STATE OF THE GREAT LAKES ISLANDS

PROCEEDINGS FROM THE 1996 U.S.-CANADA GREAT LAKES ISLANDS WORKSHOP

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EXECUTIVE SUMMARY OF THE STATE OF THE GREAT LAKES ISLANDS

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Thirty thousand islands dot the Great Lakes, often forming chains of islands known as archipelagos. The vast majority of these islands lie in the Canadian waters of Lake Huron's Georgian Bay. The islands range in size from no bigger than a large boulder to the world's largest freshwater island, Manitoulin, which is 80 miles long. While the Great Lakes are well known as globally significant bodies of water, few know that their islands form the world's largest freshwater island system. Not only are the islands not well known, but also the state of our knowledge about them is quite poor.

We do know a great deal about the general characteristics of islands. By their very nature, islands are vulnerable and sensitive to change. Islands are like living organisms, whose "body" changes shape as water levels rise and fall and as the forces of erosion and accretion take their toll. Islands often suffer violent weather events due to their 360-degree exposure to winds that sweep across the open water. Isolated for tens of thousands of years from the mainland, islands rarely gain new species and their resident species often evolve into endemics (species found nowhere else). This means that islands are vulnerable to, among other things, the introduction of exotic species (those not already living on the island).

Concurrent with their vulnerability, islands strongly attract humans to their shores. Islands capture our imagination as romantic places of mystery and seclusion. The complication comes when developers create places for people to stay on these islands. As we have watched happen in the Caribbean Islands over the past 50 years, the process of island development is one in which ownership of the island changes hands from local to foreign control (McEachern and Towle 1974). The first waves of people to visit islands are small in number and are attracted to the natural surroundings and quiet. Over time, more and more people come as runways and docks are built, hotels constructed, and natural areas paved over and filled in. This in turn brings a new type of person who wants a different experience: less wild, more cultural. Foreign banks and hotel corporations buy more and more land from islanders, and decisions about the island's future are made more and more frequently in corporate boardrooms in distant lands.

In the Great Lakes basin, these forces of development and globalization are on the horizon for our islands. Over the past several years, two five-acre islands have been sold through national auction houses for millions of dollars. Manitoulin Island is in the midst of considering many development proposals. Calls for ecotourism have increased with visitation up at Isle Royale National Park and the Manitou islands of Sleeping Bear National Lakeshore. A new ferry has been put in place to carry more people more quickly to Beaver Island. What is troubling is that this is happening before we have a good understanding of the natural values of these islands and how they contribute to our well being. Just what do we have, and what are we giving up? Can we enjoy the islands without loving them to death or turning them into theme parks?

THE U.S.-CANADA GREAT LAKES ISLANDS PROJECT

In 1995 we sought to improve our state of knowledge by establishing the U.S.-Canada Great Lakes Islands Project at Michigan State University. We spent a year talking to people and gathering information about the islands. We wanted to create a project to serve as 1) a catalyst to start a basin-wide "conversation" about the islands and conservation of biological diversity and 2) a central base or focal point for activities, data, and information about the islands. We designed the project to build on the following groundbreaking work:

- Dr. Judith Soule's comprehensive island inventory of Michigan's 600 Great Lakes islands (Soule 1993). Dr. Soule's report was funded by the Michigan Coastal Management Program and published in 1993. In her extensive bibliography of scientific studies of various Great Lakes islands, we found that only a few consider more than one island.
- Susan Crispin's work on Great Lakes biodiversity (Conservancy 1994). This is a project of the Nature Conservancy's Great Lakes Program with support from the U.S. Environmental Protection Agency's Great Lakes National Program Office.
- Dr. George Francis's leadership and publications on Great Lakes conservation programs based at the University of Waterloo's Environmental and Resource Studies Department.

As we talked to Soule, Crispin, and Francis, and to other highly experienced island researchers such as Robert Brander, Dr. Hans Blokpoel, and Dr. William Scharf, we began to piece together a picture of these islands as extremely interesting and quite possibly very significant.

THE MICHIGAN WORKSHOP

We received funds from the Michigan Coastal Management Program (MCMP) and the National Oceanic and Atmospheric Administration (NOAA) to support our efforts and to host the first United States-Canada workshop to assess the status of the Great Lakes islands. The purpose of the workshop was to draw together a small targeted group of people who manage, study, live on, or otherwise care about Great Lakes islands. Some of the 35 people we found work for state, and federal agencies or other organizations that own and/or manage islands—NOAA, MCMP and other Great Lakes state coastal programs, Parks Canada, Canadian Wildlife Service, U. S. National Park Service, the U.S. Forest Service, U.S. Fish and Wildlife Service, U.S. EPA's Great Lakes National Program Office, and The Nature Conservancy. Others work as private consultants, university researchers, or government officials who study islands—botanists, ornithologists, wildlife biologists, ecologists, island biogeographers, historians, and conservation biologists. Still others are interested in learning more about and protecting islands—people with the Georgian Bay Association, Michigan Natural Areas Council, Michigan Sea Grant College Program, and U.S. Senator Carl Levin's office. By design, this hand-selected group was multi-disciplinary, multi-jurisdictional, and binational. Further, each person not only brought to the group years of island experience, but an incredible personal commitment to the islands. This lent a particular dynamism to the workshop that we had not anticipated.

We carefully constructed the workshop to cover a great deal of territory in three days. We started the workshop with a leadoff commentary by Susan Crispin. We asked Crispin to go through the regional Great Lakes biodiversity data to look specifically at the contribution of islands. By the end of her talk, we all began to understand that these islands are not only significant in terms of biodiversity, but they are indeed *globally*

significant. After more and more talks, and discussions between talks, we began to realize that, as Judy Soule put it, all the superlatives we used to describe the islands during the three days—unique, special, exceptional, fantastic—were indeed appropriate.

THE PROCEEDINGS

These proceedings are *the first collection of papers about the islands of the Great Lakes*. Although there are still gaps—such as the role of islands in the Great Lakes fishery—the workshop papers create a basic framework of what we know about the islands, their significance, state of protection, and threats. These proceedings encompass the prepared papers and talks, as well as summaries of the discussions, findings, recommendations, and commitments of the participants. The individual papers are the work of their authors, while the joint sections were forged from dialogue and consensus among the participants. A smaller team wrote the findings and recommendations directly after the workshop based on those discussions.

While the work supported by this grant cumulates with the proceedings, the project continues. Copies of the proceedings will be presented to policy-makers in the U.S. and Canada. We will widely distribute the executive summary including on the Internet. We will continue to staff the office, maintain the home page, and serve the newly forming island network. Specific project activities will center on carrying out the recommendations presented here such as securing commitments and funding to begin work on a basin-wide island conservation strategy and compile an "inventory of inventories".

We hope that you, the reader, enjoy the executive summary and make an effort to share the information widely. We suggest you let people in leadership positions know that the islands of the Great Lakes deserve special care and attention. We hope you pay close attention and comment on proposals involving islands in your state or province. We also hope you support or even initiate efforts to fund more island research and conservation as well as to permanently protect the biological integrity of more islands. We invite you to contact us with your questions, concerns, and your own recommendations, and let us know how you would like to get involved. The future of these islands rests in all of our hands.

OVERVIEW OF THE PAPERS

Part I — State of Our Knowledge

The three leadoff commentaries outline the state of our knowledge about Great Lakes islands. Susan Crispin, while director of science for The Nature Conservancy's Great Lakes Program in Chicago, Illinois, reviewed Great Lakes natural heritage data on biological diversity[1], or biodiversity, looking particularly at the islands. Her path-breaking

[1] Biological diversity is a complicated concept. As human populations have grown and expanded, we have increased the density of people and the amount of area we inhabit such that other species have been eliminated or greatly reduced in numbers. This is said to have reduced the *diversity*--or breadth in terms of numbers--*of biological species* on Earth. At the same time, evidence is growing that a rich diversity of species provides a tremendous and irreplaceable "biological service" of what might be thought of as planetary ecological stability that benefits human as well as other species. The term biological diversity, or biodiversity for short, has several meanings. First, biodiversity refers to the total number of species (i.e., plant species plus animals plus birds, etc.). It also refers to the total number within species (e.g., total number of ruby-throated hummingbirds) as well as the genetic diversity across sub-populations of species (e.g., ruby-throated hummingbirds nesting in the Great Lakes basin). A final level is diversity at the level of individual genetic codes (i.e., the variation of this particular ruby-throated hummingbird compared to another). Many argue that one of the most important tasks humans face

paper *The Global Significance of Great Lakes Islands* reveals the factors that make the Great Lakes islands globally unique and significant. Crispin points to the lakes themselves as an incredibly large freshwater system with tremendous climatic effects on the region that create a distinctive island biota with many endemic species and rich biodiversity. She gives a lake-by-lake review of many of the special features of the islands. She warns that the small size of the islands makes them vulnerable to losing species from human disturbance and their remote locations make it difficult to gain new species. Crispin suggests we think of islands as "an important component in a much larger Great Lakes conservation portfolio." She proposes we look for commonalities among the biological resources as well as ownership and management patterns as we work to build collective conservation strategies. She urges us to be pragmatic and to bring new money to existing structures and institutions to advance the conservation of Great Lakes islands.

Dr. Judith D. Soule, now director of the Michigan Natural Features Inventory, details the status of Michigan's 600 Great Lakes islands in *Biodiversity of Michigan's Great Lakes Islands: Knowledge, Threats, Protection*. Soule suggests that Michigan has a lead role to play in island conservation policy-making because Michigan Great Lakes islands are exceptionally varied in terms of "geology, geography, history, and biodiversity". She argues that the islands be considered "a single irreplaceable resource and protected as a whole if the high value of this natural heritage is to be maintained." She describes the bird, fish, plants, and shoreline ecosystems of many islands highlighting the marshes, colonial waterbirds, Nearctic-Neotropical migrant songbirds, endemic plants, and towering dunes.

Soule points out that while the islands have only one-hundredth of the land area of the state, they hold one-tenth of the threatened, endangered, or rare species—seven times more than would be expected. She attributes this to their isolation which has protected them from disturbance; a moderated climate; their locations at the edges of state boundaries; and being the sole location for colonial waterbirds. Soule outlines the research values of islands, status of our knowledge of biodiversity, and identifies high-priority islands for inventories. She lays out the protected status by county and details inventory and protection needs. She urges bold protective action for islands whose biological integrity "should be *at the top of the list of priorities* in decisions about future use, ownership, and potential development of the islands". Because the islands are a globally unique heritage, policies should protect the islands as a system and look to *anticipate and prevent the loss of biodiversity* and to *retain ecosystem integrity*.

Dr. George Francis, recently retired from the University of Waterloo, reminds us in *Conservation Programs* that even though we have set aside important coastal areas, we have never agreed upon a basin-wide conservation goal nor do we have a forum for discussion. He suggests that we don't even know how much of a "conservation job" we have already accomplished because we face updating, reinterpreting, and making new judgments with existing data. Francis describes many outstanding collaborations in the Great Lakes basin that are addressing the conservation of biodiversity at large and even landscape levels. He suggests we can help new local efforts by reviewing the literature and cataloging successful endeavors. Francis lists existing binational agreements such as the Ecosystem Charter for the Great Lakes-St. Lawrence that could be supportive of island conservation strategies.

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is to retain as much biodiversity at all these levels as possible (Wilson and Peters 1988; Reaka-Kudla, Wilson, and Wilson 1997).

Part II — Background Papers and Talks

The next set of papers provides background on some of the key components of island ecosystems. Drs. Hans Blokpoel and William Scarf summarize recent bird research on hundreds of islands in their paper *The Importance of Great Lakes Islands as Nesting Habitat for Colonial Waterbirds*. Blokpoel and Scarf found that natural islands of the Great Lakes were home to nine species of colonial waterbirds in 572,800 nests during 1989-91. The nine species in order of prevalence are Ring-billed Gull, Herring Gull, Double-crested Cormorant, Common Tern, Caspian Tern, Great Blue Heron, Black-crowned Night Heron, Great Egret, and Great Black-backed Gull. These birds nest near one another hence they are called "colonial". They prefer islands, especially the ground nesters, because islands tend to free of ground predators when compared with the mainland.

Blokpoel and Scarf analyzed the data for relative importance of natural Great Lakes islands as nesting sites for these nine species. They found islands to be of high importance (i.e., 76-100 percent of nesting pairs chose islands over mainland) to five species (Double-crested Cormorant, Great Egret, Great Black-Backed Gull, and Caspian Tern, and Black-crowned Night Heron in the U.S. only); of medium importance (26-75 percent) to five species (Black-crowned in Canada only, Great Blue Heron in U.S. only, Ring-billed Gull, Herring Gull, and Common Tern); and of low importance (1-25 percent) to only the Great Blue Heron in Canada. They conclude that in *absolute* terms Great Lakes islands are a "unique and importance natural resource" supporting over a million nesting adult colonial waterbirds. They also conclude that in *relative* terms the islands are important as the preferred habitat for five of the nine species. Conservation strategies are complicated by the fact of the exploding populations of cormorants. They recommend targeting conservation efforts at the Common and Caspian terns. They suggest that an overall, basin-wide, multi-agency conservation strategy needs to be developed to protect these important Great Lakes waterbirds and their island habitat.

Dr. William Scharf reviewed the literature and his own extensive banding experience in an attempt to understand *The Importance of Great Lakes Islands to Nearctic-Neotropical Migrants*. Dr. Scharf believes that Great Lakes islands are of particular importance to migratory Nearctic-Neotropical species for three possible reasons. First, birds flying at night over the open water are exhausted and when dawn comes the remote islands may be the only land in sight. Second, islands are often the northward extensions of mainland that follows the flying patterns of the birds and weather systems so they are natural gathering areas. Finally, many islands are the intended summer nesting destination of some species. Scarf himself has banded a hundred species of long-distance migrants on Beaver Island (Lake Michigan) over a three-decade period.

The future of these birds is of growing concern because their winter homes in Central and South America as well as their summer Great Lakes nesting areas are increasingly being lost to fragmentation of habitat caused by development. The conservation of Great Lakes islands is critical to the overall protection of these species which on Great Lakes islands include the American Redstart, Yellow Rumped (Myrtle), Magnolia, Nashville, and Wilson's warblers; Red-eyed and Philadelphia vireos; Bank swallow; and Indigo Bunting. Indeed Scharf finds that "islands may…represent some of the best remaining contiguous forested habitats for many species".

Dr. Francesca Cuthbert of the University of Minnesota presents *Wildlife Issues on Great Lakes Islands*. Cuthbert points that island studies have made important contributions to the ecological and evolutionary theories of Charles Darwin, Alfred Russell Wallace, Robert MacArthur, and E. O. Wilson. Indeed, island biogeography theory (discussed later by Thomas Nudds) is used to help plan conservation efforts for "islandized" mainland

habitats. Cuthbert counted over 400 wildlife studies involving Great Lakes islands in Soule's 1993 report. Most of the studies are inventories and involve Isle Royale (Lake Superior) and the islands of northern Lake Michigan. The main topics were contaminants, critical breeding habitat, habitat management, general ecology, endangered species recovery, general biology, migration, and distribution.

Cuthbert reminds us that while islands have historically been important to birds and other wildlife, this is now intensified as mainland habitats have been fragmented and lost to human development: "Great Lakes islands continue to provide relatively undisturbed, and in some cases pristine, habitat conditions similar to those that existed prior to European settlement." Cuthbert outlines the wildlife research value of Great Lakes islands as "living laboratories" of the impacts of herbivores, predator-prey relationships, evolution and extinction, population dynamics, animal cycles, dispersal, and rapid population growth. They are also valuable for studying human-induced changes and conservation such as comparative mainland studies of human impacts, environmental contaminants, global change, recreation impacts, and endangered species. The islands will continue to be "especially valuable sites for studying *environmental change* issues that are of significant concern to the global community."

While much of Dr. Thomas Nudds of the University of Guelf's discussion of *island biogeographical theory*[2] is incorporated into recommendation three, there are a few additional points to highlight. Nudds stresses that when we craft arguments for conservation, we need to distinguish between the scientific and the moral, ethical, and aesthetic. In order to be scientific we must first establish a baseline to assess change, not just observe a situation and say it is a problem. Fragmentation of habitat provides a good example where we can recreate an understanding of a habitat at pre-European settlement and then measure the change from then to present day. His studies have shown that in fact the woodlots of southern Ontario do have significantly fewer species than our best estimate of the pre-settlement conditions. Nudds reminds us that we have created "functional islands" such as Point Pelee (Lake Erie), a peninsula surrounded by agricultural development that has "islandized" the peninsula into a functional island with the accompanying vulnerabilities.

While a full paper could not be included here, Dr. Emmet Judziewicz of the Wisconsin Department of Natural Resources presented some vital information on *Islands and Plants*. Judziewicz has done extensive surveying of the flora of Great Lakes islands especially of the Isle Royale and the Apostle Island archipelagos of Lake Superior. He described finding interesting disjuncts (species found outside their normal range) on the two archipelagos coming from all directions: the Arctic north; the west including the Pacific northwest and the Rocky Mountains; the east; and the south. Judziewicz points out that island endemics (species found nowhere else) are actually quite rare in the areas that he was worked. The "hotbed" for island endemics like Pitcher's thistle, Lake Huron tansy, Michigan mocking flower, and Lakeside daisy appears to be in the dolomite areas near the Straights of Mackinac.

Judziewicz has done a rare plant survey on the Precambrian sandstone Apostle islands collecting data on 1,400 grid points. These islands are actually the remnants of an old braided river channel that created a very unique archipelago with a grid-like regularity of spacing. The islands are hemlock hardwood forests with some pines on the sand spits. There are a number of sand spit complexes, usually on the south ends of the islands where

[2] A few concepts from island biogeography theory are the tendency of islands toward collapse of faunal species, and the decrease in number of species per area with both a decrease in island size and an increase in distance from the mainland.

sediment-bearing currents converge. They are an excellent place to study the effects of logging, fires, and deer browsing. Outer Island has one of the largest remaining virgin hemlock hardwood forests in the Great Lakes region at the north tip near the lighthouse. Judziewicz described what became an unexpected problem mentioned repeatedly at the workshop: the vegetative destruction brought by deer on islands.

Like Nudds, Judziewicz has tried to test island biography theory on Great Lakes islands with mixed results. He did not find that diversity increased with island height, as the theory would predict. However, when computing number-of-species-per-area curves, he did find that islands had 100 species per area versus 250 species per area on the Midwestern mainland.

Another paper that could not be included here was the talk by David Synder of Apostle Islands National Park on *Islands and Human Culture*. Synder shared many entertaining stories about the human cultural aspects of the Great Lakes islands. He has found that people living on Great Lakes islands are a tough breed, often barely surviving and frequently not there by choice. Synder describes three types of islanders: the temporaries, the locals, and the summer folk. The temporaries are people sent to islands to work without having a choice such as lighthouse keepers. Some of these "temporaries" ended up staying over 30 summers. The locals are those who went to live on islands by choice like the Norwegian fisherman in Lake Superior. The summer folk include people coming from Kansas City or Omaha to escape hay fever season or the pressures of city life. Because of their long, intimate connection with islands, all three types of islanders have much to teach us about islands including the flora and fauna.

Part III — Case Studies

We asked participants to share case studies of successful efforts that would help us better understand and protect islands, especially in terms of biodiversity. Mary Alice Snetsinger, who at the time was with Parks Canada and the Thousand Islands National Park, presented information on *the Thousand Islands Ecosystem Project*. This is a seven-year pilot project to attempt ecosystem management of the Thousand Islands National Park following the principles outlined by Edward Grumbine in 1994. These islands lie at the west end of the St. Lawrence River and are remnants of worn mountain peaks along the granite formation of the Frontenac Axis. Snetsinger is working with many different agencies and local land trusts. These efforts include FASTLINE, the Frontenac Axis-St. Lawrence Information Network for the Environment, which allows a wide sharing of regional information. They are also using satellite technology to begin to detect changes, and aerial photography to support park planning by locating sites with potential natural or cultural interest. Stewardship is a key component in their efforts because of the important role landowners play in the conservation of island ecosystems.

Patrick Northey of the Georgian Bay Association shared the efforts of his organization to find new ways to protect the islands in the Georgian Bay in his talk *The Littoral, a New Vision for the Eastern Georgian Bay*. The word *littoral* refers to a geographic area that "depends on or is related to the shore". Northey describes the vision of his organization to "change political organization from an east-west to a north-south orientation" which would "follow existing patterns of use and activity along the coastal area and outer islands and channels." They have hired a planner to develop an economic framework for ecotourism that is locally developed, provides tourism jobs in each community, and empowers more jurisdictions to protect the water and landscape.

Susan Crispin made a second contribution in her paper on *The International Alvar Conservation Initiative*. Alvar is a special type of plant community first described in Scandinavia and only found in North America in the Great Lakes basin (with 90 percent in Ontario). Crispin describes these communities as looking like an "abandoned airfield": "flat bedrock, with cracks and crevices where plants have gained a toehold." They support a wide diversity and unique mix of prairie and arctic-boreal species such that when in bloom they are so spectacular that they are referred to as nature's rock gardens. Crispin describes the international alvar conservation project and outlines some lessons learned: new money is needed for new projects; there is much support for truly international projects; coordination on this large of scale requires a big commitment of time; and decision-making can be improved by agreeing on key objectives and operating principles as a large group then conferring smaller decisions to lead actors.

Linda Witkowski of Isle Royale National Park shared *Wilderness Management Issues at Isle Royale National Park*. Isle Royale is the only island national park in the United States and is a federally designated wilderness area. Witkowski describes the challenges of managing the remote Isle Royale. One challenge is to develop a new general management plan to guide decisions and actions. Another is to address external and internal impacts such as noise, overcrowding, and toxic contaminants. The final challenge is the lack of adequate resources to study and protect the park.

Angus McLeod of Parks Canada discussed *The Land Trust Movement in Canada*. Land trusts are organizations "dedicated to helping safeguard open space, cultural resources, and wildlife habitat in communities and states and provinces." McLeod notes that land trusts are the fastest growing conservation movement in the United States, growing at the rate of one per week. They are established in local communities and use a wide range of strategies—from providing information to buying land—to conserve nature. He outlines a large slate of protection "tools" used by land trusts such as conservation easements. McLeod suggests that community-based land trusts have great potential on Great Lakes islands because many islands are privately owned.

Robert Brander, recently retired from the U.S. National Park Service, described *The Biosphere Reserve Model in Relation to Lake Superior Islands*. Biosphere reserves are a type of internationally designated protected area. These reserves were conceived as a way to "achieve a sustainable balance between the conservation of biological diversity, economic development, and maintenance of associated cultural values." Brander suggests the Lake Superior islands are particularly suited to serve as biosphere reserves by serving as sentinels to detect the long-range transport of toxic materials.

Dr. Sylvia Taylor of the Michigan Natural Areas Council discussed *Vegetation Monitoring for the Grand Island National Recreation Area*. When her organization presented detailed concerns over the management of the Grand Island (Lake Superior) as a newly designated national recreational area, they were asked to serve as technical consultants to develop a vegetation monitoring plan. Taylor outlines efforts to set up the program on this large 13,558 acre island near Pictured Rocks National Lakeshore in Michigan.

Christopher Clampitt of the Michigan Chapter of The Nature Conservancy gave background on the *Les Cheneaux Islands and the Northern Lake Huron Shoreline Program*. Clampitt described the long-term commitment of his organization to working with the local communities in this area known as one of America's Last Great Places. Their approach is to work with the local community toward landscape or ecosystem conservation. This type of conservation spans large areas of land, which in this case includes an eighty-mile stretch of biologically rich shoreline rich dotted with many endangered and threatened species.

Gordon Hayward of Peninsula Township, Michigan gave the final case study on *The Purchase of Development Rights Program on Old Mission Peninsula*. Hayward is a township planner and helped bring about a path-breaking new way to preserve agriculture on Old Mission Peninsula through the community's purchase of development rights from local farmers. His paper describes the process the township used and details the way the program works.

Commonalties

A list of commonalties was developed during a whole-group discussion after listening to all the papers and case studies. Some of the more important commonalties are:

- Great Lakes islands have extremely diverse natural features.
- Portions of some islands are much more important than others and need protection.
- Human factors such as threats and desired uses are common across case studies.
- We need inventories and baseline information including land-use histories.
- People and their cultural history are an integral part of many island experiences and we need to include them.
- Islands that are not yet "developed" need special consideration and protection.
- We need to develop an institutional framework for sustainable island management.
- We must learn island limits—economic, infrastructure, biologic—and island biological values.
- The inherent popularity of islands means we can "love them to death".

Part IV — Island Needs

The needs for Great Lakes islands were discussed in terms of these six areas:

- Inventorying and research
- Conservation programs
- Coastal policy and land use
- Cultural resources
- Public-private partnerships and land trusts
- Networking and clearinghouses

Key participants were asked give 10-minute overviews on each topic, then into small groups brainstormed and prioritized island needs. Unfortunately, space does not permit listing them in the executive summary and they are difficult to summarize. We plan to post them on our home page in the near future.

Part V — Findings and Recommendations

A small work group spent an additional day synthesizing and summarizing the workshop learnings. Briefly, the recommendations coming out of this workshop are three-fold:

1. Support island and island archipelago conservation planning

Governments and other institutions should facilitate and support efforts to develop and implement *island and island archipelago conservation strategies* protective of biological integrity. The goal of these strategies should be to *maintain the cultural and economic activity of island communities in ways compatible with the conservation of biological integrity.* This recommendation goes beyond standard notions of sustainable development that do not specify the primacy of the protection of biological integrity.

2. Document and share successes and failures

Efforts should be made to create and foster the sharing of information and experiences among Great Lakes island and island archipelago associations and initiatives. Efforts should be made to develop and share case studies describing the successes and failures of similar initiatives. To support this, we need to connect island communities to one another and to researchers and policy-makers through the Internet and other means.

3. Base conservation planning on "good" scientific information

A top priority is to *assemble an "inventory of inventories"* of species for all islands and archipelagoes for which they exist. Based on this, an assessment of the need for targeted inventories of different groups of species across different islands—to achieve basin-wide representation—can be carried out. Further, where locally driven initiatives are already underway, this information can be made available, or the local constituencies can request help with designing inventories of their own.

Part VI — Next Steps and Commitments

At the end of the workshop, participants identified the necessary next steps as well as made commitments to:

- Work toward the development of conservation strategies for Great Lakes islands and archipelagos.
- Urge governments and other institutions to facilitate and support these conservation strategies.
- Produce this set of proceedings then circulate it to island and archipelago associations and interested agencies and organizations for additional information and comment.
- Produce a second, larger *State of the Great Lakes Report* that would be finalized a year or two later. This second report would pave the way for the creation of a basin-wide *Great Lakes islands conservation strategy*.
- Strengthen the communication network among people concerned with island conservation.
- Co-sponsor a workshop with island groups and associations to share information and ideas about island conservation.

Some of these efforts are underway while others are being planned or will be undertaken in the future. A fascinating feature of the workshop was to hear this group of mostly scientists strongly advocate distributing these proceedings throughout the basin for a grassroots review before writing a second report.

Summary

We can now say with certainty *that the natural biological diversity of the islands of the Great Lakes is of global significance*. During the workshop we began to grasp the fact that *islands are not "islands"*. While islands *look* separate—indeed the word "island" implies a distinct separation—islands are intricately connected to a greater whole. We also learned there are many *excellent initiatives and programs* underway from which to build new efforts and partnerships. We talked about the *threats* facing islands and their many *needs*. Fortunately, we believe that it is *not too late*. Many important islands have intact representative ecosystems and rare and endangered coastal species.

We hope this document can serve as a springboard to launch needed cooperative, holistic efforts to better understand, protect, and manage the islands of the Great Lakes as a

collective. The participants at the workshop have pledged to work together and some new cross-jurisdictional projects are underway and others are planned. Of critical importance is the development of a basin-wide island conservation strategy. We hope readers of this report will support the development of this strategy, as well as other excellent efforts underway throughout the basin.

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PREFACE

When I was young, my father—a frustrated Norwegian wannabe sailor—took my mom, brother, and me out on a tiny fourteen-foot runabout on Lake St. Clair every summer weekend. On most days we would head for Strawberry Island, the only speck of land within the range of our small boat. Looking back, it was probably just a tiny sandy shoal, but to a young girl it was a great destination. We would anchor the boat, swim, and have a picnic lunch on the island, relaxing in the sun and family fun.

There were many other islands in my childhood despite growing up in the middle of Detroit. In the large urban Palmer Park near my home there was a tiny island in the middle of a small lake. In the winter the lake would freeze and we would skate to the island. On this island was a glorious miniature lighthouse about 20 feet tall. With our skates on, we would awkwardly climb the stairs curving around the lighthouse and look out at the world from this special winter perspective.

Belle Isle was another island in my youth, reachable by bridge just east of downtown Detroit. It, too, was magical, with horses to ride, lake carriers to watch, and enormous deserted dance pavilions from an elegant former era. There were so many fascinating places to explore: the Coast Guard station and nautical museum, pools and fountains, and an aquarium and botanical garden. As an adult, late one night I came across a herd of the island's very small white deer. I got out of my car in the moonlight and watched until they disappeared in the woods. I can still feel their eerie presence.

