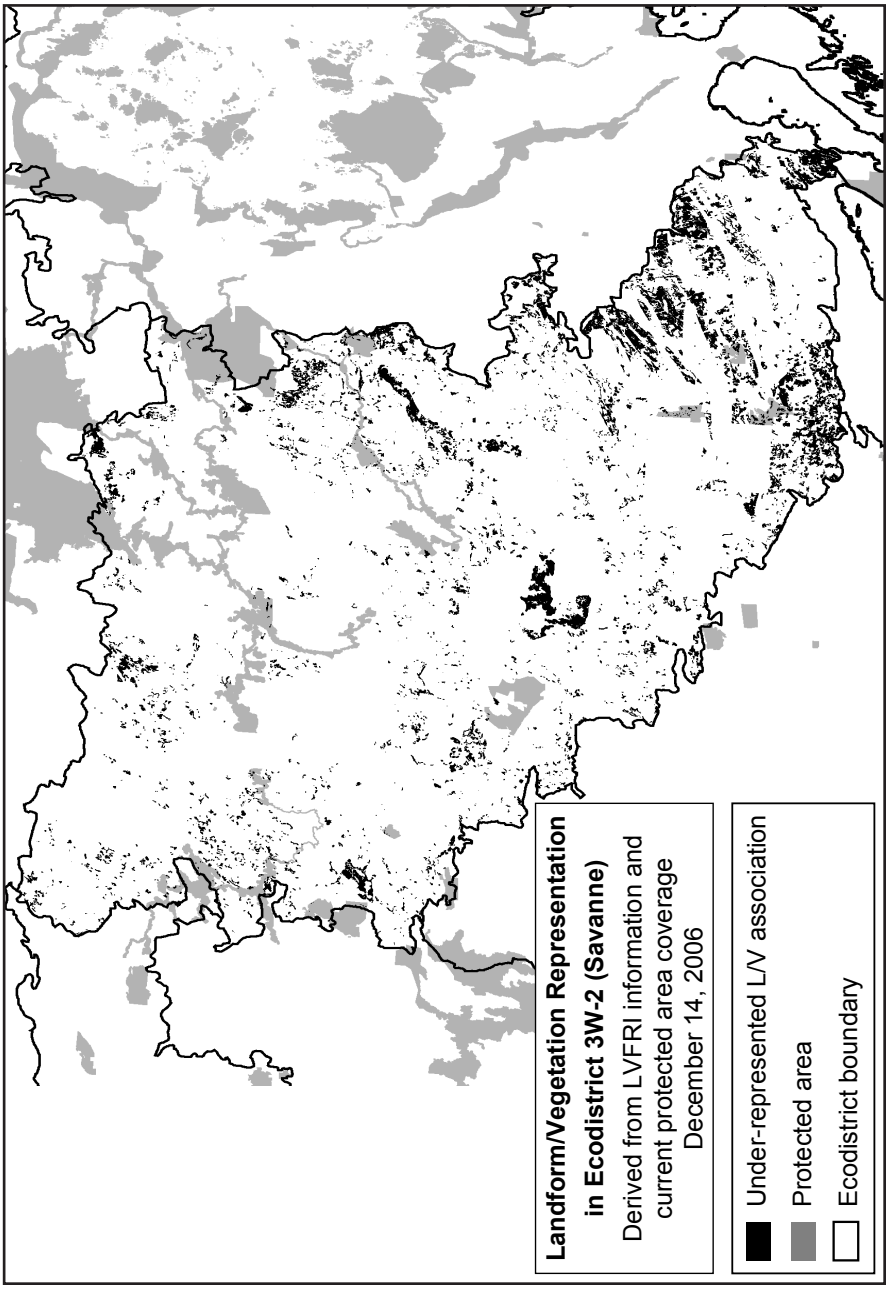
GapTool relies upon several GIS data sets to assess ecological representation; these include ecodistricts, protected areas, and landform/vegetation associations. Ontario Parks has centralized and improved the quality assurance of these provincial data sets, thus making gap analyses more reliable.

In 2005 and 2006, OMNR prepared improved provincial data sets of landform/vegetation associations. These composite data sets incorporate the best information in various regions of Ontario.

Landforms are based on the best available surficial geology data sets in various regions of Ontario: NOEGTS (Northern Ontario Engineering Geology Terrain Study), Ontario Geological Survey maps of Quaternary geology, and Surficial Geology for Southern Ontario. Ontario Parks geologists and ecologists developed a consistent provincial legend of 20 landforms. Using GIS queries, these three data sets were reclassified into this consistent provincial legend.

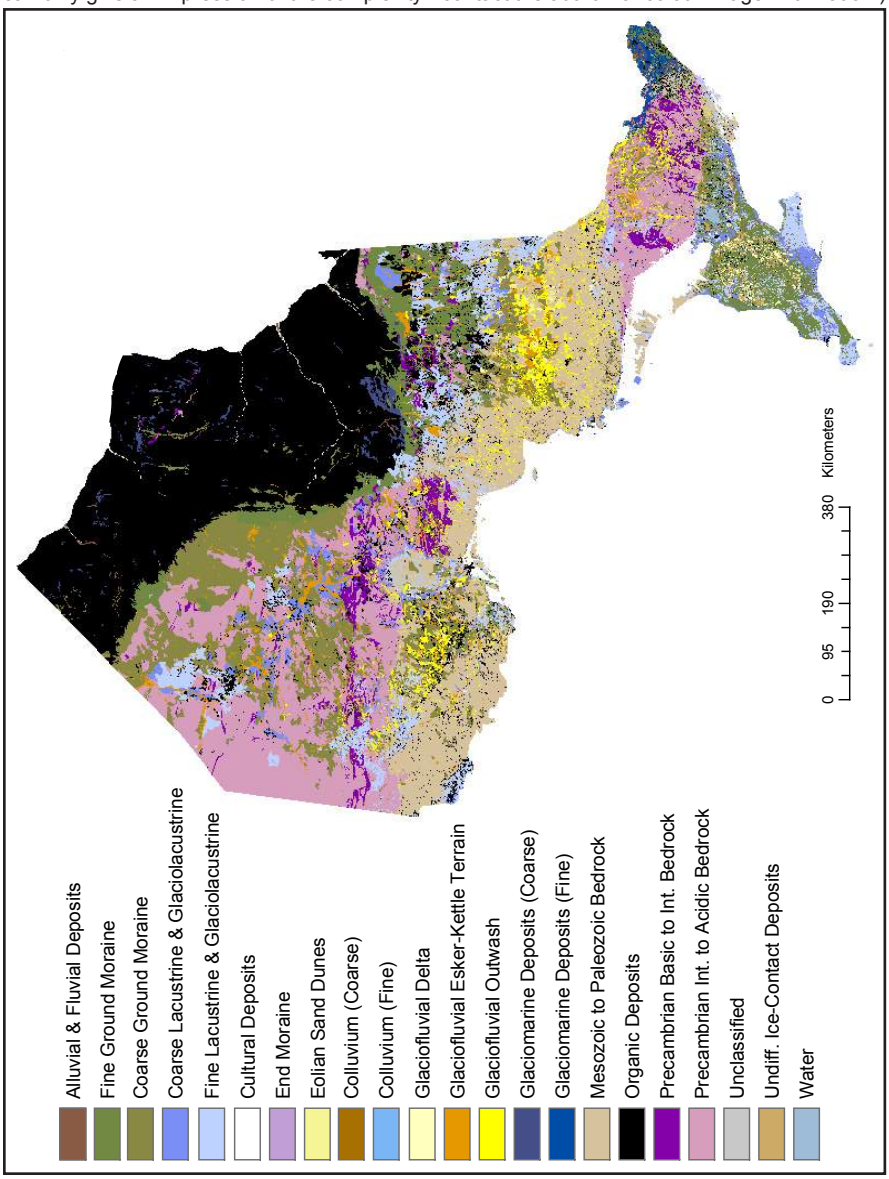
Figure 2 shows the resulting landform data, which is incorporated in the provincial L/V data sets. Three of these landforms – cultural deposits, water, and unclassified – are usually omitted from gap analyses.

Figure 1. Under-represented landform/vegetation associations in Ecodistrict 3W-2 (Savanne)



Vegetation information is derived from Forest Resources Inventory (FRI) mapping where it is available – about 24 of Ontario's 71 ecodistricts. A legend of vegetation classes was developed based primarily on the tree species composition of forest stands. Ecologists used a statistical technique known as hierarchical cluster analysis (Ward's agglomeration method) to identify clusters

Figure 2. Map of Ontario illustrating the complexity of landforms incorporated in provincial landform/vegetation data sets (This greyscale image can only give an impression of the complexity - contact the author for colour image/information.)



of stands with similar tree species composition. Non-forested areas were retained as classified in the FRI. Of the resulting 48 classes, three – open water, developed agricultural land, unclassified, and recent cutovers – are usually omitted from gap analyses.

Since FRI mapping is not available for all of Ontario, OMNR prepared a second data set with vegetation based on the best available land cover information prepared from remote sensing imagery. For all of Ontario except southern Ontario (Ecoregions 6E and 7E), the best available information is called Land Cover 2000. For southern Ontario, the data set incorporates Greenbelt remote sensing imagery where it is available, and an older data set called Land Cover 28 elsewhere. The legends used in each of these original data sets were left unchanged. Several land cover classes – pasture, cropland, open water, unclassified, plantations, and recent cutovers – are usually omitted from gap analyses. Figure 3 shows the resulting vegetation data.

By default, *GapTool* is configured to include these types of protected areas in its analyses: national parks, provincial parks, conservation reserves, wilderness areas, and recommended provincial parks and conservation reserves. The boundaries of protected areas change from time to time as sites are recommended, regulated, and revised. Ontario Parks maintains the most recent boundary information on provincial protected areas.

Other protected areas can also be included in gap analyses, provided their boundaries are stored in appropriate GIS format. These capabilities provide considerable flexibility. For example, *GapTool* can be used to:

- include other types of protected areas, such as Areas of Natural and Scientific Interest (ANSIs) or privately owned conservation easements within a gap analysis;
- assess how candidate protected areas would help to meet minimum representation requirements within an ecodistrict; or,
- conduct "what if" analyses based on various suites of potential new protected areas.

The latter type of analysis can be very helpful in informing land use planning decisions.

Reporting on current representation

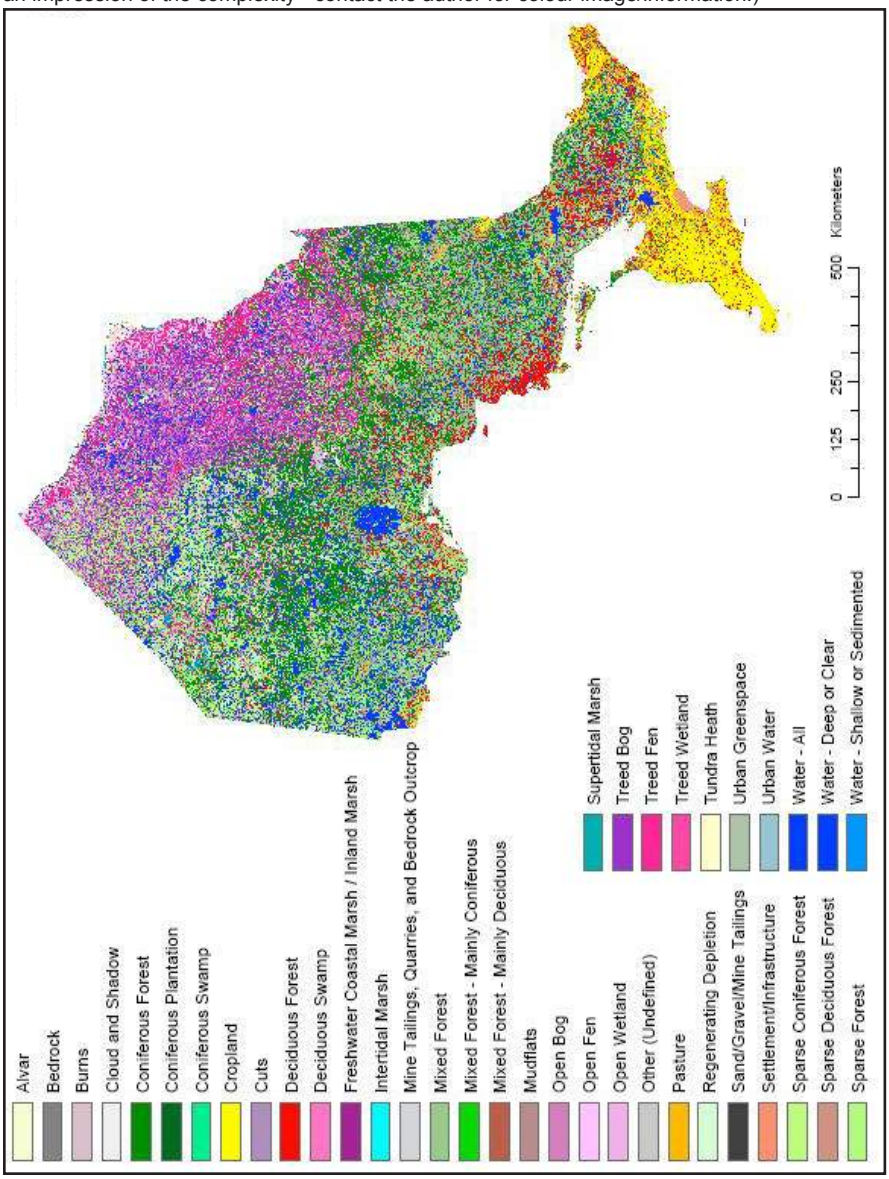
GapTool is now in regular use in Ontario Parks and elsewhere in the MNR, primarily in regional planning units. Its use greatly reduces the time required to complete gap analyses, ensures more consistent results, and allows information to be more readily kept up to date.

One of its primary uses is in producing reports and maps on current ecological representation. This information allows Ontario Parks to report on how well it is achieving its program objectives of protecting representative ecosystems. Under-represented features are also considered during the

preparation of park management plans. This "base case" information is also used to support initiatives that may involve potential new protected areas, including Crown land use planning and securement of private properties.

To reduce duplication in effort and to make these reports more widely available, thePlanning and Research Section of Ontario Parks has produced

Figure 3. Map of Ontario illustrating the complexity of vegetation incorporated in one provincial landform/vegetation data set (This greyscale image can only give an impression of the complexity - contact the author for colour image/information.)



standard *GapTool* tabular reports and maps for all of Ontario's 71 ecodistricts and over 600 regulated protected areas. The reports can be accessed by OMNR staff and is kept up to date. They are updated upon:

- interim protection for recommended new protected areas;
- regulation of new protected areas, which is normally accompanied by detailed mapping;
- changes to protected area boundaries; or
- preparation of new landform and/or vegetation data.

For inclusion in the *2006 State of the Forest Report*, OMNR prepared a map that shows under-represented L/V associations (representation gaps) for all of Ontario as of December 31, 2005 (Figure 4). This map was prepared by merging representation achievement information prepared with *GapTool* for all of Ontario's 71 ecodistricts. This is the first complete provincial map of landform/vegetation representation gaps ever produced.

The provincial map in Figure 4 provides a broad perspective on regions in which current protected area systems largely meet the minimum representation requirements, and regions in which representative protected area systems have yet to be established. The latter includes large regions of the Hudson Bay Lowlands. Natural features in much of southern Ontario (Ecoregions 6E and 7E) are also under-represented. This is not as obvious on the map because many of the features in southern Ontario, such as agricultural land, are omitted from the gap analysis. Most remaining natural features in southern Ontario do appear as representation gaps.

Conservation Planning Context

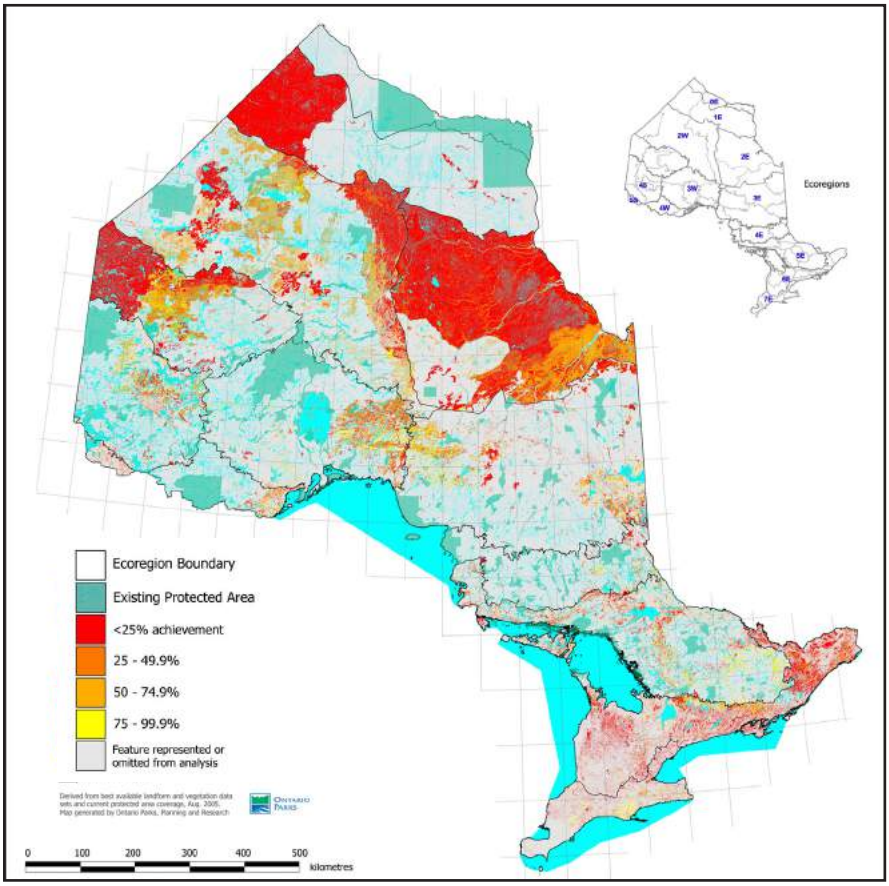
Gap analysis is one tool that can be used within a broader approach called systematic conservation planning (Margules and Pressey, 2000). In systematic conservation planning, protected area systems are designed to represent various elements of biodiversity and help ensure their persistence through time, at relatively low cost to other values such as resource extraction or development.

In conservation planning activities, OMNR often begins by identifying under-represented elements of biodiversity through gap analyses. The reports on current ecological representation prepared with *GapTool* have proven to be very helpful in this regard. Following this initial identification of under-represented features, OMNR tries to identify the "best" examples of representative features, and to design functional protected area systems, through applying the other four selection criteria described earlier – condition, diversity, ecological functions, and special features. A variety of maps, reports, and specialized conservation planning tools such as *C-Plan* (Ferrier *et al*., 2000) and *MARXAN* (Possingham *et al.*, 2000) may also be used to help design potential protected areas.

Conservation planning often involves identifying various suites of potential protected areas, only some of which may be brought forth for further

consideration. People involved in conservation planning often need to know how these alternative suites of protected areas would contribute to representing under-represented features. *GapTool* is well suited to this sort of "what-if" analysis.

Figure 4. Landform/vegetation features under-represented across Ontario



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Political, ecological, and species boundaries: implications for the identification of minimum requirements for representative protected areas

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Abstract

Various jurisdictions in Canada are currently undertaking, or have recently completed, planning for representative reserve networks. These exercises are often confined to designs within political boundaries. Others have used ecologically defined regions, such as ecozones or ecosystems, which themselves may be defined by different criteria than those used in the representative reserve network analysis. Here, we illustrate the differences in representative reserve networks for disturbance-sensitive mammals in Ontario when regions bounded ecologically versus politically are used as the target zones to identify near-optimal solutions for protected areas across multiple spatial scales. The scale of the target region has an effect on the minimum number of protected areas required to achieve representation; larger regions require more protected areas to represent all of the mammals than do smaller regions. However, for very large target regions, the total number of protected areas is less than the sum of the parts. We also illustrate how inherent boundaries in the data used for identifying representative areas may be the most efficient means to identify minimum representative networks. Constraining reserve network planning to politically bounded target regions may not result in either efficient nor effective protected area systems, but neither may be ecologically defined regions at certain scales.

Introduction

Planning for representative protected areas is often focused within politically-bounded regions (e.g., YPAS 1998; Northwest Territories Protected Areas Strategy Advisory Committee 1999) for the simple reason that implementation and management of these areas is carried out by agencies working within specific political regions (provinces, territories, nations). However, given that we know that species do not generally recognize political boundaries, using ecologically

defined regions as the target areas within which to identify representative protected areas may be more appropriate.