Boblo Island was another childhood island, with the roller coaster that frightened me to tears, a small train that circled the island, and an intriguing ghost house. Of course half the fun of Boblo was getting there on a large white ferry boat with live bands, junk food, and folding wooden chairs lining the decks. When I was fifteen my Mom let me take my four-year-old sister, Wendy, to the island. We took a bus seven miles downtown then walked to and boarded the big boat. We had an exciting day and were very sleepy on the boat and bus rides home.

As I look back, these childhood experiences provided a rich soil from which seeds later grew into this publication. In 1980, I began a graduate degree in natural resources at the University of Michigan. While taking a wildland management course from Dr. Kenton Miller, I learned that the Great Lakes was considered an *under-protected ecoregion* in terms of the amount of land set aside to protect biological diversity. I found the "under-protected" status troubling and tucked the concern away in the back of my head.

A few years later I took a position as senior policy specialist at the Michigan Department of Natural Resources' Office of the Great Lakes. One of my first responsibilities was to help garner public support so that Michigan could accept the transfer of nearly a hundred islands from the U.S. Bureau of Land Management. I became concerned about these new islands because different divisions within the agency had conflicting ideas about what to do with them. Some wanted us to sell the islands, others to use them for recreation, and still others to preserve them. I felt that we needed to reach a larger understanding of the biological, ecological, and cultural values of these islands before we could develop an informed consensus about their future.

This led me to seek out people within the agency with an interest in the islands. A small group of about five of us met several times, each sharing information about and concerns for Michigan's Great Lakes islands. Together we drafted a memorandum to one of the division chiefs recommending a strategy to develop an island policy for Michigan. After

sitting still for sometime, the strategy moved forward thanks to Jim Ribbens of the Michigan Coastal Management Program. Eventually a public committee was formed and they developed the *Michigan Islands Management Strategy*. This strategy is a first step toward better island protection and management in Michigan. Since then, Michigan's Coastal Management Program has continued island and other related work. Importantly, in 1993 they funded Dr. Judith Soule of the Michigan Natural Features Inventory to compile and assess information from existing inventories of Michigan's Great Lakes islands, the only such effort in the Great Lakes basin.

In the meantime, I worked mostly on Great Lakes water quality issues. I became a mediator and used these skills to help citizens, government, and industry struggle through conflicts about water quality. But about four years ago I felt a need to understand these conflicts in a broader context and spent six weeks studying at the University of Oslo. I wanted to gain a global perspective and learned much through an intensive course in peace research sitting side-by-side with classmates from India, Somalia, South Africa, Norway, Azerbaijan, Vietnam, Tanzania, West Palestine, Pakistan, former Czech Republic, and the United States. I came back knowing that I wanted to address broader concerns about the biological integrity of earth and help secure peaceful connections between people and nature. In 1995 I took the opportunity to pursue full-time doctoral studies at Michigan State University. My dissertation will combine philosophy with social, policy, and natural sciences to look at the ethical dimensions of development, especially as it relates to biological diversity.

Little did I know that all these factors would come together. For ten years I tried to stir up support for an island project. While there was interest, it wasn't a high priority for the organizations I worked with. Finally I decided to try on my own using Dr. Soule's report as a starting point. I submitted a grant proposal for a workshop to bring together U.S. and Canadian Great Lakes island experts including islanders, policy-makers, and researchers, most who had never met before. I found willing and enthusiastic support for this island project from Catherine Cunningham of the Michigan Coastal Management Program, and the Department of Resource Development at Michigan State University gave it a home. Dr. Eckhart Dersch assumed the role of principal investigator, and Dr. Cynthia Fridgen, Department Chairperson, gave us an office and let the project be my assistantship. The result was the birth of the U.S.-Canada Great Lakes Island Project and the work described in these pages. The project is definitely a "work in progress" and is grounded in love for the islands and all their living creatures.

KAREN E. VIGMOSTAD EAST LANSING, MICHIGAN

ACKNOWLEDGMENTS

While the spirit of this project began with a child's first sighting of a small sandy island in Lake St. Clair, it was brought to life with the support of James Ribbens and Catherine Cunningham of the Michigan Coastal Management Program and Kenneth Walker of the Office of Ocean and Coastal Resource Management of the National Oceanic and Atmospheric Administration. Over the past two years, the project has been nourished by the tangible and intangible support of Drs. Cynthia Fridgen and Frank Fear of the Department of Resource Development at Michigan State University. The project could never have been completed without the attention and care of Dr. Eckhart Dersch and dedicated and hard-working students Andrea Manion and Scott Warrow. Dr. Judith Soule of the Michigan Natural Features Inventory and Mary Alice Snetsinger of Parks Canada provided valuable background information and guidance on an ongoing basis over the last three years. Dr. George Francis of the University of Waterloo and William Stevenson of Parks Canada helped craft the agenda. Drs. Hans Blokpoel and William Scharf generously shared their knowledge of and enthusiasm for the birds of Great Lakes islands. Robert Brander of the National Park Service contributed a holistic perspective. Many other individuals in Parks Canada, the Canadian Wildlife Service, the U.S. National Park Service, and the Michigan Departments of Environmental Quality and Natural Resources have been extremely supportive. Carol Swinehart of the Michigan Sea Grant College Program did a final reading with her fine editor's eye. Special thanks to the writing group who stayed after to summarize workshop discussions: Eckhart Dersch, George Francis, Heather Hager, Angus McLeod, Andrea Manion, Tom Nudds, Mary Alice Snetsinger, and Scott Warrow. Finally, the project was brought to life, as reflected in these proceedings, by the 35 workshop participants. Each person made essential contributions to this project; indeed, this project owes its existence to all those whose words and ideas grace these pages.

CLARIFICATION OF RESPONSIBILITIES

The views expressed in the individual papers are those of the authors and do not necessarily reflect the views of the group as a whole, of any organization with which they are affiliated, nor of the granting agencies.

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INTRODUCTION

KarenE. Vigmostad
U.S.-Canada Great Lakes Islands Project

Thirty thousand islands dot the Great Lakes, often forming chains of islands known as archipelagos. The vast majority of these islands lie in the Canadian waters of Lake Huron's Georgian Bay. The islands range in size from no bigger than a large boulder to the world's largest freshwater island, Manitoulin, which is 80 miles long. While the Great Lakes are well known as globally significant bodies of water, few know that their islands form the world's largest freshwater island system. Not only are the islands not well known, but also the state of our knowledge about them is quite poor.

We do know a great deal about the general characteristics of islands. By their very nature, islands are vulnerable and sensitive to change. Islands are like living organisms, whose "body" changes shape as water levels rise and fall and as the forces of erosion and accretion take their toll. Islands often suffer violent weather events due to their 360-degree exposure to winds that sweep across the open water. Isolated for tens of thousands of years from the mainland, islands rarely gain new species and their resident species often evolve into endemics (i.e., species found nowhere else). This means that islands are vulnerable to, among other things, the introduction of exotic species (i.e., those not already living on the island).

Concurrent with their vulnerability, islands strongly attract humans to their shores. Islands capture our imagination as romantic places of mystery and seclusion. The complication comes when developers create places for people to stay on these islands. As we have watched happen in the Caribbean Islands over the past 50 years, the process of island development is one in which ownership of the island changes hands from local to foreign control (McEachern and Towle 1974). The first waves of people to visit islands are small in number and are attracted to the natural surroundings and quiet. Over time, more and more people come as runways and docks are built, hotels constructed, and natural areas paved over and filled in. This in turn brings a new type of person who wants a different experience: less wild, more cultural. Foreign banks and hotel corporations buy more and more land from islanders, and decisions about the island's future are made more and more frequently in corporate boardrooms in distant lands.

In the Great Lakes basin, these forces of development and globalization are on the horizon for our islands. Over the past several years, two five-acre islands have been sold through national auction houses for millions of dollars. Manitoulin Island is in the midst of considering many development proposals. Calls for ecotourism have increased with visitation up at Isle Royale National Park and the Manitou islands of Sleeping Bear National Lakeshore. A new ferry has been put in place to carry more people more quickly to Beaver Island. What is troubling is that this is happening before we have a good understanding of the natural values of these islands and how they contribute to our well being. Just what do we have, and what are we giving up? Can we enjoy the islands without loving them to death or turning them into theme parks?

THE U.S.-CANADA GREAT LAKES ISLANDS PROJECT

In 1995 we sought to improve our state of knowledge by establishing the U.S.-Canada Great Lakes Islands Project at Michigan State University. We spent a year talking to people and gathering information about the islands. We wanted to create a project to serve as 1) a catalyst to start a basin-wide "conversation" about the islands and conservation of biological diversity and 2) a central base or focal point for activities, data, and information about the islands. We designed the project to build on the following groundbreaking work:

- Dr. Judith Soule's comprehensive island inventory of Michigan's 600 Great Lakes islands (Soule 1993). Dr. Soule's report was funded by the Michigan Coastal Management Program and published in 1993. In her extensive bibliography of scientific studies of various Great Lakes islands, we found that only a few consider more than one island.
- Susan Crispin's work on Great Lakes biodiversity (Conservancy 1994). This is a project of the Nature Conservancy's Great Lakes Program with support from the U.S. Environmental Protection Agency's Great Lakes National Program Office.
- Dr. George Francis's leadership and publications on Great Lakes conservation programs based at the University of Waterloo's Environmental and Resource Studies Department.

As we talked to Soule, Crispin, and Francis, and to other highly experienced island researchers such as Robert Brander, Dr. Hans Blokpoel, and Dr. William Scharf, we began to piece together a picture of these islands as extremely interesting and quite possibly very significant.

THE MICHIGAN WORKSHOP

We received funds from the Michigan Coastal Management Program (MCMP) and the National Oceanic and Atmospheric Administration (NOAA) to support our efforts and to host the first United States-Canada workshop to assess the status of the Great Lakes islands. The purpose of the workshop was to draw together a small targeted group of people who manage, study, live on, or otherwise care about Great Lakes islands. Some of the 35 people we found work for state, and federal agencies or other organizations that own and/or manage islands—NOAA, MCMP and other Great Lakes state coastal programs, Parks Canada, Canadian Wildlife Service, U. S. National Park Service, the U.S. Forest Service, U.S. Fish and Wildlife Service, U.S. EPA's Great Lakes National Program Office, and The Nature Conservancy. Others work as private consultants, university researchers, or government officials who study islands—botanists, ornithologists, wildlife biologists, ecologists, island biogeographers, historians, and conservation biologists. Still others are interested in learning more about and protecting islands—people with the Georgian Bay Association, Michigan Natural Areas Council, Michigan Sea Grant College Program, and U.S. Senator Carl Levin's office. By design, this hand-selected group was multi-disciplinary, multi-jurisdictional, and binational. Further, each person not only brought to the group years of island experience, but an incredible personal commitment to the islands. This lent a particular dynamism to the workshop that we had not anticipated.

We carefully constructed the workshop to cover a great deal of territory in three days. We started the workshop with a leadoff commentary by Susan Crispin. We asked Crispin to go through the regional Great Lakes biodiversity data to look specifically at the

contribution of islands. By the end of her talk, we all began to understand that these islands are not only significant in terms of biodiversity, but they are indeed *globally significant*. After more and more talks, and discussions between talks, we began to realize that, as Judy Soule put it, all the superlatives we used to describe the islands during the three days—unique, special, exceptional, fantastic—were indeed appropriate.

THE PROCEEDINGS

These proceedings are *the first collection of papers about the islands of Great Lakes*. Although there are still gaps—such as the role of islands in the Great Lakes fishery—the workshop papers create a basic framework of what we know about the islands, their significance, state of protection, and threats. These proceedings encompass the prepared papers and talks, as well as summaries of the discussions, findings, recommendations, and commitments of the participants. The individual papers are the work of their authors, while the joint sections were forged from dialogue and consensus among the participants. A smaller team wrote the findings and recommendations directly after the workshop based on those discussions.

While the work supported by this grant cumulates with the proceedings, the project continues. Copies of the proceedings will be presented to policy-makers in the U.S. and Canada. We will widely distribute the executive summary including on the Internet. We will continue to staff the office, maintain the home page, and serve the newly forming island network. Specific project activities will center on carrying out the recommendations presented here such as securing commitments and funding to begin work on a basin-wide island conservation strategy and compile an "inventory of inventories".

We hope that you, the reader, enjoy the proceedings and make an effort to share the information widely. We suggest you let people in leadership positions know that the islands of the Great Lakes deserve special care and attention. We hope you pay close attention and comment on proposals involving islands in your state or province. We also hope you support or even initiate efforts to fund more island research and conservation as well as to permanently protect the biological integrity of more islands. We invite you to contact us with your questions, concerns, and your own recommendations, and let us know how you would like to get involved. The future of these islands rests in all of our hands.

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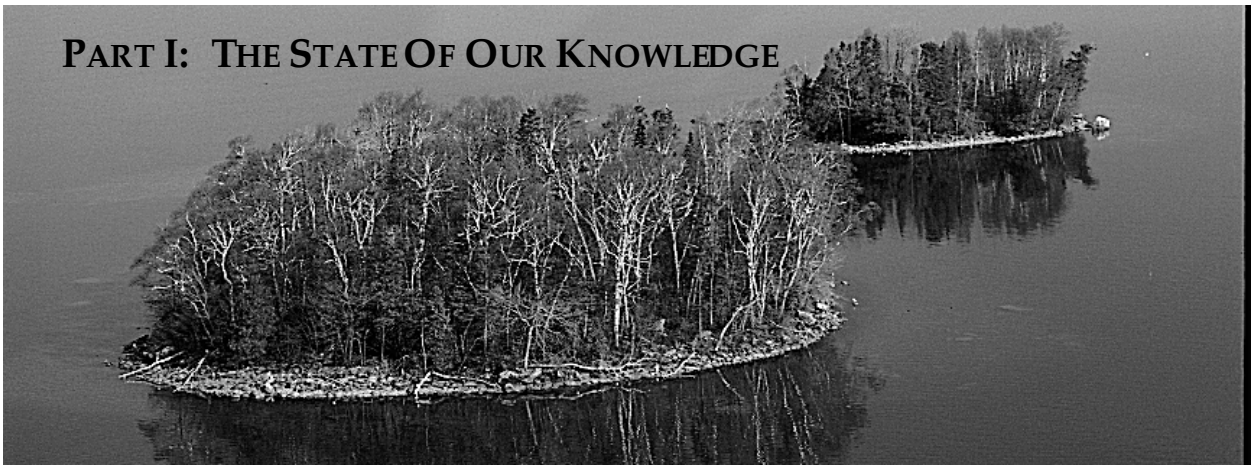

PART I: THE STATE OF OUR KNOWLEDGE

The Global Significance of Great Lakes Islands
Susan Crispin, The Nature Conservancy

Biodiversity of Michigan's Great Lakes Islands: Knowledge, Threats, Protection
Judith D. Soule, Ph.D., Michigan Natural Features Inventory

Conservation Programs
George Francis, Ph.D., University of Waterloo

THE GLOBAL SIGNIFICANCE OF GREAT LAKES ISLANDS

Susan Crispin
Great Lakes Program, The Nature Conservancy

THE SETTING

The global significance of Great Lakes islands can only be appreciated in the context of the Great Lakes themselves—the world's largest concentration of fresh surface water. These huge water bodies have a tremendous effect on the entire region. They significantly increase humidity and precipitation—especially snow, which can be up to 100 inches higher on the downwind (east) than the upwind side of the lakes. They also moderate temperature extremes, resulting in cooler springs and summers, milder falls and winters. These effects are felt most intensely along the coasts where snow can persist on the rocky shores of Lake Superior into early June. The direct forces of wind, waves, and ice scour further impact the coastal environment.

The byproduct of this unique coastal environment is a distinctive biota. Most, if not all, of the natural communities that have formed along the lakeshores are unique to this setting. Examples include the lichen-covered rockshores, sand dune communities, and coastal marshes. And although the modern Great Lakes are still in their geological infancy, several endemic plants and animals have already evolved, such as Houghton's goldenrod, the Lake Huron locust, and the Michigan monkeyflower. Data assembled from the region's Natural Heritage Data Centers show a tremendous concentration of endemic natural communities and species occurring around the Great Lakes shores, especially in the central and southern portions of the basin where inventory data is more extensive.

Islands, surrounded by the Great Lakes, experience maximum exposure to the lakes' environmental effects. In addition, they have extensive shoreline. For these reasons, islands epitomize Great Lakes coastal ecology, and might be considered showcases of the distinctive biota of the Great Lakes region. This, combined with some benefits of their relative isolation (including lower human use and, in some cases, the absence of large herbivores) suggests their potential as prime areas for conserving Great Lakes biodiversity.

While islands do present outstanding protection opportunities, some potential vulnerabilities should be borne in mind during conservation planning. First, their limited areas makes them especially sensitive to human use pressures, and may accelerate a space "crunch" between humans and the natural ecosystem—one in which humans often prevail. In addition, islands, with their smaller areas and more limited populations of organisms are vulnerable to extirpations, either from human or natural disturbances; recolonization can be very slow or impossible if habitat has been greatly reduced.

Finally, because most islands were literally underwater until about 10,000 years ago, they may not always support the full complement of coastal species (especially rarities) present in similar mainland habitats. Species assembled along much earlier ancestral mainland shorelines and were able to migrate as the lakes fell to their present levels. For these reasons, islands should be viewed, in combination with high quality coastal sites on the mainland, as important components of a much larger Great Lakes conservation portfolio.

ISLAND DIVERSITY

Spanning eight degrees of latitude and sixteen degrees of longitude, the Great Lakes encompass a tremendous range of ecological diversity, from the boreal biome along northern Lake Superior to southern Ontario's *Carolinian Zone*. The underlying geologic diversity of the basin, from the Canadian Shield nearly to the Appalachian Plateau, also contributes to its ecological diversity. Highlights of this diversity are described through a quick tour of major Great Lakes island groups. Given the limitations of our knowledge and space, this can be only the briefest of overviews, and omission of any islands or features does not suggest unimportance.

Lake Superior islands

There are two major types of islands in Lake Superior. Those along the northern shores consist of very resistant Precambrian basalt and granite, and they support a diverse flora including many arctic species, such as alpine bistort *(Polygonum viviparum)*. The forests of these very cool, moist islands are dominated by lichen-draped spruces and firs. These islands also support a number of plant species disjuncts from the Rockies or the Pacific Northwest including devil's club (*Oplopanax horridus*) which dominates the understory of Passage Island. This island lies four miles northeast of Isle Royale and is free of moose herbivory. The entire Isle Royale archipelago is a U.S. national park and Federal wilderness area. Several islands scattered along the Canadian north shore are provincial parks or nature reserves.

Along Lake Superior's southern shore, the islands are of Cambrian and Precambrian sandstones. These include the Apostles in the west, portions of which lie in Apostle Islands National Lakeshore, and Grand Island to the east which is managed by the U.S. Forest Service as a national recreation area. The Apostle Islands National Lakeshore includes the island-tip of Chequamegon Point, an excellent example of a sandy barrier spit or "glace" island that plays a critical function in sheltering the extensive coastal marsh system landward of it (similar to Long Point in Lake Erie).

Islands composed of unconsolidated sediments are rare in Lake Superior. One example is Batchawana Island, which supports extensive coastal marshes (which are also rare along Lake Superior). These features may make this currently unprotected island a good candidate for conservation action.

Lake Michigan islands

Lake Michigan has two major types of islands—those perched on glacial deposits, and those formed on limestone or dolomite bedrock. The first occur in the east-central part of the lake and include the Manitou and Fox islands. These islands, perched on glacial moraines, feature towering sand dunes along their western shores. In addition to very high quality dune communities, the Great Lakes endemic Pitcher's Thistle *(Cirsium pitcheri)* is

also found in abundance. The interior of these islands support rich forests that, in places, bear little evidence of human disturbance. The Manitou islands are part of Sleeping Bear National Lakeshore, and major portions of South Fox Island lie within a state wildlife research area.

Islands in the northern reaches of Lake Michigan are made of calcareous bedrock, often with a veneer of lake-deposited sediments. Those arcing between Wisconsin's Door Peninsula and Michigan's Garden Peninsula are part of the Niagaran escarpment, which rings the basin with a resistant rock layer forming many peninsulas and islands. These islands support extensive alkaline rockshore and cliff communities. A number of the small islands in northern Lake Michigan also offer ideal habitat for colonial nesting birds such as terns, cormorants, and gulls.

Lake Huron islands

The Niagaran and Precambrian bedrocks that dominate the shores of Lake Huron have contributed an enormous number of islands. The main basin of Lake Huron is ringed in the north by resistant dolomites and limestones, which form a discontinuous string of islands stretching from the Les Cheneaux chain in the west to the larger masses of Drummond and Manitoulin—the world's largest freshwater island. The Les Cheneaux islands, most in private ownership, support high quality bedrock shores and coastal marshes. This area, along with the adjacent mainland is the focus of the Michigan Chapter of The Nature Conservancy's *Northern Lake Huron Shoreline Project* (case study 8). This is a locally based initiative aimed at protecting the natural values that make this area special while encouraging compatible economic activity.

Farther east, Drummond and Manitoulin support a unique bedrock grassland ecosystem known as alvar, as well as most of the global range of the endemic lakeside daisy (*Hymenoxys acaulis* var. *glabra*). Only a very small portion of Manitoulin's outstanding alvar communities and lakeside daisy populations are protected, with much in corporate ownership. On Drummond Island, major alvar areas are on public conservation lands or owned by The Nature Conservancy.

Associated with Ontario's Bruce Peninsula (a continuation of the Niagaran Escarpment), are the islands of Fathom Five National Park with their distinctive "flowerpot" stack formations. Farther southwest along the Bruce lie the Fishing islands that are ringed by extensive shallow marshes.

Beyond the circle of the Niagaran Escarpment, the rocks of the Canadian Shield account for a tremendous scattering of islands in Lake Huron. Major concentrations lie in the North Channel and along the eastern shore of Georgian Bay, the latter known as the *Thirty Thousand Islands* region. The Canadian painters known as the "Group of Seven" have immortalized the character of these islands, dominated by rock barrens and stately white pines, in paintings. Several major parks—Killarney, French River, and Georgian Bay Islands—protect island features of high quality, although most of these islands are in private stewardship. Single ownership is common and development is often limited to one cottage per island. The work of the Georgian Bay Association (case study 2) and the Georgian Bay Land Trust suggests the potential of private stewardship for protecting island resources.

Lake St. Clair islands

The islands of Lake St. Clair are noteworthy because they are part of the largest freshwater delta in the world—the delta of the St. Clair River. Formed initially by glacial meltwaters, this remains an active "bird's-foot" delta. Ecologically, it is important because it harbors the last, high quality lakeplain savannas, or *oak openings* ecosystems, on the entire Great Lakes. Most lie within the Walpole Island Indian Reserve on Walpole and Squirrel islands, Ontario. These delta islands are also fringed with extensive coastal marshes, portions of which are still in a natural condition and lie within Michigan or Canadian wildlife areas.

Lake Erie islands

The only major island group in Lake Erie lies on its western end and spans the U.S.-Canadian border. Pelee, the largest island in this group, supports the southernmost alvar ecosystems known to exist, a portion of which are protected in provincial and private reserves.

Lake Ontario islands

Lake Ontario's islands are concentrated on the eastern end. They fall into two major groups—those following an arc of limestone bedrock that extends from the Bay of Quinte to New York's eastern shore, and the Thousand Islands in the upper reaches of the St. Lawrence River. A portion of the latter lie within Canada's St. Lawrence Island National Park (case study 1).

IMPLICATIONS FOR PROTECTION

Look for commonalities

Given the extraordinary diversity of Great Lakes islands, spanning the geologic, ecological and political breadth of the basin itself, designing broad protection strategies can be especially challenging. To be effective, collective strategies will need to be built on commonalities. A number of commonalities might form the basis for strategic island conservation action.

The first area of commonality to consider might be the *biological resources themselves*. Many of the communities and species distinctive to the Great Lakes shorelines occur widely and are especially well represented on islands. Organizing protection strategies around the shared biological targets can suggest broadly applicable approaches to addressing recurrent threats. It also maintains a sharp focus on biological objectives, an essential ingredient for effective conservation work.

Another area to look for strategic commonalities is in the *ownership and management patterns of islands*. This includes identifying not only public versus private ownership, but also which agencies comprise the variety of public managers. Commonalities in this area suggest key partnerships for the protection of island resources and may also lead to broad strategies for cultivating those partnerships.

Be pragmatic

The Great Lakes region has a tremendous infrastructure already in place for environmental protection and natural resource conservation. Both Federal governments and each state and province around the Great Lakes have many programs (for natural areas, coastal management, endangered species, etc.) that have tremendous potential to either advance or support protection of key biological resources on Great Lakes islands. Because financial resources as well as the time of conservation workers are usually limited, it is especially important to take maximum advantage of existing programs and capacity when planning increased efforts toward particular resources. Leavened with creativity, sometimes much can be accomplished with surprisingly little additional effort.

One way of leveraging greater protection for island resources is to simply bring these resources to the attention of appropriate managers and conservation workers, both in the public and private sectors. This can be especially effective with islands because they capture the imagination. Improved coordination and communication are great contributors to achieving a higher "profile" for targeted resources. For instance, working across boundaries to assemble information and craft statements on the importance and status of special resources throughout the basin can yield tremendous conservation interest and impact. In addition, interpretive or promotional materials that have a regional rather than local perspective can be used by cooperators in neighboring jurisdictions, thus leveraging broader protection success.

Where new efforts or programs are needed to protect specific Great Lakes island resources, we need to be very strategic in designing them. Key ingredients include clear biological objectives for significant communities and species, an understanding of their survival requirements, strategies focused on threats to their survival, and a pragmatic assessment of available time, personnel, and funding.

Great Lakes islands support far more of the Great Lakes' remarkable biodiversity than their size would suggest. With their relative isolation, they offer us some of the finest remaining opportunities to protect the unique biological legacy of the Great Lakes basin.

BIODIVERSITY OF MICHIGAN'S GREAT LAKES ISLANDS: KNOWLEDGE, THREATS, PROTECTION

Judith D. Soule, Ph.D.
Michigan Natural Features Inventory

VALUES OF THE GREAT LAKES ISLANDS

Sprinkled across all five of the Great Lakes, thousands of islands form a landscape unique in the world. Nowhere else does the combination of vast, interconnected, mid-continental bodies of freshwater and such a number and variety of islands occur. Uniqueness, beauty, value to wildlife, spiritual importance to native and other people, and scientific significance—these qualities qualify the Great Lakes islands for a status similar to precious gems. They should be treasured and protected.

Although the islands rival the mainland's habitat variety, the geography of islands, their varying degrees of isolation, varying sizes, and their very "island-ness," create conditions that are quite different than those *naturally* occurring on the mainland. For the past century, human activity has been fragmenting mainland habitats, creating a landscape of "islands" of native biota. The Great Lakes islands have much to teach us about the consequences of these activities on the mainland.

Michigan's share of this global treasure, including the islands in the state's waters of all four bordering lakes and their connecting channels, totals nearly 600 islands, including approximately 20 in Lake Erie, 32 in the Detroit River, 6 in Lake St. Clair, 200 in Lake Huron, 76 in Lake Michigan, 86 in the St. Marys River, and 175 in Lake Superior, including Isle Royale National Park. Michigan's Great Lakes islands are especially rich in their variety of geography, geology, history, and biodiversity. Although other territories have more islands, Michigan's variety of islands rivals all. Thus, to a great degree, the policies of the state of Michigan are key to the destiny of this global legacy. This is a critical time to consider what it would take to maintain or enhance the natural values of these islands.

In considering this challenge, it is important to realize that the value of a whole collection of islands is much greater than the sum of the individual islands' resources. Management policy based on an island-by-island, case-by-case approach can potentially result in degradation of the entire array of islands by diminishing potential sources of colonizing populations, or disrupting suitable habitat for migrating birds that use the islands as stepping stones. The islands must be considered as *a single, irreplaceable resource* and *protected as a whole* if the high value of this natural heritage is to be maintained.

HISTORY, PHYSICAL DESCRIPTION, AND BIODIVERSITY OF THE ISLANDS

Virtually all the unique natural features associated with the Great Lakes shoreline, including some of the best examples, can be found on Michigan's Great Lakes islands. Some features are nearly confined to islands: predator-free habitat for sensitive colony-

nesting waterbirds, and alvar (grasslands on thin soil over limestone bedrock). Unique conditions also exist: deer-free forests, absence of natural predators or competitors, unusually high populations of certain organisms (e.g., snakes on Hog Island, Beaver archipelago). Variation in geology, post-glacial history, size, isolation, and human use history are factors that makes these islands biologically varied and valuable for research.