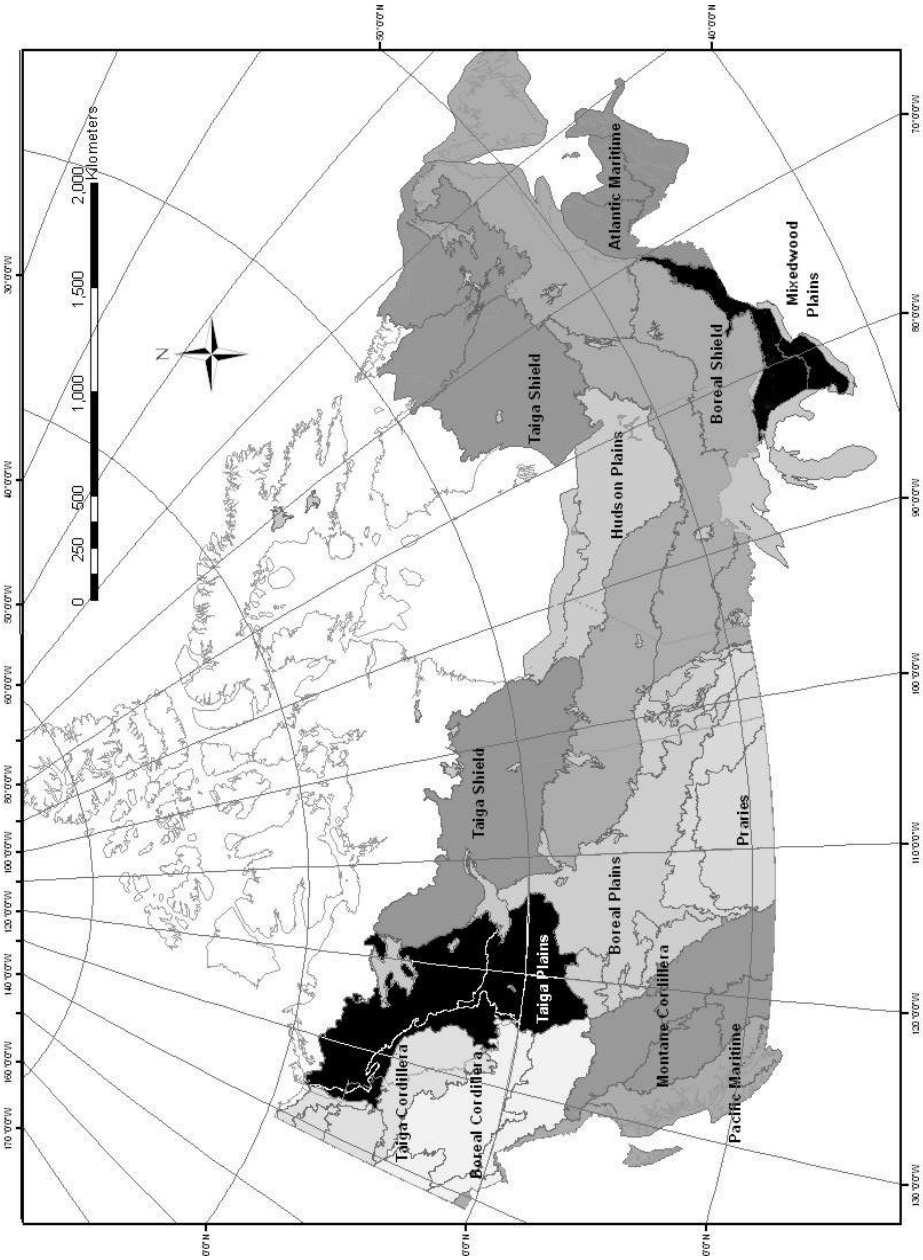
The literature on representative protected areas design is vast, and much of it is focused on the question of finding near-optimal solutions to the problem of maximizing species representation with a minimum amount of area. These approaches have made use of a variety of computerized techniques, including heuristic algorithms (Margules *et al.* 1988; Pressey *et al.* 1996, 1997), simulated annealing (e.g., McDonnell *et al.* 2002) and linear programming (e.g., Possingham *et al.* 2000). We have been carrying out work on protected areas in Canada for a number of years. Our work on representative protected areas design has taken a slightly different approach than that presented in much of the literature. Rather than ask where representative areas should be located, and then consider design elements to ensure species persistence, we have first asked "what is the minimum reserve area that is predicted to allow for species persistence?" and then asked "how many of such sized areas are needed to represent all species of interest?". We referred to the work of Gurd *et al.* (2001) to estimate minimum reserve area (MRA), and used sites that met MRA size requirements (2700-13,000 km^2) to identify minimum reserve networks within the mammal provinces of Canada using heuristic reserve selection algorithms (Wiersma and Nudds, in press). While our work on representative protected areas design has been carried out within the mammal provinces of Canada (Hagmeier 1966), most other jurisdictions prefer to use Canadian Ecosystem Framework (Ecological Stratification Working Group 1996), which divides the country into ecozones (Figure 1), ecoregions and ecodistricts as the basis for identifying ecologically defined target areas. In this study, we apply work done previously within the mammal provinces to the ecozones shown in Figure 1 which overlap with Ontario, namely the Mixedwood Plains, the Boreal Shield, and the Hudson Plains.

Intuitively, ecologically defined regions seem more appropriate as target regions for planning representative protected areas than politically bounded regions, but such areas are still somewhat arbitrarily defined. There are any number of ways to classify and delineate ecologically bounded regions, based on patterns of similarity and dissimilarity in a range of different features, including topography, soils, vegetation, climate, and species composition (e.g., the National Ecological Framework for Canada [Ecological Stratification Working Group 1996], the Soil Landscapes of Canada [Soil Landscapes of Canada Working Group 2006], Plant Hardiness Zones, or the Geological Provinces of Canada). Some of these classification systems may be more or less appropriate to use as target regions for developing representative protected areas networks, depending on the goals and objectives of a particular protected areas strategy. In addition, recent research has shown that, for some species, dissimilarity gradients do not vary any more significantly within ecoregions in North America, than they do between them, illustrating that these boundaries

may be somewhat in the eye of the beholder (McDonald *et al.* 2005).

Despite that ecologically defined regions may be somewhat arbitrary; we investigated the effects of varying the type and size of target region on the minimum requirements for representative protected areas in Ontario. Research

Figure 1. The ecozones of Canada, excluding the arctic ecozones.



in landscape ecology consistently emphasizes the scale-dependent nature of ecological processes (Wiens 1989). Scale is comprised of two elements, grain, defined as "the finest level of spatial resolution possible within a given data set" (Turner *et al.* 2001: 29); and extent, defined as the "size of the study area... under consideration" (Turner *et al.* 2001: 29). Wiersma and Nudds, (in press) showed that variation in grain size did not significantly affect the number of protected areas required to represent individual mammal provinces. Here, we examine the effect of variation in the extent of the target region.

Methods

We used sample plots of 2700 km^2 to correspond to the lowest 95% confidence interval for the MRA estimate of Gurd *et al.* (2001). We overlaid these plots on range maps representing current species ranges (Patterson *et al.* 2003) using ArcGIS (v. 9.1, ESRI) in each of the three terrestrial ecozones that overlap with the province of Ontario (Hudson Plains, Boreal Shield, Mixedwood Plains). The overlay analysis gave data on species richness and composition for the suite of candidate plots in each of the target regions. In addition, we sampled the province of Ontario for mammal species to see how the locations for representative areas varied when politically-bounded versus ecologically-bounded target regions were used.

A minimum representative network at the extents of the national and mammal provinces was identified from the suite of candidate sites using both a richness-based and a rarity-based heuristic algorithm (Margules *et al.* 1988; Pressey *et al.* 1993). Details for the algorithms can be found in our previous papers (Wiersma and Nudds, in press). We then examined whether there was a correlation between the number of sites required to represent mammals in each of the 3 ecozones and their area.

Results

The number of protected areas needed to represent each ecozone varied (Table 1). As with previous studies (Wiersma and Nudds, in press), the rarity-based algorithm was more efficient than the richness-based one. The sum of the protected areas needed within the Ontario portion of the ecoregions was 4 when the rarity-based algorithm was used, and 12 using the richness-based algorithm. However, when the province as a whole was considered as a target region, only 2-3 sites were needed to represent all mammals, using the rarity-based and richness-based algorithms respectively (Figure 2).

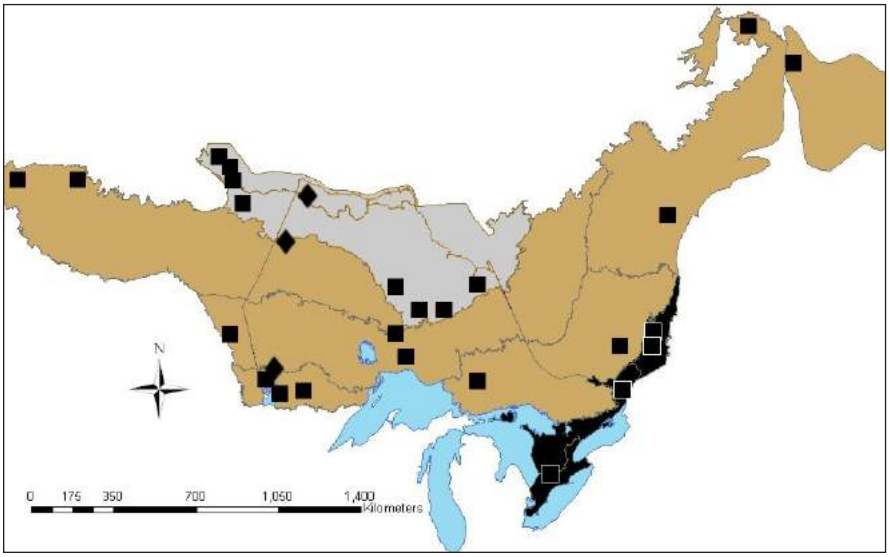
Conclusions

Similar work by Wiersma and Urban (2005) showed that size of the target region did not predict the number of protected areas required to represent all the mammals in ecoregions. Here, however, at the scale of whole ecozones, larger ecozones required more protected areas for minimum respresentation

Table 1. Ecozones, area, and number of protected areas required to represent each of them as identified using a richness-based and rarity-based heuristic reserve selection algorithm. Data is given for all of the ecozones overlapping Ontario, as well as with the portion of each that lies within the political boundaries of the province.

Target region	area (km^2)	# sites (richness based)	*# sites (rarity based)*
Mixedwood Plains	168,913	4	3
Hudson Plains	446,528	8	3
Boreal Shield	2,072,417	13	7
Within Ontario			
Mixedwood Plains (ON)	83,028	2	2
Hudson Plains (ON)	262,774	4	1
Boreal Shield (ON)	635,445	6	1
Sum of Ontario Portion of Ecozones	**981,247**	**12**	**4**
Province of Ontario	**981,247**	**3**	**2**

Figure 2. Location for representative protected areas (shown as black squares) in the 3 ecozones that overlap with Ontario as identified using a richness-based heuristic algorithm. The sites with black diamonds are those identified when the province as a whole is considered as the target region.



of all disturbance-sensitive mammals in the ecozone. Further, for no ecozone could mammals be represented in any system of protected areas bounded by Ontario borders. Nevertheless, there appears to be an 'economy of scale': far fewer sites were needed to represent all of the larger target region (Ontario) than were needed to represent the sum of the component parts (Ontario portion of the 3 ecozones). At smaller extents, protected areas may have some redundancies between ecozones in terms of which species they are representing. However, such redundancies may be desirable from a conservation standpoint, as they may conserve genetic diversity or act as an insurance against stochastic events. The redundancies observed here are in terms of representation of mammals, and these sites may not be redundant in terms of other features that occur on a finer scale on the landscape. Further consideration of issues of scale is important, then, in the context of identifying goals and targets for representative protected areas.

Sites selected as representative tend to be located near the boundaries of ecozones, or along the boundaries of ecoregions. However, not all of the representative sites are located along ecologically defined boundaries. This may be because some species' ranges follow the same underlying "signals" of climate, geology, etc. that are used to delineate the ecoregions, while others do not. An examination of Bray-Curtis dissimilarity values, which are a measure of turnover in species composition (i.e., beta diversity) across a south to north gradient shows that a number of the sites not located along the ecozones/ecoregions boundaries are located in areas with high mammal species turnover (Figure 3). Thus, measures of dissimilarity such as the Bray-Curtis measure can be used as an alternative way of identifying ecological boundaries for species, independent of ecozone's/ecoregion's boundaries. Previous work has suggested that beta diversity may be a useful predictor for identifying the number and location of representative protected areas required within a given region (Wiersma and Urban 2005).

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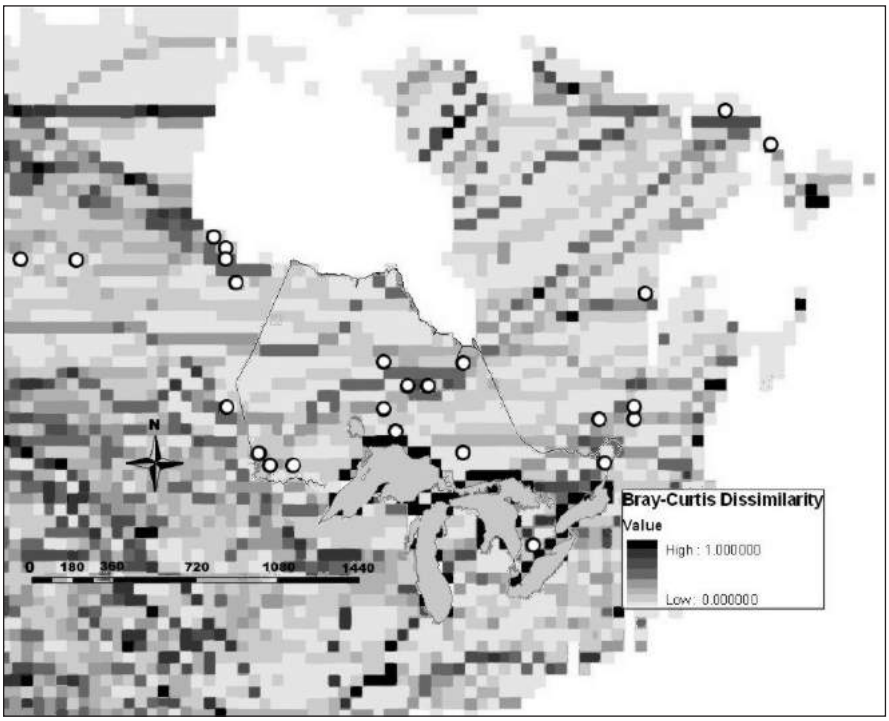
Figure 3. A map showing Bray-Curtis dissimilarity values (a measure of beta diversity, or turnover in species composition across a gradient) together with the representative sites in Figure 2. Note that a number of the representative sites coincide with areas of high turnover in species composition.



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From Urban to Rural to Hinterland: Is it time for a Provincial Protected Area Policy?

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Abstract

Over the past several decades, urban planning has moved away from the idea of "parks" as simply areas for recreation and aesthetic improvements toward that of "protected areas" which address a variety of goals including ecosystem health and biodiversity, values more typically associated with non-urban protected areas. Urban planning is increasingly incorporating understandings from the ecological sciences and urban protected area planning must be incorporated into broader regional, cross-jurisdictional approaches. Starting from the context of evolving protected area planning in Toronto, this paper highlights some protected area-oriented initiatives in Ontario. It proposes the need for a provincial protected area policy to provide an overall vision and set of goals for protected areas, from urban to hinterland, in the province. This would provide a framework to integrate protected area planning across all jurisdictions over the long-term. Such a policy, developed through a collaborative process, could also enhance the public view of and support for protected area initiatives and help educate the public about the varied roles and values of protected areas, including their importance as "green infrastructure".

Introduction

The context of this paper is evolving park and protected area planning in urban areas. A review of the literature and examination of plans and other documents for Toronto and other urban areas shows that thinking has evolved, through a number of steps, from the idea of "park" to that of "protected area".

Parks, as originally set aside in North American urban areas in the mid-1800s, were viewed primarily as places for passive, and later active, outdoor recreation in natural, albeit often highly modified, surroundings (Cranz, 1989; Platt 1994; Wright, 1983, 1984, 2000). The aesthetic value of open spaces was also a motivating factor, particularly highlighted in the City Beautiful movement of the late 19th and early 20th centuries. The recreational value of urban parks remained the focus of concern for many decades with their ability to beautify urban areas also considered important. These traditional park values began to evolve to include environmental values starting roughly in the 1960s

and growing in the 1970s and beyond. The ability of urban parks to ameliorate climate and maintain surface and ground water regimes was noted, for example, in early official plans for Toronto (MTPB, 1959).

Following this, new protected area designations were introduced in a number of jurisdictions to supplement the idea of park. Examples include the introduction of environmentally significant policy areas in Waterloo Region in 1976 (Gosselin, 2003), environmentally significant areas in Toronto in the early 1980s (MTRCA, 1982) and provincial-level designations such as Areas of Natural and Scientific Interest (ANSIs) (OMNR, 1987) and provincially significant wetlands (Environment Canada and OMNR, 1984). These areas were set aside based on scientific criteria and intended to protect "islands of green" that contained such values as species at risk and rare habitat.

By the 1990s, new planning goals such as biodiversity and ecosystem health or integrity and advances in ecosystem science such as landscape ecology and conservation biology were resulting in new approaches to urban protected area planning. Buffered, connected green space systems were developed that fulfilled a dual role, incorporating both traditional park values of recreation and aesthetics as well as environmental values (for example see MTPD, 1994). More recently, integrated green space systems, addressing a broad range of goals, and natural heritage systems, based on ecological principles to address ecological goals, have been proposed for areas such as Toronto (TUDS, 2002), Ottawa (RMOC, 1995) and Waterloo (RMOW, 1998).

What this brief history shows is that the model of urban park – as originally developed – has been, over time, supplemented by the idea of urban protected area to address evolving environmental goals. Urban planning has increasingly incorporated understandings from the ecological sciences. Urban areas have a role to play in supporting environmental objectives such as biodiversity and ecological health. Urban protected areas provide a key tool in addressing these issues.

Where to now?

One further evolution of urban protected area planning should be to incorporate urban systems into nested, hierarchical regional conservation strategies. This is based on the belief that urban areas have a role to play in supporting nature conservation objectives, with protected areas being a key tool or approach (Beatley, 2000). Based on the model of linked reserve systems (Noss, 1987), as developed in the ecosystem sciences, local (e.g. city or regional) systems are nested within broader ones (e.g. bioregional or provincial). In other words, protected area systems at broader and smaller scales are consistent with each other. In Ontario, for example, a large-scale system could be envisioned for the province as a whole or even for a subsection, such as Southern Ontario. This would provide an umbrella that would integrate and encompass regional-scale

and smaller municipal level reserve networks.

An overview of some recent protected area programs and initiatives in Ontario demonstrates that movement toward this idea is developing. This overview is by no means comprehensive and these programs and initiatives are continuing to evolve.

Greater Toronto Area

The regions around Toronto – Durham, Halton, Peel and York – have all undertaken official planning (RMOD, 1993; RMOH, 1998; RMOP; 2001; RMOY, 2002). The plans have included setting aside green space systems similar to that of Toronto. Efforts to update the official plans have included integrating more ecosystem science, for example the creation of a natural heritage system in Durham and the use of buffers and linkages (Durham Regional Planning Department, 2003). However, the need to integrate green space and/or natural heritage systems across the regions is generally lacking as a planning objective, with the exception of Toronto's and Peel's recent official plans (TUDS, 2002; RMOP, 2002).

Greater Golden Horseshoe (Ministry of Municipal Affairs and Housing)

This provincial-government initiative included the passing of the *Greenbelt Protection Act 2005* and the *Greenbelt Plan 2005* (OMMAH, 2005a; 2005b). The legislation creates a permanent greenbelt around the so-called "Golden Horseshoe" region of Southern Ontario. It builds on and encompasses regional planning for the Oak Ridges Moraine and the Niagara Escarpment. The purpose is to contain urban sprawl and to protect environmentally sensitive land and farmland. Official plans, for example those of Toronto and the regional municipalities of the Greater Toronto Area, must conform to the Greenbelt Plan. Goals include protecting and restoring connections to other natural systems within the Golden Horseshoe, such as the major river valleys of Toronto and the Oak Ridges Moraine, as well as beyond, for example to the Algonquin to Adirondack Conservation Initiative. This represents the type of nesting discussed above and in Beatley (2000).

Places to Grow (Ministry of Public Infrastructure Renewal)

The Places to Grow program allows for growth management plans to be created for designated regions (OMPIR, 2005b). An important element of the plans is to be the protection of sensitive and significant lands and water resources. A draft plan has been written for Toronto (OMPIR, 2005a). This program is seen to build on the Greenbelt Plan by creating natural systems that would connect with the broader greenbelt.

Natural Spaces Program (Ministry of Natural Resources)

This voluntary program is aimed at reducing the loss of significant natural areas in Southern Ontario (OMNR, 2005a). It encompasses the Golden Horseshoe Greenbelt. Based on the idea of stewardship, the program seeks to involve private landowners in protecting and enhancing significant areas on their land.

Provincial Parks and Conservation Reserves Act (proposed) (Ontario Parks)

This major revision to the legislation governing provincial parks is seen as a complement to the Natural Spaces Program and the Greenbelt Plan (OMNR, 2005b). Provincial parks and conservation reserves are primarily located outside of the Southern Ontario area covered by these two initiatives.

Ontario Nature's Greenway (Ontario Nature)

Ontario Nature, a non-governmental organisation, developed this initiative based on the recognition that there are many parts of a greenway already in place in Southern Ontario, including the Greenbelt and the Oak Ridges Moraine Conservation Plan (Ontario Nature, 2006). The greenway is seen as a method to unite these different initiatives under one overall goal and program to create a cohesive system of core natural areas and linkages. It is envisioned as a nested system with three scales: local community, region and bioregion (Southern Ontario).

What this incomplete list shows is that there are a number of protected area-related initiatives underway in Ontario with many focused on Southern Ontario and the Greater Toronto and Golden Horseshoe areas in particular. The list also points to a general interest on the part of both the government and non-government groups in developing a more comprehensive approach to protected areas in Ontario, including the heavily populated south, but also encompassing all parts of the province through revised provincial park legislation.

There are a myriad of activities involving a myriad of government ministries and other groups. This raises the question: What holds it all together? A study of the programs and plans shows that they discuss complementing each other, hinting at the idea of a broader vision or goal for protected areas, as though each program or initiative were part of a broader puzzle, one that includes smaller pieces in the regional and municipal official plans, for example. But there isn't anything explicitly linking them.

A Provincial Policy?

A provincial protected area policy could provide an overall vision and set of goals for protected areas, from urban to hinterland. A vision could be, for example, to create, protect, restore and enhance a nested, hierarchical natural heritage system encompassing urban, rural and hinterland areas. Goals would focus on ecological values, such as biodiversity, tying the natural heritage system into

the recent Ontario Biodiversity Strategy (OMNR, 2005c). Other goals could include the role of protected areas as green infrastructure – lands that provide life-sustaining natural features and functions such as maintaining hydrological regimes, controlling air pollution and allowing for species migration – that are as important as the functions provided by built infrastructure, and human use and enjoyment through, for example, appropriate recreation. As such, the policy would address not only natural heritage systems, with their focus on ecological principles, but also a protected area system that can address both ecological goals and the more traditional park goals of recreation and aesthetics.

This would provide a broad framework within which to discuss the roles and types of protected areas that are appropriate for different regions across the land use spectrum, i.e. from urban to rural to hinterland. For example, in urban areas, environmentally significant areas are an appropriate protected area designation, whereas in hinterland regions, provincial parks could form the core natural areas of a reserve network. Specific goals for areas across the land use spectrum could also be developed, along with programs and priorities to address these as well as the overall provincial vision and goals.

A policy such as this would provide a framework to integrate protected area planning across all jurisdictions over the long-term. Such a policy, developed through a collaborative process, could also enhance the public view of and support for protected area initiatives and help educate the public about the varied roles and values of protected areas. This in turn would help build a constituency for protected areas that could ensure success over the medium and long term of programs and initiatives such as the recent Greenbelt and Natural Spaces as well as the continued success of the provincial park system.

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Research, Analysis, Assessment

Determining Social and Ecological Indicators in Canadian Parks: Utilizing the Delphi Method

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Abstract

Impacts (social and ecological) are increasingly occurring in parks and protected areas as more people visit these special places. Appropriate responses by park mangers are predicated upon identifying these impacts and assessing their magnitude. The purpose of this study was to determine social and ecological indicators for assessing changes related to visitor use in Canadian Parks and Protected Areas. A Delphi methodology was used to consult a panel of experts, consisting of Canadian academics and parks and protected area managers. In the first round, participants identified appropriate indicators. These responses were compiled and re-sent to the participants. In the second round participants rated each item on a five point Likert type scale. Responses were compiled, items for which consensus was not achieved were removed and the refined list was distributed for a third round. A list of thirteen social and fifteen ecological indicators were eventually arrived at by the expert panel. The possibility of integrating these lists into visitor management frameworks is noted in the conclusion.

Introduction

Participation in outdoor recreation is increasing. With this increase in participation comes an increasing demand for natural resource areas to accommodate recreation activities (Dearden and Rollins, 2002). This is due to the many benefits (e.g., spiritual, social and physical benefits) associated with participation (Driver *et al*., 1991). As visitor use continues to steadily increase, so does the potential for significant degradation and impacts to the natural and social environments (Liddle, 1997). Detrimental impacts are coming to the forefront of recreation-related research. Authors such as Wall (1989), Liddle (1997) and Manning (1999) have conducted research that has demonstrated negative effects on the natural environment from such participation. The nature of recreation-related environmental impacts is complex as different types of activities result in different types of detriments.

Within the social realm, increasing participation can potentially result in the quality of the social experience being diminished. Often, increased numbers of people leads to such issues as crowding, conflict and noise pollution. By understanding these impacts, it is possible to make necessary changes to management, visitor use and policy to prevent the degradation of both the natural and social experience.

The purpose of this study was to determine a set of appropriate indicators for assessing changes in parks and protected areas, utilizing the Delphi methodology. Once indicators were determined according to the results of the Delphi, these indicators were then integrated into an existing visitor management framework to demonstrate their potential applicability.

Impacts

Impacts can be defined as effects on "natural, cultural and historical resources" that change or alter these resources in some way (Prato, 2000). The two broad categories of impacts identified for this paper are social and ecological impacts. Ecological impacts alter the natural environment in some way; sometimes it may be quite apparent, other times barely noticeable. Examples of ecological impacts can include trampling, a decrease in water clarity and wildlife disturbance (Liddle, 1997; Knight and Cole, 1995). Ecological impacts can indirectly affect the human experience and can carry wide-reaching ecological implications. All ecosystems are intricately connected; impacts in one area of an ecosystem can affect a variety of other components or processes (Binford and Buchenau, 1993).

Social impacts occur as a direct result of human activity and affect the human experience associated with the outdoor recreation activity (Rollins and Robinson, 2002). Examples of social impacts include crowding or noise pollution. The nature of social impacts can have a significant effect on outdoor recreation participation, ranging from a decrease in participation to change of locale on the part of the participants.

Indicators and Standards

To understand recreation related impacts on the natural and social environment within parks, it is necessary to understand how to examine and measure change within natural resource areas. An indictor (in ecological and social terms) is an element of a system that is highly sensitive to disturbance and can thus show marked change based on the level of disturbance (Liddle, 1997). An example of an ecological indicator is vegetative cover. Without human impacts, vegetative cover within resource areas tends to be high. After increased visitor use, vegetative cover declines.

A social indicator displays change within the social realm of an activity; the visitor experience tends to be eroded. An example of a social indictor is

noise levels. When user groups are low, noise levels tend to be non-existent or moderate. With increasing user groups, the noise levels increase; this can significantly impact the user experience. Noise levels can be identified as a social indicator because they display a change within the social setting.

The degree of acceptable change is termed a 'standard'. Standards thus can be set to assess how much change is appropriate within a given system. While indicators can be used in all areas, standards will vary depending specifically on the area in question. An example of an ecological standard could be the percentage of vegetative cover on a trail (the indicator) and its decrease resulting from hiking.

Delphi Methodology

The Delphi methodology involves consulting people with knowledge on the subject of interest, termed 'experts' (van Zolingen and Klassen, 2003). These experts make 'predictions' for the future, by determining consensus on a variety of issues. Keeney *et al*. (2001: 195), describe the Delphi as: "a structured process which utilizes a series of questionnaires or rounds to gather and provide information. The process continues until 'group' consensus is reached". Delphi methodology is useful in obtaining information from a wide range of people and determining consensus on potentially controversial issues or issues where bias may influence decisions. The Delphi utilized for this study was a ranking style Delphi (Linstone and Turoff, 1975). Participants were asked to initially generate responses and then rank a list of given responses in order of preference. In this study, responses were ranked using a Likert scale. The ranked responses were then analyzed to determine consensus among participants.

Participants (experts) were identified based on their academic and/or professional background. Academic experts were identified based on background degrees, research interests and publications in areas pertinent to this study. Professionals were identified based on management experience. Five or more years of experience in the Canadian parks and protected areas system was used as a criterion for inclusion. A total of twelve individuals agreed to participate in the study.

The round one survey was issued to participants via email. The first survey was open-ended in order to elicit a wide variety of responses from participants and sought to determine as many social and ecological indicators as is possible. This allowed for responses which were not influenced by the principal investigator. Once all surveys were returned, analysis proceeded by grouping similar responses together. All of the responses were included in the second round survey. In the second survey participants were asked to rank the responses given by filling in a chart, utilizing a 5-point Likert scale, with 1 indicating 'Not Important', and 5 indicating 'High Importance' (Young, 1998). Answers determined in the second round were analyzed to determine rank order

and to identify if consensus was reached on any of the indicators (Young, 1998). The level for consensus was determined by using the mean for each item, based on the responses from the Likert scale. Those responses that reached 66% (or 2/3) of agreement by participants were included in the third round survey (all means which fall within the top 66th percentile).

In the third survey, participants were asked to re-rank those responses that had reached consensus in the second round. Results from round two were also sent to participants, so that they could view the rankings each item had received during the previous round. This allowed participants to either change or keep their responses the same for round three. The new list generated was also analyzed using the Likert scale. The mean for each item was determined based on the participant response level and participant rankings. Any answers that reached 66% consensus were determined as a set of appropriate indicators for assessing ecological and social change in parks in Canada.

Results

The indicators identified in all three survey rounds are identified in Tables 1 and 2. In round one (Table 1), due to the diverse perspectives of the participants, many of the indicators were presented using differing terms. Indicators from round one that were similar in nature were grouped together under broad categories, to form a new list which was then issued to participants to be ranked in round two. Original indicator terms used by participants were grouped under the developed broad categories, so that participants would be able to locate their responses. In round two (Table 2), participants ranked each indicator using a Likert type scale. For each item, a mean was calculated (X=mean), determining the rank order of each item. The top 66% of indicators (taken as those that reached consensus) were included in the subsequent third round. For round three (Table 2), the participants were asked to re-rank the twenty social and twenty ecological indicators. From this ranking, a final indicator set was developed (those that reached 66% consensus rate). Only those indicators which achieved consensus in each of the rounds are included in Table 2.

Discussion and Future Implications

The final indicator sets can be potentially integrated into existing visitor management frameworks (VMFs) that require the generation of indicators. By using pre-determined lists, managers may eliminate a significant portion of work by having a starting point for their analysis of a given resource area. Since the indicators can fit within any of the VMFs, they can be applied in many settings, as different managers may utilize different VMFs. Furthermore, the developed indicator set can be used in a wide variety of settings; ranging from wilderness to recreation class parks. While these indicators are considered to be the most appropriate by Canadian experts, not all indicators are required in every case. The list can be modified to the resource context as necessary,

Table 1. Summary of Results from Round One

Ecological Indicators	Social Indicators
Pollution	Number of People/km
Over use of Vegetation	Activity Use Patterns
Non-native Animals (exotics/invasive species; number of introduced species)	Park Management Practices
Non-native Plants	Noise Levels
Biodiversity (Species richness and diversity; flourishing or deteriorating species; plant diversity; wildlife diversity)	Visitor Experience
Water Quality – Overall (clarity, flow and colour)	Visitor Behaviours
Disturbance – natural and human: can affect ecosystem integrity	Area of Remote/Wild Landscape Available
Vegetative Composition (changes in plant type; changes in vegetation)	Crowding (number of encounters with other visitors)
Endangered Species (Rare, threatened species)	Conflicts
Plant Damage	Visibility of Managers and Wardens to Visitors
Acidic Precipitation	Visible Damage
Air Quality	Resident Attitudes
Erosion	Litter
Number of extirpations	Utility/Transportation Corridor
Soil Compaction	Measures of Waste
Land use and Land Use Change	Visual Aesthetics
Kilometers of Road per area	Recreation Demand
Water Temperature	Visitor Satisfactions
Oxygen Levels in Water	Extent of Resource Use
Plant Disease	Amount and type of Regulations Placed on Visitor Behaviour
General Health of Vegetation	Introduction of Visitor Facilities and Park Infrastructure
Climate Change	Crime Rate
Wildlife Deaths due to Encounters	Visitor Motivations
Vegetation Patterns	Park Revenue (number of management dollars spent per person per area)
Presence of Indicator Species	Employment and Income (number of staff per person per area)
Presence of Flood at Historical Rates	Expenditures on the Park
Presence of Drought at Historical Rates	Demographics of Visitors
Hyper-abundant Species	Urbanization
Natural Rate of Productivity	Deviancy/Conservation Ethic
Overnight capacity of area	Change in Facilities
Water Bacterial Content	Number and Extent of Viewing opportunities for visitors
Level of Organic Material in Water	Length of Visitor Stay
Natural Rate of Decomposition	
Species Interactions	
Presence of Fire at Historical Rates	
Presence of Predation at Historical Rates	
Size of Undisturbed land	
Genetic Indicators	
Denseness of Vegetation (visibility)	

Table 2. Summary of Results from Rounds Two and Three

Ecological Indicators			
Round Two Results	**X**	***Round Three Results***	**X**
Pollution	4.83	Pollution	5
Over use of Vegetation	4.83	Biodiversity	5
Non-native Animals	4.71	Water Quality	5
Non-native Plants	4.71	Vegetative Composition	4.66
Biodiversity	4.71	Plant Damage	4.66
Water Quality	4.71	Air Quality	4.66
Disturbance	4.71	Erosion	4.66
Vegetative Composition	4.57	Soil Compaction	4.66
Endangered Species	4.57	Kilometers of Road per area	4.33
Plant Damage	4.57	Water Temperature	4.33
Acidic Precipitation	4.42	Oxygen Levels in Water	4.33
Air Quality	4.42	Plant Disease	4.33
Erosion	4.42	General Health of Vegetation	4.33
Number of extirpations	4.28	Vegetation Patterns	4.33
Soil Compaction	4.28	Presence of Indicator Species	4.33
Land use and Land Use Change	4.28		
Kilometers of Road per area	4.28		
Water Temperature	4.28		
Oxygen Levels in Water	4.28		
Plant Disease	4.28		
General Health of Vegetation	4.28		
Climate Change	4.14		
Wildlife Deaths due to Encounters	4.14		
Vegetation Patterns	4.14		
Presence of Indicator Species	4.14		

Social Indicators			
Round Two Results	**X**	***Round Three Results***	**X**
Number of People/km	4.57	Number of People/km	5
Visitor Use Patterns	4.57	Crowding	5
Park Management Practices	4.42	Visible Damage	5
Noise Levels	4.42	Litter	5
Visitor Experience	4.42	Park Management Practices	4.66
Visitor Behaviours	4.28	Noise Levels	4.66
Area of Remote/Wild Landscape Available	4.28	Visitor Experience	4.66
Crowding	4.14	Visual Aesthetics	4.66
Conflicts	4.14	Visitor Satisfactions	4.66
Visibility of Managers and Wardens to Visitors	4	Regulations Placed on Visitor Behaviour	4.66
Visible Damage	4		
Resident Attitudes	4		
Litter	4		
Utility/Transportation Corridor	3.85		
Measures of Waste	3.85		
Visual Aesthetics	3.85		
Recreation Demand	3.83		
Visitor Satisfactions	3.83		
Extent of Resource Use	3.71		
Regulations Placed on Visitor Behaviour	3.71		

X= mean response rate per indicator

and can potentially provide feedback to managers regarding the state of the resource. The standards and measures will also vary depending on the type of setting, class of park and specific management strategy.

In practice, a standardized list could foster the sharing of information and collaborative solutions among park managers. The lists developed in this study provide managers with a potential tool to aid in making decisions, sharing data, and developing measurements for a variety of sites. While the indicator lists are purely theoretical at this point (at present, they have not been used in practice), and are in the early stages of development (further research and testing needs to be done), this study showcases the potential for developing standardized indicators by utilizing the Delphi method within a Canadian context. The challenge remains for managers to employ these indicators and assess their utility in practice.

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Compartmentalizing Fire in Large Parks and Protected Areas

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Abstract

The re-introduction of fire to parks and protected areas is essential for ensuring the ecological integrity of fire-initiated and fire-maintained ecosystems; however, there is also a need to ensure that competing consumptive and non-consumptive activities are protected. Miller and Landres (2004) forwarded a method to balance competing management objectives which was applied in two steps. First, a GIS application was developed to evaluate potential ecological benefits for tree species based on fire intensity. Second, Prometheus (Canadian Wildland Fire Growth Model) was used to develop priority zones around values based on fire behaviour in heterogeneous fuel. These were combined to create a fire ecological suitability map for Nagagamisis and Quetico Provincial Parks with "priority zones" around values. The implication of this research for park planners and managers is the ability to delineate areas where fire can perform its ecological role without exposing people, property and infrastructure to risk from fire.

Introduction

Fire planning and management, in large parks and protected areas, is a paradox: although it is an essential component for regulating forest succession and biodiversity (Van Wagner and Methven, 1980; OMNR, 2002a), it can also harm people, property and infrastructure (OMNR, 2003b). Planning for fire in parks and protected areas requires an understanding of ecology, vegetation response to fire, fire regime(s), and the values to be protected. It also requires an understanding of the established management objectives for the protected area. Managers must assess when and where fire is wanted or unwanted, while ensuring that a fire will not escape established boundaries and adversely affect neighbouring values. Moreover, fire behaviour changes with seasonal

fluctuations in weather so allowing a more natural role of fire may become too hazardous and require suppression in some weather conditions. The objective of this study was to develop a decision support tool to facilitate planning for fire without overlooking the human and ecological values.

Importance of fire

Fire plays an important role in forest ecosystems by altering patch and edge dynamics, cycling soil nutrients, and ensuring different age classes and distribution of species (Heinselman, 1970); yet, decades of forest fire suppression is pushing fire dependent ecosystems to more fire-intolerant species (OMNR 2003a; OMNR 2004). Heinselman (1970) extolled the importance of fire for ecosystem renewal and maintenance in Minnesota, USA. In 1979, the Canadian Park Service also recognized the importance of fire and began to alter its policies to reflect the role of fire in the ecosystem (Van Wagner and Methven, 1980; Woodley, 1995; Canadian Park Service, 1989). Van Wagner and Methven (1980) documented the importance of allowing a more natural role for fire in large parks because most forest vegetation species in Canada were either fire-initiated or maintained by regular fire regimes. Altering these fire regimes, through years of fire suppression, could lead to changes in forest species composition, which may not reflect the vegetation management objectives of the park.

Fire's important ecological role conflicts with both consumptive and non-consumptive human activities and poses many challenges for planners and resource managers striving to achieve a balance. This conflict has led to an acknowledgement of the need to incorporate ecological, social and economic factors into the planning process (OMNR, 2003a; Woodley, 1995; Heinselman, 1970).

Fire management strategy for Ontario and Provincial Protected Areas

The fire management strategy for the province of Ontario focuses on the protection of: people; property and infrastructure; where possible, timber resources; and ecological values, such as species at risk (OMNR, 2004). The diversity of ecosystems and human activities in the province has led to the designation of six broad fire management zones that reflect social, ecological and economic land uses or processes. Designation of the "Parks Zone" encourages managers to allow fire to perform its ecological role, provided fire does not negatively impact other uses or values that the park is striving to protect (e.g., critical wildlife habitat). It also recognizes that fire, as an ecosystem process fundamental to restoring ecological integrity, is an under represented process in provincial parks and protected areas. There are three objectives set out in Ontario's fire management policy for facilitating the re-introduction of fire: 1) to encourage the inclusion of fire into the park planning and management process to achieve vegetation management objectives, such as ecosystem restoration; 2) to require consideration and documentation of fire's role in

achieving management objectives; and 3) to establish clear goals for the use of, and response to, fire such that the people, property, infrastructure and ecological values at risk are not lost to fire (OMNR, 2004).

Methods

To balance the ecological need for fire on the landscape and protect people, property and infrastructure, a decision support tool was developed based on the conceptual methodology proposed by Miller and Landres (2004). As case studies, both Nagagamisis (North East Ontario) and Quetico (North West Ontario) Provincial Parks were selected because the parks:

- have forest vegetation species consisting of boreal species (fire-initiated or fire-maintained);
- are large in size (approximately 475,000+ hectares (ha) for Quetico and almost 70,000 ha for Nagagamisis);
- contain Aboriginal values, including archaeological sites (OMNR, 2002b);
- have adjacent cottage communities and timber resources;
- are mandated to have a fire management strategy integrated with neighbouring forest management units to ensure that landscape scale ecosystem objectives, such as the woodland caribou recovery plan, are not compromised by catastrophic fire.

The methodology behind the decision support tool consisted of two distinct components: 1) establishment of fire priority zones around values to protect; and 2) evaluation of the potential ecological effect of a forest fire using the 95th percentile fire weather as a worst case scenario.

Protecting Values

The development of fire-priority (buffer) zones around values is problematic in heterogeneous fuels because it is possible to create a buffer zone that is representative of potential fire behaviour. The spatial arrangement of fuel composition and continuity, topography, and the uncertainty associated with weather also make it difficult to calculate a suitable fire-priority zone around a value using conventional GIS. To overcome this limitation, Prometheus (Canadian Wildland Fire Growth Model) (Anon. 2005) was used to create the priority zones around values. The innovation here was instead of simulating fires approaching a value, the value itself was used as the ignition point and the wind direction was rotated through the cardinal direction for each simulation. Additionally, adjustments were made to the topographic data (aspect) to ensure the effect of topography was properly accounted for. The results of the simulations (fire perimeter polygons) were combined using the overlay capability of GIS to create the priority buffer zones for each value.

Species Response to Fire

Assessing the ecological response of vegetation to different intensities of forest fire was also problematic because there was a general lack of information as to how species respond to different intensities of forest fire. The Fire Effects Information System (FEIS) database (Ulev, 2005) provides some insight into species fire ecology but there is still a lack of detailed research into fire effects based on intensity. For this study the ecological impact was defined as the ability of a species to survive a given fire intensity or the ability of a species to regenerate following a fire. An index was developed to standardize the ecological response to fire based on the calculated head fire intensity for each fuel type and compared with the available literature on tolerable fire intensities for each species. The Normalized Difference Fire Intensity Index (NDFII) is given as follows:

Equation 1. Normalized Difference Fire Intensity Index (NDFII).

$$NDFII = \frac{Spp_{tol} - HFI}{Spp_{tol} + HFI}$$

Where: Spp_{tol} is the species maximum tolerance for fire intensity in kW/m; and, *HFI* is the head fire intensity as calculated by the Fire Behaviour Prediction System (FBP) (Hirsch, 1996; Taylor *et al*., 1997; Stocks *et al*., 1989; Van Wagner, 1987).