Table 1. Sizes of the ten largest islands in Michigan's waters of the Great Lakes

Island	County	Size in acres
Isle Royale	Keweenaw	139,021
Drummond	Chippewa	83,087
Beaver	Charlevoix	36,791
Sugar	Chippewa	31,625
Bois Blanc	Mackinac	23,659
North Manitou	Leelanau	14,414
Grand	Alger	13,564
Neebish	Chippewa	13,765
Dickinson	St. Clair	6,751
South Manitou	Leelanau	5,344

Birds, fish, and plants

The islands along the north shore of Lake Huron, in the St. Marys River and in the St. Clair Delta have extensive marshes that serve as valuable stopover points for many migrating waterfowl. Other islands serve as nesting sites for certain waterfowl. A high proportion of Great Lakes populations of colonial waterbirds breed in Michigan's waters of the Great Lakes. Of the colonial waterbirds nesting on the U.S. Upper Great Lakes in 1989, Michigan claimed 75 percent of the double-crested cormorant and ring-billed gulls, 89 percent of Caspian terns, and 83 percent of common terns. Many of the islands are considered important migratory stopover sites for Nearctic-Neotropical migrant songbirds and for raptors, and harbor fish spawning areas. Several species of plants are found only along the Great Lakes shores and nowhere else in the world. Scientists call such species *endemic*. All these endemic plants—Pitcher's thistle, Lake Huron tansy, dwarf lake iris, and Houghton's goldenrod—occur on Michigan Great Lakes islands.

Shoreline ecosystems

The entire array of mainland Michigan shoreline features and associated ecosystems are also found on the islands: from sand / gravel beaches backed by open sand dunes (e.g., Beaver, High, North and South Fox), perched dunes (South Manitou, High), wooded dunes and swales (Grand), Northern fen (St. Martin — Mackinac County, Marquette),

interdunal wetlands (Beaver, Hog), and marshy shores (Sugar, Harbor, Dickinson, Grand), to cobble (High), bedrock (Thunder Bay, Isle Royale, Drummond), and cliffs (Grand, Drummond). The dunes, like the plants described above, are also endemic: nowhere else on earth are there dunes of this size and extent along the shore of a body of fresh water.

Threatened, endangered, and exemplary natural features

When compared to the rest of the state, Michigan's Great Lakes islands have a *disproportionately high* number of occurrences of endangered, threatened or rare species, exemplary natural communities (characteristic plant associations that provide the vegetative structure of ecosystems), and other special natural features (collectively called "elements" in this report).

Table 2. Michigan Great Lakes islands with more than 10 element occurrences (EOs)

Island	County	Number of EOs
Isle Royale	Keweenaw	220
Other islands in Isle Royale	Keweenaw	156
Drummond	Chippewa	85
Beaver	Charlevoix	67
Bois Blanc	Mackinac	29
South Manitou	Leelanau	19
Belle	Wayne	19
Sugar	Chippewa	17
Harsens	St. Clair	17
South Fox	Leelanau	15
High	Charlevoix	14
Grosse Ile	Wayne	11
Thunder Bay	Alpena	11
Manitou	Keweenaw	11

Some *933 element occurrences* have been found on these islands. This is about one-eleventh of the state's total known element occurrences, whereas the islands represent only about one-hundredth of the state's land area (total island area is about 420,800 acres). Even after excluding the 361 element occurrences on Isle Royale and surrounding islands, the remaining islands have about seven times more element occurrences than would be expected. The unusual number of rare or exemplary natural features on islands can be attributed to protection from human disturbance by virtue of isolation, moderated climate, location at the extreme edge of the state's boundaries, and the fact that colonial nesting waterbirds nest almost exclusively on islands. Island isolation provides protection for some highly sensitive shoreline species. For example, piping plovers find refuge on isolated island beaches where humans, dogs, and vehicles less frequently disturb them.

ISLAND RESEARCH VALUES

Some of the factors that make islands valuable sites for biological research are as follows:

1. Islands have discrete boundaries, and immigration and emigration are limited for many groups of organisms. This is an aid in population studies. As Allen (1971, p. 180) put it when discussing the value of Isle Royale National Park as an outdoor research laboratory:

> The striking limitations of its biota represent a measure of simplification over what is commonly found elsewhere. As an island, it offers relatively "confined" populations of animals, which can be inventoried somewhat more easily than is possible on study plots in more extensive habitats.

2. Island biogeography and the study of evolutionary processes among island populations have provided intriguing questions for investigation since the time of Darwin. The variation in age, size, isolation, degree of natural disturbance, and history of connections with the mainland among Michigan Great Lakes islands provides excellent conditions for these lines of investigation.

3. The flora and fauna of many islands are often missing some species, which can provide an ideal setting for comparing interactions among coexisting species.

4. Increasingly, conditions on the mainland mimic conditions on islands. Natural habitat is isolated by development or intensive agriculture in many portions of the mainland. Studies of effects of isolation on flora and faunas of islands can help us understand the consequences of artificial creation of island-like conditions on the mainland.

Examples of biological research on islands

A fruitful resource for biological research, Michigan's Great Lakes islands have served as laboratory for a number of long-term and comprehensive studies. Isle Royale has hosted long-running studies of moose and wolves. Long-term studies on the effects of deer browsing on vegetation have been performed on North Manitou Island. Both moose and deer studies have shown dramatic vegetation changes caused by heavy browsing when deer and moose populations were high. The Great Lakes islands offer the rare chance to study the ecology of native ecosystems where deer populations are not maintained at artificially high levels. Other research topics included island biogeography, predator-prey relations, and competition studies.

1. **Island biogeography studies**: Islands are especially intriguing to ecologists because of the fruitful source of insight they were for Charles Darwin. Islands present a set of basic scientific puzzles: origin of the biota, relationship of island size and isolation to the number of species present, species responses to lack of traditional competitors or predators, and the process of speciation. The islands of eastern Lake Michigan, and to a lesser extent, those of western Lake Michigan have inspired a number of studies of these subjects. Phillips *et al.* (1965), and Ozoga and Phillips (1964) discussed origins of vertebrate fauna in the Beaver Islands. Scharf (1973) studied the vertebrates and discussed faunal affinities on South Manitou Island. Corin (1976) discussed effects of island size on vertebrate fauna of the Huron Islands, Lake Superior. Long (1978) discussed vertebrates on the Grand Traverse chain (western Lake Michigan at the mouth of Green Bay), and included discussion of Apostle Islands in Wisconsin. Invertebrate faunas have largely been neglected for biogeographic studies on Michigan islands, but

Scharf (1991) used the flea fauna of certain mammals to decipher routes of mammal colonization of the eastern Lake Michigan Islands. There is room for a great deal more research on invertebrate biogeography on Michigan's Great Lakes islands.

2. **Predator-prey relations**: Examples of studies that focused on predator-prey relations are Peterson's Isle Royale wolf / moose studies (Peterson 1959-1992), and studies of red-fox predation on gulls on South Manitou Island (Shugart 1977, Shugart and Scharf 1977, Southern *et al.* 1983).

3. **Competition studies**: Examples of studies of competition include research on coyotes and wolves on Isle Royale (described in Krefting 1969), and a study of voles and mice on the Grand Traverse islands (Long 1978). Some studies have found situations on the islands where a species' usual competitors are missing and consequently that species occupied different habitats compared to mainland populations. Ozoga and Phillips (1964) noted that chipmunk and deer mice use different habitats on Beaver Island, Lake Michigan, than on the mainland.

STATUS OF KNOWLEDGE OF ISLANDS BIODIVERSITY

While many biological inventories of the Great Lakes islands have been conducted, no one island has been thoroughly studied for all groups of organisms, and large gaps in knowledge of island biodiversity still exist (Table 3). Colonial nesting waterbirds are the only group of organisms that has been consistently and repeatedly inventoried throughout the islands over the last three decades. In the last decade piping plover inventories have also been quite complete, and potential peregrine falcon habitat has been investigated on islands throughout Michigan's Great Lakes.

Table 3. High priority inventory needs on Michigan Great Lakes islands

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County Island	Inventories needed
Alger	
Grand Island	plant, animal
Chippewa	
Drummond Island	community, plant, animal
Sugar	community, plant, animal
Neebish	community, plant, animal
Lime	community, plant, animal
Harbor	community, plant, animal
Potagannissing Bay & Detour Passage islands	rare plant, animal
Mackinac	
Bois Blanc	community, plant, animal
Marquette	community, plant, animal
Albany	plant, animal
Little LaSalle	plant, animal
LaSalle	community, plant, animal

BigSt. Martin	community, plant, animal
St. Martin	community, plant, animal

Charlevoix

Beaver	community, plant
Garden	community
Hog	plant, invertebrates
High	plant, invertebrates
Whiskey	community, plant

Delta

Summer	community, plant
Little Summer	community, plant
Poverty	community, plant
St. Martin	community, plant

Bay

Wildfowl Bay islands	community, plant, animal

Alpena

Thunder Bay Island	plant
Crooked Island	community, plant
Middle Island	community, plant

St. Clair

Harsens	community, plant
Dickinson	community, plant

Leelanau

South Fox	community, plant, animal
North Fox	plant, animal

The Beaver Island group, one of the better-known groups, still lacks vertebrate inventory for Hog Island and invertebrates for all except a few groups on Beaver Island. Drummond also has an obvious gap in information on native invertebrates. The recent plant inventory on Grand Island showed a surprising number of species, but the list is still incomplete because much of the island was not covered. North and South Manitou have had thorough botanical surveys, but Beaver Island has not.

Since communities are a key to ecosystem health, they are a good starting point for inventory of biodiversity. Adequate inventory of natural communities is largely lacking among the islands, although Michigan Natural Features Inventory has made some strides in the 1990s towards completing inventories of significant shoreline communities throughout Michigan, including some of the islands. For example, we have been surveying alvar, a limestone bedrock community type. This survey work is also being carried out in other parts of the Great Lakes basin. For the past two years we have also surveyed bedrock shorelines of other types on Manitou Island (Keweenaw County), the islands of western Lake Michigan, and the islands of northern Lake Huron. Dunes and Great Lakes marshes have also been fairly well surveyed on the islands. Most of the larger islands

could use inland community inventories. The islands are clearly rich in outstanding natural values, and completion of inventory work will certainly reveal an even greater wealth of natural heritage.

PROTECTION AND THREATS TO ISLAND BIODIVERSITY

The status of biodiversity on the islands cannot be assessed solely by compiling lists of the biota present, but requires evaluation of the likelihood of their persistence.

Ongoing and anticipated threats and opportunities for protection

Many of the islands are currently experiencing pressures and threats similar to those experienced on the mainland Great Lakes shoreline, and this can be expected to increase. These include habitat destruction and degradation by developments or homes, alterations of shorelines with revetments and seawalls, and off-road vehicle use. These also include manipulations of marshy shorelines that benefit certain species but, in the process, eliminate habitat for other species. Clearly, there is a need for island conservation plans that provide for human needs in ways compatible with the maintenance of ecosystem integrity.

Islands provide a unique opportunity for conservation. They are naturally ecologically buffered, contain complete ecosystems, and have discrete boundaries that can ensure limited access and facilitate management of visitor use. One critical opportunity we have on Great Lakes islands is the chance to allow Great Lakes ecosystem processes, such as dune building and shoreline erosion, to continue unchecked. This opportunity is largely impractical on the mainland where so much of the shoreline has already been developed for human uses that are often incompatible with the natural dynamics of shoreline processes. For this reason, the islands can provide a much-needed laboratory for study of the dynamic ecology of Great Lakes shorelines.

Current status of protection of the islands

Current protection status of the islands ranges from mandated permanent protection provided to dedicated wilderness areas to a lack of any formal protection (tables 4 and 5). Isle Royale and North and South Manitou Islands are examples of islands provided a high degree of protection by ownership and dedication. Beaver and Drummond are examples of islands with many significant natural features that are only partially protected. North Fox Island, a small island with ten known element occurrences, is an example of an ecologically significant island that has been proposed for major development. Other islands are scheduled for auctioning by private landowners. It is urgent that a sound conservation strategy be developed soon.

Table 4. Protected Michigan Great Lakes islands by county

Alpena County	
Gull, Grass, Bird islands	Michigan Nature Association preserve

Scarecrow Island	Michigan Islands Wilderness Area, U.S. Fish and Wildlife Service, administered by Shiawassee National Wildlife Refuge
Charlevoix County	
Shoe, Pismire, Gull islands	Michigan Islands Wilderness Area, U.S. Fish And Wildlife Service, administered by Shiawassee National Wildlife Refuge
Hat	The Nature Conservancy preserve
Chippewa County	
Harbor Island	The Nature Conservancy preserve
Delta County	
Two islands	Michigan Nature Association preserve
Emmet County	
Waugoshance, Temperance islands	State of Michigan dedicated Natural Area, administered by Wilderness State Park
Grand Traverse County	
Power Island (=Marion I.)	Grand Traverse County park with deed restriction to maintain wilderness nature ("good forestry and wildlife management" are allowed)
Keweenaw County	
Isle Royale	U.S. Wilderness Area, administered by National Park Service
Passage Island	U.S. Research Natural Area (all but 1 acre), administered by National Park Service
Mackinac County	
Government Island	U.S. Wilderness Area (RARE II) administered by Hiawatha National Forest
Round Island	U.S. Wilderness Area (RARE II) administered by Hiawatha National Forest
Marquette County	
Huron Islands	U.S. Wilderness Area (formerly National Wildlife Refuge) administered by Seney National Wildlife Refuge.

Table 5. Partially protected Michigan Great Lakes islands

Alger County	
Grand Island	National Forest Recreation Area, small Research Natural Area, administered by Hiawatha NF
Alpena County	
Middle Island	State of Michigan, Forest Management
Thunder Bay	U.S. Coast Guard, managed by Shiawassee National Wildlife Refuge

Charlevoix County	
Fisherman Island	Fisherman Island State Park, undeveloped
Garden, High, Hog, Horseshoe, Tims, Little, parts of Beaver and South Fox Islands	State of Michigan, Beaver Islands Wildlife Research Area
Chippewa County	
Drummond Island	State Forest land, private, and Maxton Plains Nature Conservancy preserve
Sugar Island	Chase S. Osborn Preserve, Univ. of Mich. in one large and several small parcels, administered by Univ. Mich. Biological Station
Lime, Mare, parts of Burnt Island plus many other small islands in vicinity	State of Michigan, administered by Forest Management (Lake Superior State Forest) and Wildlife Divisions
Delta County	
Round, Poverty, most of Summer, and parts of Little Summer Islands	State of Michigan, administered by Forest Management (Lake Superior State Forest)
Huron County	
Wildfowl Bay Islands: Heisterman (= Stony), Lone Tree, N. Mineshas (= Defoe), Katechay (= Middle Grounds)	State of Michigan, administered by Wildlife Division (Wildfowl Bay State Wildlife Area)
Keweenaw County	
Porter's Island	State of Michigan, proposed Wilderness Natural Area, administered by Parks Division
Manitou Island	U.S. National Forest Service
Leelanau County	
South Fox Island	Part State of Michigan, Beaver Islands Wildlife Research Area.
Mackinac County	
Bois Blanc Island	More than half owned by State of Michigan, Mackinaw State Forest, includes Mixed Forest Natural Study Area, Snake Island/Mud Lake Natural Area, Northshore Research Natural Area; also The Nature Conservancy has a preserve, and there are many private owners.
Little LaSalle	The Nature Conservancy owns part, rest private
Marquette Island	The Nature Conservancy has two preserves at Voight and Peck Bay. Les Cheneaux Foundation also owns some land intended to remain undeveloped.
Mackinac	State Park (development is limited)
Crow	State of Michigan, administered by Wildlife Division
Marquette County	
Picnic, Little Presque Isle, Larus, and Garlic Islands	State of Michigan, administered by Wildlife Division
St. Clair County	

Dickinson, Harsens, Strawberry, and other small islands	State of Michigan, administered by Wildlife Division St. Clair Flats Wildlife Area
Wayne County	
Celeron	State of Michigan, administered by Wildlife Division

ISLAND INVENTORY AND CONSERVATION NEEDS

As a first step in ensuring maintenance of the aesthetic and biological values of the islands, the gaps in inventory of the islands should be filled before the islands are further altered in any way. For efficiency, these inventories should focus on high quality natural communities, migratory bird visits, waterfowl resources, and rare, threatened, and endangered species. The results will help to better define island conservation needs and priorities.

High priority inventory needs

Islands that lack protection but are known to have significant natural features or have a high potential for such features but lack adequate inventory are of highest priority for inventory. These islands are:

Grand Island (Alger County)
Drummond, Sugar, Neebish, and Lime islands; islands in Potagannissing Bay and Detour Passage; Harbor Island (Chippewa County)
LaSalle, Little LaSalle, Albany islands (Mackinac County)
Crooked, Middle islands (Alpena County)
Wildfowl Bay islands (Bay County)
Beaver, Garden, Whiskey, Hog and High islands (Charlevoix County)
South Fox Island (Leelanau County)
Summer, Little Summer, Poverty, and St. Martin (Delta County)
Dickinson and Harsens (St. Clair County)

Needs for protective designations

Ideally, the islands, as an integral part of the fabric of the Great Lakes ecosystem, would be systematically moved into protective ownership and managed for maintenance of their natural values. This would be a significant step toward providing for the maintenance of intact examples of many of Michigan's native ecosystems, as well as ensuring the integrity of this globally unique resource.

Realistically, it is crucial that the protection needs be prioritized. Systematic prioritization of protection needs could be accomplished with a mechanism known as a *scorecard* procedure. This procedure uses number of elements, quality rank of each occurrence, endangerment status, and degree of protection at each site to rank protection priorities. The following islands are considered of highest priority for further protection based on lack of protection and known or potential significant natural features:

Drummond	Harsens
Bois Blanc	Dickinson
Marquette	Beaver
Little LaSalle	North Fox
LaSalle	South Fox

In 1993, I included Grand Island (Alger County) on this list. However, in the meantime, the National Forest Service has been working with the Michigan Natural Areas Council to develop monitoring and protection plans for the island. This island deserves continuing attention to protection issues as its development as a national recreation area proceeds.

Protection for certain islands should be considered in an ecoregional context that includes interstate and international cooperation. For example, long-term conservation of the biota of the Michigan islands in the St. Clair River Delta may be tied to long-term conservation of the seed sources for prairie species on Walpole Island (Ontario). Similarly, Drummond Island (Michigan) is very close to Cockburn and Manitoulin islands (Ontario), and ecological processes on the three islands are undoubtedly linked. In western Lake Michigan, the chain of islands between Wisconsin's Door Peninsula and Michigan's Garden Peninsula are clearly biologically linked. Conservation management organized cooperatively across these state and national boundaries would greatly enhance effectiveness of management and protection actions.

Inventory and conservation recommendations

To conserve the unique values of Michigan's Great Lakes islands, the following actions are recommended:

1. Proceed immediately with completion of natural features inventories on the islands listed in Table 5.

2. Require that islands are inventoried and that environmental evaluation is performed prior to any further alterations.

3. Move toward development of a complete scorecard for all the islands.

4. Develop a policy that treats islands in the aggregate as a state resource, sets maintenance and restoration of the islands' native biodiversity as an overriding goal, and restricts further alteration of islands to actions that are compatible with maintenance of natural values of the islands.

5. Support acquisition of islands by the state or conservation organizations, and provide protective designations for publicly owned islands, concentrating first on those islands indicated above (Drummond, Bois Blanc, Marquette, Little LaSalle, LaSalle, Harsens, Dickinson, Beaver, North Fox, and South Fox) as high priorities for protection.

6. Develop management plans that integrate human uses with maintenance of island ecosystem integrity and all the natural values of the islands.

7. Limit further development of island shorelines while exploring protective options. For example, develop incentives to bring private islands into permanent protective status and/or, as the State of Oregon did, designate coastal shorelines a public resource.

8. Prevent the introduction of invasive exotic species to islands.

9. Initiate and participate in interstate, regional, and international planning for island conservation.

While number 7 above suggests considering turning island shorelines into public ownership or other forms of protected status, I do not mean to suggest that humans have no role on islands. I also acknowledge that political and fiscal realities make this proposal difficult in the near future. The key point is that our Great Lakes islands, and particularly those in eastern Lake

Michigan, are a natural resource to which the often over-used word "unique" is aptly applied. We should *consider bold actions to ensure their protection*, and these should include careful consideration of the appropriate role of private ownership and use. I contend that *maintenance of the biological integrity* of the islands should be at the *top of the list of priorities* in decisions about future use, ownership, and potential development of the islands.

A serious commitment to the endurance of this *globally unique heritage* would be evidenced by a policy that treated all the islands as a group, as a complete, invaluable landscape. Because many of the islands are relatively undisturbed at present, and because of their discrete and unique nature, islands offer possibilities to *anticipate and prevent* loss of biodiversity and ecosystem integrity. In this way, the need for future restoration can be short-circuited by protecting intact, functioning systems before they are degraded.

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CONSERVATION PROGRAMS

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Three sets of questions can be asked about the state of our knowledge about conservation programs with special reference to Great Lakes islands.

1. To what extent have conservation objectives already been achieved?

Thanks to the efforts of many people over the years, a large number of important natural areas in the Great Lakes Basin are formally protected. Many designations came about through efforts of government agencies in the various Federal, state and provincial jurisdictions to create their own systems of parks or other protected areas under different statutory authority and policies. Private sector initiatives, for example through The Nature Conservancies in both countries, have also contributed significantly.

So how does this all add up? Collectively, to what extent do all of these protected areas viewed together serve to conserve the full range of natural diversity to be found in the Great Lakes Basin, and especially along the coastal zones and archipelagos? Note the implicit goal in this question. All the main players who would have to build on what has been accomplished so far in order to achieve it have never agreed upon this conservation goal. Nor does some transjurisdictional forum exist where this goal and its implications could be discussed with the view to formulating conservation strategies and priorities informed by a basin-wide perspective.

Agreement would also be needed on a common system for classifying the natural diversity to be found in the basin. If one took a relaxed view and suggested that all that is needed are some woodlands, wetlands, and shorelines, then the job is done. However, if one took the analysis much further by adopting The Nature Conservancy's classification of habitats and natural communities (while also making sure that whatever classification is used is extended to include the Great Lakes' aquatic ecosystems as well as terrestrial ecosystems), then much work would still to be done. It would require updating or reinterpreting information about the ecosystem elements that occur in protected areas. Also needed is some judgment about their condition and long-term viability, and information on other occurrences of elements outside of protected areas that might be acquired to fill "gaps" or increase the number of sample elements that are brought under formal protection. Until this is well underway, it would be hard to know if the conservation job is mainly done or just begun.
Related issues of management at both the site and landscape levels need also to be addressed, as others will be pointing out.

2. ***What collaborative initiatives are underway to further the protection of biodiversity, especially in archipelagos?***

While individual conservation initiatives for particular sites are to be encouraged, increasingly some "greater ecosystem" concept that spatially extends well beyond the site level is found helpful for identifying conservation priorities and protection needs. This entails collaboration among a number of "players", and a need to examine conservation objectives in the context of human cultural values and the economic viability of human communities. Several such initiatives are underway in the Great Lakes Basin:

• **Thousand Islands (Ontario) at the head of the St. Lawrence River:** A binational *1000 Islands Cooperative Action Group* is exchanging information for a region that would "link" the Adirondacks in New York State with Algonquin in Ontario. A vision statement for guidance relates conservation concerns to recreation development, tourism, and people's sense of place;

• **Georgian Bay Islands (Ontario):** *The Georgian Bay Association* has launched a regional endeavour it refers to as "The Georgian Bay Littoral" extending from the North Channel to the Severn River. The Littoral would serve to relate conservation concerns to recreational use issues and to the economic needs of recreation-serving local communities;

• **Apostle Islands (Wisconsin) in Lake Superior**: The *Alliance for Sustainability* initiative embraces the Greater Chequamegon, Bayfield (Wisconsin) and Apostle Islands National Lakeshore region. It seeks to relate recreation and tourism activities associated with the islands as well as other economic activities and potentials for enhanced community sustainability; and

• **Rossport Islands (Ontario) in Lake Superior:** A local *Rossport Islands Management Board* is seeking protective management for nearby islands, in part through the development of tourism facilities on the mainland in or near the village of Rossport itself.

It would be desirable to know more about the potential for collaborative strategies for other major island systems in the Great Lakes such as the western Lake Erie islands, the Manitoulin Island complex, and other islands in northern Lake Michigan.

There is a large "literature" on what makes for effective collaboration for consensus seeking and shared decision making. This might be reviewed to help groups embarking on island conservation. Experience from other collaborative endeavours in the Great Lakes Basin may also be helpful, because they are learning how best to work together within the same kinds of institutional arrangements and constraints that the island conservation groups face. Examples include:

• The *Carolinian Canada* program in southern Ontario;
• The land and water protection strategies developed locally for the Grand Traverse Bay watershed in Michigan; and

• The *Eastern Upper Peninsula Partners in Ecosystem Management Group in Michigan*, focusing on management issues for more than one million acres of shared forestlands.

As governments throughout the Great Lakes Basin are being "down-sized", the private sector will be called upon more to help implement conservation strategies. Experiences with conservation land trusts and the use of different "tools" such as conservation easements and private landowner stewardship programs would be worth documenting and disseminating. Legislative or policy provisions that facilitate or impede these developments vary among jurisdictions, and especially between the United States and Canada. Canada still seems to have more impediments.

3. *Which binational programs pertaining to the Great Lakes might complement or support endeavours for island conservation?*

There is a considerable history of binational cooperation between the United States and Canada on matters of shared concern about the Great Lakes. Table 1 lists the main binational agreements. Components of three of these could be supportive of island conservation strategies.

Table 1. Binational agreements concerning the Great Lakes

Boundary Waters Treaty, 1909
- International Lake Superior Board of Control, 1914
- International St. Lawrence River Board of Control, 1953
- International Air Quality Advisory Board, 1966
- Great Lakes Water Quality Agreement, 1972; 1978; 1987
- International Great Lakes Levels Advisory Board, 1977
- Air Quality Agreement, 1991

The Migratory Birds Treaty, 1916
- The North American Waterfowl Management Plan, 1986, 1994

The Niagara Treaty, 1950
- International Niagara Board of Control, 1953

Convention on Great Lakes Fisheries, 1955
- Joint Strategic Plan for the Management of Great Lakes Fisheries, l981
- Strategic Vision of the Great Lakes Fishery Commission (GLFC) for the Decade of the 1990s, 1992

St. Lawrence Seaway, 1959

Great Lakes Charter, 1985

The Great Lakes Toxic Substance Control Agreement, 1986
- Great Lakes Protection Fund, 1988

Declaration of Intent (Niagara River and Lake Ontario), 1987
- Lake Ontario Toxics Management Plan, 1989

The Indiana Declaration (Navigation), 1991

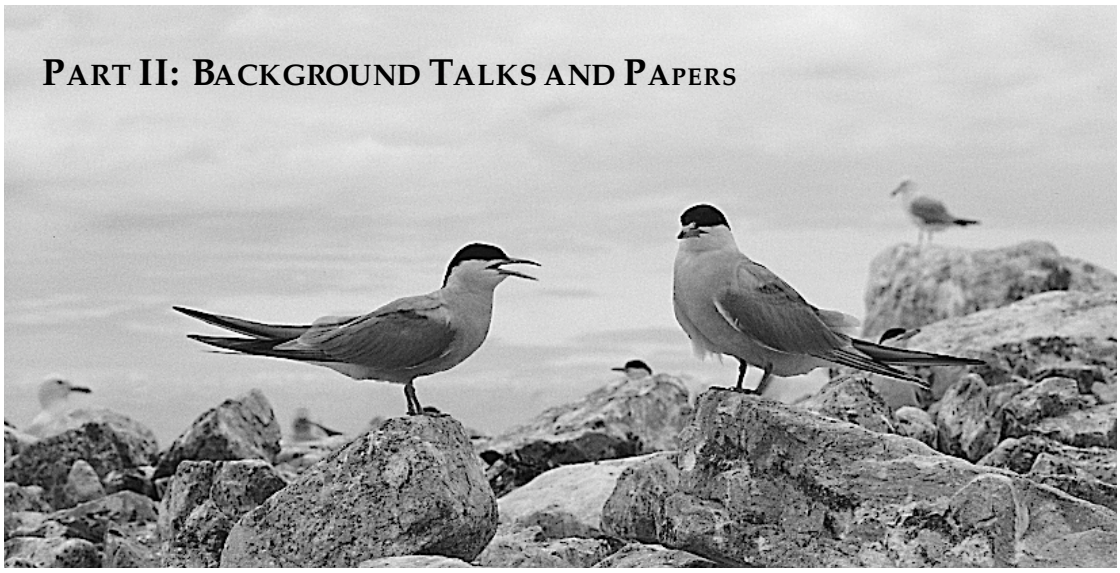
Great Lakes Water Quality Agreement: Remedial action plans being prepared for 42 degraded nearshore "areas of concern" sometimes include habitat restoration or protection measures. When fully implemented they will improve the environmental quality of surrounding areas, including nearby islands in a few cases. The "stakeholder" processes developed to address these issues also offer useful experience about what effective collaboration entails. The Lake

Superior Binational Program is exploring the possibility of using protected areas, including islands, as possible research and monitoring sites for tracking the "health" of the Lake Superior Basin. The State of the Lakes Environment Conference (SOLEC '96) reviewed background papers on the state of nearshore aquatic ecosystems, coastal wetlands, and nearshore terrestrial ecosystems, and may be useful for people interested in Great Lakes islands.