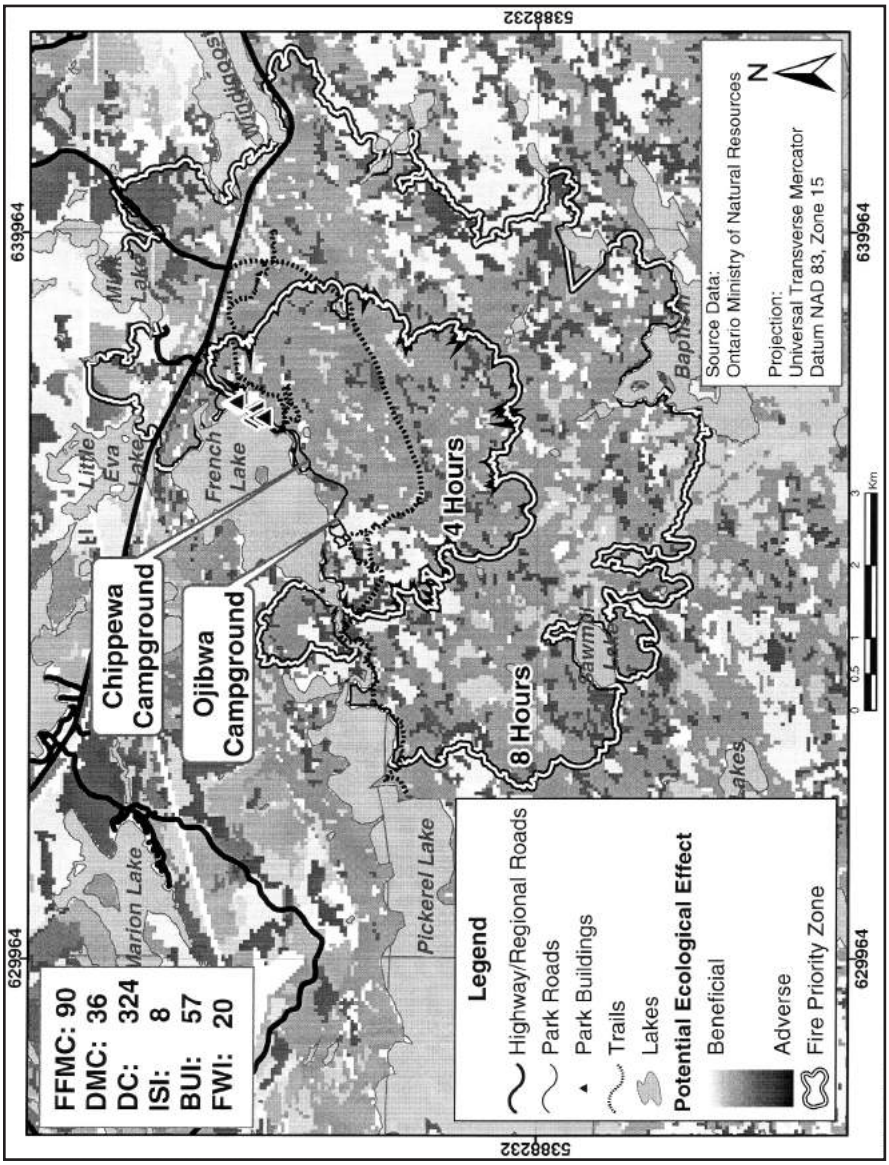
The rationale for this equation was to reduce the range of fire intensities to a measure from -1 (adverse) to +1 (indifferent or possibly beneficial). The index does not provide a measure of how much a given species will be affected by fire. It should also be noted that this index could be applied to all flora, provided tolerance to head fire intensity is known, but this study was limited to tree species only. The establishment of species tolerance level was based on the literature (Ulev, 2005; Taylor *et al*. 2000; Chambers *et al*., 1997) and the FBP system (Hirsch, 1996; Taylor *et al*., 1997; Stocks *et al*., 1989; Canadian Forest Service, 1984). The species tolerance for fire (kW/m) was derived using the average fuel build-up conditions and the point (in the FBP tables for that fuel type) at which more than 50% of the crown of coniferous species would be burned (FBP system). A custom application was developed to calculate the NDFII using the same 95th percentile fire weather data to establish fire-priority zones, for selected areas in each park. The overlay capabilities of GIS were then employed to combine the ecological response and fire-priority zones to create a map for planners, park staff or fire personnel to use in dealing with present or future fire events.

Results

Figure 1 shows the results from Quetico Provincial Park and the Dawson Trail Campground (results from Nagagamisis were similar). The shape of the priority

zones clearly reflects the potential fire behaviour and the effect that natural fire breaks, such as water, have on the delineation of fire priority zones. The values to protect in this example were the Chippewa and Ojibwa campgrounds. The two highlighted fire-priority zones reflect the amount of time a fire would take

Figure 1. Fire-priority zones and potential ecological effect of fire for Quetico Provincial Park, Ontario.



FFMC = fine fuel moisture code
DMC = Drought moisture code
DC = drought code
ISI = Initial spread index
BUI = build up index
FWI = fire weather index

to reach the campgrounds (4 and 8 hours respectively). The results also show the varied ecological response to a fire, given the 95th percentile fire weather conditions, ranging from adverse (dark grey) to possibly beneficial (light grey). The areas in light grey that are outside the fire-priority zones could be considered potential candidate sites for prescribed burning to reduce fuel loads or meet vegetation management objectives.

Discussion

The compartmentalization of forest fire in large parks and protected areas can be realized using this decision support tool because areas of beneficial or indifferent effects can be clearly delineated from those areas where fire has either an adverse effect or should be excluded to protect values at risk. One clear advantage of this tool, and the resulting map, is its simplicity. It allows park planners, staff or fire personnel to make either operational or long-term decisions about where and when fire can be allowed to perform its ecological role without compromising the safety of people, property and infrastructure. The ability to delineate fire-priority zones around values is not restricted to structures – other values such as timber stands or endangered species habitat could also be used. The potential for defining areas where fire can be allowed will also ease the fears of local resource managers afraid of economic losses as a result of fire. This decision support tool would facilitate the use of fire in parks and protected areas.

Compartmentalizing fire management also allows us to ensure that a wide range of activities, such as fire response and fire use (e.g., prescribed burning), can be managed in large parks and protected areas. The seasonality of extreme fire behaviour can prevent well developed prescribed burning plans from implementation because ideal burning conditions are often never realized. This decision support tool allows park planners to assess potential risk and benefits based on daily, historical or forecasted weather data. In addition, the combination of a forest fire risk probability map would also help identify if areas are more susceptible to or at a high risk of burning (Doran, 2004). Knowing the relative risk for the surrounding area will help guide the implementation of prescribed burning plans to help meet vegetation management objectives, such as fuel hazard reduction, or ensuring ecological integrity.

This methodology provides park planners and land use managers with a simple decision support tool that has many advantages. The key benefits are the simplicity and ease of use: In the event of a fire, park staff can examine its location in relation to priority zones and make an informed decision as to a course of action. This tool does not require the collection or creation of any new spatial data sets because it exploits the existing forest resource inventory and provincial fuel and fire weather databases used for other OMNR applications. The use of existing data sources does not add to the cost of implementation because the data already exists. In addition, by using existing data the decision

support tool can be applied to any area within the province – or country for that matter – where fuel, weather and forest resource data is available.

Future Research

The development of this decision support tool is a first step toward integrating ecological benefits with the risk of loss from forest fire, yet there are still many areas that must be examined to improve the robustness of this tool. A more realistic measure of ecological benefit/risk is needed for different species, including non-tree species. How species respond to different intensities of forest fire may not be easily standardized, therefore more research to examine or quantify the benefits based on head fire intensity is also needed. Furthermore, the inclusion of fire regimes will greatly improve the ability to compartmentalize fire because areas that are overdue for fire can help park planners prioritize fire treatment options and assess the risk to neighbouring activities. In addition to fire regimes, proximity to seed sources should be included in any assessment of potential benefits from fire. Other ecological effects such as the provision or restoration of habitat and the reduction of invasive species need to be incorporated into the decision support tool.

The technological component of this decision support tool will require further development of the user interface so that it is easily integrated with existing GIS software used by OMNR staff and so that parameters, such as species response to fire intensity, can be easily modified by the user. In addition, this tool should be integrated with the internet map server capabilities of GIS such that park personnel do not have to rely on GIS technology, nor GIS software licensing fees, to use the tool.

In conclusion, the development of this decision support tool will help park planners and local resource managers balance the fire management paradox such that the ecological integrity of fire-initiated or fire-maintained ecosystems can be ensured while also accounting for the protection of people, property and infrastructure. Compartmentalizing fire in large parks and protected areas will help balance the competing land uses within and around parks with the ecological goals and objectives established in the park planning process. Fire-initiated and fire-maintained species must be allowed to burn – with this tool, park planners and resource managers can easily determine when to allow fire and where it can perform its ecological role.

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Habitat Characteristics and Distribution of the American Badger (*Taxidea taxus jacksoni*) in Southwestern Ontario

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Abstract

*Southwestern Ontario contains a complicated agricultural landuse pattern, benefiting open and edge wildlife including small furbearing mammals, ground-burrowing rodents, and birds of prey. The most endangered furbearer in the tobacco belt region is the American badger (*Taxidea taxus jacksoni*). With a population currently below 200, recovery plans are now being drafted to implement measures for restoration projects. Badger sightings and information solicited from the public by the Ontario Badger Recovery Team between 1999 and 2005 have helped create an inventory database. Electronic maps of landuse, physiography, roads, and vegetation were developed using Geographical Information Systems. The location of each badger sighting was then used to correlate habitat specificity and environmental characteristics. Of the 52 badger sighting reports, 46% of the sightings were reported in the vicinity of Simcoe, where a dense population exists. The majority of badgers were found on or near sand plains and open fields. 19% were 'Dead on Road', mostly found near Highway 3 near Simcoe, and near Highway 403 near the City of Brantford. Road underpasses constructed in the United Kingdom for the European badgers (*Meles meles*) have been successful in reconnecting of habitat severed by high-use roads, and should be considered in Ontario's badger habitat. Environmental factors such as pollution, predation, and hunting do not appear to have a significant affect on population decline.*

Introduction

The American badger (*Taxidea taxus*) is predominately found in tall-grass prairies, fields and meadows throughout North America. Their current distribution ranges from the mountains of British Columbia through to Southwestern Ontario, and south towards Mexico. They are fossorial carnivores often in pursuit of prey species including ground squirrels (*Spermophilus* spp.), woodchucks (*Marmota* spp.), voles (*Microtus* spp.), and rabbits (*Sylvilagus* spp.) (Ontario Badger Recovery Team, 2005). Females give birth to a litter of 2 to 5 in their second

year. Sex ratio is 1:1 (Environment Canada, 2006). Rate of survival decreases 50% each year where they may survive up to 13 years (Messick and Honecker, 1981). Populations are decreasing; however few studies have specifically addressed the cause of population decline. The least studied subspecies, *T.t. jacksoni*, (hereinafter "Jacksoni badgers") are found only in the Great Lakes region. Jacksoni badgers are currently listed "endangered" by both provincial and federal governments (COSEWIC 2006, OMNR 2005). In Ontario, a high density of Jacksoni badgers exists around the Town of Simcoe (Environment Canada, 2006).

Study Area

Only the largest known badger distribution range in Ontario was used in our study area. Other smaller badger habitats in Grey-Bruce, Quetico, and Rainy River were excluded. This research mostly encompassed the 'tobacco belt region'; from approximately London to Nanticoke, Turkey Point to Cambridge. This area was formerly a lake bed, so the area is fertile and sandy. The tobacco belt region contains a matrix of landuse patterns including a mixture of rural and urban centres. This landscape also contains one of the richest areas of tall-grass prairies, significant wetlands, and Carolinian forests in Ontario (Nelson *et al.* 2004).

Methods

From 1999, the Ontario Badger Recovery Team – a branch of the Ontario Ministry of Natural Resources – initiated an awareness campaign to solicit from local residents any information on badgers, including sightings, dens, road kill, and pelts for genetic testing (Ontario Badger Recovery Team, 2005). In late 2005, all 52 recorded sightings were provided for this research. One record was removed from most analysis (REC-18) because it was outside of the study area. A few other records were split into multiple sub-records since the record was for a badger and cubs. In total, the database contains 59 unique sightings. Using Geographical Information Systems (GIS), each confirmed sighting of a Jacksoni badger was assigned a UTM co-ordinate based on given information, then plotted onto all electronic maps. In cases where inadequate information was provided on the sighting location, a best guess co-ordinate was assigned. Since badgers are always seeking new territories (Long and Killingley 1983), point locations only provide an idea on where badgers can be found.

Individual electronic map layers in ArcMap format were cropped to the study area. Maps include physiography, soils, landuse, roads, parks and protected areas, infrastructure corridors and right-of-ways, and waterways. Redundant and duplicate attributes in each map legend were reclassified to allow visual simplification of maps. For example, "corn", "tobacco", and "vegetable" was simplified into "Row Crops". Information was not lost in the simplification process as it was retained in the database for further analysis.

Two maps in paper format were used for further analysis and comparison. A map that combined three previous studies – reported in Newhouse and Kinley (2002) – was scanned to create an electronic map compatible for GIS analysis. The 20-year map contained badger sightings that were used to compare recent finding with previous studies. Another map was taken from the Atlas of Mammals in Ontario (Dobbyn, 1994) to determine whether food resources are available and plentiful.

The maps produced by using spatial overlays qualitatively compared all sightings to determine any spatial correlation of habitat preference. They were also used to understand plausible factors involved in low population numbers throughout Southwestern Ontario. Furthermore, 10 confirmed 'dead on road' (DOR) reports were mapped separately to determine areas of high road moralities.

Results

A high density of Jacksoni badgers is found in the vicinity of the Town of Simcoe, becoming sparse towards the City of London. Two sightings were reported in Grand Bend and in Glen Morris – just outside of the study area. Population distribution from this study is consistent with previous reports.

Jacksoni badgers were sighted in areas where three biophysical criteria were met: sandy soils, landuse compatibility and abundance of prey species.

Of the badger sightings, 35% were found directly on a sand plain and an additional 14% were within 125 metres of a sand plain. Figure 1 indicates some badgers along clay plains; however, with closer analysis, badgers were actually seen near waterways where soils are friable. The maps used were too coarse in scale to map shoreline habitats.

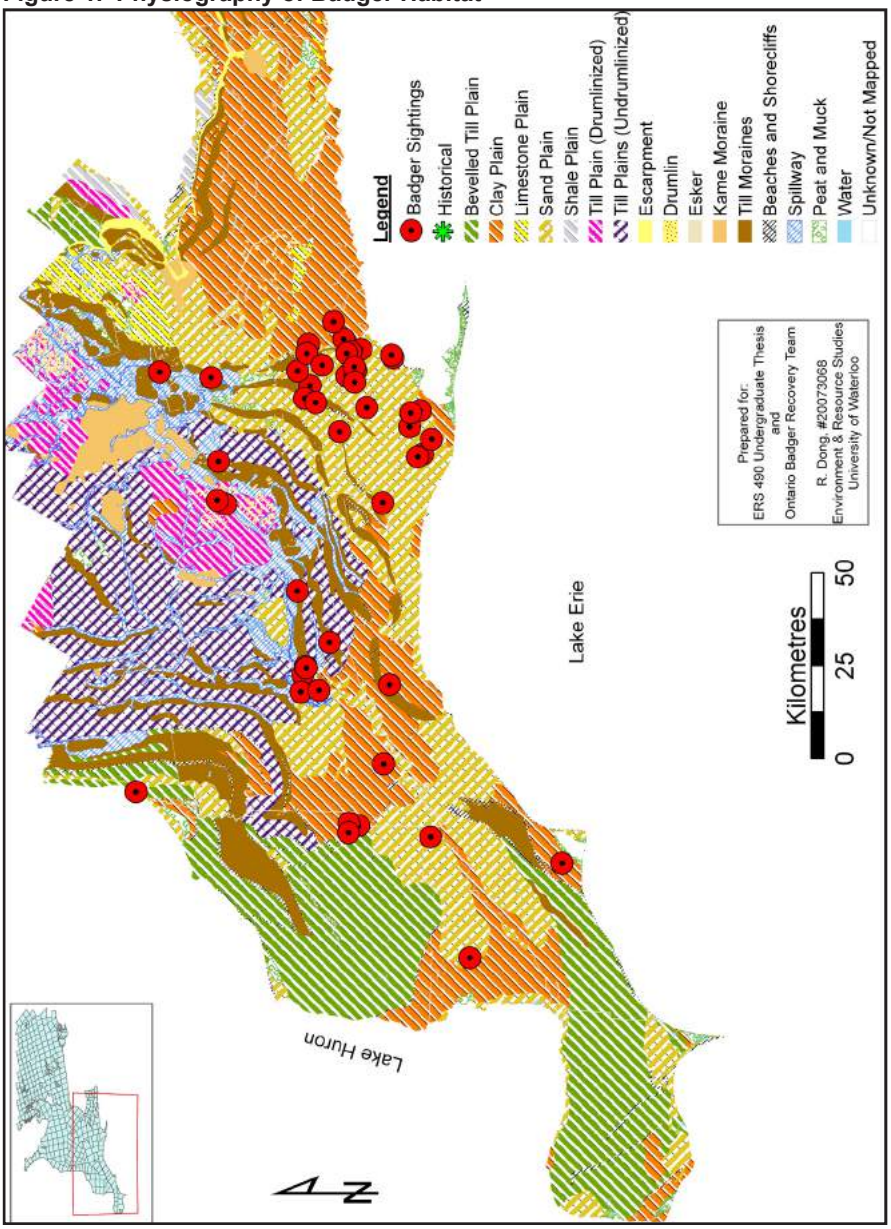
With respect to landuse, 31% of the badgers were closer to areas dominated by agricultural fields, rather than areas dominated by row crops (27%) (Figure 2). A high concentration of badgers is found in areas where fields are most dominant compared to areas dominated by row crops. A few badgers were reported in an urban environment, mostly in the outskirts of the Town of Simcoe.

Dobbyn (1994) reported all four main prey species were living in badger territories. The most abundant species are the woodchuck (*Marmota monax*), Eastern cottontail (S*ylvilagus floridanus*), Eastern chipmunk (T*amias striatus*), and Meadow vole (*Microtus pennsylvanicus*). From information provided by this mammal atlas, it appears food resources are not likely to be a limiting factor on badger abundance.

The road network throughout most of southern Ontario is created in a European grid style. Roadkills made up 17% of the badger sightings in this study. Two badgers were killed on or near Highway 403, whereas five were

killed near or on a secondary highway, of which four were along Highway 3 towards the east of the Town of Simcoe (Figure 3). Distance calculations of roads indicate that a badger travelling in one direction will cross one sideroad at least every 1.5 kilometre, a major arterial road every 5 kilometres, and a highway every 26 kilometres. Since badgers are constantly on the move in pursuit of

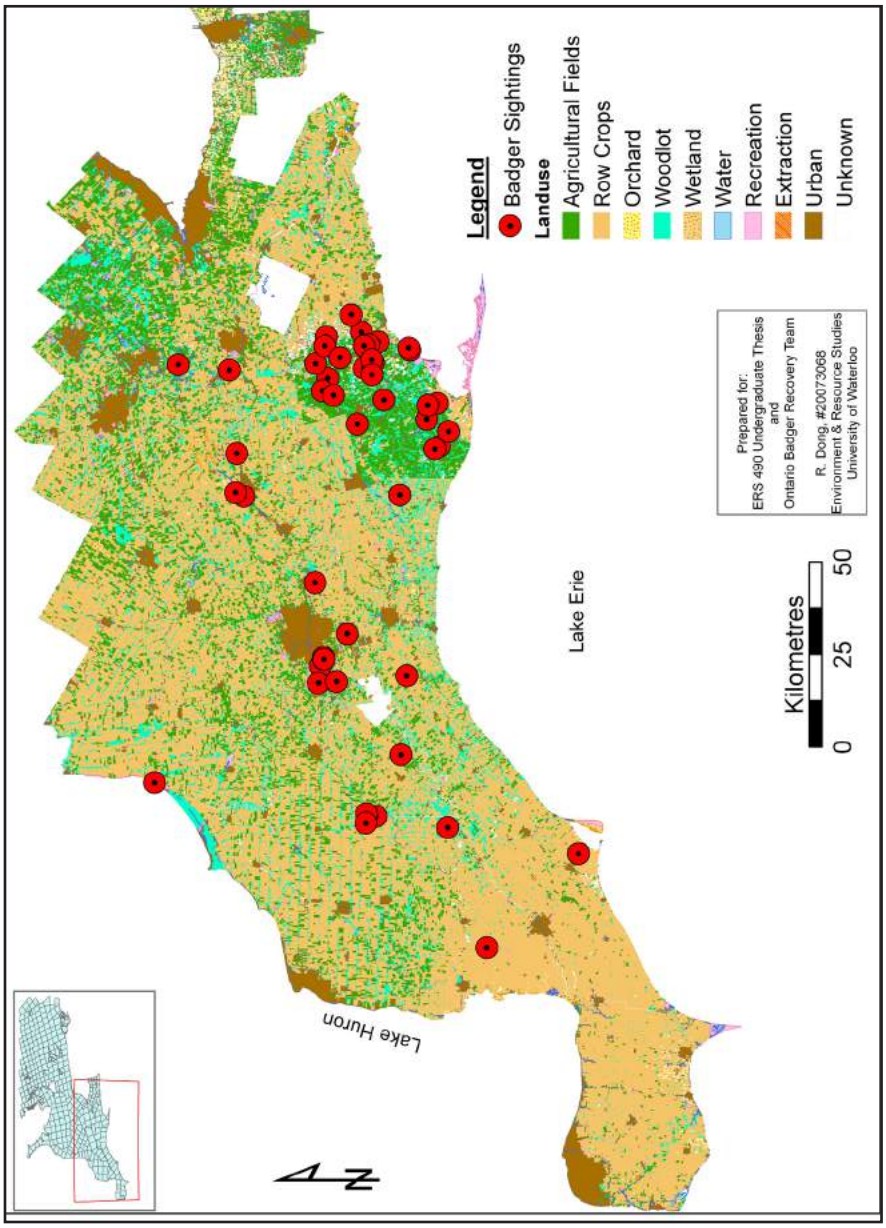
Figure 1. Physiography of Badger Habitat



prey, the likelihood of it being road killed increases every metre it travels.

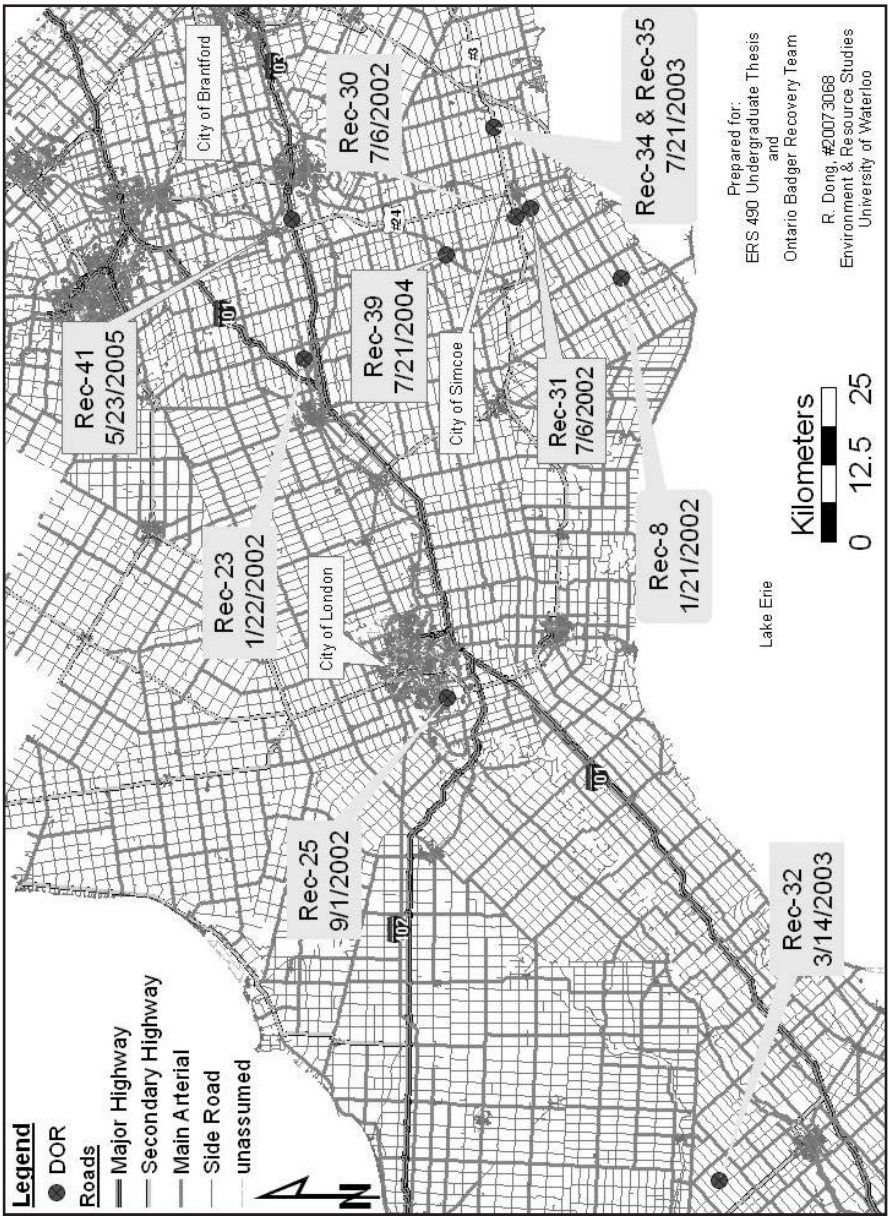
As opportunistic feeders, badgers continuously roam to find new food resources. Badgers do not appear to use wildlife "corridors" where tracts of prime habitat are used to move from one locale to another. This is suggested by creating a map of railway and hydro transmission corridors since many wildlife

Figure 2. Landuse in Badger Habitat



species use these relatively undisturbed right-of-ways to move throughout a landscape. Only through radio-tracking techniques will it be possible to accurately determine whether corridors are used by badgers. Employing wildlife underpasses could be successfully used – as demonstrated by recovery efforts in the United Kingdom (Neal, 1986).

Figure 3. "Dead on Road" Badger Reports



Discussion

Pollution from land use does not seem to be a factor leading to population decline. Hancox (1991) suggests high PCB levels have a detrimental effect on *Mustelids*, however PCB use has been banned in Canada since 1985 (Environment Canada, 2003). There seems to be no intense pollution source in the tobacco-belt region, aside from urban and agricultural inputs.

Mammals that predate badgers include foxes, coyotes, and eagles (Neal, 1986); however, most predation occurs when they are most vulnerable – when young and small. In the tobacco-belt region, it is uncertain whether predation poses a severe risk to badger population. Given that predators are not abundant and their prey species are variable, it is unlikely predators are suppressing the badger population.

Deliberate removal and hunting of badgers in Ontario is illegal. However, since 1990, an average of one badger per year has been accidentally trapped on a trapline intended for coyotes or foxes (Milne, 2005). Many residents in badger territories are not aware of the existence of badgers when interviewed. Currently in Canada, there is no market for badger pelts nor badger meat, thus it is assumed that direct human interactions are not a factor.

Food for badgers remains plentiful. However, when prey is not readily available, badgers are capable of diversifying their diet to consume seeds, vegetation, and soil insects (Neal, 1986).

Shelter also remains plentiful throughout Southwestern Ontario. Sandy soils can be found throughout the landscape, favouring digging and burrowing activities. Badgers in Idaho were as dense as 5 per square kilometre (Messick and Hornocker, 1981). Agricultural fields, meadows and prairies can be found throughout the tobacco-belt region and can readily support a larger number of badger dens. That said; habitat throughout the tobacco-belt region is highly fragmented by roads formed in a European grid pattern.

Badgers are important as a cultural identity to the United Kingdom, as beavers are to the Canadian identity (Westray, 2005). Unfortunately in Canada and most of the United States, badgers do not have the same appeal. Whereas badger paraphernalia litters many stores throughout Europe, there are only a few popular charismatic characters depicting the badger in North America. Paulette Bourgeois and Brenda Clark's children's cartoon and book series "Franklin the Turtle" includes a badger and the mascots of Brock University, University of Wisconsin, and Tall-grass Ontario are badgers. In both countries, field naturalists agree that seeing a badger provides excitement to the viewer.

Britain passed the Badger's Act in 1973 to prevent cruelty to, and to protect badgers from any harm (Neal, 1986). In Canada, badgers do not share the same level of protection as they are only protected under the Species at Risk Act (Environment Canada, 2006; COSEWIC, 2006). The endangered

T.t. jeffersonii badgers in British Columbia are currently being restored by the removal of concrete medians from roads to reduce road mortality (Parks Canada, 2005). In the UK, culverts constructed under roads as wildlife underpasses have been successful in preventing badger mortalities from busy traffic (Neal, 1986). Ontario's badgers might share the same benefits if these measures were implemented in strategic locations throughout Southwestern Ontario.

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Many thanks to the Ontario Badger Recovery Team, especially Ron Gould and Dave Reed, for allowing me the opportunity to study badgers in greater detail. Dr. Robert Milne, Dr. Ian McKenzie, Dr. Steve Murphy, and Dr. Roger Suffling greatly contributed their knowledge to many themes in this paper. Many thanks to Dr. Paul Eagles for supervising this paper, and to Dr. Gordon Nelson for allowing me the opportunity to present this paper at the Annual General Meeting for the Parks Research Forum of Ontario. The use of a quiet working space, provided by Professor Larry Lamb was greatly appreciated. Financial assistance was provided by the Canadian Wildlife Federation's Orville Erickson Memorial Scholarship award.

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Most importantly, thanks to the custodial staff and visitors of the Dorney Garden for maintaining my interest in this complex field of study.

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Long-term population estimates and synchronous variation in two populations of black rat snakes (*Elaphe obsoleta)* in Eastern Ontario

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Abstract

*Synchronous variation describes the pattern that occurs when variables, such as population size, from several separate populations increase or decrease together. It is common in animal populations and is relevant when studying species of conservation interest because synchrony prevents population rescue. We used 23 years of mark-recapture data to test for the presence of synchronous variation in population size for two separate populations of the threatened black rat snake (*Elaphe obsoleta*) in Eastern Ontario. The Jolly-Seber method was used to estimate population size. The population sizes tended to vary synchronously from 1982 to 2005. Synchronous variation in population size can be attributed to the Moran effect, where two separate populations become synchronous due to common environmental perturbations. Evidence of synchrony has serious conservation implications; this population of black rat snakes is more vulnerable to environmental perturbations because all subpopulations would become rare simultaneously.*

Introduction

Long-term population monitoring plays an essential role in conservation. Examining population trends is the only means to assess species status and to evaluate the efficacy of management actions.

Synchronous variation is common in animals (Ranta *et al.* 1995; Hudson and Cattadori 1999). Subpopulations that vary asynchronously can rescue neighbouring populations through dispersal (Koenig, 1999), lessening the risk of local extinctions. In contrast, subpopulations that vary synchronously may cause the entire population to be more susceptible to extinction. We used 23 years of mark-recapture data to test for population size synchrony among two genetically distinct populations of the threatened black rat snake (*Elaphe obsoleta*) in Eastern Ontario, thus extending the work of Weatherhead *et al.* (2002).

The black rat snake is limited in Canada to a few disjunct populations along the north shore of Lake Erie and one continuous population on the Frontenac Axis of Eastern Ontario.

Methods

Study sites

Two sites in Eastern Ontario were compared in this analysis, St. Lawrence Islands National Park (SLINP) and Queen's University Biological Station (45º 37'N, 76º13'W). Sites are separated by a major 4-laned highway and the St. Lawrence River.

Data collection

The biology station captures were limited to areas near the biology station (1.8 km^2) while the SLINP captures were limited to a study site (2.0 km^2) on Hill island, a large island (5.6 km^2), almost entirely owned by Parks Canada. Mark-recapture data were collected from 1982 to 2005 at Hill Island and from 1981 to 2005 at the biology station. Male, female, and juvenile snakes were captured opportunistically and at hibernation enclosures in all years.

Population size estimates

Population sizes were estimated using the Jolly-Seber method, which makes the following assumptions: (1) populations are open (birth, death, immigration and emigration occur) (2) every individual has the same probability (α_t) of being captured (3) every individual has the same probability of survival (Φ_t) from time t to time t+1 and (4) individuals do not lose their marks. This method enables us to calculate the proportion of animals marked (α_t), the size of the marked population, and population size (N_t) (Krebs, 1998). Population estimates were then log-transformed to normalize their distribution (Koenig, 1998). We regressed, by site, estimated population sizes on year to test for significant temporal trends. To determine if population size was synchronous between populations, we used the Pearson moment correlation between the two time series. Instead of using the log transformed data directly, correlations were tested using the difference between logs of two successive observations. This detrends the data and puts the emphasis on synchrony (Koenig and Knops 1998; Bjørnstad *et al.* 1999).

Results

The St. Lawrence Islands National Park population shows a non significant increase from 1981 to 2005 ($r = 0.23$, $P = 0.30$) (Figure 1) while the biology station population shows a significant trend, decreasing from 1983 to 1993 and increasing from 1994 to 2005 ($r = 0.73$, $P < 0.001$) (Figure 1). A quadratic regression was fit to the biology station data since a linear regression was non significant and there was clear evidence of curvature. The synchrony between estimated population sizes was positive, but non significant ($r = 0.28$, $P = 0.22$) (Figure 2).

Figure 1. Annual trends in estimated population size (log-transformed) from the Jolly-Serber model for black rat snakes (*Elaphe obsoleta*) at Hill Island and the Queen's University Biology Station

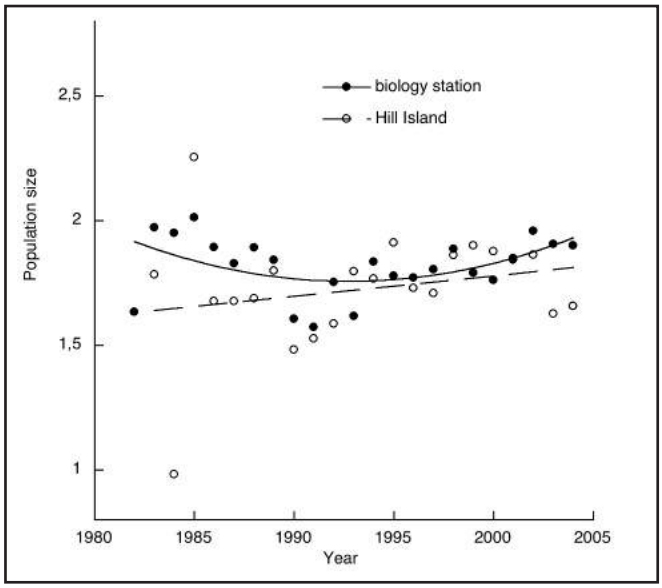
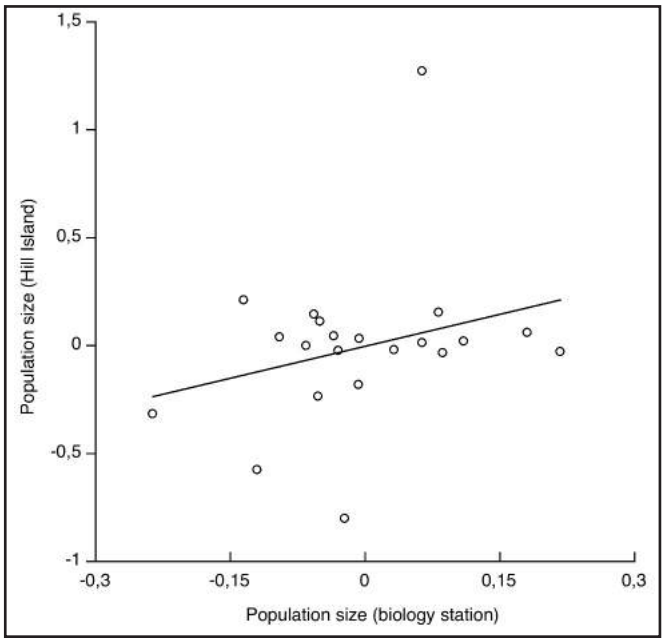


Figure 2. The first difference time series of log-transformed annual population size



Discussion

These additional years of mark-recapture data have shed light on interesting long-term trends. Weatherhead *et al*. (2002) found a significant decrease in the population size at the biology station while our new data show that this pattern is changing. Our analysis was limited to estimates in population size, while Weatherhead *et al*. (2002) examined other parameters such as probability of survival, recruitment and age structure. They were able to associate the population decline to a decrease in recruitment, which in turn had shifted the age structure of the population to more mature individuals. If this trend remains true, increased recruitment may be largely responsible for the population increase at the biology station. Much black rat snake research has been accomplished at the biology station in recent years (Blouin-Demers *et al*. 2002; Blouin-Demers and Weatherhead 2002; Blouin-Demers *et al*. 2003; Weatherhead *et al*. 2003), promoting stewardship with local cottagers and possibly increasing recruitment through the use of experiments that require the protection of clutches by means of laboratory hatching (Blouin-Demers *et al*. 2005). In addition, northern populations, particularly ectotherms, can also be seriously influenced by changes in climate (Post and Stenseth 1999; Willette *et al*. 2005). Recruitment as well as other important ecological processes are affected by fluctuations in climate and in turn influence the internal dynamics of populations (Stenseth *et al*. 2002; Ciannelli *et al*. 2005). Examining the effects of climatic variation on key internal dynamics, such as recruitment and sex-ratios may enable us to better interpret what is happening to our northern populations.

Similar to Weatherhead *et al.* 2002 we found some evidence of population synchrony. Since these populations are separated by over 30 km and are genetically distinct (Lougheed *et al.* 1999), this synchrony is attributable to common stochastic environmental factors, the Moran effect (Engen and Sæther, 2005). As mentioned above, these two populations are found in this species' northern range (Prior and Weatherhead, 1998) and are thus submitted to similar stresses, such as a 6 month hibernation period (Blouin-Demers *et al.* 2000). Such stresses, combined with other environmental factors play an important role in synchronizing nearby populations.

Other parameters such as recruitment, percent of mature individuals and sex-ratios must be investigated with this new data to permit us to closely examine the individual dynamics of these populations. As recommended by Weatherhead *et al.* in 2002, although population sizes have a tendency to vary synchronously, indicating that the black rat snakes' Canadian population may be susceptible to overall decline, internal dynamics are essential to examine before employing similar conservations strategies for both populations.

Acknowledgments

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The Effect of Moisture on the Decomposition Processes in the Disturbed Peatlands of the Wainfleet Bog

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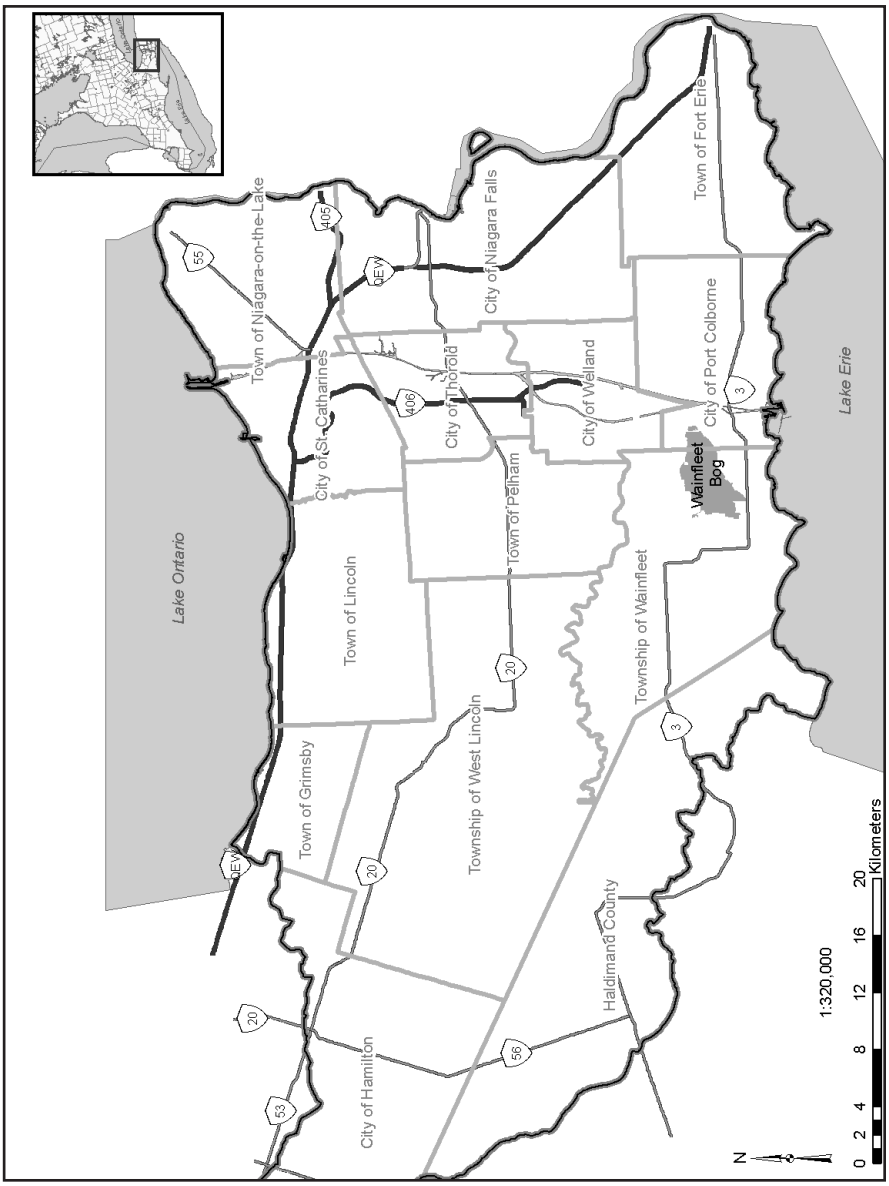
Abstract

The Wainfleet Bog, in the Niagara Peninsula, is home to many species designated as "at risk" in Ontario. The bog, however, has been negatively impacted by drainage and peat mining. Over the past decade, stong efforts have been made toward managing, preserving and restoring the bog ecosystem. Study suggests that remediating moisture levels is an important aspect of restoration. This paper reports on research into the effects of moisture on decomposition processes. Two hypotheses were tested: (1) that increased soil moisture will decrease decomposition rates, and (2) that increased soil moisture will reduce the abundance of macroinvertabrate decomposers. Research results supported the first hypothesis, but did not fully support the second one. Based on these results, recommendations relevant to restoration efforts are made.

Introduction

The Wainfleet Bog is the largest protected wetland (1500 ha) in the Niagara Peninsula (Figure 1). This ecosystem sustains many floral and faunal taxa with a Species at Risk designation in Ontario (MacDonald 1992; Niagara Peninsula Conservation Authority 1997). Prior to its protection by the Ontario Ministry of Natural Resources, Niagara Peninsula Conservation Authority and Nature Conservancy of Canada, this ecosystem was highly impacted by drainage and peat mining. In the last 10 years, there has been a strong effort to manage, preserve, and restore this ecosystem. Research into peatland restoration is a relatively new science, but evidence from the scientific literature suggests the first step to restoring a disturbed peatland, such as the Wainfleet Bog, is to remediate soil moisture levels. This study examined the effect of increased soil moisture levels on the decomposition processes in the highly disturbed peatland of the Wainfleet Bog.

Figure 1. Regional map illustrating the location of Wainfleet Bog



Research Objectives

1. To test the hypothesis that increasing soil moisture levels will significantly decrease decomposition rates of natural and artificial substrates.
2. To test the hypothesis that increasing soil moisture levels will significantly reduce the abundance of macroinvertebrate decomposers such as collembola.

Methods

Decomposition studies were conducted in 2003-2004 using microcosms at study plots throughout the peat-harvested areas of the Wainfleet Bog. Microcosms (Figure 2) were randomly assigned a specific moisture treatment. Moisture treatments included a Control (existing bog conditions), Container Wet (temporary inundation), Container Wet Cover (temporary inundation with shade) and Container Saturation (near undisturbed conditions). Container Wet and Container Wet Cover treatments received approximately 4L of bog water every 14 days during ice-free conditions in addition to naturally occurring sources such as precipitation. Microcosms assigned the Container Saturation were designed to mimic the saturated soil moisture conditions of an undisturbed bog. Microcosms assigned the Control received the naturally occurring soil moisture conditions.

Decomposition was measured using two methods:

1. Litter bags containing wooden toothpicks (n=960), Whatman 1 filter paper (n=480) and *Betula pendula* leaves (n=40) were buried for specific time intervals (up to one year), removed and weighed. Mass-loss of litter was interpreted as a measure of decomposition.
2. To measure the effect of moisture on macroinvertebrate decomposers, the abundance of collembola was monitored for eleven weeks (880 observations) within each of the microcosms.

Figure 2. Photographs showing examples of the microcosm setup in the field

Results

The results of litter bag study found the Container Saturation treatment significantly reduced the mass-loss of toothpicks ($p<0.001$) and Whatman 1 filter paper ($p<0.001$) over one year (Figures 3A and 3B). Also, the Container Saturation significantly reduced the mass-loss of *B. pendula* leaves ($p<0.01$) over one year (Figure 4). The Container Saturation treatment reduced the mass-loss of toothpicks by 30%, filter paper by 20% and *B. pendula* leaves by 18% when compared to the Control. The Container Wet Cover treatment was also found to significantly reduce the mass-loss of toothpicks by 7% ($p<0.05$) and filter paper by 15% ($p<0.01$) when compared to the Control.