Great Lakes Fishery Commission: The Joint Strategic Plan for the Management of Great Lakes Fisheries calls for the development of fish community objectives for each of the Lakes, and for biennial "state-of-the-lakes" reports. Protection for critical fish habitats adjacent to islands would be an important linkage between island conservation and fishery interests.

The North American Waterfowl Management Plan: This was updated in 1994 to include Mexico as well as the United States and Canada. It identified major areas of continental significance for waterfowl along with population objectives sought for individual species of waterfowl. The lower Great Lakes-St. Lawrence is one area of continental importance, in part because of the major staging areas for migrating waterfowl in the lower lakes, some important wintering areas (such as the upper Niagara River), and further east, breeding habitat for black ducks. Coastal wetland protection may be an important linkage between island conservation and waterfowl interests.

Finally, note should also be made of the "Ecosystem Charter for the Great Lakes-St. Lawrence" prepared by the *Great Lakes Commission* through extensive consultations. The charter includes principles in support of ecological integrity and biodiversity, and could possibly be used by government agencies and other institutions to justify greater involvement in island conservation issues.



PART II: BACKGROUND TALKS AND PAPERS

The Importance of Great Lakes Islands as Nesting Habitat for Colonial Waterbirds
Hans Blokpoel, Ph.D., Canadian Wildlife Service, and William C. Scharf, Ph.D., Ecological Inventory

The Importance of Great Lakes Islands to Nearctic-Neotropical Migrant Birds
William C. Scharf, Ph.D., Ecosystem Inventory

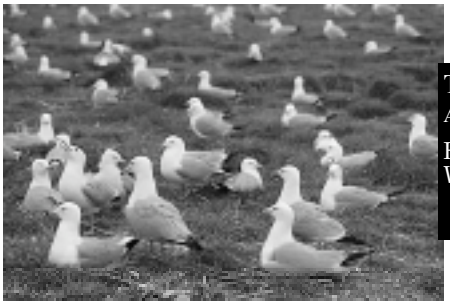
Wildlife Issues on Great Lakes Islands
Francesca J. Cuthbert, Ph.D., University of Minnesota

While the written papers of the following talks are not available, their ideas on these critical topics are incorporated into other sections. For example, Dr. Nudds' talk became part of the discussion leading to recommendation three. These talks are also summarized in the executive summary (pp. xii-xiii).

Great Lakes Island Biogeography Studies
Thomas Nudds, Ph.D., University of Guelph

Islands and Plants
Emmet Judziewicz, Ph.D., Wisconsin Department of Natural Resources

Islands and Human Culture
David Synder, Apostle Islands National Park



THE IMPORTANCE OF THE ISLANDS OF THE GREAT LAKES AS NESTING HABITAT FOR COLONIAL WATERBIRDS

Hans Blokpoel, Ph.D., Canadian Wildlife Service
William C. Scharf, Ph.D., Ecological Inventory

ABSTRACT

Nine colonial waterbird species nested on the natural islands of the Great Lakes during 1989-1991 with a total nesting population of 572,800 nests. The nesting populations for the nine species were, in order of diminishing size, as follows: Ring-billed Gull (449,300 nests), Herring Gull (76,900), Double-crested Cormorant (25,000), Common Tern (6,630), Caspian Tern (5,900), Great Blue Heron (4,170), Black-crowned Night Heron (3,680), Great Egret (1,250), and Great Black-backed Gull (17). The relative importance of the natural islands of the Great Lakes as nesting habitat was high for four species, medium-to-high for one species, medium for three species, and low-to-medium for one species. Threats to the nesting colonial waterbirds and the need for their conservation are briefly discussed.

INTRODUCTION

Colonial waterbirds are usually defined as waterbirds that frequently or always nest close to one another. Most colonial waterbird species, and especially the ones that nest on the ground, prefer to nest on islands to reduce nest destruction by ground predators. In the Great Lakes there are large numbers of islands and many of them are used for nesting by colonial waterbirds. The number of islands varies greatly among the lakes, ranging from fewer than 25 in Lake Ontario to tens of thousands in Lake Huron and the Georgian Bay.

Although the great majority of the islands in the Great Lakes are natural, several islands are made by humans and support large numbers of nesting colonial waterbirds. In this paper we deal only with natural islands, including islands that have remained more or less in their pristine state as well as islands that have been grossly altered by human activities. In other words, islands that were artificially created—such as dredge spoil islands, diked disposal facilities, insular breakwaters, etc.—are not dealt with in this paper.

The purpose of this paper is to evaluate the importance of the aggregate of the natural islands of the Great Lakes as nesting habitat for colonial waterbirds. We will do so by presenting the numbers of nests (which equal the number of nesting pairs) counted on them and by briefly discussing these figures in a larger conservation context. We make no attempts here to evaluate the relative importance of individual islands.

METHODS

The data that we present here are a synthesis of the results of Canadian and U.S. census work carried out concurrently on both sides of the international border during the 1989-1991 nesting

seasons. Some of the results of these inventories have been published (Blokpoel and Tessier 1993, 1996, 1997; Austen *et al.* 1996), while the remaining results are being prepared for publication.

Generally speaking, all islands were visited during the inventories and all active nests were counted or their numbers estimated. More details of the methods, timing, etc., can be found in Blokpoel and Tessier (1993). (For completeness sake, we also list below, under "Other Relevant Papers", the publications that describe the results of earlier inventories that were done in 1976-1980).

RESULTS

Nesting species

We report here on nine species of colonial waterbirds that nested in the Great Lakes during 1989-1991. These included one cormorant species, three heron species, three gull species and two tern species (Table 1). The gulls and terns nested on the ground, the herons nested in trees and shrubs, and the cormorants nested both in trees and on the ground.

Table 1. Colonial waterbirds nesting regularly in the Great Lakes Basin listed by common and (scientific) names

Double-crested Cormorant (*Phalacrocorax auritus*)
Black-crowned Night Heron (*Nycticorax nycticorax*)
Great Egret (*Casmerodius albus*)
Great Blue Heron (*Ardea herodias*)
Ring-billed Gull (*Larus delawarensis*)
Herring Gull (*Larus argentatus*)
Great Black-backed Gull (*Larus marinus*)
Common Tern (*Sterna hirundo*)
Caspian Tern (*Sterna caspia*)

The degree of coloniality varied among species. Some species, such as the Ring-billed Gull, were always found nesting in colonies, whereas others, such as the Herring Gull, were frequently found nesting as individual pairs and also in small and large colonies.

Numbers of nests

The natural islands of the Great Lakes supported some 573,000 pairs of colonial waterbirds during 1989-1991 (Table 2). Assuming an average production of two fledglings per nest, the total population at the end of the breeding season would be well over 2,000,000 birds.

Table 2. Estimated numbers of nests of colonial waterbirds on natural islands of the Great Lakes, 1989-1991*

Species	Canada	U.S.	Combined Canada & U.S.
Double-crested Cormorant	11,400	13,600	25,000
Black-crowned Night Heron	980	2700	3680
Great Egret	150	1100	1250
Great Blue Heron	970	3200	4170
Ring-billed Gull	268,500	180,800	449,300
Herring Gull	41,500	35,400	76,900
Great Black-backed Gull	9	8	17
Common Tern	5,700	930	6,630
Caspian Tern	2,800	3,100	5,900
TOTAL	332,000	240,800	572,800

*Numbers between 100 and 1,000 are rounded off to the nearest ten and numbers over 1,000 to the nearest 100.

Nest numbers were not distributed evenly between the Canadian and U.S. portions of the Great Lakes. Although Canada had larger numbers overall, the U.S. had much higher numbers for the three heron species. On the other hand, the number of Common Tern nests in Canada was much greater than that in the U.S. Ring-billed Gulls and Herring Gulls were also more numerous in Canada (Table 2).

Of the nine species, the Ring-billed Gull was by far the most abundant, with almost 450,000 nests (78.4 percent) of the grand total of 572,800 nests. Herring Gull nests numbered 76,900 or 13.4 percent of the total. Cormorants were the third most numerous species (25,000 nests, 4.4 percent), and the other six species together made up the rest (21,647 nests, 3.8 percent)

To express the importance of islands in relative terms, we expressed the numbers presented in Table 2 as the percentage of a larger area, in this case the Great Lakes drainage basin. Because most of the necessary information is not well known, our results, shown in Table 3, are based on very crude estimates. Nevertheless, Table 3 shows that for colonial waterbirds in the Great Lakes watershed, the natural islands in the Great Lakes are of high importance as nesting habitat for four species, high-to-medium for one species, medium for three species, and medium-to-low for one species.

Table 3. Relative importance of the natural islands of the Great Lakes as nesting habitat for colonial waterbirds*

Species	Relative importance
Double-Crested Cormorant	High

Black-crowned Night Heron	Medium (Canada), High (U.S.)
Great Egret	High
Great Blue Heron	Low (Canada), Medium (U.S.)
Ring-billed Gull	Medium
Herring Gull	Medium
Great Black-Backed Gull	High
Common Tern	Medium
Caspian Tern	High

*Numbers indicate nesting pairs as a proportion of the estimated nesting populations in the Great Lakes drainage basin; low is 1-25 percent, medium is 26-75 percent, high is 76-100 percent.

DISCUSSION

The importance of the natural islands

In *absolute terms*, the Great Lakes islands support large numbers—some 570,000 nesting pairs or well over a million adults—of nine colonial waterbird species. This clearly indicates that they are unique and important natural resources.

In *relative terms*, the Great Lakes are also important for several of the nine species rely to a large extent on the islands for their annual reproduction. In other words, in the Great Lakes watershed the Great Lakes islands provide, in the aggregate, critical habitat for these bird species.

Threats to nesting colonial waterbirds

The colonial waterbirds that nest on Great Lakes islands face a range of threats including nest washouts, human disturbance, habitat loss, and toxic chemicals (Table 4).
Most birds tend to build their ground nests on the higher portions of nesting islands to protect them against storm waves. However, many islands are almost fully occupied by nesting birds and the only places left for newcomers are on the outer edges of the islands where their nests are prone to inundation. Common Terns face a similar problem when Ring-billed Gulls begin to take over the terns' traditional nesting islands: the earlier arriving gulls usurp the higher, central portions of the islands, thus forcing the later-arriving terns to nest on the periphery.

Table 4. Threats to colonial waterbirds on the Great Lakes islands

Water level fluctuations (nest inundations)
Short-term: storms, boat wakes, seiches
Long-term: natural year-to-year fluctuations, regulations
Human disturbance
Inadvertent: boaters, anglers, hunters

Planned: vandals, scientists

Habitat loss / deterioration
Cottages, developments, etc.

Predation / diseases

Inter-species competition
Double-crested Cormorant vs. Black-crowned Night Heron
Ring-billed Gull vs. Common Tern

Toxic chemicals

Changes in food availability

Human disturbance ranges from raids on islands to destroy eggs and chicks (as has happened at a cormorant colony, Ewins and Weseloh 1994) to inadvertent damage caused by curious visitors wandering through colonies. In mixed-species colonies of Caspian Terns and Ring-billed Gulls, human visits usually have greater impact on the terns than on the gulls. The terns fly off their nests whereas the gulls are much bolder and less willing to move away from their nests and often intent on eating or at least destroying the eggs in unattended tern nests.
Habitat loss and deterioration due to human activities (such as building of cottages, fishing camps, docks, etc.) are incremental processes that generally affect the bold species less than the shy species, but in the long run all species will have less habitat to nest and reproduce.

Diseases are occasionally noted in bird colonies and then usually effecting cormorants and gulls, although other species also have been involved. Nevertheless, it appears that diseases are unlikely to have a major role in regulating numbers of the island-nesting colonial waterbirds.

Ground-nesting waterbirds avoid nest depredations by mammals by nesting on islands that are so small that they are unable to support predatory mammals. However, even island-nesting birds are not immune to attacks by avian predators, such as Great Horned Owls (*Bubo virginianus*) and Black-crowned Night Herons. This is especially possible if the nesting island is close to the mainland or if avian predators are nesting in a wooded portion of the nesting island.

There is a significant amount of inter-species competition for nest sites on the islands. As mentioned already for ground-nesting species, Common Terns in the Great Lakes are being displaced from many of their traditional nesting islands by larger and earlier-nesting gulls, especially the Ring-billed Gull, the numbers of which have increased enormously over the last three decades.

Among the tree-nesting species, cormorant numbers have been "exploding" in the Great Lakes (Scharf and Shugart 1981, Weseloh *et al.* 1995) and the larger cormorants easily out-compete the night herons in situations where both species nest in the same trees.

Toxic chemicals are much less a problem now than in the early 1970s (Bishop *et al.* 1992, Pettit *et al.* 1994), but they are still present (albeit at lower levels) in the eggs of the Great Lakes colonial waterbirds. For most species the present levels of contaminants apparently are not affecting their populations, but in some of the so-called "hot spots" or "areas of concern" certain

contaminant levels are still elevated and may have an impact on reproductive success and the occurrence of deformities (Fox *et al.* 1991).

Fish is an important food resource for the Great Lakes colonial waterbirds, and some species depend on them entirely. During recent decades, the food web of the Great Lakes has been altered through introduction of exotic species (either purposely or inadvertently), and through fisheries and fish-stocking programs. The overall effect of all these changes on the diet, reproductive success, and population levels of colonial waterbirds is not well known and is likely to vary among both lakes and species.

The need for conservation of islands for colonial waterbirds

Programs that provide adequate protection of the nesting colonies on the Great Lakes islands need to be developed so that the reproductive efforts will be successful. Adequate reproduction is, of course, essential for the long-term health of their populations.
When discussing conservation of colonial waterbirds on the Great Lakes, one must consider that:

1. Not all of the colonial waterbirds are in need of protection efforts and, in fact, some species should be controlled;
2. Effective conservation efforts for target species will likely require more effort than setting aside some islands for nesting because of the competitive interactions between some species;
3. Although bird conservation tends to focus on endangered species, the conservation of islands will likely involve several bird species, as well as other taxa, simultaneously; and
4. Conservation takes place at many different levels and usually involves jurisdictional, financial, legal, socioeconomic, and, thus, political considerations.

Of the nine species found nesting in the Great Lakes, Double-crested Cormorants and Ring-billed Gulls have been increasing at high rates, and their current large populations are causing a variety of real and perceived socioeconomic problems in certain areas. The problems caused by Ring-billed Gulls (reviewed by Blokpoel and Tessier 1986) can usually be solved, at least at the local level, by a variety of control techniques (Blokpoel and Tessier 1992). Cormorant problems in North America were the subject of a recent symposium (Nettleship and Duffy 1995) and are of particular interest in the Great Lakes (e.g., Weseloh and Collier 1995). In addition, these two species are affecting other bird species and this has led to efforts to reduce such impacts. A project to protect the nesting habitat of a major Common Tern colony on Lake Erie from being taken over by Ring-billed Gulls is described by Morris *et al.* (1992).

Ring-billed Gulls can and will nest on all substrates where Common Terns like to nest. Because Ring-billed Gulls are bigger and arrive earlier, they have taken over many traditional tern nesting islands in the Great Lakes (Courtney and Blokpoel 1983) and this trend is likely to continue. Thus, if a certain island that is now supporting a medium-to-large tern colony is set aside for conservation purposes, it may well be that the island will be taken over by gulls and that human intervention will be required to maintain the Common Tern colony. On the other hand, Caspian Terns have nested successfully and in stable numbers for many decades on the same islands despite the increase of the gulls. Because the Caspian Terns nest on only relatively few islands, these islands obviously have very high conservation value for this species.

Bird conservation usually focuses on those species that are officially designated as endangered, rare, and/or of special concern. In the context of the Great Lakes islands, this would mean we would be interested in the Black-crowned Night Heron, Great Egret, Great Black-backed Gull and the two tern species. In the Canadian Great Lakes, the Great Egret is a relatively new

breeding species that has expanded its breeding range northwards from the U.S., and the Great Black-backed Gull, also a recent invader, is essentially a marine species that has established a foothold as a breeder in the Great Lakes over the last three decades (Ewins *et al.* 1992). It could be argued that protection of these two species is, therefore, of lower priority than that of the Common and Caspian Terns, which have historically nested in the Great Lakes.

Another complicating factor is that the need for conservation can, and is, being pursued at several levels: national (i.e., Canada and the U.S. in the case of the Great Lakes islands), state (eight states bordering the Great Lakes), provincial (all Canadian portions of the Great Lakes are in Ontario), and lower levels of government such as conservation authorities, regional municipalities, cities, etc. All these different levels may have different criteria to rank conservation priorities and different modes of operations to effect conservation in the field. In addition, conservation is the main concern of many non-governmental organizations such as The Nature Conservancy and World Wildlife Fund, and they, too, may use differing criteria and ways for realizing their conservation plans.

Clearly, it is well beyond the scope of this paper to provide detailed plans for the conservation of colonial birds that nest on the natural islands of the Great Lakes. However, having shown the importance of these islands for colonial waterbirds, we hope that this paper stimulates the various organizations to develop the necessary conservation programs. Certainly, the workshop of the U.S.-Canada during the summer of 1996 was a step in the right direction, and we hope that this kind of binational, multi-agency approach will continue.

ACKNOWLEDGMENTS

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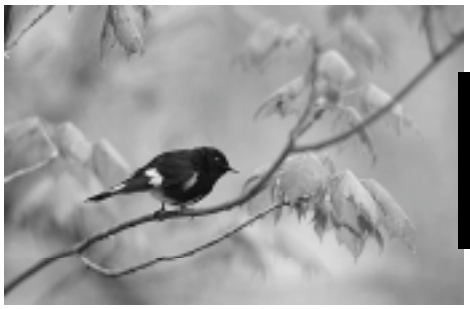

THE IMPORTANCE OF GREAT LAKES ISLANDS TO NEARCTIC-NEOTROPICAL MIGRANT BIRDS

William C. Scharf, Ph.D., Ecological Inventory

Increasing concern has been expressed for the survival of Nearctic-Neotropical migrant birds that nest in northern latitudes and migrate to Central and South America where they spend their non-nesting months. The impact of habitat changes on these bird species are best summarized in Terborgh (1989), Askins *et al.* 1990, Moore and Simons (1992), Sherry and Holmes (1992), and Finch and Stangel (1993). The basis for concern stems from recent fragmentation and destruction of nesting habitats in northern latitudes and destruction of rainforests in southern latitudes. Recognizing the significance of Great Lakes islands to Nearctic-Neotropical migrants as stop-over, refueling, and as nesting habitats is critically important to the survival and conservation of their populations. Great Lakes islands are major regional migration concentration sites (for reasons stated below) and protection of these specific habitats is long over-due.

I began studies of bird migrations on Lake Michigan islands in 1967 with a systematic mist netting and banding program that grew to include five islands (described by Hatt *et al.* 1948) of the Beaver Island archipelago: South Manitou, North Manitou, South Fox, High, and Garden islands. The banding program has formed the basis of several publications describing the distribution and abundance of migratory birds on islands (Scharf 1973, 1983a, 1983b, 1984, 1997; Scharf *et. al.* 1979; Scharf and Jorae 1980; Scharf and Stewart 1980; and Case and Scharf 1985). Others known to have banded migrants on the Beaver Island archipelago are Gary W. Shugart, Leonard Graf, and Michael L. Chamberlin.

Great Lakes islands are attractive to migrating Nearctic-Neotropical birds, as well as shorter-range migrants, for at least three possible reasons (Scharf 1973).

1. Nocturnal migrants caught over open water at dawn seek the nearest land.

Islands seemingly far from northern (in the fall) or southern (in the spring) shorelines still act as powerful magnets at dawn, attracting nocturnal migrants that venture over water in a flight originating from locations hundreds or more kilometers distant the previous night. These approaching birds are often observed flying at dawn during migration seasons in an exhausted and desperate state. Islands far from mainland shores may be the migrant land bird's only means of survival when caught over open water at dawn.

2. Islands often represent northward extensions of the mainland and are included in the flight-path North by internal orientation mechanisms of birds and stochastic events of weather patterns.

Broad-front migrations result in large migratory concentrations on islands in north-south proximity to a mainland point. One example of this is the leading line from Pointe Betsie and Sleeping Bear Point guiding migrants to North and South Manitou islands in Lake Michigan (Michigan). The magnitude of movement and aggregation of migrating birds on these islands during the migration season is visually obvious to keen observers. To further document the migrations, I have regularly captured and banded approximately a hundred species of long-distance migrant birds on the Beaver Island archipelago, Lake Michigan (Michigan), over a three-decade period.

3. Islands are the intended destination for nesting individuals of migratory species regularly resident on islands (although they return to tropical destinations each winter); the islands are the bird's residences for the nesting season.

I have recaptured several individuals of Nearctic-Neotropical migrant species on Lake Michigan islands in years subsequent to their initial banding (Table 1, Figure 1). Recaptures show that some individuals and species (found only in tropical latitudes in the winter) choose the same island route repeatedly. Repeating individuals have so far been recaptured only on the same island as their initial banding. Individuals have been recaptured during several subsequent breeding seasons. The reoccurring presence of individual long distance migrants also demonstrates the potential importance of island habitats for nesting migrants in addition to stopovers during migration. No estimate of the number of birds nesting versus the number continuing their migration is possible with present data. Conventional ecological thought usually attributes only limited and discontinuous nesting habitat to islands, but at this time, when mainland habitats are being seriously fragmented, islands may also represent some of the best remaining contiguous forested habitats for many species.

Table 1. Nearctic-Neotropical migrant bird species recaptured on Great Lakes islands in years subsequent to initial banding.

American Redstart Warbler (*Setophaga ruticilla*)
Yellow Rumped (Myrtle) Warbler (*Dendroica coronata*)
Magnolia Warbler (*Dendroica petechia*)
Nashville Warbler (*Vermivora rufiapilla*)
Wilson's Warbler (*Wilsonia pusilla*)
Yellow Warbler (*Dendroica petechia*)
Red-eyed Vireo (*Vireo olivaceous*)
Philadelphia Vireo (*Vireo philadelphicus*)
Bank Swallow (*Riparia riparia*)
Indigo Bunting (*Passerina cyanea*)

Figure 1. Known ages of American redstart warblers (*Setophaga ruticilla*), a Nearctic-Neotropical migrant species, recaptured on South Manitou Island

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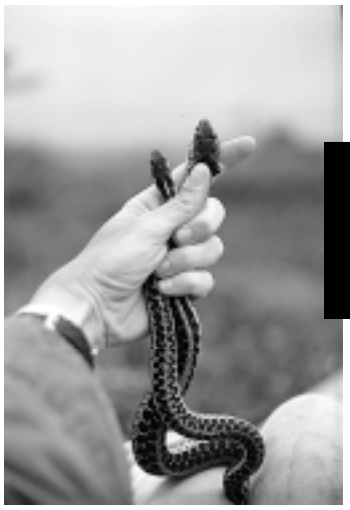

WILDLIFE ISSUES ON GREAT LAKES ISLANDS

Francesca J. Cuthbert, Ph.D.
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INTRODUCTION

Island-dwelling animals have long been of great interest to naturalists and their study has perhaps contributed more than any other aspect of zoology to the foundation of evolutionary biology (Hatt *et al.* 1948). For example, studies on distribution of animals on the Galapagos Islands and the Malay archipelago independently led Charles Darwin and Alfred Russell Wallace to develop similar theories of natural selection in the mid-1800s. About a century later, Robert MacArthur and E. O. Wilson (1963; 1967) used island fauna to predict and explain species diversity and abundance at the level of communities. Their work is considered one of the most important contributions to ecological theory. More recently the study of wildlife on islands has become a priority to conservation biologists because island biogeography theory can be applied to mainland habitat "islands" that have become isolated as a result of global ecosystem fragmentation (Meffe and Carroll 1997). Additionally, islands have proved valuable for studies on exotic species invasions and the vulnerability of endemic species to extinction.

The islands of the Great Lakes have long intrigued naturalists and scientists. One of the earliest published studies was a description of the natural history of Beaver Island, Lake Michigan (Strang 1855). More scholarly works were produced by Adams *et al.* (1909) on the ecology of Isle Royale, Lake Superior, and by Wood (1911) on the avifauna of the Charity Islands, Lake Huron. The purpose of this paper is to summarize wildlife research on islands in the Great Lakes focusing on past contributions and future opportunities for study. Although many studies have been done on islands in all five lakes and their connecting waters, I used Soule's (1993) report *Biodiversity of Michigan's Great Lakes Islands* as the primary source of information for this review. Soule's document provides a good overview of island-based wildlife research because her references are extensive and the report includes islands in three lakes (Superior, Michigan, and Huron).

EXAMPLES OF WILDLIFE RESEARCH CONDUCTED ON GREAT LAKES ISLANDS

Soule's (1993) report contains over four hundred literature citations for studies done on Great Lakes islands within Michigan waters. Over half of the studies and inventories specifically

focus on wildlife or at least include animals as part of the study. This demonstrates the strength of human interest in wildlife. The topics addressed through wildlife studies on islands are broad and include the following subjects: contaminants, critical breeding habitat, habitat management, general ecology, endangered species recovery, general biology, migration, and distribution.

Most studies were done on Isle Royale, Lake Superior (the nation's only island national park) and the islands of northern Lake Michigan, and many can best be described as inventories. For example, approximately fifty are surveys of island vertebrates (e.g., birds, mammals, reptiles, and amphibians) and about twenty are surveys focusing on or include invertebrates (e.g., insects, and mollusks). Soule (1993) reports that inventories indicate that 50 to 75 percent of mainland vertebrates also occur on the islands. Approximately twenty studies address hunting issues for specific species or populations, especially white-tailed deer (*Odocoileus virginianus*) and sharp-tail (*Tympanuchus phasianellus*) and ruffed grouse (*Bonasa umbellus*). Another group of studies are species-oriented and focus primarily on mammals or birds. For example, there are about 20 studies on Isle Royale moose (*Alces americana*) and/or wolves (*Canis lupus*), 20 studies on white-tailed deer, and a small number of studies (one to four each) for beaver, red fox, coyote, snowshoe hare and small mammals. Studies on birds focus primarily on colonial waterbirds (over fifty references), peregrine falcon (*Falco peregrinus*) habitat assessment, piping plovers (*Charadrius melodus*), general raptor papers, Nearctic-Neotropical migrants, and waterfowl. Four papers are on the biology of the garter snake (*Thamnophis sirtalis*). A final category of wildlife studies can be generalized as single-species records and brief natural history. Typically these are accounts of unusual observations on islands. Soule (1993) referenced 27 papers of this type.

THE IMPORTANCE OF GREAT LAKES ISLANDS FOR WILDLIFE

Prior to European settlement of the Great Lakes region, the islands provided important breeding habitat for colonial waterbirds because these sites were typically located adjacent to productive feeding areas and were free from predators. Additionally, the islands provided critical habitat for birds migrating over the open waters of the Great Lakes during both spring and fall. Today the islands continue to hold these same values for wildlife, but the importance of island sites is now *intensified* because habitat changes on the mainland have significantly reduced and altered mainland habitat that was previously used by migrants and in some cases breeding birds. Great Lakes islands continue to provide relatively undisturbed, and in some cases pristine, habitat conditions similar to those that existed prior to European settlement. For some rare species, such as the endangered piping plover, islands provide habitat for over 25 percent of the breeding population (Powell and Cuthbert 1992).

THE VALUE OF WILDLIFE RESEARCH ON GREAT LAKES ISLANDS

Through discussions with other island investigators, my own experiences, and literature cited in Soule's (1993) report, it is clear that wildlife research on Great Lakes islands has made important, and in some cases unique, contributions to a wide range of basic and applied topics in science. Because of their extent, number, wide distribution, diversity, and relatively undisturbed condition, Great Lakes islands remain exciting sites for future research efforts that focus on wildlife biology and conservation. Although this list is by no means exhaustive, the following are some examples of past and future studies.

Basic biological research

Great Lakes islands are *living laboratories* for field studies that are difficult to conduct in other environments. For example, islands are ideal for the study of impacts of *herbivores* [e.g., white-tailed deer, snowshoe hare (*Lepus americanus*), moose, and beaver (*Castor canadensis*)] on vegetation structure, community dynamics and, in some cases, ecosystem-scale patterns. Using islands for these studies is especially valuable because some of these islands have never had deer populations, others have had or currently have very large populations, and some islands have populations of intermediate size so comparisons can be made.

Islands are also ideal research sites for studies on *predator-prey relationships*. Important studies focusing on moose and wolves (e.g., Mech 1966; Peterson 1977) and on colonial waterbirds and their predators [red fox (*Vulpes fulva*), coyote (*Canis latrans*), owls, and snakes] have been conducted on islands in the Great Lakes (Cuthbert unpublished data; Southern *et al.* 1985). Additionally, there are extremely dense populations of snakes on many of the islands, which provide opportunities for predator-prey studies not available on the mainland.

Basic questions about *evolution and extinction* are often answered using island populations. Typically the focus is on morphological differences between mainland and island populations as well as studies of genetic isolation among island populations. Furthermore, islands are good locations for studies on *population dynamics* because population boundaries on islands are usually more distinct than on the mainland. Specific topics that have been or could be studied include *animal cycles* (e.g., rodents and snowshoe hare), *dispersal* (e.g., wolf, beaver), and *rapid population growth* [e.g., ring-billed gulls (*Larus delawarensis*), and double-crested cormorants (*Phalacrocorax auritus*)].

Research on human-induced changes and conservation

Great Lakes islands are valuable as laboratories for studying *human impacts* at local, regional and global scales. For example, Great Lakes islands often provide sites where populations of native species can be studied without the presence of *exotics* such as house sparrow (*Passer domesticus*) and European starling (*Sternus vulgaris*). Islands also offer potential research opportunities for studying the *population dynamics* of brown-headed cowbirds (*Malothrus ater*) in relation to their impacts on mainland songbird populations.

Some of the most extensive studies of *environmental contaminants* in the Great Lakes region have been conducted at colonial waterbird sites in all five of the lakes. These nesting islands are ideal for contaminant studies because the large colonies facilitate large sample sizes and represent a continuum of contaminant exposure. Furthermore, island and associated coastal habitat are expected to be significantly impacted by predicted changes in global climate, and provide potential research opportunities to measure and monitor *global change*. For example, wildlife population dynamics may be useful for modeling global warming impacts.

Additionally, the islands provide important sites for comparative studies of *human recreational impacts*. Most coastal habitat is heavily used for summer tourism throughout the Great Lakes. The pristine conditions on some islands provide research opportunities to measure human impacts on physical features and their associated plant and animal communities (e.g., coastal dunes). Finally, the islands have played an important role in research on the biology and conservation of *endangered species* (e.g., wolf, piping plover), and these efforts are likely to continue and increase in importance as mainland habitat management and protection becomes more difficult to achieve due to development pressures.

SUMMARY

Great Lakes islands provide important and in some cases critical habitat for diverse populations of vertebrates and invertebrates that broadly represent the mainland fauna of the region. Past research has demonstrated that the islands are valuable natural laboratories for basic and applied research. There is tremendous potential for future research on the islands. The inaccessibility of many Great Lakes islands has led to their long-term isolation from human impacts that otherwise extend throughout most of the developed world. This makes Great Lakes islands especially valuable sites for studying *environmental change* issues that are of significant concern to the global community.

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PART III: CASE STUDIES

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Case Study 2: The Littoral, a New Vision for the Eastern Georgian Bay
Patrick Northey, Georgian Bay Association

Case Study 3: The International Alvar Conservation Initiative
Susan Crispin, The Nature Conservancy

Case Study 4: Wilderness Management Issues at Isle Royale National Park
Linda Witkowski, Isle Royale National Park

Case Study 5: The Land Trust Movement in Canada
Angus McLeod, Parks Canada

Case Study 6: The Biosphere Reserve Model in Relation to Lake Superior Islands
Robert Brander, National Park Service

Case Study 7: Vegetation Monitoring for the Grand Island National Recreation Area
Sylvia Taylor, Ph.D., Michigan Natural Areas Council

Case Study 8: Les Cheneaux Islands and the Northern Lake Huron Shoreline Program
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Case Study 9: The Purchase of Development Rights on Old Mission Peninsula
Gordon Hayward, Peninsula Township, Michigan

CASE STUDY 1: ST. LAWRENCE ISLANDS NATIONAL PARK

Mary Alice Snetsinger
St. Lawrence Islands National Park

THE THOUSAND ISLANDS: STEPPING STONES ACROSS THE ST. LAWRENCE

St. Lawrence Islands National Park (SLINP) consists of Canadian islands among the Thousand Islands at the west end of the St. Lawrence River. On the border between the province of Ontario and New York state, the Thousand Islands result from the geologic history of the area. The Frontenac Axis is a granite formation that connects the greater body of the Canadian Shield to the Adirondack Mountains; the islands occur where the remnants of worn and weathered mountain peaks remain, the rocks of lower elevation being covered by the St. Lawrence River.

Park islands constitute 900 hectares of land in the form of all or part of twenty-one islands, distributed along 80 kilometers of the river. Canada's smallest national park, also one of the oldest, SLINP cannot hope to maintain ecological integrity (its mandate outlined in the National Parks Act) acting alone, no matter how skilled our efforts. Park holdings are fragmented, partly due to their island nature, and face a variety of pressures from the large population of people in the region.

Historically, people have inhabited the region for many years, including prehistoric use by natives, on a seasonal basis. The major influx of settlement began in the 1783-4 with the immigration of the United Empire Loyalists who cleared the land for agriculture. The Thousand Islands became highly popular for recreational purposes in the mid to late 1800s, resulting in the construction of many large and elaborate resorts, railroad access, steamship ferry systems, and many private "castles" on the islands.

Today, land use in the region is varied:

- urban centers are growing outwards from several points;
- rural residential use is growing;
- farm abandonment is allowing some cleared lands to return to a forested state through natural succession;
- recreational activities have been increasingly popular in the region since the 1950s; and
- the St. Lawrence Seaway brings heavy vessels through the region from the Great Lakes and up to the Great Lakes from around the world.

ECOSYSTEM MANAGEMENT

Edward Grumbine's (1994) review of ecosystem management publications identified ten themes of ecosystem management:

1. Hierarchical context: a "systems perspective" that looks at all levels and seeks connections.

2. Ecological boundaries: management must work across administrative and political boundaries.

3. Ecological integrity: protecting total native diversity, and ecological patterns and processes.

4. Data collection: more research and data collection, and better management and use of collected data.

5. Monitoring creates an ongoing feedback loop of useful information.

6. Adaptive management: approaches management as a learning process that incorporates results of previous actions.

7. Interagency cooperation: managers must cooperate, integrating differing mandates and goals.

8. Organizational change: changes in the structure and operation of resource management agencies.

9. Humans embedded in nature: people cannot be separated from nature.

10. Values: human values play a dominant role in ecosystem management goals.

St. Lawrence Islands National Park is entering the fourth year of a seven-year ecosystem management pilot project. Grumbine's analysis of ecosystem management themes was a very timely and useful check against which to measure our approach. We also identify two other themes important to our project. Grumbine did not highlight these as specific themes, although he did touch on aspects of them. However, we felt them to be so important that we also focused on them individually. They are:

11. Goals and objectives: having a clear understanding of the desired result is critical to success.

12. Communications: vital to success, the park must clearly identify all stakeholders and communicate clear and audience-appropriate information on ecosystem management, and the communications must be truly interactive.

SLINP Program Weaknesses and Strengths

An assessment of the SLINP ecosystem management program identifies the following weaknesses and strengths:

Weaknesses	Strengths
Organizational change	Interagency cooperation
Adaptive management	Data collection
Values	Goals and objectives
	Communications

WEAKNESSES

The weaknesses of the program generally fall into areas over which the park, as an organization, has little control. Organizational change, for instance, which implies changes in the structure of agencies and the way they operate (Grumbine 1994), is a complex and long-term issue. Change is occurring at the park level and is reflected in such things as the formation of inter-agency committees. SLINP also has input into the process of change as part of a larger organization, but the change of such things as professional norms is typically a very slow one, and the park can have only a small degree of influence.

Adaptive management refers to the assumption that scientific knowledge is provisional and that, therefore, management must be looked at as a learning process or continuous experiment. Incorporating the results of previous actions allows managers to remain flexible and to adapt to uncertainty (Grumbine 1994). However, this idea involves changes to entrenched approaches and beliefs, and SLINP can play only a small role in such a large-scale and long-term evolution.

Similarly, SLINP cannot expect to play any major role in affecting or modifying people's fundamental values. Despite the role of scientific knowledge, societal values play a dominant role in ecosystem management goals (Grumbine 1994). No government agency or agencies can dictate what those values will be; we can only offer information and choices and hope to affect the decisions made through the provision of the best available data.

STRENGTHS

The SLINP program is doing well in some areas. Interagency cooperation is a requisite of using ecological boundaries and requires cooperation between Federal, state or provincial, and local management agencies as well as private parties (Grumbine 1994). Managers must learn to work together and integrate conflicting legal mandates and management goals.

The park has a record of cooperative efforts, chiefly at an operational level. These include joint efforts with the Canadian Wildlife Service and the New York State Department of Environmental Conservation. These efforts have been broadened with the initiation of the ecosystem management approach. They include work with the Canadian Thousand Islands Heritage Conservancy (a grass-roots, nonprofit land trust), the St. Lawrence Parks Commission (a provincial commission examining a biosphere reserve initiative), and acting as a catalyst in the formation of *FASTLINE* (the Frontenac Axis - St. Lawrence Information Network on the Environment).

FASTLINE is an international, multi-agency coalition with a goal of sharing information and facilitating regional analyses that none of us would do alone. The group has been working together on an ad hoc basis for almost four years, but has only been more formally recognized since the fall of 1994. Since 1994, the group has signed a memorandum of understanding and an accompanying terms of reference, has developed a bibliography of Canadian and American resource management agencies in our area of cooperation (with contact names and addresses and information on mandate and data available), has sponsored an international research needs symposium, and has developed a funding proposal and terms of reference to carry out a gap analysis. Current members of *FASTLINE* are the Cataraqui Region Conservation Authority, Queen's University, the St. Lawrence Parks Commission, St. Lawrence Islands National Park, and the United States Fish & Wildlife Service.

Grumbine (1994) pointed out that ecosystem management requires more research and data collection and better management and use of existing data. SLINP has a good data bank of information about parklands but relatively little information about the surrounding parts of the ecosystem. With the implementation of this ecosystem management project, this approach is being broadened.

The use of new technology is one area that has great potential for the types of analyses we need to do, and has been embraced by the park. Satellite images are being used to better understand landscape-scale features, functions, and processes. Change-detection work has begun, using geographic information systems to analyze these images. The analytical power available through the use of these computer systems allows the analysis of complex, large-scale changes, and processes.

Similarly, detailed information from aerial photography is used to support park planning. Again, by using computers we can do predictive analyses to identify sites of potential natural or cultural interest. For example, physiographic features can be analyzed to identify sites of potential archaeological interest.

Grumbine (1994) does not identify goals and objectives as an explicit theme, although he does refer to their importance. However, we feel that they are important to the success of the ecosystem management project at SLINP and we have focused a significant effort on clearly defining our own goals and objectives.

"No man is an island." It has been widely acknowledged that conservation of biodiversity and maintenance of ecological integrity goals cannot be met by simply managing lands over which we have jurisdiction. Though SLINP is an islands park, we are profoundly affected by and cannot ignore what is going on around the islands of the park. It was the realization that we cannot meet our mandated goals on our own, no matter how skilled our management, that led to the ecosystem management pilot project.

The definition of our goals and objectives has been captured in an Ecosystem Conservation Plan. Its development reflects some aspects of organizational change for a planning team developed it with participants from the park, other resource management agencies, and a representative of local residents. The plan clearly describes what we want to achieve and how we hope to achieve those things. It also identifies the need for a long-term ecosystem monitoring program. Such a program is now being developed, and parts of the monitoring have already been initiated.

Communication is the final aspect of the SLINP program that has been very successful. The park has traditionally done a good job of communicating natural history information to park visitors, school groups, and special interest groups. With the advent of the ecosystem management project, the focus of the park has been to broaden the information being transmitted to include ecosystem themes and messages. Failure to communicate with other groups and the public regarding our ecosystem management project and its goals and objectives would doom its chance of success.

The communications efforts have also included a media messages series and a landowner stewardship manual. The media messages were short articles—prepared for the park by a freelance writer—and distributed to daily, weekly and tabloid newspapers in the region. The message themes were varied, covering aspects of the ecosystem and including interviews with a number of the people living in it. The stewardship manual is a landowners' guide to caring for their lands. Produced in cooperation with the Canadian Thousand Islands Heritage

Conservancy, the manual is being sold to cover the costs of reprinting. When the conservancy feels that the market has been saturated, any profits will be put into other conservancy projects.

STEWARDSHIP

Stewardship is critical to the achievement of our goals. Most of the land in the Thousand Islands is privately owned. Government managers cannot hope to achieve goals of maintaining ecological integrity by acting on their own. Despite governments' ability to legislate land use and management to some degree, most such decisions are made on an ad hoc basis by individual landowners. Many of those landowners have no intent to destroy or degrade the environment surrounding them, but are simply unaware of the broader consequences of their actions or know of no alternative courses of action.

The challenges faced in the Thousand Islands are the same as those affecting biodiversity elsewhere: habitat destruction, fragmentation, and degradation; the introduction of exotic species; resource harvesting; and pollution. With a large human population, the attendant pressure on the natural and cultural heritage of the area will not decline. The adoption of a stewardship ethic, what Aldo Leopold (1949) termed a "land ethic," may be one option with a strong potential to offer some balance to the traditional expectation that government will undertake all the necessary effort to conserve our ecosystem.

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CASE STUDY 2: THE LITTORAL, A NEW VISION FOR THE EASTERN GEORGIAN BAY

Patrick Northey
Georgian Bay Association

The *Eastern Georgian Bay Littoral* is a vision designed to preserve and enhance the unique landscape and culture of the islands and coastal areas of the eastern Georgian Bay in Ontario, Canada. The word "littoral" is a geographic term for an area that depends on or is related to the shore. The vision then is to change political organization from an east-west to a north-south orientation to follow existing patterns of use and activity along the coastal areas and outer islands and channels.

The *Littoral* is not a theoretical exercise, it is an action plan based on the assumption that the new provincial government is open to creative solutions for reducing the number of municipalities from eight hundred to three hundred as quickly as possible. Our response is to take advantage of the fact that we have directors from across the whole eastern and northern shoreline of Georgian Bay and try to achieve three objectives:

1. Show politicians and concerned citizens a more natural social and economic affinity in a north-south planning entity than having segments of the bay appended to the eastern or land-based entities which exist today. Our strategy is to avoid any involvement in the political merger discussions and to concentrate on filling the other two voids:
   a. Economic development
   b. Waterbody use planning

2. Provide a framework for filling the two voids which will persuade key local tourism operators to take an active role in the design and implementation of the economic development or, as we call it, the ecotourism plan for their community and the whole *Littoral*.

3. Help local community leaders to drive the implementation across the Littoral.

STEPS TAKEN TO FILL THE VOIDS

We have hired a well-known planner (Joseph Berridge) to develop an economic framework for the *Littoral*. His approach is not to create a one-right-answer report, but to generate a focused discussion among key citizens in the various *Littoral* service centre communities around what is possible. The purpose is to get the creative juices of individuals in each community aroused and involved in developing and implementing a north-south ecotourism plan.

OUR DEFINITION OF ECOTOURISM

We think of ecotourism as maximizing income for local residents while protecting the key resource—water and landscape—from ecological degradation. We are not talking about resorts every mile up the shore. We are talking about assisting the existing resorts, which are the lifeblood of their communities. For example, the Delawana Hotel at Honey Harbour is talking about becoming a year-round resort. This would change Honey Harbour dramatically because seasonal jobs would become permanent. Another example is that Britt and Key Harbour are welfare zones. They could use an attractive boater-friendly waterfront plan to launch their revival.

THE ROLE OF ECOTOURISM PLANNING

The ecotourism plan must have three features. First, it must include a locally developed plan for each community. Second, it must provide tourism jobs in each community. Finally, it must empower one or more jurisdictions to protect the *Littoral* water and landscape which are its key attractions. This empowerment must include:

1. The ability to deliver existing services such as land use planning, garbage disposal, and road maintenance.

2. The ability to expand marine enforcement.

3. Development of a waterbody use plan which addresses issues such as:
   a. Protection of water from pollution
   b. Control of marine speed, noise, and wakes, as densities dictate
   c. Plans for diverse and compatible recreational uses such as
      i. Anchorage bays for wilderness and weekend boaters
      ii. Resorts
      iii. Camping
      iv. Service centres, including transition marinas, boater marinas with entertainment, boater-friendly communities with entertainment, shopping, and cultural activities

STEPS TAKEN SO FAR

All of the affected townships are aware of the *Littoral* and three of the four have financed this stage of development. The Ontario Ministry of Municipal Affairs and Housing has said they think the concept has merit, but they will not impose it from the top. That said, if they smooth out the bumps and help us get access to various budgets, I suspect that they will have an influence. Furthermore, they have introduced us to the general manager of the Northern Ontario Heritage Fund, which has just been given $200 million, and tourism is one of the areas mentioned in their mandate.

While making the *Littoral* concept a reality may seem far-fetched, it is well to remember that political circumstances have given us an opportunity to protect the destiny of this marvelous resource. We believe that with a good framework for an ecotourism plan and a complementary waterbody use plan for the whole *Eastern Georgian Bay Littoral*, we can provide a chart and a course, which will benefit all. I believe our chance for success is very good. Furthermore, I think we will know in a few months—not years—whether we have a chance to succeed.

CASE STUDY 3: THE INTERNATIONAL ALVAR CONSERVATION INITIATIVE

Susan Crispin
Great Lakes Program Office, The Nature Conservancy

I was asked to describe the International Alvar Conservation Initiative because it represents a coordinated effort to protect a unique slice of Great Lakes biodiversity across the entire region. This paper discusses 1) the target resources, 2) the process of organizing the project and setting objectives, 3) progress made to date, and 4) lessons learned.

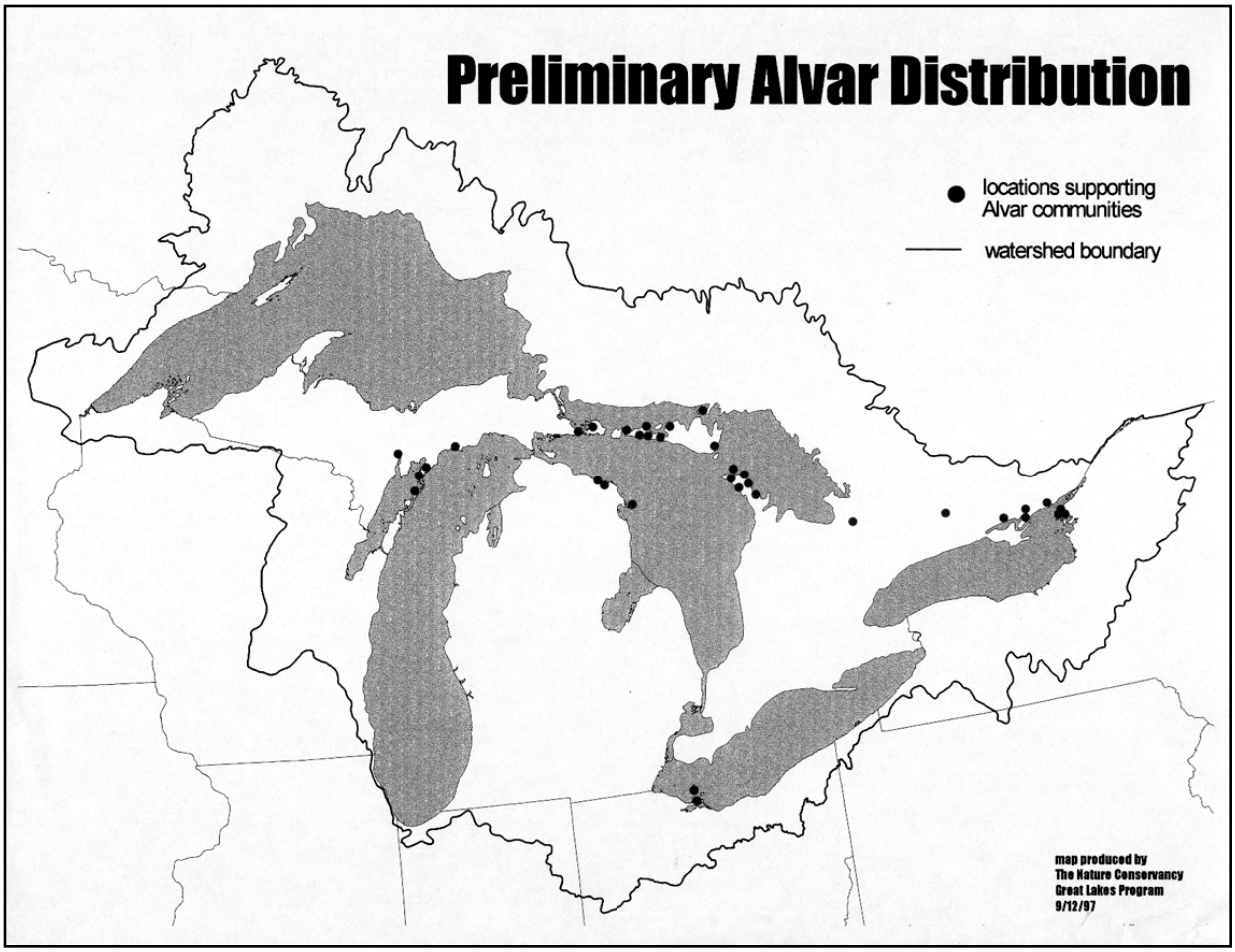
THE RESOURCE

First, what ***is*** an alvar, anyway? In truth, it doesn't look like much. The first time I saw one, it reminded me of an abandoned airfield. Flat bedrock, with cracks and crevices in which plants have gained a toehold. But like just about anything else, when you get to know them, they start to grow on you. They come in a great variety, and support a fascinating diversity of plant and animal life, including an unlikely mix of prairie and arctic-boreal species. Because they can be so colorful when in bloom, they've been called "Nature's Rock Gardens."

Alvars are scientifically defined as "areas of horizontal limestone or dolomite bedrock characterized by distinctive flora and fauna, with very thin or absent soil, sparse tree cover, and alternative periods of flooding and extreme drought." Swedes were the first to describe this type of ecosystem.

In North America, alvars are known only in the Great Lakes region (Map 1). While our alvars are structurally similar to the European ones, their species composition is quite different from those of the Old World. The zodiac of alvars in the Great Lakes region follows the arc of the Niagaran Escarpment. They range from Michigan's western Upper Peninsula eastward through the archipelago of northern Lake Huron, and down the Bruce Peninsula. They reappear on the islands of western Lake Erie and Ohio's Marblehead Peninsula and at scattered locations across southeastern Ontario to northwestern New York.

Map 1. Preliminary alvar distribution in the Great Lakes basin



In all, approximately 90 percent of Great Lakes alvar areas lie in Ontario. Because they are rare in New York and Michigan, The Nature Conservancy chapters there have fielded major projects to ensure their protection. But because each state had so little of the whole, trying to understand their rarity, diversity and ecology was like two blind-folded people trying to describe an elephant—one by touching the tail and the other the trunk. They were understandably frustrated with their lack of information on the great body of alvars outside their project areas. They expressed a keen desire for more communication with Canadian colleagues on the ecology and protection of Ontario's alvars.

While the first North American alvars were identified in Ontario in the 1960s, progress in their protection has been limited. Ontario alvar experts Paul Catling and Vivian Brownell reported only some protection at only five sites as of 1995 (Catling 1995), and identified serious threats from quarrying and development. On this basis, they recommended Ontario's alvars as a high priority for further protection.

From a regional perspective, alvars presented an ideal opportunity for coordinated conservation planning. Their importance as an endemic Great Lakes ecosystem of national and global significance, the international concern for their protection, and the need for more information to support ongoing conservation activity all provided a good basis for coordinated regional action. It also offered an opportunity to develop and test a much-needed model for collaborative region-wide conservation of key Great Lakes ecosystems. Such a model could be useful for strategic protection of many other endemic Great Lakes features such as dunes, coastal marshes, lakeplain prairies, and bedrock shores.

ESTABLISHING THE PROJECT

To gauge the level of partner interest in a collaborative initiative, The Nature Conservancy's Great Lakes Program Office organized a meeting of key alvar conservation experts in the summer of 1994. Attended by about 20 individuals from New York, Ontario and Michigan, this group shared information and reviewed their collective knowledge base on alvar conservation. They identified three major areas in which greater knowledge is needed to inform and drive successful alvar conservation work. These areas are:

1. What is it?
   - What is the diversity of alvar communities across their range?
   - What rare species—especially invertebrates—do they support?

2. Where is it?
   - How are key community types and species distributed across the alvar range?
   - Which sites are of the highest quality?
   - What combination of sites would best protect all alvar species and communities?

3. How does it function and what needs to be done to protect it?
   - Is periodic fire necessary to sustain alvar ecosystems?
   - What is the source of annual floodwaters and are they threatened by human activities?
   - How much browse damage is caused by large deer populations?
   - How severe are exotic species, and what are the "triggers" for their expansion?

One benefit of this meeting was a tremendous exchange of knowledge. Part of the gathering included visiting an actual alvar site, giving folks an opportunity to compare perceptions and have a "hands-on" learning experience. Another outcome of the meeting was that the group decided to move ahead in developing a grant proposal to the Great Lakes Protection Fund. Seven major goals were identified for the proposed three-year project:

1. Develop an accurate range-wide assessment of the distribution and extent, character, diversity, condition, conservation status, threats, and ecological requirements of alvar systems and their individual components within the Great Lakes-St. Lawrence drainage.

2. Document a series of high quality sites that represent the best opportunities to ensure long-term protection of the full range of alvar diversity and function, and make recommendations for their protection.

3. Develop a working knowledge of how alvar ecosystems function, including the ecological conditions and processes essential to their maintenance, major threats, and techniques available to address those threats.

4. Increase awareness of the uniqueness and value of Great Lakes alvar systems among scientists, policymakers, landowners, and the general public through scientific and interpretive materials and through the popular media.

5. Identify and engage key institutions and individuals representing all levels (national, state or provincial, regional, local) in setting conservation objectives and implementing strategies to protect key areas.

6. Develop a mechanism for monitoring the status of alvar elements and ecosystems and, collectively on a regular basis, assessing new information, progress toward objectives, and making course corrections to improve the success of alvar conservation strategies.

7. Create a replicable model for regional collaboration in the identification, understanding, and conservation of biodiversity using an ecological approach and building on existing institutional capacity.

The budget to accomplish these objectives totaled over $400,000. Half was requested from the Great Lakes Protection Fund, with about 25 percent pledged by the partners and the remaining 25 percent to be raised from other sources. The request to the Fund was successful, and a growing group of cooperators met again in the spring of 1995 to begin planning implementation of the project.

PROGRESS TO DATE

With the second year of field work now drawing to a close, the project has already yielded some very interesting results. Ecological inventories have documented many different types of alvar communities, including alvar shorelines of shelving rock, inland alvars on areas of nearly solid pavement, alvars on crumbling cobble-strewn substrates, and alvar savannas with scattered bur oaks. Even more remarkable is that each of these types occurs on Manitoulin Island, which appears to support the highest area, diversity, and quality of alvars in the entire region.

Other alvar types are being documented at many high quality sites elsewhere in the region. These include the unique riverine alvar along Michigan's Escanaba River and the grassy alvars of the Carden Plains (long a stronghold of cattle ranching in southern Ontario). Species surveys are also turning up valuable information. Ontario snail expert Wayne Grimm is finding rare glacial relict species, as well as what he believes to be a number of species that are new to science. Leafhopper expert Andy Hamilton has found a surprising number of rare species in the alvars of Ohio's Marblehead Peninsula, which were thought to have been largely decimated by quarrying. Large populations of the regional endemic plants lakeside daisy and ram's-head lady's-slipper have also been documented, especially in the alvars of Manitoulin Island.

Preliminary research results have also been promising. A study of alvar hydrology has shown that floodwaters come primarily from surface runoff rather than groundwater. The unique bur oak alvar savannas of Manitoulin Island appear to be maintained, at least on the modern landscape, by cattle grazing. Coring of some diminutive juniper and cedar trees on the alvars has revealed them to be many hundred of years old, displacing the notion that periodic fires have maintained those rocky plains in an open condition. And a preponderance of Canada bluegrass (*Poa compressa*) on some of the alvars in southeastern Ontario appears to indicate heavy disturbance from past cattle grazing. These insights, and more that will undoubtedly emerge from the research now underway, will be invaluable for planning, protection, and management strategies.

Good progress has also been made toward increasing awareness of Great Lakes alvars as a unique and valuable resource. Project partners have produced several articles in newsletters and magazines that highlight alvars and the international efforts to protect them. By borrowing the design of a new information kiosk at New York's premier alvar preserve, workers in Michigan saved money and time in setting up a similar interpretive structure at Michigan's major alvar preserve.

Finally, the engagement of key partners has grown organically through the publicity and outreach generated by working group members. Now numbering over forty active participants, the working group is also beginning to make plans for the third year of the project. This final phase will focus on analyzing the information collected and sharing results with a broader audience that includes land managers, key decision-makers, and conservation practitioners. With the benefit of this information, priorities and objectives can be set for alvar conservation across the entire region and joint strategies developed to achieve them.

Already, the information, publicity, and momentum generated by this project are helping to support increased protection for important alvar areas, particularly in Ontario where the need is greatest.

PRELIMINARY LESSONS LEARNED

Since the project is still mid-stream, we haven't yet made a careful review of strengths and weaknesses, successes and failures, and lessons learned from them. However, from our experience so far, I can make a few observations and suggestions about how to manage successfully a project of such geographic scale and institutional complexity.