Figure 3. Mean toothpicks (A) and Whatman 1 filter paper (B) mass remaining at 1, 2, 3, 4, 6 and 12 months in the treatment variants: Control, Container Wet, Container Wet Cover, and Container Saturaton. Mean values with standard deviations, n=40

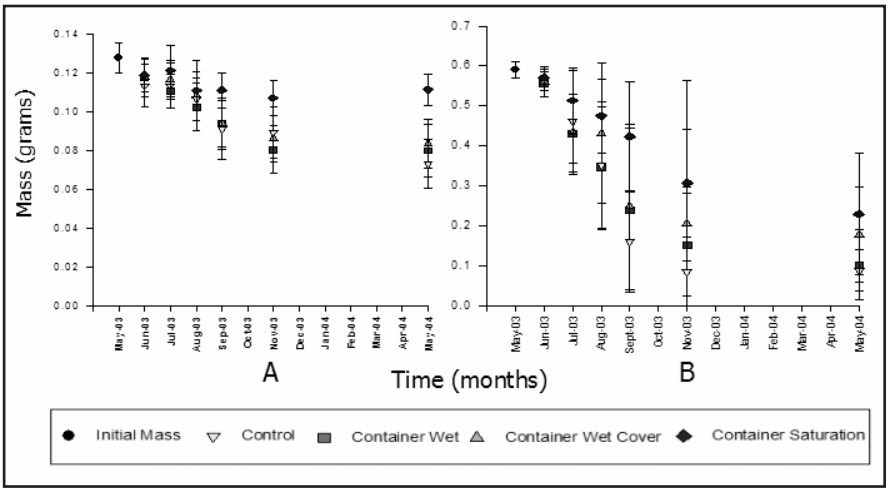
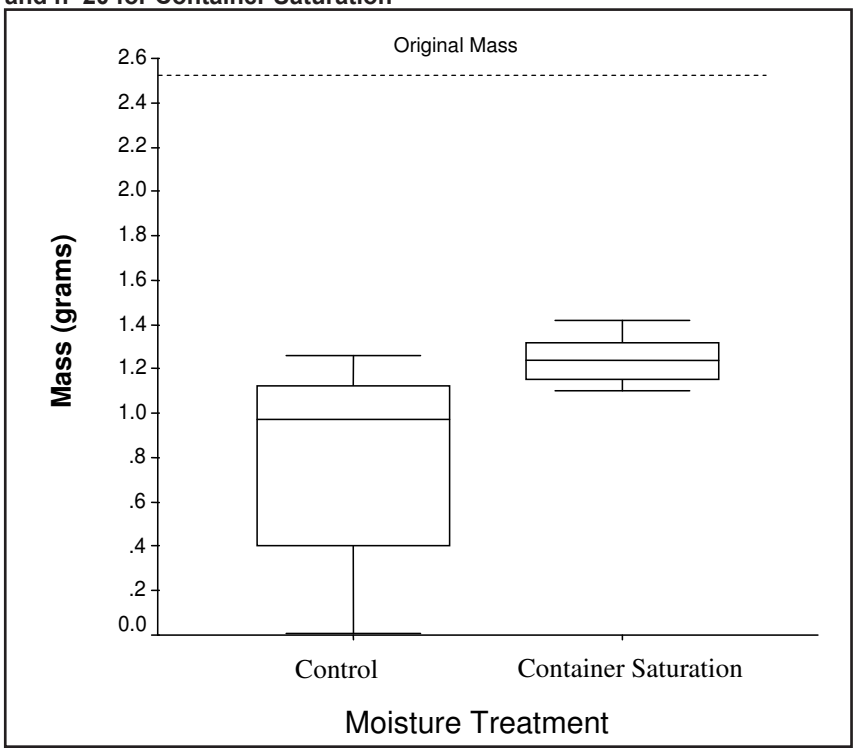
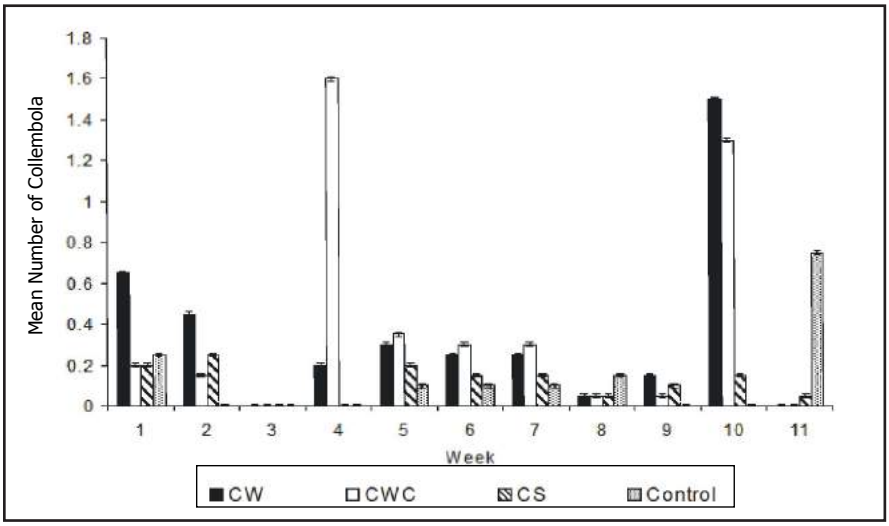


Figure 4. Median mass of *B. pendula* leaves with upper and lower quartiles, and maximum and minimum range values with n=18 for Control and n=20 for Container Saturation



The results of the collembola macroinvertebrate decomposer study found that the wet moisture treatments did not significantly ($p>0.05$) reduce the abundance of collembola decomposers when compared to the Control (Figure 5).

Figure 5. Mean number of observations (n=880) of collembola over 11 weeks (May-October 2003) in teh moisture variants: Control, Container Wet, Container Wet cover, and Container Saturation. Mean with standard error n=20



Conclusions

The results of this study support the hypothesis that increasing soil moisture levels will significantly decrease decomposition of artificial and natural substrates found within the soil. Rewetting soil to moisture levels near those of undisturbed conditions demonstrated the greatest reductions in decomposition compared to temporary inundation. However, rewetting alone may not fully influence the directional shift of nutrient turnover and signify a shift towards a peatland vegetative community. Girard *et al.* (2002) found considerable regeneration of vegetative community in a peat-mined bog with restored soil moisture conditions; however this community was not indicative of a fully functioning peatland. Other restoration techniques that ensure the reestablishment of Sphagnum mosses are necessary to returning disturbed peatlands to carbon accumulating ecosystems.

The results of this study do not fully support the hypothesis that increasing soil moisture levels in a disturbed peatland will reduce the abundance of collembola macroinvertebrate decomposers. It is clear other variables need to be considered before this relationship can be fully understood. However, soil ecologists estimate that macroinvertebrates are responsible for only approximately 2-10% of organic matter decomposition in terrestrial ecosystems

(Adl 2003). Therefore, reductions in microbial populations are likely more significant in affecting directional change in decomposition within the bog.

Recommendations

1. Ensure restoration efforts of degraded peatlands are directed to retaining soil moisture levels through blocking drainage ditches and improving ground cover.
2. Create conditions that are favourable to re-establishing a healthy Sphagnum moss vegetative community.
3. Examine the potential impact of rewetting on Species At Risk that may have become adapted to the dry conditions.
4. Initiate a complete hydrologic study that clarifies the water budget for the Wainfleet Bog.

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Is there a statistical association between Ferns and Garlic Mustard (*Alliaria petiolata*) in forest stands along the Niagara Escarpment?

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Abstract

*One major factor affecting native plant species in southern Ontario seems to be the invasion of forest floors by alien plant species such as garlic mustard (*Alliaria petiolata*). However, Garlic mustard now appears to have affected sensitive, even fragile, ecosystems that we should preserve. Ferns once dominated the ecosystem in southern Ontario. Personal observation – along with other reference work – suggests that they are disappearing. It has been hypothesized that there is a statistical association ($p \leq 0.5$) between ferns and garlic mustard on the Niagara Escarpment in Ontario Canada. Subsequently, it was theorised that the decrease in the distribution of ferns on the Escarpment is a result of garlic mustard proliferation. To test this hypothesis, data were collected concerning the presence or absence of ferns and garlic mustard during the months of May, June and July 2005 using the Bruce Trail and other side trails as transects, covering a total trail distance of 12.6 kilometres. The study targeted all known fern species found in the escarpment's forests. Random points were selected on either side of the trails and the presence or absence of both taxa were noted using a $1m^2$ quadrat. The results revealed that there is a significant statistical relationship between the two taxa ($X^2 = 8.2$; $df = 1$; $p = 0.004$). A coefficient of association (V) value of -0.14 revealed the association to be negative. The negative association clearly identifies garlic mustard as one plausible factor affecting ferns on the escarpment. The results have far reaching implications regarding biodiversity conservation on the escarpment, as different conservation groups manage these forest stand areas. It likewise indicates that systems once considered undisturbed might be impacted negatively by several factors including this invasive plant.*

Introduction

Ferns were once abundant in southern Ontario. Preliminary observation suggests that they are disappearing from the ecosystems where they once proliferated. One area in southern Ontario that had an abundance of ferns is the Niagara

Escarpment. Field observations supported the notion that there is a decrease in the distribution and abundance of these plant species from this ecosystem. The decline may be attributed to changes in the environmental conditions, fragmentation and disturbance factors. Change in environmental and or ecological conditions often predisposes a site to invasion by opportunistic plant species. Garlic mustard (*Alliaria petiolata*) is one such plant species that now thrives on the Escarpment.

Anderson *et al* (1996) noted that garlic mustard is an exotic plant species that has invaded woodlands in several areas in midwestern and northeastern United States and Canada, where it is displacing the indigenous understory flora. Examples of such invasion can be seen on the forest floor in conservation areas throughout the Niagara Region.

Havinga *et al* (2000) listed garlic mustard as an invasive plant that required attention in southern Ontario and Bowers (2002) suggested that a statistical relationship might exist between the distribution of garlic mustard (*Alliaria petiolata)* and fern populations on the Niagara Escarpment. The purpose of this study was to ascertain whether a statistical association exists between garlic mustard and ferns.

Methods and Materials

Study areas

The seven areas used in this study were Balls Fall's, Louth Conservation Area, Short Hills Park, DeCew Falls, Woodend Conservation Area, Queenston Heights, and Niagara Glen. All sites are on the Niagara Escarpment a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Biosphere Reserve and appear to have different levels of disturbance. The forests comprise a variety of tree species at different successional stages. These sites have various recreational trail types. The trails vary from paved areas allowing access to motorized vehicles to steep rugged terrains. The Bruce Trail is the major recreational trail. The main trails cover a distance of over 850km. Riley *et al* (1996) noted that these seven forests are recognised as Areas of Natural and Scientific Interests (ANSI's). The areas are managed by three different organizations: Niagara Parks Commission, Niagara Peninsula Conservation Authority and the Ministry of Natural Resources. Figure 1 provides the location of the study sites. Garlic mustard has been recorded along sections of the Bruce Trail (Bowers, 2002; L'Ecuyer-Engelen, 2002) in some of the locations where this study was conducted.

L'Ecuyer-Engelen (2002) identified six different fern species along the trail demonstrating that ferns still inhabit the area. The focus of this study was on fern species found adjacent to the recreational trails.

All data collection was done to ensure minimal damage to habitat, existing ferns or other native species. No live plant specimens were removed from any

of the study sites. Personal experience and Blossey (2003) have revealed that humans act as vectors to transferring seeds. Data were collected on different days thereby limiting the possibility of transferring foreign species from one area to another.

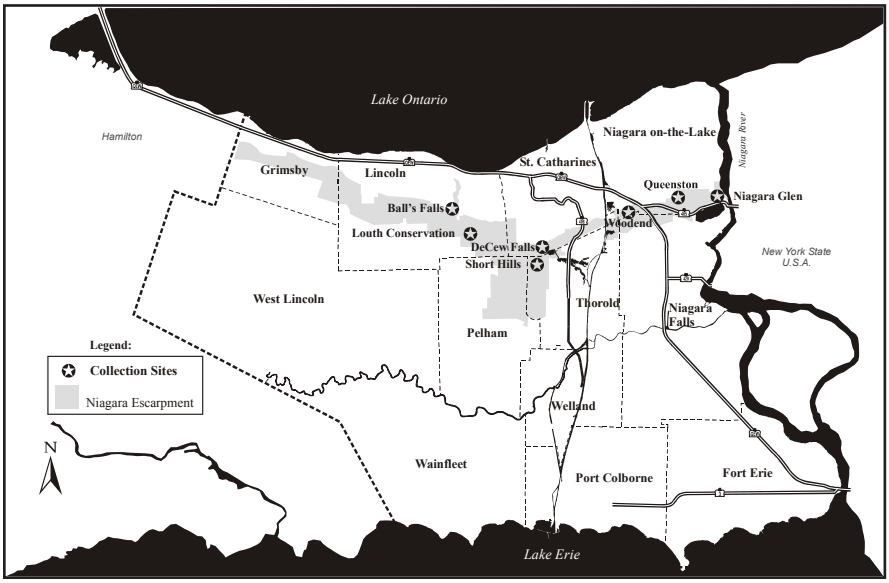
Methods

Data were collected at the seven sites using the Bruce and side trails as transects. Collection started where there was full leaf canopy and began with the first fern specimen encountered in Section 1 after entering the designated trails. Fern specimens used for decorative purposes (e.g. planted at the entrance to respective sites) were not considered part of this study. Random distances were selected along the trails to determine individual collection points.

Access to each collection point was perpendicular to the trails and aided in reducing undue site disturbances.

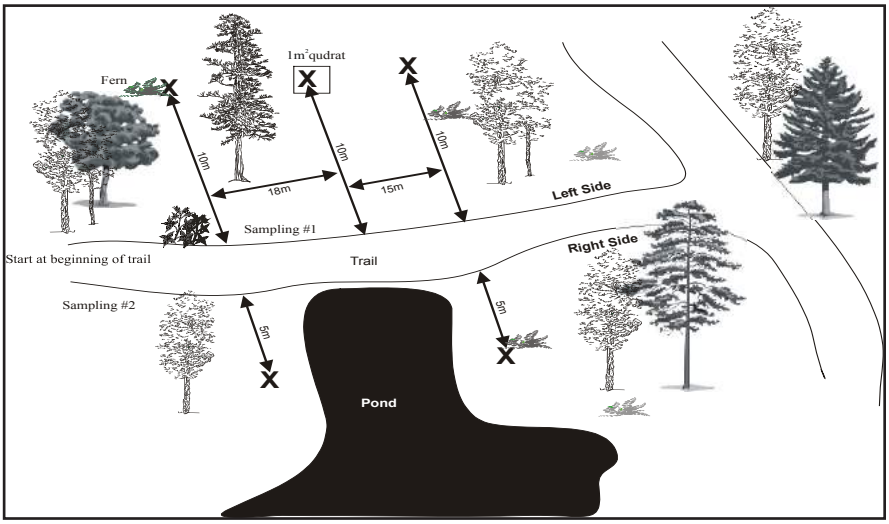
The study sites were divided into two sections. Section 1, which comprised the areas left of the designated trails and Section 2 comprised of the areas right of the same trails. Data were collected 10 metres from the trail in Section 1. Points 10 metres from the trails were considered to have lower levels of disturbance and likely provided more suitable growth conditions for ferns. It was theorized that these areas would be least impacted by garlic mustard. Data were then collected directly opposite of Section 1 in Section 2. Collection points here were 5 metres from the trails. It was felt this area would have a higher level of disturbance

Figure 1. Map of Niagara Region showing sections of the Niagara Escarpment and the location of the seven study sites.



when compared with Section 1 and that garlic mustard would be more abundant closer to the trails (Shimp, 2002). Where areas were inaccessible due to rivers, slopes or any other physical barriers, the next random point along the trail was selected and used instead. Figure 2 provides a representation of the sampling technique.

Figure 2. Data Collection Outline of the sampling technique used in collecting data on respective trails



Data Collection

Data were collected using $1m^2$ quadrats. Two random number tables were used to choose the collection points along each transect. The mean distance between collection points was 15 metres**.** The total number of sampled points for each site ranged from 64-83.

A minimum of five individual sampled points with fern species recorded per site was considered adequate for evaluation. This number of individual fern species per site was selected to standardize the results. It was felt that if the site did not support a viable fern population then the results would not reflect the true association between the ferns and garlic mustard.

The data were collected in the months of May, June and July (2005) when all fern species were in their active growth stages. The trees had full canopy at the time of collection. Canopy cover is considered essential as most fern species in this study could be considered as forest species requiring some shade for optimal growth. The collected data were then entered into a 2X2 contingency table from which they were analysed (Table 1).

Table 1 Method for analysing collected data

	Garlic Mustard	
Fern Species	Present	Absent
Present		
Absent		

(Modified from Sokal and Rohlf, 1981)

Results

The study recorded 14 different fern species at the sites. Table 2 shows the total number of fern species found for each site. Data were collected from 572 points along 12.6 kilometres of main and side trails. Fourteen different fern species were identified as compared to the 31 species recorded in the same areas by Riley *et al.* (1996). (Note that Riley *et al*. used systematic searches rather than random sampling). Sensitive fern (*Onoclea sensibilis*) was found at DeCew Falls but was not found by Riley *et al* (1996).

Site-by-site and grouped analyses were done to determine the statistical association between ferns and garlic mustard. Five sites from the data collection met the criteria of having a minimum of five sampling points with ferns. Two combined site analyses were done, the first excluding Queenston and Woodend

Table 2. UTM references and the number of fern species identified in the seven study sites.

Forest	UTM References	Collection Dates	# of species found by Lyons	# of species recorded by Riley *et al*(1996)	Garlic Mustard Present
Niagara Glen	570 760	2005-05-23	7	22	Yes
Queenston	575 800	2005-06-22 2005-06-17	2	8	Yes
Woodend	500 790	2005-05-21	2	5	Yes
DeCew Falls	405 745	20050-6-04	6	11	Yes
Short Hills	395 730	2005-06-22	4	19	Yes
Louth Conservation	358 750	2005-07-01	3	18	Yes
Ball's Falls	320 780	2005-07-03	7	16	Yes

Modified from Williams-Linera et al 2005

Conservation Area where few or no ferns were found, and the other including these two areas. The outcome of these analyses changed the results only marginally.

The analysis was done on the right and left side of the trails, and then combined for individual sites. Tables 3 and 4 show the results. Table 3 shows that there is no statistical association between the two taxa at any site taken by itself. Table 3 shows the p and V-values for individual sites. By contrast, Table 4 shows a statistically significant relationship between the two taxa when all the sites were combined. Table 4 shows the p and V- value from the analysed data for the five sampling sites and then all sites.

The results here are significant with p-values of 0.004 and 0.001 for five sites and all sites respectively. These values revealed a strong statistical association between garlic mustard and fern species on the escarpment. The combined analysis revealed that there is a weak negative association between the two taxa (V= -0.14).

Garlic mustard was abundant at all the sites. Vast monocultures existed. Figure 3, taken at Woodend, is one example of the monoculture.

Table 3. Statistical analyses for individual sites

	Left side	Right side	Site Combined	
Sites	p-value	p-value	p-value	V-value
Niagara Glen	0.921	0.577	0.067	+0.06
Queenston	0.706	0.746	0.565	+0.07
Woodend	0.212	0.402	0.704	+0.04
Short Hills	0.845	0.834	0.483	-0.01
DeCew Falls	0.845	0.350	0.403	-0.1
Louth Conservation	0.011	0.975	0.079	-0.19
Ball's Falls	0.424	0.121	0.079	-0.19

Table 4. Statistical analyses for all sites combined

5 sites (Excluding Woodend and Queenston)	p -values	V- value
Left side	0.04	-0.14
Right side	0.066	-0.17
Sites combined	0.004	-0.14
Data from the 7 sites		
Left side	0.008	-0.16
Right Side	0.074	-0.11
Sites combined	0.001	-0.14

Figure 3. Large monocultures of garlic mustard at Woodend

Discussion

The results from this study on the seven forest stands provide evidence that there is a negative statistical association between ferns and garlic mustard. (Table 4 p= 0.004 and V = -0.14.) This allowed for the rejection of the null hypothesis that there is no statistically significant association between garlic mustard and fern species.

The results from this study have clearly identified garlic mustard as a plausible factor affecting ferns (V = -0.14). There are clearly other factors impacting ferns on the escarpment. These factors may include: the trails, climatic conditions, fragmentation, human collection, and air pollution.

Both the raw and processed data indicate that ferns were not abundant at any of the sites, and that there was no statistical association between ferns and garlic mustard at the individual sites (Table 4). Of the 31 species recorded by Riley *et al* (1996) 14 were found in this study. This represents 45% of the known fern species within the study areas.

The data collection techniques used in this study differed from those of Riley *et al* (1996) who surveyed specific sites during their study that had been known since the 1970s or earlier, many of them as International Biological Program (IBP) sites or significant natural areas. Because of the different techniques used, it is not possible to make a direct comparison of the number of species identified in these studies.

Fern distribution at these sites should still be of concern. Comments made by Lewis (1991) suggest that ferns were so abundant once, that they were easily observed upon visiting the different sites on the escarpment. While this study did not include vegetative surveys, the findings are noteworthy as they support previous observations that the fern species are disappearing from the frontier they once occupied in profusion (Lewis 1991).

Conclusion

The study on the Escarpment revealed that there is a statistically significant negative association between fern species and garlic mustard. Garlic mustard was clearly identified as a plausible factor affecting ferns on the Niagara Escarpment. Studies should now be conducted to identify the other factors affecting ferns.

To effectively address the problem, management efforts must represent a collective approach by the various bodies that are responsible for the individual conservation sites to protect native ferns from the effects of garlic mustard and other relevant factors currently impacting their distribution and abundance.

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Provincial Parks and Conservation Reserves Act in Ontario

The main reason for including these papers is to show the overall content in the new Act and, specifically, to draw attention to the inclusion of research and monitoring as major functions in Ontario Parks and Conservation Reserves.