- New money is essential to support new work. Many great project ideas fail because the responsibility for carrying them forward rests with people who, though enthusiastic and capable, are already over-committed.

- On the bright side, there is tremendous potential for support of truly international, region-wide work with clear objectives and is well planned.

- Coordination and support (financial, communications, meetings, etc.) of large-scale, multi-partner efforts requires a major time investment—in the case of this project, 30 to 50 percent of two professional full-time equivalents, as well as some administrative support (about 10 to 20 percent). Without dedicated coordination and support, too much responsibility for project minutia falls back on participants (who need to be contributing expertise rather than administrative services), and/or is likely not to get done at all.

- The ease of group decision-making is inversely proportional to group size. It is virtually impossible to achieve broad consensus on all of the many decisions that need to be made in a project such as this, due both to the challenge of communicating among so many actors and the wide variety of individual perspectives and opinions. We found that what worked best was to achieve agreement at meetings on the key objectives and operating principles, and then confer authority to make actual decisions in various areas to identified lead actors who would consult with group members as appropriate and feasible.

- It's important to be crystal clear about project objectives and stick to them, but at the same time to be flexible about the means of achieving them. This allows room for creativity, different points of view, and learning as you go.

- There will be some level of disagreement (especially about methods and details) that's simply unresolvable and must be accepted, but it's critical that everyone feels they've had a chance to be heard.

- As is always true in life, money complicates things. Access to new money will generate healthy competition among ideas and their proponents and can also place partners who are independent researchers or contractors in an awkward position with respect to participating in group decisions on priorities and funding allocations. Disagreements in this area are the most difficult to manage (open and frank discussion can even be a challenge) and may ultimately fall to the project manager(s) to resolve.

These are just a few early observations, and we undoubtedly have many lessons yet to learn. Hopefully, they can provide some insights into the challenges of such an undertaking. At any rate, our experience so far suggests that the benefits and satisfaction of working across borders to protect Great Lakes biodiversity greatly outweighs the complexity of those challenges.

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CASE STUDY 4: WILDERNESS MANAGEMENT ISSUES FACING ISLE ROYALE NATIONAL PARK

Linda Witkowski
Isle Royale National Park

INTRODUCTION

Isle Royale National Park was established in 1931 as the nation's only island national park. The island is located in Lake Superior and can only be reached by boat or float plane. The main island is 45 miles long and 9 miles wide and is surrounded by two hundred smaller islands. There are no roads on the island and activities operate on natural time following the rhythms of light and dark. The isolation, ruggedness, natural beauty, and prevailing solitude of the island offer visitors a sense of seclusion and respite. Days are measured in footprints.

Lake Superior has been an insulating and protective factor for island species as well as a daunting challenge to continued human habitation. Nearly all of the land portion of the park is wilderness and the island is managed to preserve its natural state and wilderness values. Visitors depend on their own perceptions, physical skills, and selves. Two-thirds of the park is water encompassed within a four and half mile boundary so opportunities for waterborne adventure abound. The park is also an International Biosphere Reserve.

As is common with many islands, the flora and fauna of Isle Royale are unique. There are at least one distinct sub-species of trout and several threatened plant species. The park is the site of the world's longest running study of wolves and moose in predator/prey relationship. The island has a rich cultural history, which includes use by native peoples, copper mining, commercial fishing, lumbering, maritime activities, and resort communities.

MANAGING A WILDERNESS

As stated in the National Park Service's *Management Policies* (1988):

> The National Park Service will manage wilderness areas for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness. Management will include the protection of these areas, the preservation of their wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as wilderness. Public purposes of wilderness will include recreation, scenic preservation, scientific study, education, conservation, and historical use.

In 1976, 99 percent of the land portion of the park was legislated as wilderness. Some areas outside the legislated wilderness were identified as potential wilderness area (PWA) additions while the most heavily developed and used areas were excluded. The PWAs contained some level of development incompatible with wilderness designation, but it was of a type that might be removed in the future so as to reinstate the wilderness characteristics of the PWA. No final decisions have been reached regarding the PWAs.

Isle Royale National Park management staff must confront a number of challenging issues. Summaries of the most serious of these follow.

PLANNING ISSUES

Management is now working without current plans to guide decisions and actions or to address issue-specific or event-specific problems. Without effective planning it is very difficult to initiate preemptive measures for the protection or to determine appropriate levels of use.

A General Management Plan (GMP) is currently being developed. This will be a two-year process with significant public involvement. The GMP process requires an Environmental Impact Statement to meet the National Environmental Protection Act requirements. A GMP must be in place before other plans can be started. The plan will be a broad planning document from which other plans such as a Wilderness Management Plan can be developed. As part of the GMP, a Visitor Experience and Resource Protection (VERP) process will be completed. The VERP information will help identify thresholds at which visitor experiences deteriorate and when resources are unacceptably impacted. It will be used to identify management zones within the park. Preliminary concept alternatives were shared with the public in out GMP newsletter in June 1996 (Issue 3).

The park is currently without a Wilderness Management Plan (WMP) to guide decisions on management and use of the legislated wilderness. Once the GMP is in place, work can begin on a WMP.

EXTERNAL AND INTERNAL IMPACTS

Noise. Noise has become a major concern. One of the descriptors of wilderness is that it is a place "which has outstanding opportunities for solitude or a primitive and unconfined type of recreation" (NPS *Management Policies* 1988). It is virtually impossible to escape noise impacts on Isle Royale. Sources include powerboats operating in the non-wilderness areas, aircraft, and noisy campers. For example, a recent study noted that an aircraft flies over the island every eleven minutes and that powerboat noises can be heard while canoeing on Intermediate Lake. President Clinton has directed the Federal Aviation Agency and Federal land management agencies, including the National Park Service, to cooperate to develop plans to manage aircraft over-flights of sensitive areas. The aviation industry will also be involved in this effort.

Overcrowding. Overcrowding in Isle Royale wilderness during peak use is another growing problem. Peak time typically runs from mid-July through the third week in August. However, the park's popularity is increasing. Visitations in both 1994 and 1995 topped the previous year's levels. This not means more people are on the island during the peak season, but that the park's season is also expanding. Currently only group campers—seven to ten people in a party—must make advance reservations. While a solution has yet not been identified, we are

considering (within the framework of GMP development) a park-wide reservation system that would require all users—hikers, boaters, canoeists, kayakers, etc.—to make advance reservations.

Toxic contaminants. One of the most serious concerns for the entire Lake Superior Basin is that of toxic contaminants. This concern, which is shared by governments, organizations, and individuals, spurred creation of the Lake Superior Binational Program. Concern is for both toxics transported in the atmosphere and point-source discharges such as from pulp mill, mines, and other facilities. Isle Royale was the site where the notion of atmospheric transport of toxics was first recognized when polychlorinated biphenyls (PCBs) and similar toxic materials were found in Siskiwit Lake in the early 1970s. At that time, the researchers expected to use Siskiwit Lake as their "pristine" control site, but instead found high levels of PCBs, which had to be attributed to atmospheric transport. More recently, the herbicide Atrazine has been documented as being present in park waters. In reality, park staff believe the whole spectrum of toxics are present on the island due to distant sources. The good news is that for some toxics, such as PCBs, the levels appear to be dropping.

LACK OF ADEQUATE RESOURCES TO STUDY AND PROTECT THE PARK

There is a lack of good information on many of the park's resources thus it is difficult to say we are "protecting" them. The need for information is critical. In some cases we don't know what we have. In other cases we don't know the "health" level of the resource.

A good example is the coaster brook trout. We have a fish that people can still catch and eat, but according the U.S. Fish and Wildlife Service, the number of spawning pairs is considered to be "dangerously low". Without good information on the size of the population, which we are currently trying to determine, we cannot know if the trout can handle the fishing pressure. A joint effort between the park and the Fish and Wildlife Service may help us answer these questions.

We also lack information on our amphibians, small mammals, insects, and so on. We have good information on the "charismatic" species such as the wolf and moose, and because of this we have a firm policy of how to "manage" them. We are just now getting good information on our inland lake fish. This should help staff develop better management policies and fishing regulations both to protect the fish and provide recreational fishing opportunities. But as to other species, we don't have current valid information or the resources to gather it.

The lack of human resources and the erosion of sources of funding hamper the ability of park managers to address on-the-ground management issues and to gather important information. There is considerable competition within the park for the limited funds available. We must meet state laws in providing potable water and sewage treatment, for example, and these types of needs often must be placed as higher funding priorities than natural or cultural resource management needs.

Our natural resources management staff has only two full-time positions and one summer seasonal position. In some fiscal years the park is able to fund one or two seasonal biological technician positions and/or obtain assistance from a Student Conservation Association resource assistant to help augment the regular staff's ability to actually do some resource management work. While the park has invested over $100,000 in geographic information system (GIS) equipment, the GIS operator position has been vacant for more than two years. Management doesn't have the funding nor the employment ceiling needed to hire a replacement.

Meanwhile, important baseline information is not being collected, inventory and monitoring work is not being accomplished, and the very tools that could be used to support informed management decisions remain idle. Wilderness ranger positions are unfunded which often leaves fragile resources vulnerable to illegal fires, noisy campers, and other unacceptable—but undetected—visitor impacts. The trail maintenance crew has been reduced from 12 to 4 workers and trail conditions are deteriorating following two years of inadequate maintenance.

Park management depends heavily on outside research and assistance. Isle Royale retains high value as an undeveloped wilderness island from the scientific standpoint. While the island certainly receives some human impacts, such as the toxins, it remains one of the better places to study the impact of humans in an ecosystem with very little direct human disturbance. While some might say we oversell the notion of Isle Royale as such a great "natural" laboratory, there remain strong elements of the concept.

CASE STUDY 5: THE LAND TRUST MOVEMENT IN CANADA

Angus McLeod
Parks Canada

WHAT ARE LAND TRUSTS?

Land trusts are organizations dedicated to helping safeguard open space, cultural resources, and wildlife habitat in communities and states and provinces. Land trusts are non-profit, charitable, non-governmental, community-based organizations that work with landowners and public agencies through private sector initiatives to protect land. It is the fastest growing conservation movement in America with over a thousand trusts now formed and growing at the rate of one per week. These organizations have formed because:

- people want choices to ensure their vision for their land continues
- people want to make their own decisions
- there is a generational change involving the transfer of large amounts of land and the parents don't trust their kids to continue to protect the land
- government is turning more power over to people
- development pressures on critical natural areas are increasing

LAND TRUST ACTIVITIES

Land trusts choose to operate in a number of ways from soft (providing information) to hard (acquiring land) approaches. Land trust can do the following:

1. Provide information on the conservation needs of the community and the role of the trust and its activities.

2. Seek community-based knowledge and understanding of the landscape values that define the community.

3. Educate the public about the natural and cultural values of the community's resources and the value of contributing to protection.

4. Assist in land use planning, working with local councils; state, provincial, and Federal agencies; and developers in creative ways to protect areas of mutual interest.

5. Advocate changes in planning and tax policy and legislation.

LAND PROTECTION STRATEGIES

Land trusts work from a tool kit of land protection strategies that are flexible and tailored to the needs and desires of the landowners, the land, and the community. Protection tools include:

- information and education
- verbal agreements
- written agreements
- management agreements
- leases
- conservation easements
- purchase/sale-back
- creative development
- acquisition
- conservation real estate
- donations to acquire land
- property donations and bequests
- purchase and conveyance of land
- purchase of development rights
- work with developers and local planning offices
- recognizing and rewarding good stewardship efforts

BENEFITS OF LAND TRUSTS FOR ISLANDS

Development can assist communities financially and socially, however uncontrolled development can be costly. While local, state and provincial, and Federal agencies are concerned about the impacts of development, they are often limited in what they can do, the resources they have, and the time it takes to act. On the other hand, community groups can act quickly and directly. Community groups may also have greater support within the community for their intentions, actions, and long-term commitments. Community-based trusts work with neighbours to identify, notify, protection, and manage lands important to the community.

As we look at the islands of the Great Lakes, many will be under private ownership, feeling development pressures, part of family estates, key elements in the sense of place of communities, and vital links in the protected area landscape. These are all reasons to encourage the development of new and existing land trusts in the Great Lakes basin.

Land trusts have the advantage of:

- being flexible, able to act quickly, and with discretion
- setting an example to neighbours and developers on how to manage property
- functioning on a face-to-face basis for fundraising
- building confidence in the community to work towards a desired future and vision

For more information, contact the Land Trust Alliance, 1319 F Street, N.W., Suite 501, Washington, DC 20004-1106, 202/638-4725, FAX 202/638-4730.

CASE STUDY 6: THE BIOSPHERE RESERVE MODEL AND LAKE SUPERIOR ISLANDS

Robert C. Brander
U.S. National Park Service

THE LAKE SUPERIOR BASIN

The Lake Superior basin contains 56,000 square miles of lake surface and 59,000 square miles of watershed. There are six major political jurisdictions: two nations, three states, and one province. The basin includes three large islands—Isle Royale, St. Ignace, and Michipicoten—and six archipelagos—Rossport, Slate, Black Bay Peninsula, Pic, Suzie, and Apostle. The majority of the islands are protected as parks under Federal, state, or provincial governments, or are within areas being considered for park designation. Approximately 450,000 people live in the basin with half within the two metropolitan areas of Thunder Bay and Duluth-Superior.

THE BINATIONAL PROGRAM

Six jurisdictions signed the *Binational Program to Restore and Protect the Lake Superior Basin* in 1991. This is a Great Lakes basin demonstration program with two overall objectives:

1. Zero discharge of persistent, bioaccumlative toxic materials.
2. Ecosystem management at the scale of an entire lake basin.

The program also has five ecosystem objectives:

1. Aquatic community
2. Terrestrial wildlife
3. Habitat
4. Human health
5. Developing sustainability

THE BIOSPHERE RESERVE MODEL

In 1992 the International Joint Commission recommended that Canada and the United States consider creation of a UNESCO-MAB Biosphere Reserve for the Lake Superior basin. The biosphere reserve concept was included in the Lake Superior Binational Program (LSBP). Parks Canada and the U.S. National Park Service have the lead in the LSBP to develop the concept. A biosphere reserve is based on the concept that it is possible to achieve a sustainable balance between the conservation of biological diversity, economic development, and maintenance of associated cultural values. The primary interest is in the biosphere reserve as a model for achieving the ecosystem objective of sustainability, and not in the biosphere reserve designation *per se*. Isle Royale is one of three designated biosphere reserves in the Great Lakes basin. The other two are the University of Michigan Biological Station on Douglas Lake in Michigan and Long Point in Lake Erie.

Applying the biosphere model

To apply the biosphere reserve model, one "core area" would be established in each ecoregion in the basin. "Zones of cooperation" would surround each core area. In these zones, human settlements would be managed to achieve the greatest possible harmony with the ecosystem functions represented in the nearby core areas. There are some ten recognized terrestrial (land-based) ecoregions in the Lake Superior basin and hence ten core areas would be established to meet the conditions of the biosphere reserve model. However, the ecoregions of Lake Superior *per se* are not known at this time. There is a rich array of protected areas already in place in the Lake superior basin to serve as the core areas. In addition, more than 90 percent of the Ontario portion of the basin is in public land. Importantly, some human settlements appear to be predisposed to accept principles of sustainability including Rossport and Marathon in Ontario, the Keweenaw Peninsula of Michigan, and Chequamegon Bay, Wisconsin.

The role of Lake Superior islands

Lake Superior is the ultimate sink for most of the basin's human-caused effluent. Most islands in the lake are or may soon be in protected status. The islands themselves are strategically placed in terms of atmospheric and lake currents to intercept these effluents including toxic materials. Isle Royale, arguably the largest freshwater park in the world, was in fact the location where long-range atmospheric transport of polychlorinated biphenyls (PCBs) was first detected. If island park managers and governments accept our proposed application of the biosphere reserve model, then Lake Superior islands become the ultimate places to detect human activity that has become unsustainable in terms of toxic materials. Of course, if the biosphere reserve model works as we hope it will, those unsustainable activities will be deterred and stopped long before they begin to affect ecosystem functions on and around the Lake Superior islands.

CASE STUDY 7: VEGETATION MONITORING FOR THE GRAND ISLAND NATIONAL RECREATION AREA

Sylvia Taylor, Ph.D.
Michigan Natural Areas Council

Grand Island is one of the larger Great Lakes islands at 13,558 acres. It lies in Lake Superior one-half mile north of Munising (Michigan) and shelters Munising Harbor. Grand Island's 26 miles of shoreline are primarily sandstone cliffs similar to those of nearby Pictured Rocks National Lakeshore. During high water levels earlier in Great Lakes history there were three islands which were later joined into Grand Island as lake levels receded. The resulting union produced a high level of ecosystem and coastal diversity. Island diversity is characterized by swamp forest, two lakes, sand beaches, and a coastal fen. Northern hardwood forests cover the highlands from which numerous small streams, many with waterfalls, cut deep ravines to Lake Superior. These support lush vegetation reminiscent of temperate rainforest conditions.

In the early 1900s Cleveland Cliffs Iron Company acquired a large percentage of Grand Island real estate with the intention of developing a resort and game preserve. Due to the short tourist season, unfavorable winter game habitat, and extra expenses that islands bring, the company ended up by selling off commercial timber, then, in the 1980s, offering the property for sale. A group called the *Trust for Public Lands* purchased Grand Island and held it until 1990 when the Federal Government purchased the land and directed the U.S. Forest Service to manage the island as a National Recreation Area. Except for a few private cabin ownerships, the island became open to public recreation. Current use is primarily day-biking and back-packing. Nevertheless, local business interests still hope for facilities which would attract major income-producing tourism.

Management of Grand Island was assigned to the Hiawatha National Forest which initiated environmental review of potential impacts of alternative development plans. The "public scoping" process produced eight alternative plans which included those having intensive commercial development. A draft environmental impact statement (EIS) was issued in 1992. The Michigan Natural Areas Council (MNAC) commented on the alternatives favoring uses having least impact on the island's threatened species and delicate ecosystems. The MNAC was provided a Forest Service conducted tour of Grand Island vegetation and was included in conflict resolution procedures. The 1994 final EIS "selected alternative" plan was a blend of several of the original plans. It allowed some commercial development, which would impact sensitive vegetation and called for vegetation monitoring

The MNAC agreed to assist the Forest Service monitor the effects of increasing public use on island vegetation. In 1995 a cooperative agreement (Co-operative Agreement Act of 1977; PL 9-224) was finalized between MNAC and the Forest Service to:

1. Establish a system to collect scientific data measuring the impacts of land use on sensitive areas including aquatic, wetland seep, edge, sand beach, and cliff-face communities.

2. Devise a means by which the Forest Service can evaluate the scientific data collected through the monitoring system.

3. Recommend a method by which the scientific findings derived from a monitoring system can be linked with Forest Service management decision-making.

4. Design the program of monitoring, evaluating, and decision-making so that is can be self-executed by the Forest Service at the end of the third year.

5. Identify areas needing systematic botanical investigations and provide plant inventories for some of these areas.

In July, 1996 a group of 13 MNAC members and associates spent four days on Grand Island evaluating the needs and scope of the proposed monitoring program. The next three years will be spent implementing the cooperative agreement. Particular attention has been given to:

1. **Roadsides.** The open edges of island trails provide habitat for a diversity of species absent within the forest. Orchids, ferns, sedges, and other attractive native plants grow with the usual mix of wayside exotics. A threatened grass, *Danthonia compressa*, is scattered along the trails. Major road improvements would severely injure this plant community yet failure to maintain open roadsides would result in its decline.

2. **Williams Landing.** A beach grass new to science, considered derived from an intergeneric cross between *Ammophila breviligulata* and *Calamogrostis canadensis*, is abundant on the sand beach adjacent to the ferry dock. This beach had been occupied by buildings, which were removed in the 1960s. The age of the hybrid grass population is unknown. An old Scotch pine plantation by the dock provides a seed source for pines to germinate among the grass plants. Young pines are rapidly displacing the beach grass. However, the grass is colonizing fresh sand annually dredged for dock maintenance. The scientific importance of this species or its potential for use in erosion control has yet to be studied.

3. **The north beach.** At the north end of Grand Island there is a beach among many miles of rocky coast that provides a safe landing for small boats and is an attractive destination for visitors. This beach is part of a small research natural area. A dune grass *Elymus mollis,* which is a Michigan species of special concern, shares dominance with *Ammophila breviligulata*. *Elymus mollis* appears to be seeding into recently disturbed sand, while *Ammophila briviligulata* maintains dense clonal development with little seed production. It is not known whether strict beach protection would help or hinder the *Elymus mollis* population.

4. **The tombola.** Two highlands (former islands) are connected by a wide strip of land with a sand beach facing lake-ward (Trout Bay) and a fen-marsh facing Munising (Murry Bay). Pines and dry sand vegetation lie between. The beautiful tombola beach is the primary destination of many visitors. There are three designated campsites. Dry sand 120vegetation adjacent to the beach has lichen mats sensitive to foot traffic. Under heavy wear knapweed and other exotics replace these lichens. The fen side is very sheltered from Lake Superior and

constitutes an unusual coastal aquatic feature. There is a small boat dock adjacent to the fen but its use is limited to cabin owners. Increased use of Murry Bay would have unknown impacts on the fen-marsh community.

The MNAC seeks to design a monitoring project that will help determine where vegetation protection or management is needed. It is already clear that some vegetation is in greater need of active management than protection. Uncomplicated long-term methods must be developed to evaluate the effects of protection and active management. For example, photo-monitoring, vegetation mapping, and benchmark stakes which measure changes in clones are included in preliminary monitoring plans for the north beach. An annual check would determine which measurements to retake in a particular year. If *Elymus mollis* begins to decline due to competition from *Ammophila braviligulata,* the Forest Service might consider less protection and increased use of the beach.

Although the vegetation of Grand Island was well studied during preparation of the EIS, vast interior areas have not been examined in detail. Ravines cutting the northern hardwoods, swamp forests, interior wetlands as well as exterior cliff faces are presently less subject to human impacts so have received less attention. Little attention has been given to nonvascular plants. MNAC intends to determine where additional botanical surveys are needed—perhaps leading to discovery of vegetation in need of protection and/or management.

The 1996 MNAC group was able to stay on the island in a Forest Service cabin thus facilitating more contact with local people and other visitors. These contacts left the impression that even development-oriented people were becoming interested in the tourist value of unusual plants. It may turn out that the most important outcome of the MNAC monitoring project will be to help develop this interest and, by example, show that unique plant communities are among Grand Island's most valued assets.

CASE STUDY 8: LES CHENEAUX ISLANDS AND THE NORTHERN LAKE HURON SHORELINE PROGRAM

Christopher Clampitt
Michigan Chapter of the Nature Conservancy

The Michigan Chapter of The Nature Conservancy is working to conserve the ecosystems and endangered species of the Les Cheneaux islands region through a dramatically different program—that of *landscape* or *ecosystem conservation*. The *Northern Lake Huron Shoreline Program* seeks to protect the incomparable natural beauty and rich biodiversity of an eighty mile stretch of shoreline and associated islands between Pointe aux Chenes and Drummond Island on the Northern Lake Huron shoreline in Michigan's Upper Peninsula. This area is unusually rich with coastal marshes, interdunal wetlands, northern fens, beaches, dunes, bogs, forest glades and limestone-based alvar grasslands. Numerous rare species such as Bald eagles, ospreys, Nearctic-Neotropical migrant birds, Caspian and Black terns, threatened fish species, and moose call this area home. The shores are the foundation of the coastal food chain, and are home to federally threatened dwarf lake iris, Houghton's goldenrod, and Pitcher's thistle as well as delicate orchids. In the mature deciduous forests is the federally threatened Hart's-tongue fern. No one has enough money to rescue every significant biological community threatened by development in this incredibly rich region. But while "checkbook conservation" is not the entire solution, when combined with productive partnerships and win-win solutions it gains enormous leverage.

The region is home to an independent breed of people who earn a living from the natural resources of the region, often having to piece together two or three part-time jobs to make a living. Mining, timbering, fishing, agriculture, and the dominant tourism and second-home construction industries all depend on the natural resources and natural beauty of the area. Yet there are ecological and economic signs of stress. While no single road, marina, industry, shopping center, dock, shoreline cabin or activity can be blamed for the incremental decline in biological diversity or quality of life, when added up the stress is clear. For example, perch fishing has declined dramatically, water quality is down, shoreline development has encompassed virtually all non-wetlands sites and is now encroaching on the fragile marshes, and deer are eating white pine saplings that are future forests and summer homes to migrant birds. As biological diversity declines, so goes the rural sense of place, character, and lifestyles that make this region so special.

Rather than pursue piecemeal efforts, the goal of the Program is to protect the ecological and economic health of the entire region. The Nature Conservancy believes it is possible to have both jobs and nature—a sustainable economy and a sustainable ecosystem. Understanding this interconnectedness is basic to a sustainable future. And because of the resilience of the local ecosystems—often protected by the good stewardship of residents—there is reason for hope for a sustainable future for people and nature in this region. Those with the greatest stake in the outcome are those who live on the shores on Northern Lake Huron and share their lives with the natural world around them. The Nature Conservancy, as one player, hopes that by listening, learning, and dialogue we can realize the dreams of a sustainable future for this incredible coastal region.

CASE STUDY 9: PURCHASE OF DEVELOPMENT RIGHTS ON OLD MISSION PENINSULA

Gordon L. Hayward
Peninsula Township, Michigan

On August 2nd, 1994, the voters of Peninsula Township made a decision to preserve the farmland and scenic views on Old Mission Peninsula (Michigan). This decision allows the Township to channel growth in ways that will not destroy the agricultural industry or the quality of life. My purpose in being here today is to describe how one local unit of government (Peninsula Township) has been planning for resource protection and how the *Purchase of Development Rights Program* was established.

NEED FOR AGRICULTURAL PRESERVATION PROGRAM ON OLD MISSION PENINSULA

Peninsula Township is located in Grand Traverse County in northwest Michigan. Peninsula Township is 16 miles long with 42 miles of Lake Michigan shoreline and separates East from West Grand Traverse Bay. The City of Traverse City forms the southern border of the township. Peninsula Township has experienced substantial growth pressure on the agricultural lands and shorelands of the township. The significant changes in elevation and proximity to water that make the area unique for fruit production also make the area very desirable for residential development. The township is involved in a long-term project to protect the unique agricultural land of Peninsula Township. The land is suitable for both residential and agricultural purposes and the short-term economic return resulting from the conversion of land from agricultural to residential use is difficult for farmers to forego. In addition, the value of the property for tax purposes is based in part on the ability to convert to residential uses.

The township has regulated the use of land since 1968 through zoning and a master plan, but it recognizes that zoning regulations and capital improvement planning alone will not preserve this valuable and unique resource for more than a short period of time. Of the 17,700 acres in Peninsula Township, there are currently some 12,000 acres of land in the agricultural district with about 10,000 acres containing the majority of the currently active agricultural enterprises.

LONG-RANGE PLANNING VERSUS SHORT-TERM GAINS

I think it is important to mention some of the basic questions and assumptions that I considered while analyzing the issues and options facing the residents and property owners of Peninsula Township as we considered agricultural land preservation:

- What is the future for a society that does not preserve its resources for future generations?
- What will that future be like if there is no investment in maintaining or enhancing present resources?

- What is the value of short-term economic gains realized by converting prime and unique lands to other uses, if the result is that there are no longer opportunities for long-term gains?

It is absolutely essential that productive agricultural land be available for the production of food and fiber today and in the future. This was recognized by the legislature as spelled out in the planning and zoning enabling acts for local governments. The responsibility for the answers to the above questions ultimately falls upon the individual property owner unless there is some "intervention" by others.

Local units of government are responsible for the public decisions regarding land resources issues unless the state or Federal government decides to also become involved. Regulations of land use by the exercise of "police powers" (e.g., health, safety, and general welfare) have been shown to be inadequate for the preservation of land for the long-term needs of the people. One has only to look at the sprawl of residential, commercial, and industrial development to realize the shortcomings of relying only on police power regulations (zoning, subdivision control). Even careful planning and spending for capital improvements such as roads, transportation, sewer, and water systems have had only temporary effects on long term resource preservation. In addition, Supreme Court decisions in recent years have emphasized the limits on the use of police power ordinances to achieve land protection and preservation. However, there are two acts that provide additional tools for resource protection in Michigan: the Conservation and Historic Preservation Easement Act (P. A. 197 of 1980) and the Farmland and Open Space Preservation Act (P. A. 116 of 1974).

Peninsula Township residents have decided to exercise their responsibility to preserve some unique agricultural land in the township for future generations. They have determined to make an investment today in order to insure or even improve the quality of life into the future. In this process, they have determined that the role of their local unit of government is to address resource preservation issues and achieve a balance of short-term and long-term goals. Furthermore, the process of balancing short- and long-term goals is done within the context of an overall plan for the future. A "comprehensive plan" addresses the need for land to be used for purposes such as residential, commercial, industrial, recreation, transportation, and public facilities as well as land for the production of food and fiber. While zoning and other police power ordinances are essential ingredients in resource protection, zoning by itself will not be effective in long-range resource preservation.

PENINSULA TOWNSHIP AGRICULTURAL PRESERVATION PLAN

There are currently five options available or being considered by Peninsula Township to permanently protect unique farmlands and other unique lands from inappropriate development. I would like to briefly comment on each of them to show how they collectively address the goal of agricultural preservation.

1. Residential cluster development

Peninsula Township agricultural zoning district has a five acre minimum lot size. The zoning ordinance allows *planned unit developments* that allow farmers to sell one-half to one-acre lots for residential development and keep or sell the resulting open space. There is a permanent restriction (i.e., conservation easement) on future development on the remainder of the agricultural land and the overall density of housing is not increased. One property owner or several owners that are willing to participate in a joint cluster project can use this option.

Another type of clustering includes special use permits for projects such as *Winery Chateau* where a condition of the special use permit is that 75 percent of the land has to remain in active agricultural production.

2. Purchase of development rights

On August 2, 1994, township voters approved a property tax increase of 1.25 mills for fifteen years. The Township will now purchase the right to build houses on some 2,000 acres of prime and unique farmland from farmers in the Township which will create a critical mass of farmland protected from residential development so that farming can continue into the future. This purchase of development rights will provide a basis for the transfer of development rights and village cluster programs. The State of Michigan has purchased the development rights on one farm and is considering further purchases to supplement the township purchase program.

During periods of economic stress when the cost of production is not covered by agricultural product sales, agricultural property owners are compelled to look for other ways to raise cash for the fixed and operating costs of farming. The two methods available besides drawing on their own cash reserves are to borrow or to sell assets. The Township feels that farmers will continue to farm if they have an opportunity to do so. The problem is they cannot compete with other farmers economically when they are farming land that has as a major part of its value (and resulting property taxes), the potential for conversion to other uses such as residential. One of the ways to reduce this "residential development value" is to sell part of their assets in the form of "development rights". Two potential purchasers of development rights are governmental or non-profit agencies who will not use the "rights" on some other property, and a developer who will purchase the rights if they can use them to increase the housing density in another area.

The benefits of this approach to the residents are that it:

- Preserves a unique agricultural resource
- Reduces the number of houses on the Peninsula
- Reduces property taxes over the long term for roads, fire stations, paid police, and fire fighters
- Reduces future traffic problems
- Preserves open space and rural character
- Retains shoreline, farmland, and scenic views
- Retains quality of life and maintains equity in property
- Guides development to appropriate areas

The benefits to landowners include:

- Program is voluntary, each farmer can decide for themselves
- Farmers receive money for the development value of the land and keep the farmland for their business
- An immediate cash return to farmers for retirement, debt reduction, or new investment in plantings or equipment
- Reduction of property taxes to those related to agricultural use.
- Reduces value of property for estate planning
- Assurance that residential development will not create a situation where continued farming is impractical

3. Local open space development rights agreement (P.A. 116)

The planning commission is considering a new amendment to the comprehensive plan. The amendment would allow the township to enter into agreements with farmers for a minimum of ten years if the farmer would agree to not develop their property. In exchange, the property would be assessed at the restricted agricultural rate during the term of the agreement. This is intended to allow the farmer to farm without being faced with higher and higher taxes. It will prevent premature development of the farm, and would also allow the township time to negotiate clustering or purchase of development rights on the property.

4. Village cluster

The Peninsula Township Planning Commission is undertaking a study of creating one or more *village clusters* as a way of encouraging the shifting of development potential from agricultural land to a higher density area where public facilities can be economically provided and where lower cost housing opportunities can be created. This program will supplement or become part of the transfer of development rights program. An addition element in this program is developing the concept of a "fast track project review process" which, it is hoped, will encourage developers to use the transfer of development rights option rather than traditional development.

5. Transfer of development rights

Peninsula Township is currently working on a transfer of development rights concept. Under this program, farmers in areas designated in the township master plan as *transfer sending areas* would be able to sell the right to develop houses on their property to someone wishing to develop land identified as a *transfer receiving areas* in the master plan. A property owner in a receiving area would be allowed to develop to a higher density by using development rights purchased from a sending area.

DISCUSSION OF COMMONALTIES AMONG THE CASE STUDIES

This is a "shopping list" of things we found common across the case studies. Many of these items found their way into the various work groups in the next section. We found that:

- The Great Lakes islands are of global importance and interest.
- The natural features of Great Lakes islands are extremely diverse
- Portions of some islands are much more important that others and need protection
- Human factors are common across case studies in terms of threats and desired uses
- All things are linked
- We need inventories and baseline information including land use histories
- Manitoulin Island is a phenomenal place that needs special attention and protection.
- People and their cultural history are an integral part of many island experiences and we need to include them
- Native Americans and summer people have much to offer in terms of island ecological histories
- A local sense of place is important

We believe it is critical that we:

- Protect those islands that are not yet "developed"

- Develop an institutional framework for sustainable island management
- Understand island limits—economic, infrastructure, biologic—and biological values
- Understand the economic as well as the ecological system, and incorporate economic considerations into conservation and biodiversity programs
- Develop a strategy to decide what's important and why
- Involve all local interests at the start of protection efforts
- Build on existing programs
- Define and consider all potential uses
- Develop strong communication tools and do multi-level communication
- Explore the possibility of island land trusts and consider and expand non-regulatory approaches

Problems we face:

- lack of national goals and objectives
- the inherent popularity of islands means we can "love them to death"
- vegetative damage by deer herds
- there are a wide variety of interested and affected parties with differing priorities
- action tends to happen only during crisis

PART IV: THE NEEDS OF THE GREAT LAKES ISLANDS

Inventory
Judith Soule, Ph.D., Michigan Natural Features Inventory

Research
Thomas Nudds, Ph.D., University of Guelph

Conservation Programs
George Francis, Ph.D., University of Waterloo

Coastal Policy and Land Use
Catherine Cunningham, Michigan Coastal Management Program

Cultural Resources
David Snyder, Apostle Islands National Lakeshore

Public-Private Partnerships and Land Trusts
Angus McLeod, Parks Canada, and Sylvia Taylor, Ph.D., Michigan Natural Areas Council

Networking and Clearinghouses
Karen Vigmostad, U.S.-Canada Great Lakes Islands Project

ISLAND INVENTORY NEEDS

Judith Soule, Ph.D.
Michigan Natural Features Inventory

As we can see, we still have an incomplete picture of the biological resources and conservation needs for the vast majority of Great Lakes islands. The gaps in inventory are many, even among Michigan's rather well studied six hundred or so islands. Contemplating the logistics of a basin-wide biological inventory quickly becomes overwhelming. Considering all the different groups of organisms and ecosystems, the techniques and appropriate times of year, transportation, etc., such a comprehensive inventory quickly becomes a large budget project. Thus, it is important to consider how to prioritize inventory efforts.

As a first step in prioritizing, we need to consider the needs that biological inventory on the Great Lakes islands can fulfill. What comes to mind are these three:

- basic scientific knowledge of both unique and characteristic Great Lakes-influenced ecosystems;
- support for local conservation efforts, especially where threats are imminent; and
- clarification of biological conservation values and needs

As a conservationist, the latter is perhaps the most compelling reason for pursuing more complete inventory of the Great Lakes islands. For example, the ongoing Great Lakes basin-wide inventory of the alvar ecosystem, which is at its best and most extensive on Manitoulin and Drummond islands, is providing a clear picture of the status and conservation needs of this rare natural community. The results of this study should allow us to make a strong case for conservation action at our best remaining or recoverable alvar sites. As a biological scientist, I find the former also perpetually intriguing. However, I also recognize that local conservation efforts often have the greatest potential for actually bringing about conservation results. We may find the greatest benefit from inventory work by looking for areas where we can both illuminate biological conservation needs (thus we hope adding to scientific knowledge) and support or stimulate local conservation efforts.

PRIORITIZING BIOLOGICAL INVENTORY NEEDS

One way to prioritize biological inventory needs is to focus first on elements of biodiversity that are uniquely associated with the Great Lakes. As we have heard earlier in this workshop, the Great Lakes islands epitomize the unique features of this region. They are entirely influenced by the climatic effects of the lakes. They have high quality examples of all the characteristic shoreline types. They have populations of all the unique (endemic) species associated with the Great Lakes shorelines. Clarification of the potential role of islands in conservation of these special Great Lakes elements of biodiversity should be the central focus of an island inventory. The types of information we should try to get from an inventory to ensure that we have a complete (or adequately complete) picture of the remaining Great Lakes shoreline ecosystems are to learn:

1. Where the best examples currently exist,
2. The relative quality of islands versus mainland occurrences, and
3. Something of the potential for islands to continue to support these ecosystems and species.

In Michigan, we have come a long way down this path. We have completed fairly thorough inventories of alvar, bedrock shorelines, Great Lakes marshes, sand dunes, piping plover beaches, peregrine falcon nesting cliffs, and shoreline endemic plants on both the mainland and island shores. The shoreline endemic plants could use more work on the islands, as could insects. Some significant biological holes include the role of islands in providing fish spawning and nursery areas and feeding areas for colonial waterbirds.

Another way to think about prioritizing is to look for the *geogmphical holes* in knowledge. This is useful because the islands within an archipelago tend to have many common geological characteristics, have influences on one another, and their conservation needs can best be assessed by considering them all as a whole. Geographically, in Michigan we have the most knowledge of the Beaver islands in eastern Lake Michigan and Isle Royale, although there are still significant holes in both places. We recently did some community work for the first time in the western Lake Michigan islands as well as Manitou Island off the tip of the Keweenaw Peninsula, some northern Lake Huron islands, and Drummond Island. Elsewhere in the basin, it appears from discussions here that inventory has been less thorough. Some of the poorest known island groups, I gather, include the western Lake Michigan group, those in Potaganissing Bay of the St. Marys River, those in Georgian Bay, and those along the north shore of Lake Superior. Manitoulin island—being the apparent center of alvar in the basin—could also use more inventory work.

Another important prioritizing factor for inventory and research work is to emphasize work that will illuminate *ecological functions* among islands. For example, how do birds use islands during migration? How important are archipelagos as a group? Does it matter if one island in a chain is highly altered? How important are large islands for maintaining the flora and fauna of smaller islands? Thus, targeting a whole archipelago for inventory work, whenever possible, is most likely to yield information that will help promote conservation goals. The plant inventory work of Judziewicz in the Apostle islands (and elsewhere) is a good example of a thorough archipelago inventory. Inventory of island use for stopover and breeding sites for Nearctic-Neotropical migrant songbirds would be useful. To my knowledge, little is known about the ecological relationships among our islands throughout the Great Lakes.

A final prioritizing factor should be that of *risk or threat*. Where we already know that biological diversity is at risk on our islands, we should make sure that we have adequate information to help support conservation efforts.

CONCLUSIONS

Biologically speaking, it seems that we need to have a better idea of just what is known about the biota and ecosystems of Great Lakes islands outside Michigan. A good place to start setting basin-wide inventory priorities might be by preparing an *inventory of existing inventories* similar to what I prepared in 1993 for Michigan's islands.

Strategically speaking, sponsoring and organizing inventories is an appropriate role for agencies and large conservation organizations. Inventories and basic research provide the basis for clarifying and setting conservation priorities necessary to fulfill agency and organization

mandates and goals. Supporting in principle and funding inventories should be a high priority for these organizations.

Realistically speaking, inventory work should be directed where it can fulfill biological needs and also catalyze or energize conservation efforts. Where local conservation efforts are already underway, financial support for inventory may be more easily obtained. These areas are also likely to correspond to areas where threats are greatest. The local impetus to act requires a strong sense of place, and a sense of urgency, usually brought on by a perceived threat to the integrity of that sense of place. This is not to say that we should target inventory entirely opportunistically, but rather, that we should not put on scientific blinders and ignore the "human factor." We can use inventory work to bolster the local conservation efforts and also to build on local efforts to accomplish broader conservation goals. Inventory can be useful in providing a broader context to local issues and raising awareness of the need for larger scale conservation. Thus, I am suggesting that we target some inventories to attempt to tap into local efforts that are situated near (but not necessarily right in) biologically significant island groups.

RESEARCH

Thomas Nudds, Ph.D.
University of Guelph

DISCUSSION GROUPS 1 AND 2: RESEARCH AND INVENTORY

The upshot of the discussion was that we need an *inventory of inventories* so that we can assess the needs of particular islands and archipelagos. We did not prioritize any particular islands for inventory or any particular groups of "elements" for range-wide inventory, but we did begin to identify some islands of particular interest (see below).

We need to:

- Complete an inventory of inventories for islands outside Michigan that is accessible via the Internet and put into a matrix such as:

Major Archipelago	Geologic Substrate	Land Use History	Protection Status	Flora	Fauna	Natural Communities
Archipelago 1 Island A Island B						

- Complete an inventory of human land use history on an archipelago basis
- Do a comparative analysis of the various historical post-settlement uses of islands
- Complete an inventory of invertebrates—this is urgent before more are lost
- Complete basin-wide impact studies of the effects of 1) cormorants and 2) ring-bill gulls on other colonial nesting birds and island biota
- Understand the fisheries significance of islands especially in terms of spawning and nursery areas
- Create disturbance and alternation histories and do a comparative analysis looking at both human and biotic elements (cormorants, ring-bill gulls)
- Compile bedrock soils and substrates to show alliance
- Inventory and research the significance of islands for migratory species including use for summer breeding and migration routes
- Inventory acquisition priorities
- Prioritizing islands by rapid ecological assessment, do flora, fauna, and natural communities inventory of selected islands
- Begin monitoring (repeat inventory) of selective areas and species, and piggy-back on other inventories for maximum effectiveness
- Compile an inventory of ongoing monitoring efforts and create a clearinghouse (Ecological Monitoring Assessment Network (EMAN) exists in Canada and the U.S.)
- Develop site quality criteria based on species composition and diversity similar to "natural"
- Inventory all protected species and regulated entities on all islands
- Umbrella taxa / indicator taxa, and plants / communities as indicators of other taxon
- Complete a massauga inventory

Islands and areas of special importance (but in no particular order) to inventory are:

- Western Lake Erie islands because the situation is changing rapidly due to zebra mussels and birds
- An all-biotic inventory of the islands along the north shore of Lake Superior
- Inventory from the Straights of Mackinac through Manitoulin Island
- The North Channel and MacGregor Bay granite and till islands (French River mouth)
- The Beaver Island archipelago including Beaver Island for plants, communities
- Basic inventory of the Door and Garden peninsulas
- The Detroit River islands such as Belle and Grosse Ile which are important for a research continuum
- The delta islands of Lake St. Clair
- U.S. Thousand Islands in the St. Lawrence River
- Islands of the Georgian Bay
- Potaganissing Bay islands off of Drummond Island; Harbor Island
- Islands of the St. Marys River
- Inventory protected and unprotected islands for baseline data, etc.
- We need to develop prioritizing factors[3] for conservation-driven inventories and research such as:

    Globally rare biota and communities
    Public interests and concerns
    Regionally rare biota and communities
    Cultural resources that are Great Lakes-specific such as lighthouses
    Ecological anomalies (exotics, disturbances, "pest" species)
    Quality measures (e.g., non-disturbed)

[3] These need further discussion.

CONSERVATION PROGRAMS

George Francis, Ph.D.
University of Waterloo

DISCUSSION GROUP 3: CONSERVATION PROGRAMS

The governments of the United States and Canada are signatories to the global Biodiversity Convention and the Climate Change Convention. They have also committed to the ideal of a sustainable society. We need to:

- Need to shift from a reactive to a proactive process that stresses prevention of deterioration of islands
- Collaborate at a larger spatial scale *at the same time* we begin a community-driven (place-driven) island conservation effort
- Consider the six lakes the "universe" and look at the whole system
- Develop a conservation strategy for the Great Lakes ecosystem
- Make sure the big picture concept is relayed to the public on island issues
- Conduct research and inventories that are scientifically defensible and complete a gap analysis
- Develop reciprocal partnerships for inventorying and monitoring
- Help the scientific community find dollars for research and monitoring
- Develop ways for local communities to ask for scientific help
- Identify islands at risk
- Identify success stories in the making and highlight them as "special distinction communities"
- Understand the importance of economic vitality to local communities and the importance of the sense of place
- Ask government agencies to be facilitative, supportive, and to share information and other resources
- Be aware of our shared destinies
- Improve our ability to address conflicts by focusing on interests and not positions
- Consider developing an "umbrella" campaign for all citizens that would link the Great Lakes, the islands, and water quality under a common umbrella of interest
- Develop indicators of sustainability such as a basin-wide sense of identity, recognition of shared future destinies, and understanding of connectedness
- Have local communities define transition (rather than development) economics as a collective exercise
- Look at the hydrodynamics

COASTAL POLICY AND LAND USE

Catherine Cunningham
Michigan Coastal Management Program

The Federal Coastal Zone Management Act (CZMA) establishes national policy for the nation's coasts. Michigan's Coastal Management Program (MCMP) was one of the first state programs to receive Federal approval under the CZMA. Just as Michigan's Great Lakes islands reflect the variety of mainland shoreline types, the problems and issues confronting island managers are the same issues coastal managers are addressing on the mainland. Coastal management issues such as the fragmentation of habitats and the loss of significant natural features take on increased importance on islands. Michigan's Great Lake islands are located, in their entirety, within Michigan's coastal management boundary. The policies and objectives set forth in the CZMA and MCMP provide an excellent framework for island management and protection.

The objectives of the MCMP are straightforward:

- Protect coastal resources
- Limit development in coastal hazard areas or on lands sensitive to alteration
- Provide or enhance public access
- Preserve historic cultural resources
- Conduct research to improve knowledge
- Provide educational outreach on coastal resources

These objectives are accomplished through the administration of state environmental protection regulations, providing financial and technical assistance to coastal communities and administration of the Federal consistency provisions of the CZMA.

The State of Michigan has ownership interest in hundreds of Great Lakes islands. In some instances, ownership includes entire islands; in others, the state may own a parcel of land or simply an interest in mineral or surface rights. The Michigan Departments of Environmental Quality (DEQ) and Natural Resources (DNR) regulate and manage island properties as public trust resources for the citizens of the state. The DNR has management responsibilities over certain state-owned lands and the DEQ has regulatory authority over construction and development on both state and private lands. The DNR prepared an Island Management Strategy for island properties. The Island Management Strategy outlined several good recommendations for management and criteria for island acquisition and was adopted by the Natural Resources Commission in 1992.

Michigan does not have an environmental protection statute specific to islands. Land and water development in Michigan, whether on islands or the mainland, is regulated by a network of Federal and state environmental protection law and in some instances local zoning. While not developed to address islands, these statutes protect significant natural island features such as wetlands and sand dunes. The state environmental laws that protect coastal and island resources comprise the core of the MCMP.

Unlike many other states, land use planning in Michigan, is primarily done at the county, township or municipal level. The MCMP has found that involving local governments and supporting local initiatives is an effective way to improve coastal planning, protection, and management. Both state and local governments have used Coastal Management Program grants for island-related projects. Examples of MCMP projects undertaken by island communities include:

- Conducting a traffic feasibility study and creating interpretive displays on Mackinac Island
- Developing a long-term biological monitoring program for Grand Island
- Revised zoning for North Fox Island which established an Island Conservation District
- Lighthouse preservation and park development on Beaver Island

The Coastal Management Program has also funded several natural feature inventories of coastal endemic species, bedrock lakeshores, wooded dune and swale complexes, presettlement vegetation, historic wetlands, lakeplain prairies, and landtype associations. More recently, the MCMP funded the Michigan Natural Features Inventory's "Biodiversity of Michigan's Great Lakes Islands" (Soule 1993), the 1996 U.S.-Canada Great Lakes Islands Workshop at the Ralph A. MacMullen Center, and the printing of these proceedings. Because of their global significance, islands are a priority for the MCMP and plans are in process to fund critical island inventories and other projects of importance to island protection.

An important tool available to state coastal managers are the Federal consistency provisions contained in Section 307 of the CZMA. Under this statute, Federal agencies conducting activities, issuing licenses or permits, and federally funded projects must comply with state environmental laws. The real benefit of Federal consistency is not so much the regulatory provisions, although they can be useful, but the coordination and consultation that is built into the Federal consistency process. The CZMA requires that Federal agencies consult with the state coastal management program early in their planning process so that the state can identify concerns, applicable state laws, and have substantive input into the planning process.

During the 1996 Island Workshop, Federal and Great Lakes state coastal managers met to discuss ways to improve island management. The group determined that new state environmental regulations specific to islands were neither necessary nor feasible. Island management can be improved through better coordination between government agencies administering environmental regulations and island management activities. The group determined that another coastal management priority is to put sound scientific information into the hands of island managers and decision-makers. Ideas for improved island management that the group identified are outlined below.

DISCUSSION GROUP 4: COASTAL POLICY AND LAND USE

After discussing coastal policy and land use as it relates to Great Lakes islands, this group concluded that:

- New state regulations are not necessary nor feasible
- ***Additional management tools are needed for local initiatives**
- ***Islanders and private landowners need education and involvement**
- We need formal recognition of islands as a system when making individual management and funding and permit decisions (priorities)

- It would be helpful to have International Joint Commission involvement in working with states and the Province of Ontario to develop an international policy or binational program on Great Lakes islands
- ***Visitors need to be educated about minimizing their impacts**
- We need to supplement coastal policies with non-regulatory approaches
- We should improve coordination and communication among managing agencies
- We should use the consultation and coordination provisions of Federal consistency
- ***We need to forge new partnerships**
- We should continue funding island issues (i.e., inventories, management plans, education, local initiatives, conferences, and so on)
- Efforts are needed to increase public awareness of the significance of the Great Lakes islands such as with a non-game poster, Year of the Great Lakes Islands event, brochures, etc.

**Indicates highest priority*

CULTURAL RESOURCES

David Snyder
Apostle Islands National Lakeshore

DISCUSSION GROUP 5: CULTURAL RESOURCES

Conservation of cultural integrity might be defined as the maintenance of lifestyles and historical amenities that represent and characterize the unique nature of local island culture and values. For example, if Federal moneys are involved, the National Historic Preservation Act (Section 106) requires that we take into consideration the significance of cultural resources. Assessing and understanding the cultural integrity of the Great Lakes islands is not only intrinsically valuable, but is also vital in gaining a holistic ecological perspective. Cultural history can allow a determination of pre-settlement conditions of the islands and demonstrate the effects of human impacts on the islands. Areas of human use followed by long-term inactivity can illustrate examples of natural succession and reclamation.

Cultural and ecological values often conflict; an understanding of both sets of values should better enable us to make decisions about island conservation and the trade-offs that may be involved. Conflict can be minimized at the outset by consideration and inclusion of all parties involved.

As part of our island assessment, we need to inventory historical and cultural resources. This inventory should consist of local residents' long-term knowledge that can be gathered through story-telling, old maps, journals, diaries and photos. The inventory should also include ethnographic resources (e.g., First Nation traditions) and archeological/historical sites that can be added to GIS maps of the region.

People find history fascinating. The consideration of cultural resources will build a sense of community awareness and appeal in an emotional way to people who are interested in both the ecology and cultural traditions.

Specific island needs in terms of cultural resources include:

1. Record storytelling about island residents and long-term users, especially senior citizens, to enrich our appreciation of islands. We need to do more of this because long-term residents and users have a special, irreplaceable understanding of their islands. Often they understand and can identify sub-species of biota because they have long-term knowledge that no one else has.

2. When setting policy, consider all stakeholders at the beginning. The residents need to be comfortable with decisions. Sometimes conflicting uses result after poor planning. Sometimes too much is tried initially. For example, at Sleeping Bear Dunes National Lakeshore historic structures were purchased with the initial intent to remove them, but now park managers are required to preserve and come up with management options for them. This raises many questions such as whether easements or some other options would have been better.

3. If Federal money is involved in island manipulation, the National Historic Preservation Act (Section 106) requires that we assess cultural resources and their significance.

4. Use cultural information to determine the early or pre-settlement conditions.

5. The lessons from long-term human use followed by periods of inactivity—where success has wiped out traces of flourishing communities or development—is an interesting example of natural reclamation.

6. It's a value judgment, but we can look at over-development and detrimental resource extraction in horror and learn lessons about what not to do.

7. Not every little log cabin needs to be or should be preserved. Cultural resources need to be looked at and evaluated in the context to the larger area. Comparing resources helps us decide what is special and needs to be preserved. We need to look at cultural resources holistically and realistically.

8. Oral traditions of history should be gathered about all islands as soon as possible while the old people are still alive. Even when funds are tight, volunteers can be trained to work as recording resources such as at Michigan State University's program to train oral historians.

9. All islands should have cultural resource surveys, and architectural sites and buildings should be put on geographic information systems for management.

10. Partnerships should be developed with existing organizations such as municipalities, historical societies, tribes, national park service areas, and universities to tap into existing programs.

11. People find history fascinating, and appeals to people about preserving island cultural resources may be more relevant to people who are not into "nature" or biology.

12. Cultural resources pre-date European contact and we should research and involve ethnographic resources. First Nations and Native Americans should be involved in discussions of island cultural resources.

13. Humans are a cultural resource and are a part of the ecosystem.

14. Sometimes cultural resources or long-held traditions and values conflict with natural resource management. When this happens, dialogue among all interested parties needs to be undertaken in order to reach consensus.

15. As outsiders, we need sensitivity in directing and leading local resource preservation.

16. There needs to be a central repository for island cultural resources including oral histories (written, audio, and video), archival sources (letters, diaries, lighthouse keepers journals),

photographs (which need to be located, gathered, and catalogued), Great Lakes maps and old lake charts, and maps of field locations of cultural resources.

PUBLIC-PRIVATE PARTNERSHIPS AND LAND TRUSTS

Angus McLeod, Parks Canada and
Sylvia Taylor, Ph.D., Michigan Natural Areas Council

NETWORKS AND CLEARINGHOUSES

Karen E. Vigmostad
U.S.-Canada Great Lakes Islands Project

Networks and clearinghouses are critical if we are to guide human activities in ways compatible with the ecoregional and ecosystemic dimensions of Great Lakes islands. First, networks among people allow us to study thoroughly and *come to understand these large-scale ecological dimensions*. Multi-disciplinary networks allow ornithologists to work with botanists, island biogeography theorists, historians, wildlife biologists, silviculturalists, policy specialists, and so on. As work among the disciplines progress, so does our broader understanding and appreciation of ecological connections, pathways, and relationships, as well as the human dimensions.

Second, networks allow us to *better protect and manage* the islands. Cross-sector networking permits researchers to talk with government officials, islanders and owners, developers, private non-profits, and so on. Cross-jurisdictional networks allow people from Michigan to cooperate with Wisconsin to cooperative with Ontario and so on, as well as with their counterparts in Federal, regional, and local governments. Finally, cross-institutional networks allow collaboration among all of the above so that disciplinary, sector, and jurisdictional boundaries practically disappear. This allows the broadest and deepest level of understanding to emerge among a new "community" of scholars and practitioners.

Networks have several problems. First, collaborations are costly to individuals and their institutions. Collaboration adds *time* to every project, obligates additional *money*, and requires more *energy*. We almost always have to give up other things in order to collaborate. This means that before we make commitments, we must seriously consider the trade-offs. Second, collaboration can be messy, frustrating, and at least initially increase conflicts between and among disciplines, institutions, and individuals. Developing skills such as active listening and negotiation to work through these conflicts is an essential component of building strong and effective networks.

Networks are infinitely varied. Probably most fundamental are the informal networks because all important work begins here. Informal networks take the form of phone calls, letters, and emails to discuss issues and share ideas and experience. Formal arrangements become necessary when the complexity and/or intensity of issues grows beyond the ability of individuals to cope. This "forces" institutional commitments with more sophisticated and formalized mechanisms. Task forces, study groups, memorandums of understanding, and other arrangements characterize formal networks. Conferences, workshops, and even new organizations can develop to serve particular networks.

Clearinghouses are repositories of information and resources that can serve a network. People organizing central clearinghouses serve network partners by gathering and maintaining information and other resources needed by the larger group. "Hard" copies of research papers, maps, videotapes, and critical reference materials are stored in one place and catalogued and made available to others. Decentralized clearinghouses are becoming more possible through expanded use of electronic communication and the Internet. We can set up home pages that allow immediate access to vast bibliographies, papers, books, journals, discussion papers, and conference proceedings without the need to have everything in one physical location. Additional links from the home page allow connections to other disciplines, organizations, issues, and sources of funding and support. Electronic discussion lists can be set up fairly easily and inexpensively. Discussion lists allow running dialogues among people with very specialized interests no matter where they live or what type of work they do. Once equipment is purchased and access time provided, electronic communication can provide a "democratic" way to involve many people from almost anywhere on Earth.

DISCUSSION GROUPS 6 AND 7: PARTNERSHIPS AND COMMUNICATION

We included discussions of community awareness and education; networking and clearinghouses; and land trusts and easements. We feel that all three topics support the implementation of the overall goal identified in this report. We considered what is different (and needs to be emphasized) about *islands*, and what we can do. We made the assumption that the isolated nature of many islands makes them unique in some ways that need to be built into the communication strategies.

ISLAND COMMUNICATION NEEDS

Due to the fundamental need for good communications, a *communications strategy* should be prepared as an essential element of any conservation strategy. We suggest an overall communication theme of "Islands Are Not Islands". Such a strategy should cover all three topic areas below.