It's in Our Nature – An Introduction to the Provincial Parks and Conservation Reserves Act*

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Abstract

The Provincial Parks and Conservation Reserves Act was passed by Ontario's Legislative Assembly on June 19, 2006. The new act provides a legislative framework for provincial parks and conservation reserves managed under the 1954 Provincial Parks Act and the Public Lands Act. Highlights of the new act include:

- *Inclusion of high level policy direction in legislation;*
- *Aboriginal and treaty rights are recognized;*
- *Protected areas planning with consultation, and state of protected areas reporting, are mandatory;*
- *Industrial uses are prohibited with limited exceptions;*
- *Any significant reduction in the size of a protected area must be endorsed by the Legislative Assembly;*
- *Administrative and enforcement authorities are updated.*

The Provincial Parks and Conservation Reserves Act will provide a firm foundation for managing the Ontario protected area system consisting of more than 600 areas with almost 9.4 million hectares.

Background

Ontario's system of protected areas includes 329 provincial parks, 292 conservation reserves and 10 wilderness areas with a combined area of almost 9.4 million hectares. These areas are currently managed under three separate pieces of legislation.

The current Provincial Parks Act was passed in 1954 when there were only 8 provincial parks. Since that time much has changed. The number of provincial parks has grown tremendously. Equally important, there is better understanding of the importance of protection, conservation science, and the broader social benefits provided by protected areas. To address concerns associated with the growing park system, and the increasing complexity of park

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planning and management, Ontario was a leader in developing comprehensive system planning and management policies. Yet, while the 1954 act was amended from time to time, it was not subjected to a full review.

The Wilderness Areas Act was passed by Ontario's legislature in 1959. A total of 33 areas were regulated under this Act, but 23 of them were subsequently included within provincial parks. The Wilderness Areas Act allows resource extraction in any area that exceeds 270 hectares and provides limited protection, because no supporting regulations or policies are in place.

The first conservation reserves were regulated in 1994 when an enabling regulation (Regulation 805/94) was approved under the Public Lands Act. This regulation provides that mining, logging and aggregate and peat extraction are not permitted in conservation reserves, but otherwise the legislative and regulatory framework for their management is the same as for other Crown lands. The Ontario Living Legacy Land Use Strategy, approved in 1999, led to the regulation of 352 new protected areas including 259 new conservation reserves. Consequently, conservation reserves have become a much more important component of the protected areas network.

Given the expansion of the protected areas network, and the shift in public expectations about how protected areas should be managed, pressure began building for a review of the Provincial Parks Act. In April 2003 Dalton McGuinty, as leader of Ontario's Liberal Party, made a commitment to review Ontario's legislation for provincial parks, with the intention of enhancing protection of natural heritage. In October 2003 Mr. McGuinty became Premier when the Liberal Party won the majority of seats in the provincial election and formed Ontario's government. Consequently, in September 2004 the Ministry of Natural Resources launched a review of the legislative framework for provincial parks, conservation reserves and wilderness areas.

This review began in September 2004 with consultation about eight legislative proposals. The review included legislation for provincial parks, conservation reserves and wilderness areas. Input was gathered via an Internet-based consultation tool and by more conventional means. Meetings were held with stakeholders, First Nations, and Ministry of Natural Resources employees. The Ontario Parks Board of Directors, a public advisory committee, made recommendations for new legislation after meeting with key stakeholders.

Based on the eight legislative proposals, a review of external and internal input, and consideration of the advisory committee's recommendations, the Ministry of Natural Resources drafted proposed legislation. Bill 11: An Act to Enact the Provincial Parks and Conservation Reserves Act was introduced in Ontario's Legislative Assembly for First Reading on October 25, 2005. After Second Reading the bill was referred to the Standing Committee of the Legislative Assembly, which held a day-long hearing, undertook clause by

clause review and considered amendments. Bill 11, as amended, received Third Reading on June 19, 2005 and received Royal Assent the next day.

As of January 30, 2007 the Ministry of Natural Resources is preparing a set of regulations under the Provincial Parks and Conservation Reserves Act. Once the regulations are approved the new act will come into effect.

Highlights of the Provincial Parks and Conservation Reserves Act

A comparison of the new Provincial Parks and Conservation Reserves Act with the 1954 Provincial Parks Act shows many differences. The overall flavour of the changes can be found in the dedication statement of each act. The 1954 Provincial Parks Act dedication states:

> *All provincial parks are dedicated to the people of the Province of Ontario and others who may use them for their healthful enjoyment and education, and the provincial parks shall be maintained for the benefit of future generations in accordance with this Act and the regulations.*

The concept of natural heritage protection is not recognized in any way. The Provincial Parks and Conservation Reserves Act includes a dedication that is more explicit:

> *Ontario's provincial parks and conservation reserves are dedicated to the people of Ontario and visitors for their inspiration, education, health, recreational enjoyment and other benefits with the intention that these areas shall be managed to maintain their ecological integrity and to leave them unimpaired for future generations.*

The Section 1 purpose statement of the new act reads:

> *The purpose of this Act is to permanently protect a system of provincial parks and conservation reserves that includes ecosystems that are representative of all of Ontario's natural regions, protects provincially significant elements of Ontario's natural and cultural heritage, maintains biodiversity and provides opportunities for compatible, ecologically sustainable recreation.*

The purpose and dedication make explicit the Legislative Assembly's intentions in passing the new act and will guide interpretation of the act by the courts, in the event of litigation.

The Provincial Parks and Conservation Reserves Act applies to both provincial parks and conservation reserves. No longer will conservation reserves be managed under the Public Lands Act. Rather, under the new act these two types of protected areas are to be equal partners in a protected areas system. While it is not addressed in the act itself, the government has stated

its intentions to consider the 10 remaining wilderness areas through a public planning process, and make decisions to regulate them under the new act, where warranted, or let them revert to general use Crown land. Once this process is completed the Wilderness Areas Act could be rescinded. At that point there would be one legislative framework for Ontario's protected areas, rather than three, as is now the case.

Ontario's legislation now includes objectives for establishing and managing protected areas. For provincial parks these are:

- To permanently protect representative ecosystems, biodiversity and provincially significant elements of Ontario's natural and cultural heritage and to manage these areas to ensure that ecological integrity is maintained.
- To provide opportunities for ecologically sustainable outdoor recreation opportunities and encourage associated economic benefits.
- To provide opportunities for residents of Ontario and visitors to increase their knowledge and appreciation of Ontario's natural and cultural heritage.
- To facilitate scientific research and to provide points of reference to support monitoring of ecological change on the broader landscape.

For conservation reserves the objectives are:

- To permanently protect representative ecosystems, biodiversity and provincially significant elements of Ontario's natural and cultural heritage and to manage these areas to ensure that ecological integrity is maintained.
- To provide opportunities for ecologically sustainable land uses, including traditional outdoor heritage activities and associated economic benefits.
- To facilitate scientific research and to provide points of reference to support monitoring of ecological change on the broader landscape.

These objectives recognize that a wider range of ecologically sustainable land uses typically occur in conservation reserves, consistent with policies developed since the first conservation reserves were regulated in 1994. As well, there is explicit recognition that parks play an active role in natural heritage education, with many parks providing education programs. Both sets of objectives recognize for the first time the important role protected areas play in supporting scientific research.

Section 3 of the new act states that:

> *The following principles shall guide all aspects of the planning and management of Ontario's system of provincial parks and conservation reserves:*
>
> - *Maintenance of ecological integrity shall be the first priority and the restoration of ecological integrity shall be considered.*

- *Opportunities for consultation shall be provided.*

The act goes on to define ecological integrity. Section 3 makes it clear that maintenance of ecological integrity (EI) must be embedded in planning and management policies and practices. As well, the need to undertake appropriate consultation – hitherto a requirement of other legislation and protected areas policy but not the Provincial Parks Act itself – is now embedded in the act.

During consultation First Nations and some other stakeholders asserted strongly that aboriginal and treaty rights should be explicitly recognized in the new act. While the bill tabled for First Reading did not include such a provision, an amendment approved at third reading provides explicit recognition. Section 4 states that:

> *Nothing in this Act shall be construed so as to abrogate or derogate from the protection provided for the existing aboriginal and treaty rights of the aboriginal peoples of Canada as recognized and affirmed in section 35 of the* Constitution Act, 1982.

Since 1978 Ontario has had a policy framework for provincial parks that recognizes six park classes: wilderness, natural environment, nature reserve, historical, waterway and recreation. The Provincial Parks Act allowed parks to be designated to classes, but did not specify the classes or state objectives for each. The new act does both. Now that objectives for the six classes are established in legislation there is general guidance for development of lower level policies associated with each park class. The act also would allow the government to establish a new aquatic class park in the future. This would be done only after consultation about a science and policy framework for the new class.

Under previous legislation protected area boundaries were established by Cabinet by regulation. Cabin*et al*so had unlimited authority to deregulate protected areas and could approve the elimination (deregulation) of a protected area. The new act allows Cabinet to continue to regulate protected areas and make small deletions, sometimes described as housekeeping boundary amendments. However, any deletion from a protected area of more than 1% of its area, or 50 hectares, whichever is less, would have to be endorsed by the Legislative Assembly. This ensures that any major deletion from a protected area will be subject to public scrutiny and debate.

In the first half of the 20th century land in some provincial parks was made available for private use. This practice was so extensive in Long Point and Presqu'ile provincial parks that eventually some lands were removed from the parks. To ensure that land in protected areas remains a public trust, the new act does not allow creation of new leases, land use permits or licences of occupation for private use. In fairness to those who now have leases, licences of occupation or land use permits in protected areas, the act allows existing tenure to be extended, subject to the act and regulations. New commercial tenure can be permitted. The rationale for this is that in some cases commercial tourism facilities can

support outdoor recreation and associated economic benefits. Any decisions to allow commercial tourism would be made through a planning process with consultation. Privately owned lands are not regulated as part of protected areas, and the act would not apply to such lands. The longstanding policy is that private lands may be purchased on a willing seller – willing buyer basis for inclusion as part of a protected area, but will not be expropriated.

The Provincial Parks and Conservation Reserve Act requires that management direction be approved for each protected area within 5 years of each area's establishment, or if the area already exists, within 5 years of the act's coming into effect. Previously there was a policy requirement for producing plans, but not a legislated requirement. Management direction is defined in the act. While the act does not mandate a mandatory review period, it does require that each management direction be assessed every 10 years and a determination be made about whether a public review of the management direction is warranted. The Ministry of Natural Resources will then make the results of the assessments public. With more than 600 areas under management, it is critical that management planning efforts be focused where there is a real need for public review. There is a provision that a new protected areas planning manual will have to be developed within two years of the act coming to effect.

The new act mandates state of protected areas reporting and general direction is provided regarding what must be reported. Reporting must be undertaken on a 5-year cycle, with the option of addressing some components each year, rather than issuing a full report every 5 years and nothing in the interim.

Inclusion of industrial use prohibitions in the new act is a significant advance. Mineral exploration and mining, commercial timber harvest, aggregate and peat extraction, and electrical power development are prohibited with some specific exceptions. Important exceptions include:

- Timber can be harvested for resource management purposes, such as habitat management for a species at risk;
- Existing electric generation facilities can remain and may be upgraded or maintained;
- Waterpower sites can be developed for use by communities not connected to Ontario's electrical grid, subject to some stated conditions;
- Existing aggregate pits authorized under the Aggregate Resources Act can remain in use;
- Timber and mining access roads or trails can be permitted, also subject to stated conditions;
- Commercial timber harvest can continue in Algonquin Provincial Park only and new aggregate pits can be established to support forest management operations, subject to some conditions intended to limit use of aggregate on forest access roads.

Only a relatively small number of Ontario's 621 protected areas will be affected by exceptions.

Aside from industrial uses, the Provincial Parks and Conservation Reserves Act does not generally address other activities or "permitted uses". Rather, it allows Cabinet, or in some cases the Minister of Natural Resources, to make regulations to control activities where required. This provides flexibility to adapt to changing needs and expectations. For example, if, after consultation, policies are changed and decisions are made to allow or restrict a specific activity, it will be much easier to develop or amend a regulation than to amend the act itself.

With regard to hunting the new act maintains the status quo. Hunting is not permitted in parks unless there are specific regulations under the Fish and Wildlife Conservation Act to allow it. Conversely, hunting is permitted in conservation reserves unless there are regulations under the Fish and Wildlife Conservation Act to prohibit it.

A second area where the Provincial Parks and Conservation Reserves Act deals with permitted activities is with regard to mechanized travel in wilderness class parks. The Section 8 objective for wilderness class parks says that "… visitors travel by non-mechanized means…" The act allows the Minister to make exceptions to allow mechanized travel by regulation in certain limited circumstances, based on policies first approved in 1978. In essence, existing policies regarding mechanized travel in wilderness parks will have to be reflected in regulations.

The new act provides a number of new administrative and enforcement authorities. It also maintains the status quo with regard to current Ontario Parks financial authorities, so that provincial park fees and other park revenues will continue to be dedicated to supporting provincial park programs. There is provision to set up a fund to provide financial support for natural heritage protection and education for both provincial parks and conservation reserves. This could support future fund raising programs that would encourage donations and bequests.

Conclusion

The 1954 Provincial Parks Act provided a flexible framework for expanding Ontario's provincial park system and developing an extensive and respected policy framework. More than half a century later the Provincial Parks and Conservation Reserves Act recognizes the progress made in protected areas planning and management, and 21st century expectations and attitudes about our treasured natural areas. The new act solidifies in legislation the most fundamental protected areas policies and provides a solid foundation for future progress.

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Analysis of Second Reading of Bill 11: Provincial Parks and Conservation Reserves Act, 2005*

CPAWS Wildlands League and Sierra Legal Defence Fund

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Introduction

In November 2005, CPAWS Wildlands League hosted a forum for interested parties on the newly introduced *Provincial Parks and Conservation Reserves Act, 2005* (Bill 11).[1] Over 20 groups participated including representatives from academic institutions, environmental non-government organizations and lawyers. Although the general reaction to Bill 11 was positive, there were some very serious concerns expressed about its shortcomings by all present.

The remarks collected from this forum and others are summarized below. While these comments are drawn from the many submissions at this forum or in response to it, they should be seen as the sole property and representation of CPAWS Wildlands League and Sierra Legal Defence Fund.

General Comments

We applaud the government of Ontario's efforts to set out on a new path toward meaningful long-term ecological stewardship of parks and conservation reserves in Bill 11. With its strong commitment to put nature first in parks and conservation reserves management, the proposed *Parks and Conservation Reserves Act* takes Ontario from the back to the front of the pack in terms of protecting park wildlife and wilderness – natural assets that for far too long have had only paper-thin protection in this province.

However, there are clearly elements within Bill 11 that undermine the central purpose of ensuring ecological integrity in the management of Ontario's system of parks and conservation reserves. In addition, there are several instances where protection would be made stronger through some simple wording changes.

The comments below are organized in into two specific sections. First, we present a narrative on the six key issues that must be addressed to satisfy our concerns, along with specific suggestions to address those concerns. We then summarize and organize our suggestions (including minor wording

* A version of this paper was presented at PRFO 2006, including recommendations for changes in the Act, some of which are noted in the previous paper by Robert Moos.

[1] Bill 11 can be found at the following URL: http://www.ontla.on.ca/documents/Bills/38_Parliament/session2/b011_e.htm

changes suggested by various interested parties) to correspond with Section numbering as in the First Reading of Bill 11 for ease of reference. Throughout this submission, *current wording in Bill 11 is italicized* and our suggestions are underlined.

A. Ecological Integrity

To achieve the ecological integrity objective, Bill 11 must ensure that every aspect of protected areas planning and management is consistent with that goal. Addressing the considerable weaknesses outlined below with regards to ecological integrity will make Bill 11 consistent with the Ontario Biodiversity Strategy (OBS), which recognizes the concept of maintaining biodiversity on the greater landscape (defined through multiple mechanisms, particularly sections 22 – 26 of the OBS). Addressing the issue of the greater park ecosystem will also make Bill 11 consistent with the Provincial Policy Statement which requires municipalities to identify and protect significant wildlife habitat, including significant wetlands and forests, by ensuring that development (if allowed) does not damage the natural values and functions of such areas (*Provincial Policy Statement,* 2005: section 2.1). Finally, changes to address ecological integrity will make Bill 11 consistent with the MNR's stated strategic direction, particularly its emphasis on an ecosystem approach to resource management (*Our Sustainable Future: Strategic Directions,* 2005: 7).

Greater Park Ecosystem

The greatest threat to ecological integrity (EI) comes from deleterious activities outside protected area borders. Bill 11 is completely silent on how EI within parks and conservation reserves will be protected from adjacent activities, thus leaving ecological integrity vulnerable to its greatest threat. It is imperative that an ecosystem management perspective is taken to ensure the ecological integrity of Ontario's system of parks and conservation reserves.

Therefore Bill 11 must include strong language regarding ecosystem management on the basis of the greater park ecosystem (GPE), which clearly articulates the intent to plan and manage parks and conservation reserves from an ecosystem perspective. We suggest the following clause be added to the Planning and management principles (s.3) in order to ensure full protection of EI within parks and conservation reserves:

> s.3.3. An ecosystem management approach based on the greater provincial park ecosystem or the greater conservation reserve ecosystem shall be employed to maintain or restore ecological integrity within provincial parks and conservation reserves.

Fully Integrating EI Protection

To achieve EI, the concept must be better integrated throughout Bill 11 so that it can be operationalized. A few key changes to Bill 11 would help to ensure

that this objective is met.

1. Wording needs to be changed to establish the maintenance and restoration of EI as the *over-riding* priority of planning and management (s. 3.1). This provision must read:

> s.3.1. "*Maintenance* or restoration *of ecological integrity shall be the* over-riding *priority*."

2. Bill 11 must commit to developing indicators of ecosystem integrity that will be used for the purposes of protected areas planning and management. To this end, the following should be added to Definitions (s.4), Advisory committees (s.22) and Management direction (s.9). In addition, a section should be added to Bill 11 requiring that the Minister develops Indicators of Ecological Integrity within 2 years of Royal Assent:

> s. 4.(4) For the purpose of this Act and the regulations, ecological integrity shall be determined in accordance with the Indicators of Ecological Integrity.
>
> *s. 22. The Minister, with the approval of the Lieutenant Governor in Council, may appoint committees to perform such advisory functions as are considered necessary or desirable in connection with the administration of one or more of the provincial parks*, including the preparation of the Indicators of Ecological Integrity, *and fix the terms of reference and procedures of such committees.*
>
> s. 9.(3) *A management direction, ...*
> (d) shall include the Indicators of Ecological Integrity.

3. The EI objectives for provincial parks and conservations reserves must be strengthened to include the concept of ecological restoration. In many protected areas, EI cannot be achieved unless restoration is undertaken. The words "and restored" should be added to the end of the EI objectives in s.2. :

> *s.2.(1) The following are the objectives in establishing and managing provincial parks:*
> *s.2.(1)1. To permanently protect representative ecosystems, biodiversity and provincially significant elements of Ontario's natural and cultural heritage and to manage these areas to ensure that ecological integrity is maintained* and restored.
>
> *s.2.(2) The following are the objectives in establishing and managing conservation reserves:*
> *s.2.(2)1. To permanently protect representative ecosystems, biodiversity and provincially significant elements of Ontario's natural and cultural heritage and to manage these areas to ensure that ecological integrity is maintained* and restored.

4. The impairment of ecological integrity is often incremental and difficult to predict. Given such uncertainty, a precautionary approach to planning and

management is needed. The precautionary principle is an emerging international norm in environmental legislation (incorporated into many federal laws in Canada). Its importance is recognized in *Our Sustainable Future: Strategic Directions* (2005: 7). The precautionary principle should be incorporated by adding the following Definition (s.4.(1)) and Planning and management principles (s.3), respectively.

> s.4.(1) "**Precautionary approach**" means that where there are threats to ecological integrity, lack of scientific certainty will not be used as a reason for postponing measures to prevent damage to ecological integrity, and is the application in practice of the precautionary principle.
>
> s.3.4. A precautionary approach shall be employed.

5. Management planning is central to achieving the EI objective and must be mandatory for all parks and conservation reserves. While Bill 11 requires that the MNR prepare a management direction that applies to each park and conservation reserve (s.9.(1)), it must also require that a management direction include a management statement or a management plan for all protected areas. All site level management should be covered by a management plan or a management statement. To this end, change the wording from "may" to "shall" in s.9.(3)(c):

> s.9.(3)(c) "shall *include a management statement or a management plan.*"

The distinction between management statements (s.9.(4)) and management plans (s.9.(5)) is sufficient to provide flexibility in terms of the depth of planning that must occur, so that requiring the ministry to prepare one or the other for all protected areas is feasible and reasonable. However, these definitions set priorities for management attention based upon capital works rather than on EI needs. These definitions must be altered to ensure that the EI objective is operationalized at the management planning level.

> *s.9.(4) A management statement is a document approved by the Minister that provides a policy and resource management framework that*
> (a) identifies key natural and cultural heritage features and processes;
> (b) identifies current and expected internal and external impacts upon ecological integrity; and
> (c) *addresses a limited number of non-complex issues or proposals or both for limited capital infrastructure or resource management projects for one or more provincial parks or conservation reserves or for a combination of them.*
>
> *s.9.(5) A management plan is a document approved by the Minister that provides a policy and resource management framework* that

(a) identifies key natural and cultural heritage features and processes;
(b) identifies current and expected internal and external impacts upon ecological integrity; and
(c) *addresses substantial and complex issues or proposals or both for substantial capital infrastructure or resource management projects for one or more provincial parks or conservation reserves or for a combination of them.*

Similarly, Section 8 must make boundary changes subject to the test of ecological integrity. Section 8.(1) should be qualified to be "consistent with the purpose, dedication, objectives and principles of this Act."

Section 12.(1) should likewise be reworded to direct attention to the purpose and objectives of the Act:

s.12.(1) Land in provincial parks and conservation reserves shall be used and occupied in accordance with this Act and the regulations and in a manner that is consistent with the purpose, dedication, objectives and principles of this Act.

Public review of management directions is essential. To ensure that these are posted on the *Environmental Bill of Rights* (EBR) Registry, change "or" to "and" in s.9.(8), so that it reads:

… posted in the registry established under the Environmental Bill of Rights, 1993 and *made available …*

6. Ecological integrity shall ultimately be the test for approvals of any resource access roads and utility corridors. The general rule must be that resource access roads and utility corridors are prohibited. In a limited number of cases, and subject to the test in s.20, some resource access roads or utility corridors may be permitted. Thus, s.19 needs to be altered as follows:

Resource access roads **prohibited**
s.19.(0.1) Resource access roads and trails for non-provincial park and conservation reserve uses in provincial parks and conservation reserves are prohibited.
Exception
s.19.(1) Subject to the approval of the Minister, with or without conditions, resource access roads and trails for non-provincial park and conservation reserve uses in provincial parks and conservation reserves may be *permitted in the following circumstances:*
1. Roads and trails that are required for reasonable access to existing mining tenure or claims within a provincial park or conservation reserve or surrounded by a provincial park or conservation reserve.
2. Roads and trails that are required to access minerals or timber outside of a provincial park or conservation reserve.

Utility corridors **prohibited**
s.19.(1.1) Utility corridors, including but not limited to utility corridors for electrical transmission lines, in provincial parks and conservation reserves are prohibited.
Exception
s.19.(2) Subject to the approval of the Minister, with or without conditions, utility corridors, including but not limited to utility corridors for electrical transmission lines, may be *permitted in provincial parks and conservation reserves* if the utility corridor will service remote communities only.

B. Prohibitions: Logging, Mining, Hydroelectric Development

Industrial activity must be prohibited in protected areas. Logging, mining and hydroelectric development are inconsistent land uses with protected areas and compromise their ecological integrity. This must be clearly stated in the legislation.

Participants in our forum were pleased that industrial development was generally prohibited in parks and conservation reserves (s.15). However, serious concerns were expressed about the many exceptions to the prohibitions (s.16-18).

1. Bill 11 specifically allows logging in Ontario's flagship Algonquin Park to continue. It does not prohibit or even include a provision to phase out industrial logging in the park (s.16). It is unacceptable that logging and resource road building will be allowed to continue. Already, over 70% of the park is open to logging, with more than 8,000 km of industrial roads fragmenting thousands of hectares of the park. Industrial logging, no matter how well managed, has profound negative effects on ecosystems and species and does not belong in one of our highest profile parks. Eroding Algonquin's ecological integrity from within is unacceptable. We must treat it the same as all other parks and prohibit logging.

If this issue is not addressed in Bill 11, then the province must immediately move all land currently allocated that is not being logged into permanent protection and begin a review of the impacts of logging in Algonquin with a view to addressing these impacts and making Algonquin fully protected over time. The ecological integrity of Algonquin must receive the same protection as all other parks.

2. Bill 11 should clearly prohibit new 'Mining' land-use designations that would further threaten protected areas (e.g., Lake Superior Highlands C.R. proposal). The pattern of legitimizing illegal staking of withdrawn land through declaration orders must end.

3. Hydroelectric developments have negative impacts on the ecological integrity of protected areas. The exceptions provided to hydro, in Bill 11, must

minimize that impact by prohibiting development for export out of remote communities. Furthermore, re-development or alterations to any pre-existing hydroelectric facilities in protected areas must improve the ecological integrity of the protected area.

Section 18.(1) should also include the following:
re-development or alterations to any pre-existing hydroelectric facilities in protected areas must improve ecological integrity.

Section 18.(2) should read:
"…*generation of electricity may be developed in provincial parks and conservation reserves for use within remote communities that are not connected to the IESO – controlled grid* and not for export outside of the community."

C. First Nations

Bill 11 is silent on the Aboriginal and treaty rights of Aboriginal peoples and on their potential role in the creation, planning and management of parks and conservation reserves. It provides no creative opportunities for the possible development of an Aboriginal class of parks or for the co-management of protected areas with Aboriginal communities. These shortcomings are unacceptable and completely out of step with new protected areas legislation across Canada that reflects an increasing understanding and appreciation of Aboriginal rights and interests with regard to protected areas.

1. Bill 11 must provide clear direction to all involved in the creation, planning and management of protected areas. The Aboriginal and treaty rights of Aboriginal peoples must be honoured (as per the recognition and affirmation of those rights in section 35 of the *Constitution Act, 1982*). At a minimum, there should be a provision that states:

Nothing in this Act shall be construed so as to abrogate or derogate from the protection provided for existing Aboriginal or treaty rights of the Aboriginal peoples of Canada by the recognition and affirmation of those rights in section 35 of the *Constitution Act, 1982.*

2. Bill 11 must require that prior to establishing new protected areas or enlarging an existing protected area, the Minister identify and consult with all local Aboriginal communities whose lands or traditional territories are affected by such establishment or enlargement. Suggested wording:

The Minister shall, prior to establishing a new provincial park or conservation reserve or enlarging an existing provincial park or conservation reserve identify and adequately consult with all local Aboriginal communities whose lands or traditional territories may be affected by such establishment or enlargement.

3. Bill 11 must ensure that in the formulation of each management plan, the following are considered: opportunities for co-operative management or joint management with local Aboriginal communities, inclusion of indigenous and traditional ecological knowledge, sharing of economic benefits from the protected area, and involvement of an Aboriginal person from local Aboriginal communities with traditional ecological knowledge in the preparation of the plan. Suggested wording:

> The Minister shall ensure that in the creation of a new provincial park or conservation reserve and in the formulation of each management plan or direction,
> (a) opportunities for co-operative management with local Aboriginal communities are considered;
> (b) traditional ecological knowledge of Aboriginal peoples is considered; and
> (c) an Aboriginal person with traditional ecological knowledge is considered for involvement among the individuals establishing the new provincial park or conservation reserve or preparing the management plan or direction.

4. The classes of protection should include places nominated by Aboriginal peoples. These should cover cultural significance, such as important fish and wildlife areas, areas important to maintaining traditional ways of life, and sites of ancient villages or rock paintings. We believe such a class of protected areas is important to respect Ontario and Canada's Aboriginal heritage. Such areas should be considered for full Aboriginal management. To this end, we propose the following change to s.7:

> *(4) The objective of cultural heritage class parks is to protect elements of Ontario's distinctive cultural heritage,* including sites nominated by Aboriginal peoples, *in open space settings for their intrinsic value and to support interpretation, education and research.*

D. Wilderness Class Parks

Bill 11 weakens the protection afforded Wilderness Class Parks by altering the wording that has been used to describe this park class since the 1970's (s.7.(2)). The long-standing description of Wilderness class parks states that "Wilderness parks are substantial areas where the forces of nature are permitted to function freely and where visitors travel by non-mechanized means ..." Bill 11 replaces this with: "*The objective of wilderness class parks is to protect large areas where the forces of nature can exist freely and visitors travel* ***primarily by non-motorized means*** ..." [emphasis added]. This re-definition substantially alters the understanding of what Wilderness Parks are, with the potential to negatively affect the ecosystems that they protect and the recreational experiences that they offer, in serious ways. Bill 11 must revert to the long-standing definition

and clearly state:

"… *where visitors travel* by non-mechanized means…"

E. Park Boundary Permanence

Bill 11 proposes to "permanently protect a system of provincial parks and conservation reserves" (s.1). "Permanent protection" is echoed in the objectives for both provincial parks (s.2(1)1) and conservation reserves (s.2(2)1). In order to ensure permanent protection, it is imperative that legislative amendment is required to alter boundaries of existing provincial parks and conservation reserves. The proposed land disposition provisions (ss.8(3) and 8(4)) contradict the purpose of Bill 11 and are completely unacceptable. The *Canada National Parks Act*, section 5, permits the establishment or enlargement of parks through regulation but does not permit existing park boundaries to be altered in order to remove lands from a park. Similar requirements are provided in the *Canada National Marine Conservation Areas Act*, Saskatchewan's *Parks Act* (s.4), and British Columbia's *Park Act* (s.5(6)). In Quebec, the *Parks Act* expressly prohibits the sale or exchange of park lands (s.5) and requires public hearings before changes to boundaries are made (s.4). Bill 11 should require that permanent protection for Ontario's provincial parks and conservations reserves is consistent with these other jurisdictions. All reductions in protected areas must require the approval of the Legislative Assembly except in the case of claims respecting aboriginal rights or land being added to a National Park.

> Sections 8(3) and 8(4) be removed and section 8(5) be renumbered.
>
> Section 8(1) be amended to read [deleting "decrease or" from the third line]:
> *The Lieutenant Governor in Council may by order set apart as a provincial park or a conservation reserve any area in Ontario, may increase the area of any provincial park or conservation reserve and may prescribe the boundaries of any provincial park or conservation reserve* consistent with the purpose, dedication, objectives and principles of this Act.

F. Municipal Jurisdiction

Municipalities have jurisdiction over certain types of crown land such as unopened road and shoreline allowances. Bill 11 appears to adequately transfer all land within protected areas to provincial jurisdiction once the park or conservation reserve is regulated (s.30). However, there is no consistency of process regarding decisions by municipalities over provincial Crown Land under *interim protection* or when a *Federal/Provincial agreement* comes into existence to create a new federal protected area. This situation gives municipalities the right to issue road permits in interim protected areas without any requirement to notify the province or the public. This situation has occurred recently in an interim protected provincial park (Kawartha Highlands) and on

provincial Crown land managed as a national park by Parks Canada (Bruce Peninsula). Suggested wording:

> Prior to making any land-use decisions regarding provincial Crown land that receives interim protection or is part of a federal provincial agreement and is under the jurisdiction of a municipality, the municipality shall engage in a public process, consistent with the *Environmental Bill of Rights, 1993*.

Specific Suggestions

For ease of reference, all the specific suggestions are included here, organized to correspond with section numbering in Bill 11. *Current wording in Bill 11 is italicized* and our suggestions are underlined.

Section 1, Purpose:

s.1. The purpose of this Act is to permanently protect a system of provincial parks and conservation reserves that includes ecosystems that are representative of all of Ontario's natural regions, protects provincially significant and other *elements of Ontario's natural and cultural heritage, maintains biodiversity and provides opportunities for compatible, ecologically sustainable recreation* and research.

Section 2, Objectives:

s.2.(1) The following are the objectives in establishing and managing provincial parks:

1. To permanently protect representative ecosystems, biodiversity and provincially significant elements of Ontario's natural and cultural heritage and to manage these areas to ensure that ecological integrity is maintained and restored.

2. To provide opportunities for ecologically sustainable land uses, including compatable *outdoor recreation and associated economic benefits.*

s.2.(2) The following are the objectives in establishing and managing conservation reserves:

1. To permanently protect representative ecosystems, biodiversity and provincially significant elements of Ontario's natural and cultural heritage and to manage these areas to ensure that ecological integrity is maintained and restored.

New section, Aboriginal rights:

(1) Nothing in this Act shall be construed so as to abrogate or derogate from the protection provided for existing Aboriginal or treaty rights of the Aboriginal peoples of Canada by the recognition and affirmation of those rights in section 35 of the Constitution Act, 1982.

(2) The Minister shall, prior to establishing a new provincial park or conservation reserve or enlarging an existing provincial park or conservation reserve, identify and adequately consult with all local Aboriginal communities whose lands or traditional territories may be affected by such establishment or enlargement.

(3) The Minister shall ensure that in the creation of a new provincial park or conservation reserve and in the formulation of each management plan or direction,

(a) opportunities for co-operative management with local Aboriginal communities are considered;

(b) traditional ecological knowledge of Aboriginal peoples is considered; and

(c) an Aboriginal person with traditional ecological knowledge is considered for involvement among the individuals establishing the new provincial park or conservation reserve or preparing the management plan or direction.

Section 3, Planning Principles:

s.3. The following principles shall guide all aspects of the planning and management of Ontario's system of provincial parks and conservation reserves:

1. Maintenance or restoration *of ecological integrity shall be the* over-riding *priority.*

2. Opportunities for consultation shall be provided.

3. An ecosystem management approach based on the greater provincial park ecosystem or the greater conservation reserve ecosystem shall be employed to maintain or restore ecological integrity within provincial parks and conservation reserves.

4. A precautionary approach shall be employed.

Section 4, Definitions:

Add the following to subsection 4.(1):

"**Precautionary approach**" means that where there are threats to ecological integrity, lack of scientific certainty will not be used as a reason for postponing measures to prevent damage to ecological integrity, and is the application in practice of the precautionary principle.

s.4.(3) For the purpose of subsection (2), ecological integrity includes, but is not limited to,

(b) levels of air and water and land quality *consistent with protection of biodiversity and recreational enjoyment.*

s.4.(4) For the purpose of this Act and the regulations, ecological integrity shall be determined in accordance with the Indicators of Ecological Integrity.

Section 5, Dedication:

s.5. Ontario's provincial parks and conservation reserves are dedicated to the people of Ontario and visitors for their inspiration, education, health, recreational enjoyment and benefit, and shall be planned and *managed to maintain* and restore *their ecological integrity and to leave them unimpaired for future generations.*

Section 7, Classification:

s.7.(1) The Lieutenant Governor in Council shall *classify provincial parks in one of the following classes:…*

s.7.(2) The objective of wilderness class parks is to protect large areas where the forces of nature can exist freely and visitors travel by non- mechanized *means while engaging in low-impact recreation to experience solitude, challenge and integration with nature.*

s.7.(4) The objective of cultural heritage class parks is to protect elements of Ontario's distinctive cultural heritage, including sites nominated by Aboriginal peoples, *in open space settings for their intrinsic value and to support interpretation, education and research.*

Section 8, Boundaries:

Sections 8(3) and 8(4) be removed and section 8(5) be renumbered.

Section 8(1) be amended to read [deleting "decrease or" from the second line]: *The Lieutenant Governor in Council may by order set apart as a provincial park or a conservation reserve any area in Ontario, may increase the area of any provincial park or conservation reserve and may prescribe the boundaries of any provincial park or conservation reserve* consistent with the purpose, dedication, objectives and principles of this Act.

Section 9, Provincial park and conservation reserve planning:

s.9.(3) A management direction,

…

(c) shall *include a management statement or a management plan.*

(d) shall include the Indicators of Ecological Integrity.

s.9.(4) A management statement is a document approved by the Minister that provides a policy and resource management framework that:

(a) identifies key natural and cultural heritage features and processes;

(b) identifies current and expected internal and external impacts upon ecological integrity; and

(c) *addresses a limited number of non-complex issues or proposals or both for limited capital infrastructure or resource management projects for one or more provincial parks or conservation reserves*

or for a combination of them.

s.9.(5) A management plan is a document approved by the Minister that provides a policy and resource management framework that:

(a) identifies key natural and cultural heritage features and processes;

(b) identifies current and expected internal and external impacts upon ecological integrity; and

(c) *addresses substantial and complex issues or proposals or both for substantial capital infrastructure or resource management projects for one or more provincial parks or conservation reserves or for a combination of them.*

s.9.(8) The results of the examination of management directions under subsection (7) shall be posted in the registry established under the Environmental Bill of Rights,1993 and *made available for public information by other appropriate means.*

Section 10, Reporting:

s.10.(2) The report shall provide a broad assessment of the extent to which the objectives of provincial parks and conservation reserves are being achieved, including ecological and socio-economic conditions and benefits, the degree of ecological representation, number and area of provincial parks and conservation reserves, threats to and measures taken for *ecological integrity and ecological health and socio-economic benefits.*

s.10.(4) The reports shall be posted in the registry established under the Environmental Bill of Rights, 1993 and *made available for public information by other appropriate means.*

Section 11, Administration:

s.11.(1) The Minister is responsible for achieving the purpose and objectives of this Act and for *the control and management of provincial parks and conservation reserves and shall designate a superintendent to have charge of each provincial park and a district manager or conservation reserve manager to have charge of each conservation reserve.*

s.11.(2) As part of the approval of a management direction, the Minister shall *define areas on maps or plans of provincial parks or conservation reserves as zones and* [the word *may* has been deleted] *prescribe or approve policies that apply to the zones.*

Section 12, Use and occupation of land:

s.12.(1) Land in provincial parks and conservation reserves shall be used and occupied in accordance with this Act and the regulations and in a manner that is consistent with the purpose, dedication, objectives and principles of this Act.

Section 14, Hunting:

s.14.(3) Notwithstanding subsections (1) and (2), hunting, trapping, snaring or removal of species at risk is prohibited in provincial parks and conservation reserves.

Section 15, Prohibited uses:

s.15.(1) The following activities shall not be carried out on lands or waters *that are part of a provincial park or conservation reserve:*

s.15.(1)5. Other industrial uses including, but not limited to, water taking and the use of mixing zones to meet water quality objectives, guidelines or standards.

Section 18, Exception, existing hydro-electricity generation sites:

Section 18.(1) should also include the following: "re-development or alterations to any pre-existing hydroelectric facilities in protected areas must improve ecological integrity."

s.18.(2) Despite section 15 and subject to the approval of the Lieutenant Governor in Council, facilities for the generation of electricity may be developed in provincial parks and conservation reserves for use within communities that are not connected to the IESO-controlled grid and not for export outside of the community.

Section 19, Resource access roads and utility corridors:

***Resource access roads* prohibited**

s.19.(0.1) Resource access roads and trails for non-provincial park and conservation reserve uses in provincial parks and conservation reserves are prohibited.

Exception

s.19.(1) Subject to the approval of the Minister, with or without conditions, resource access roads and trails for non-provincial park and conservation reserve uses in provincial parks and conservation reserves may be *permitted in the following circumstances:*

> *1. Roads and trails that are required for reasonable access to existing mining tenure or claims within a provincial park or conservation reserve or surrounded by a provincial park or conservation reserve.*
> *2. Roads and trails that are required to access minerals or timber outside of a provincial park or conservation reserve.*

***Utility corridors* prohibited**

s.19.(1.1) Utility corridors, including but not limited to utility corridors for electrical transmission lines, in provincial parks and conservation reserves are prohibited.

Exception

s.19.(2) Subject the approval of the Minister, with or without conditions, utility corridors, including but not limited to utility corridors for electrical transmission lines, may be *permitted in provincial parks and conservation reserves* if the utility corridor will service remote communities only.

Section 22, Advisory committees:

s.22. The Minister, with the approval of the Lieutenant Governor in Council, may appoint committees to perform such advisory functions as are considered necessary or desirable in connection with the administration of one or more of the provincial parks, including the preparation of the Indicators of Ecological Integrity, *and fix the terms of reference and procedures of such committees.*

New section, Municipal land-use decisions when subject to interim protection

Prior to making any land-use decisions regarding provincial Crown land that receives interim protection or is part of a federal provincial agreement and is under the jurisdiction of a municipality, the municipality shall engage in a public process, consistent with the *Environmental Bill of Rights, 1993*.

Section 33, Facilities and services in provincial parks:

s.33.(1) The superintendent in charge of a provincial park and the district manager or conservation reserve manager in charge of a conservation reserve may develop and operate facilities and provide services consistent *with the purpose and objectives of this Act and subject to the management direction for the provincial park or conservation reserve.*

s.33.(2) The superintendent in charge of a provincial park and the district manager or conservation reserve manager in charge of a conservation reserve may enter into agreements for the development and operation of facilities and the provision of services in respect of the provincial park or conservation reserve only if proposed developments, operations or services are consistent with the purpose and objectives of this Act and subject to the management direction for the provincial park or conservation reserve.

Section 52, Regulations:

s.52.(1) The Lieutenant Governor in Council may make regulations,

…

(e) protecting provincial resources in provincial parks and conservation reserves, including, but not limited to, flora, fauna, habitats, geological features, hydrologic features, scenic features, *cultural features and archaeological features;*

Remove the exemption power of clause 52(2)(e).

Section 61, *Mining Act*:

s.61. Section 31 of the Mining Act is repealed and the following substituted:

Provincial parks and conservation reserves

On and after the day subsection 15 (1) of the Provincial Parks and Conservation Reserves Act, 2005 is proclaimed in force, prospecting or the staking out of mining claims or the development of mineral interests or the working of mines in provincial parks and conservation reserves *is prohibited.*

New section, Development of indicators of ecological integrity:

The Minister shall develop Indicators of Ecological Integrity within 2 years of Royal Assent.

Acknowledgements

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An Update: The Provincial Parks and Conservation Reserves Act*

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The Provincial Parks and Conservation Reserves Act received Second Reading on May 8, 2006. It was referred to the Standing Committee on the Legislative Assembly for clause by clause review. The Standing Committee held a hearing with respect to the act. Based on presentations and advice received, the Standing Committee subsequently approved a number of amendments.

On June 19, 2006 the Provincial Parks and Conservation Reserves Act, and amendments recommended by the Standing Committee, passed Third Reading in the Legislative Assembly. Royal Assent was provided by the Lieutenant Governor on June 20, 2006. Royal Proclamation, which will bring the new act into effect, is pending. Key amendments approved by the Legislative Assembly upon Third Reading include the following:

- Section 4 was added to recognize existing aboriginal and treaty rights;
- Subsection 8(2), the objective for wilderness class provincial parks, was amended to provide that "visitors travel by non-mechanized means" except as may be provided by the regulations. An associated amendment allows the Minister to make regulations allowing mechanized travel in certain circumstances, which are listed in Subsection 54(3);
- Section 9 was amended to provide that any withdrawal of land from a provincial park or conservation reserve exceeding 1% of its total area, or 100 hectares, whichever is less, would have to be endorsed by the Legislative Assembly;
- Section 50 was amended to provide that fines would be higher for a second or subsequent contravention of the act, as a means to encourage compliance with the act.

Additional amendments fine tuned some provisions of the act, clarified intentions and corrected errors.

It is expected that proposed regulations under the new act will be released for public consultation in the spring of 2007. Once consultation is concluded, and regulations receive approval, it will be possible for the government to proclaim the Provincial Parks and Conservation Reserves Act.

The Act can be found at:
http://www.e-laws.gov.on.ca/LaDBws/Statutes/English/06p12_e.htm

* As an update on the new Act, this report was prepared by Robert Moos on March 22, 2007.