1. Networking and clearinghouses

- draw people together
- use existing systems and networks
- share data

First steps

1. Identify all groups in the Great Lakes involved with or concerned about the ecological and cultural aspects of islands.

2. Identify those groups with similar island interests.

3. Identify what networking needs are required.

4. Refine the existing U.S.-Canada home page and actively promote its use. Investigate funding sources to assist island interests in gaining access to the Internet.

5. Activate the U.S.-Canada list server.

2. Partnerships

- staff cuts have a higher cost on islands because of the costs of doing business, therefore partners can help to fill voids
- islanders often have a very strong sense of identity that must be considered as a strength in developing partnerships
- land-water interface is the focus of many groups
- public-private partnership is a tool to create and achieve the vision
- since island owners are often absentee or seasonal residents, ensuring some form of long-term vision or use is needed
- land trusts are the largest growing conservation movement; they can provide a "one-stop-shop" for individuals to explore their choices for the future of their lands
- change the way of doing business

First steps

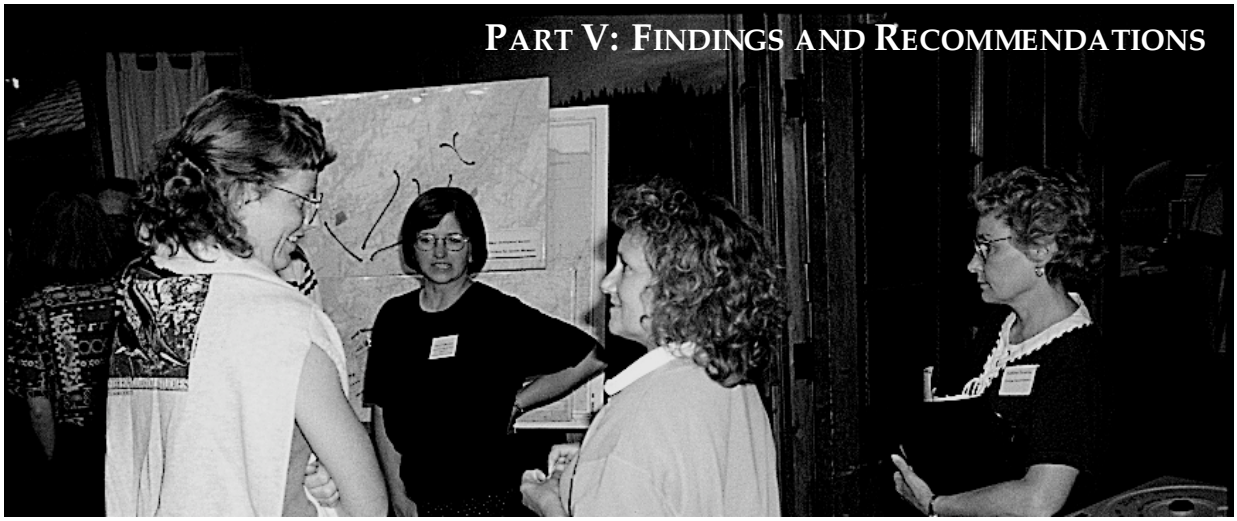
1. Promote the concept of land trusts as a tool for community-based local groups to achieve their island-based conservation goals

3. Community awareness and education

- due to the isolated nature of islands, we need to encourage "big picture" thinking
- think globally, act locally
- remember that people make a difference
- communication as a two-way street
- communication as dialogue

First steps

1. Identify the audiences to ensure that messages are appropriately focused.



Based on the discussions over two days, the writing team summarized the findings and recommendations:

1. Support Island and Archipelago Conservation Planning

The governments of the United States and Canada are signatories to the global *Biodiversity Convention*. They have also committed to the ideal of a *sustainable society*, as is evidenced by the U.S. President's Advisory Council on Sustainable Development and the Canadian National Round Table on the Economy and the Environment.

Within the Great Lakes basin there are a number of important binational, inter-governmental agreements, notably the *Great Lakes Water Quality Agreement* and the *Great Lakes Fishery Convention*. Programs associated with these two agreements have recognized the need to adopt an *ecosystem approach* towards fulfilling their goals and objectives, whereby systems perspectives are taken to help inform local actions. The *Ecosystem Charter for the Great Lakes-St. Lawrence* has been endorsed by a large number of government agencies, private sector associations, and other institutions and groups within the Great Lakes basin. The charter explicitly acknowledged the need for ecosystem integrity, biodiversity, and societal sustainability.

Islands and archipelagos within the Great Lakes are a major component of the Great Lakes basin ecosystem (as defined by the *Great Lakes Water Quality Agreement*). They provide critical habitats for both nearshore aquatic and terrestrial ecosystems and their valued fish, wildlife and other biotic components. Islands also have diverse human cultural heritage values, which reflect the history of aboriginal and early European settlements. However, certain environmental changes and development pressures also threaten them.

Concerns about this situation have resulted in several collaborative endeavors within the Great Lakes basin to develop what we are calling *island conservation strategies:*

By island conservation strategy, we mean strategies that fully protect the biological integrity of islands and archipelagos in perpetuity for humans and other living creatures.

Most are attempting to combine the maintenance of cultural and economic vitality with protection of the islands and their characteristic natural features. These endeavors are not only consistent with commitments to biodiversity and sustainability undertaken by governments in the Great Lakes basin and global levels, they exemplify the kinds of local community initiatives that are needed to follow through and implement these commitments.

Vibrant natural and human economies depend on the maintenance of ecosystem processes and functions that are supportive of natural diversity. Therefore the *goal of a conservation strategy* should be:

To maintain the cultural and economic activity of island communities in ways compatible with the conservation of biological integrity.

Some islands, or sections of them, will be able to support human activities including residence. Other islands may need to be excluded from human use in order to meet the overarching goal of the conservation of biological integrity.

***Recommendation 1*:** Governments and other institutions should facilitate and support efforts to develop and implement *island and archipelago conservation strategies* protective of biological integrity.

2. Document and Share Successes and Failures

While individual initiatives are always important and should be encouraged, fully developed conservation strategies are, of necessity, collaborative endeavors involving diverse stakeholder organizations and groups. Several of the endeavors underway within the Great Lakes basin—for example the *Alliance for Sustainability* embracing the greater Chequamegon/Bayfield, Wisconsin/Apostle Islands area of Lake Superior; the *Georgian Bay Littoral* concept of the Georgian Bay Association in Georgian Bay; and the *Thousand Islands Ecosystem Project* in the St. Lawrence River between the Adirondacks and Algonquin—exemplify the range of issues to be addressed, and local organizational arrangements that are emerging to do this. There is considerable opportunity for exchanging experience to mutual advantage among these communities and groups.

Complex stakeholder processes to achieve common goals through shared decision-making are widespread in North America. Much can be learned about the social dynamics and institutional arrangements that are usually associated with success as well as failure. It is desirable to document the experience and examples from the Great Lakes basin that are not necessarily associated with islands. Prime examples are the *Grand Traverse Bay Watershed Initiative* (concentrating on pollution prevention and watershed management), the *Eastern Upper Peninsula Ecosystem Management* group (centered on forest management), and the *Carolinian Canada* project (focused on conservation of remnant natural woodlands in southern Ontario that exhibit a species composition associated with the Eastern deciduous forest biome). Other efforts outside the Great Lakes basin, such as *Coastal Maine,* that are directed to island conservation issues may also be illustrative.

Topics to examine, other than the factors associated with the effectiveness and efficiencies of their interactive processes (including means for dispute resolution), include collaborative

inventories, research, monitoring, protective management for significant cultural and ecological features, and legal and/or policy frameworks that facilitate and support collaborative endeavors.

> ***Recommendation 2***: Efforts should be made to *create mechanisms to share information and experiences* among Great Lakes island and archipelago associations and initiatives. Efforts should also be made to develop and share case studies describing the successes and failures of similar initiatives.

3. Base Conservation Planning on "Good" Scientific Information

To achieve the overall goal of the conservation strategy for the islands of the Great Lakes, it is necessary to evaluate the *biological integrity* of the islands. The U.S. Environmental Protection Agency defines biological integrity as "species composition, diversity and function similar to that of natural environments in the same geographic region." Islands have long been used as contained laboratories, or microcosms, of larger, nearby mainland ecosystems. In that role, they have served importantly to elucidate the natural processes that govern the distribution and abundance of species. Indeed, the entire science of conservation biology has been an outgrowth of early studies of islands. Against this background of knowledge of the behavior of the natural system, it should be possible to detect, monitor, and assess the effects of environmental changes brought about by anthropogenic agents. Such effects may be diverse and include those due to the long-range transport of air- and water-borne toxins and other pollutants, and those that are the result of changes in the configuration and extent of native habitats that affect the abundance and movements of species within and among islands. Thus islands afford excellent opportunities to examine the nature and extent of the effects of environmental threats from sources both external and internal to islands.

For instance, different types of species appear to respond in regular and predictable fashion to changes in the extent of natural habitats (Figure 1).

Figure 1. Real species-area relations for 38 islands in Georgian Bay, Lake Huron in 1995. Large islands have more species than small ones, and there are more plants than birds, and more birds than herptiles or mammals, especially on small islands. Suppose a developed island (A) has fewer species of birds than an undeveloped island of the same size (B). The length of the line of !-B is a measure of the effect of that development. Further, if bird species are affected, that might indicate that mammals are affected also (C), but research is required as to the usefulness of indicator taxa.

In general, larger islands have more of all types of species than smaller islands, but islands of a given size typically have more species of plants than birds, and more species of birds than reptiles, amphibians or mammals. The difference in the number of species across these groups is most exaggerated on the smallest islands. The regularity of these relationships across the relatively few archipelagoes of the Great Lakes that have been studied suggests a means to rigorously evaluate the effect of environmental change by enabling comparative analyses with islands in natural, undisturbed states (such as those in protected status in national parks whose mandate, in part, is to serve as ecological baseline controls). Thus, consistent with the overall objective, the extent of economic development (residential, recreation, etc.) compatible with the maintenance of biological integrity can be evaluated in ways that are scientifically credible and defensible.

Further, these patterns suggest the means to develop *rapid indices of ecological integrity* that are critical to the continued monitoring of the effects of environmental change. For example, plants and insects are probably too diverse and numerous to survey economically on a regular basis; similarly reptiles, amphibians and mammals are too secretive. But, if the diversity of birds, for instance, is predictably related to the diversity of other groups, then birds might comprise an "umbrella group" for rapid assessment and diagnosis of the approximate state of diversity of other species too expensive to survey. Birds have the additional advantage that many lay people are sufficiently expert in the identification of birds to enable the immediate involvement of local people in research and inventory work of practical importance to them.

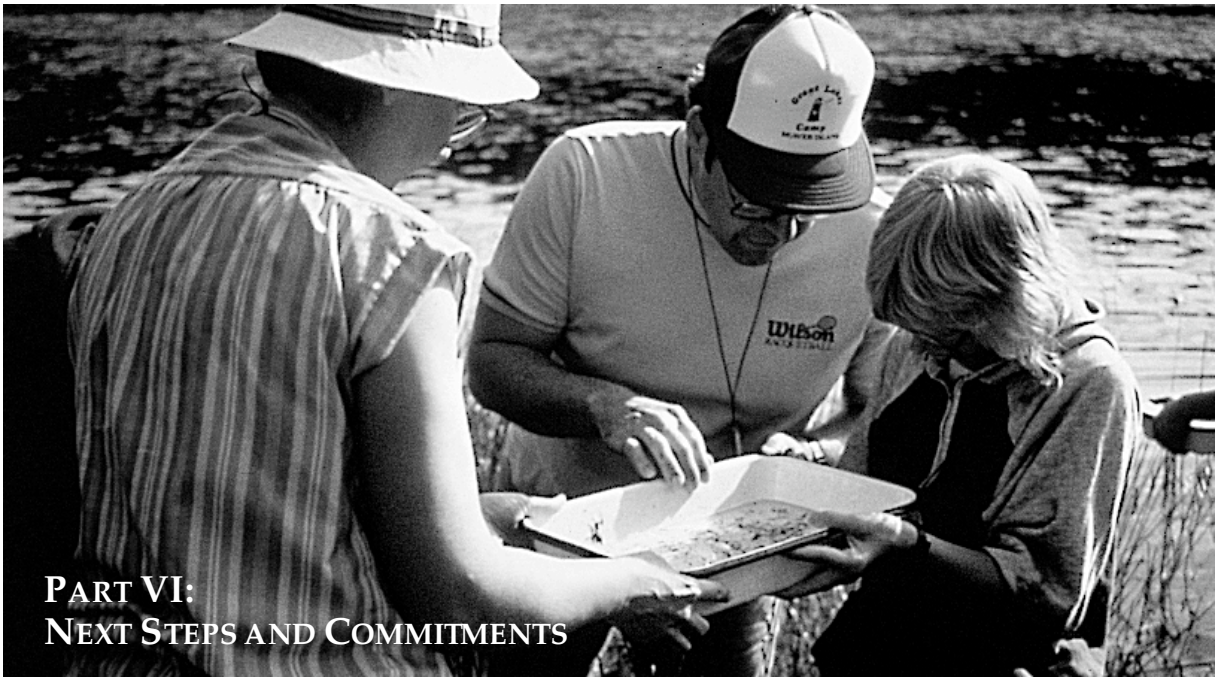
Finally, information about the occurrence of individual species across islands is critical to informed decisions about the extent and distribution of human economic activity. For instance, if species are found to be distributed in "nested" fashion (Figure 2), smaller islands might be deemed expendable from the standpoint that some limited development on them shouldn't compromise the biological integrity of the archipelago as a whole. Conversely, if species are "non-nested", then the implications for planning development would need to include consideration of the unique distributions of individual species on particular islands. However, there is a caveat. If small islands are the source of individuals that allow the persistence of the species on larger islands, then careful consideration would have to be given to developing small islands, regardless of the nested pattern of species occurrences. Therefore, research is required to learn about the extent to which the persistence of species on some islands might depend on the distance to and abundance of species on nearby islands and coastal mainlands.

Figure 2. Schematic figure of the occurrence (composition) of species on islands of various sizes. In A, species are nested such that all species on small islands are also present on larger ones. In B, non-nested patterns indicate that some species are unique to small islands. These patterns have different implications for planning economic activity and island development.

Clearly, to achieve these objectives, adequate, validated and high quality species inventories are essential. A first priority, then, is to *assemble an "inventory of inventories"* of species for all islands and archipelagoes for which they exist. Based on this, an assessment of the need for targeted inventories of different groups of species across different islands can be carried out to achieve basin-wide representation. Further, where locally driven initiatives are already underway, this information can be made available, or the local constituencies can request help with designing inventories of their own.

> ***Recommendation 3:*** Governments and other institutions should facilitate and support efforts to assemble an "inventory of inventories" for the Great Lakes islands.

♦♦♦♦♦



PART VI:
NEXT STEPS AND COMMITMENTS

To carry out these recommendations, workshop participants commit to the following next steps:

1. Work toward the development of conservation strategies for Great Lakes islands and archipelagos. These strategies should be locally driven but informed by the Great Lakes basin as a region.

Next steps:
- Understand and document what is already going on in terms of ongoing initiatives such as the work in the Apostle islands and of the *Georgian Bay Association*.
- Identify potential or emerging groups in island and archipelago communities for future collaborative work.
- Identify other models and examples from other North American communities (e.g., Maine and California) as well as internationally (e.g., the Baltic Sea).
- Be available to work with and support island and archipelago communities in developing conservation strategies.

2. Urge governments and other institutions to facilitate and support these conservation strategies.

Next steps:
- Widely distributed the executive summary of these proceedings to appropriate government agencies and officials as well as other leading Great Lakes institutions.
- Seek information and in-kind contributions to develop conservation strategies.
- Develop a pilot project identifying key indicators and supporting data that could be used to monitor the effectiveness of conservation strategies.

3. Produce an initial *State of the Great Lakes Islands Report* by September 1, 1998. This report should be circulated to island and archipelago associations and interested agencies and organizations for additional information and comment then finalized by September 1, 1999. This report will pave the way for future development of a basinwide Great Lakes islands conservation strategy.

Next steps:
- Identify binational intergovernmental programs, institutions, and commitments that could support or compliment the development of conservation strategies for islands and archipelagos.
- Seek support, information, and in-kind contributions to support the preparation and distribution of this report.
- Summarize relevant monitoring activities.
- Collect an "inventory of inventories" of biological and cultural information and activities involving Great Lakes islands and archipelagos.

4. Strengthen the communication network among people concerned with island conservation. This network should include U.S., Canadian, and First Nation islanders, researchers, policy-makers, and managers.

Next steps:
- Develop and circulate a directory of island and archipelago communities and facilitate an exchange of newsletters.
- Refine the Great Lakes island home page to make it useful to these communities, and make space available for their use as well as a separate list server.
- Activate the U.S.-Canada's island discussion list to tie islanders and relevant mainland communities with one another as well as linking them to policy-makers and researchers.
- Seek support to enable island communities to get on the Internet.
- Prepare a current short list of foundations that will fund Great Lakes island projects noting any major restrictions.

5. Co-sponsor a workshop with island groups and associations to share information and ideas about island conservation.

Next steps:
- Seek funds to enable island communities to help develop and participate in the next workshop.
- Seek funds to enable island communities to help prepare the basinwide Great Lakes islands conservation strategy.

STATE OF THE GREAT LAKES ISLANDS: A SUMMARY

Karen E. Vigmostad
U.S.-Canada Great Lakes Islands Project

This report summarizes the work of 35 Great Lakes island experts—researchers, policy-makers, managers, and islanders—brought together August 18 to 22, 1996 in Roscommon, Michigan. With over 30,000 islands and nearly a hundred years of Great Lakes cooperation between Canada and the United States, it seems almost inconceivable that this was the first gathering of its kind. But indeed, the workshop was the first attempt to gather binational experts from all over the basin. Many of the participants have devoted as many as 30 years to studying, managing, living on, and otherwise caring for Great Lakes islands and their human and non-human inhabitants. Several drove over twelve hours to reach the workshop site. Others cleared their schedule to devote time to this workshop. Some incurred significant personal costs.

As a result of their hard work, we can now say with certainty *that the natural biological diversity of the islands of the Great Lakes is of global significance.* As Judith Soule said at the workshop, the superlatives used to describe the Great Lakes islands—unique, special, magnificent, and rare—do indeed apply. The islands are important elements in an incredibly rich and rare freshwater coastal ecosystem.

As we talked and shared experiences, we began to grasp the fact that *islands are not "islands".* While islands *look* separate—indeed the word "island" implies a distinct separation—islands are truly intricately connected parts of a greater whole. Indeed, islands are alive with connections to near and distant lands. Sometimes islands connect to other islands in groupings known as archipelagos. Other times they connect to coastal mainlands by wind patterns or through the crossing of large mammals over frozen waterways. Still other times they are linked to distant lands through the migration of birds and butterflies. To think of islands as "islands" is wrong.

We also learned of many *excellent initiatives and programs* already underway from which to build new efforts and partnerships to better protect the islands. Importantly, many individuals in local communities are working together to ensure the protection of "their" island in perpetuity. We learned of many successful public and private efforts to protect islands and their biological integrity like the *Northern Lake Huron Shoreline Program, the Littoral* in the Georgian Bay, and the *St. Lawrence Islands National Park Ecosystem Management Pilot Project*.

We also know that many islands face *threats.* Development pressures follow a predictable pattern as global economic forces take root in local communities: hotels and second homes go up, land changes ownership to people or corporations in distant lands, and ecological relationships are disrupted. Toxic contaminants arrive "airmail" on their shores. Browsing deer eliminate plant species. Exotic species decimate natives. People come in increasing numbers to "recreate" on islands and permanently alter habitats. Efforts to control water levels prevent natural fluctuations and reduce coastal diversity. Cumulative impacts of development go unrecorded.

We learned that islands have *many values*. Islands provide living laboratories from which to study the processes of extinction and evolution. They harbor interesting and rare species, and a wealth of biological diversity. Islands hold promise as case studies for human struggles to learn how to live sustainably on this Earth.

We have also learned that islands have *needs*. Islands are uniquely rare at the same time they are supremely vulnerable. Islands are in effect living organisms with a history, life, and destiny of their own. But islands don't vote or pay taxes. They don't have a voice at public forums or in corporate boardrooms. Islands are absolutely dependent on humans to ensure their biological integrity. They need us to better understand and protect them, especially those that are still wild and "undeveloped".

Finally, we learned that it is *not too late*. Many important islands have intact representative ecosystems. People really care about islands and change is in the air. The participants at the workshop have pledged to work together to craft new initiatives. Small projects are beginning to take root in the form of new attention to islands. For example, the Michigan Coastal Management Program has increased the priority of islands for coastal inventory work, and, for the first time, researchers from Wisconsin and Michigan are formally collaborating to inventory the islands of northern Lake Michigan

We hope this document can serve as a springboard to launch additional cooperative, holistic efforts to help better understand, protect, and manage the islands of the Great Lakes as a collection. Our three recommendations are to document successful projects, compile an inventory of inventories, and develop a basin-wide island conservation strategy. We hope U.S and Canadian readers of this report will join us in the support of these and other critical efforts to prevent degradation of the Great Lakes islands and preserve their globally significant biological diversity.

LIST OF APPENDICES

APPENDIX A: LIST OF WORKSHOP PARTICIPANTS

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APPENDIX B: SUGGESTED READINGS, INTERNET RESOURCES, AND ISLAND ORGANIZATIONS

This listing is just a taste of publications about islands, biological diversity, and individual Great Lakes islands and archipelagos. An updated version will be posted on the Islands of the Great Lakes home page (http://rdserv1.rd.msu.edu/islands) as we continue to gather references and other materials.

ISLANDS — GENERAL

Campbell, David G. 1996. *Islands in Space and Time*. New York: Houghton Mifflin Company.

Carlquist, Sherwin. 1974. *Island Biology*. First Ed. New York: Columbia University Press.

Gorman, Martyn. L. 1979. *Island Ecology*. Edited by G. M. D. a. C. H. Gimingham. First Ed, *Outline Studies in Ecology*. London: Chapman and Hall.

Kakazu, Hiroshi. 1994. *Sustainable Development of Small Island Economies*. Boulder, CO: Westview Press.

McEachern, John, and Edward L. Towle. 1974. *Ecological Guidelines for Island Development*. First Ed, *IUCN Publications New Series No. 30*. Morges, Switzerland: International Union for Conservation of Nature and Natural Resources.

Menard, Henry W. 1986. *Islands*. First Ed, *Scientific American Library*. New York: Scientific American Books, Inc.

Sparks, John, and John Andrew Burton. 1976. *Worlds Apart: Life in Cities and Islands*. First Ed. New York: Doubleday and Company Inc.

Stevenson, R. E. and F. H. Talbot. *Islands*. First Ed, *The Illustrated Library of the Earth*. Emmaus, Pennsylvania: Rodale Press, Inc.

Williamson, Mark. 1981. *Island Populations*. First ed. Oxford: Oxford University Press.

GREAT LAKES ISLANDS

A good place to begin is the *Islands of the Great Lakes Internet home page below*, or contact the U.S.-Canada Great Lakes Islands Project, Department of Resource Development, Michigan State University, 314 Natural Resources Building, East Lansing, Michigan 48824-1222, 517/432-6218.

http://rdserv1.rd.msu.edu/islands

The papers in these proceedings have many references on Great Lakes islands. For information on Michigan's islands, the best source is:

Soule, Judith D. 1993. Biodiversity of Michigan's Great Lakes Islands: Knowledge, Threats and Protection. Lansing, MI: Michigan Department of Natural Resources.

The Great Lakes Information Network maintained by the Great Lakes Commission is the best Internet site for the Great Lakes in general:

http://www.great-lakes.net/

They have a nice section on ecosystems:
(http://www.great-lakes.net/ecosystem/ecosys.html)

STATE AND REGIONAL EFFORTS TO PROTECT ISLANDS

State of Maine. *Maine: Exploring Limits: Making Decisions About the Use and Development of Maine's Islands*. 1994. Maine State Planning Office, Augusta, ME.
State of Michigan. December 3, 1992. *Island Management Strategy Committee Report*. Michigan Department of Natural Resources, Lansing, MI.

BIODIVERSITY — GENERAL

1996. *Saving Biodiversity: A Status Report on State Laws, Policies and Programs*. Washington, DC and Albuquerque, NM: Defenders of Wildlife and Center for Wildlife Law.
Baskin, Y. 1994. Ecosystem Function of Biodiversity. *BioScience* 144:657-660.
Eldredge, Niles. 1998. *Life in the Balance: Humanity and the Biodiversity Crisis*. Princeton, NJ: Princeton University Press.
Engel, J. Ronald. 1993. The Role of Ethics, Culture, and Religion in Conserving Biodiversity: A Blueprint for Research and Action. In *Ethics, Religion and Biodiversity: Relations between Conservation and Cultural Values*, edited by L. S. Hamilton. Cambridge: The White Horse Press.
Glowka, Lyle, Grancoise Burhenne-Guilmin, and Hugh Synge. 1994. *A Guide to the Convention on Biological Diversity, Environmental Policy and Law*. Gland and Cambridge: IUCN.
Goulet, Denis A. 1993. Biological Diversity and Ethical Development. In *Ethics, Religion and Biodiversity: Relations Between Conservation and Cultural Values*, edited by L. S. Hamilton. Cambridge: The White Horse Press.
Institute, World Resources, The World Conservation Union, and United Nations Environment Programme. 1992. *Global Biodiversity Strategy: Guidelines for Action to Save, Study, and Use Earth's Biotic Wealth Sustainable and Equitable*. Washington, DC: World Resources Institute.
Institute, World Resources, The World Conservation Union, and United Nations Environment Programme. 1992. *Global Biodiversity Strategy: Policy-makers' Guide*. Washington, DC: World Resources Institute.
Kellert, Stephen R. 1996. *The Value of Life: Biological Diversity and Human Society*. Washington, DC, Covelo, CA: Island Press.
Klemm, Cyrille de and Clare Shine. 1993. *Biological Diversity Conservation and the Law*, IUCN, Gland, Switzerland and Cambridge, UK. ISBN: 2-8317-0192-9
Myers, Norman. 1991. Global Biodiversity II: Losses, edited by G. K. Meffe and C. R. Carroll. Sunderland, MA: Sinauer Associates, Inc.
Perlman, Dan L., and Glenn Adelson. 1997. *Biodiversity: Exploring Values and Priorities in Conservation*. Malden, MA: Blackwell Science, Inc.
Raven, Peter H. 1994. Defining Biodiversity. *Nature Conservancy* 44 (1): 11-15.
Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1997. *Biodiversity II: Understanding and Protecting Our Biological Resources*. Washington, DC: Joseph Henry Press.
Snape, William J., III, ed. 1996. *Biodiversity and the Law*. Washington, DC and Covelo, CA: Island Press.
Wilson, E. O., and F. M. Peter, eds. 1988. *Biodiversity*. Washington, DC: National Academy Press. See pp. 3-18, "The Current State of Biological Diversity".

GREAT LAKES BIODIVERSITY

The most prominent biodiversity effort in the Great Lakes basin is The Nature Conservancy's Great Lakes Program. For more information, see the two documents below or contact Helen Taylor, Executive Director, The Nature Conservancy Great Lakes Program, 79 W. Monroe Street, Suite 1309, Chicago, IL 60603, 312/759-8017.

Nature Conservancy Great Lakes Program. 1997. *Great Lakes in the Balance: Protecting Our Ecosystem's Rich Natural Legacy*. Chicago, IL: The Nature Conservancy Great Lakes Program.
http://www.tnc.org/greatlakes/

Nature Conservancy Great Lakes Program. 1994. *The Conservation of Biological Diversity in the Great Lakes Ecosystem: Issues and Opportunities.* Chicago, IL: The Nature Conservancy Great Lakes Program.
http://www.tnc.org/greatlakes/

The University of Waterloo has publications on biosphere reserves and regional efforts that are relevant to island discussions with a couple examples listed below. Contact the Department of Environment and Resource Studies, University of Waterloo, 200 University Avenue West, Waterloo, Ontario, Canada N2L 3G1 519/888-6576.
http://www.fes.uwaterloo.ca/Departments/ERS/ers.html

1993. *Lake Erie Biodiversity and Ecosystem Health.* Paper read at Lake Erie Biodiversity and Ecosystem Health Workshop, at University of Waterloo. Waterloo, Ontario.

Brian, McHattie, and Skibicki Andrew J. 1992. *Conserving Biodiversity in the Context of Great Lakes Biosphere Reserves.* Paper read at Conserving Biodiversity in the Context of Great Lakes Biosphere Reserves, at University of Waterloo. Waterloo, Ontario.

The Great Lakes Information Network has a section on biodiversity: http://www.great-lakes.net/ecosystem/biodivers.html

ISLAND ORGANIZATIONS

Island Institute

410 Main Street, Rockland, Maine 04841
207/594-9209; FAX 27/495-9314
Institute@midcoast.com
This organization has excellent publications including the annual *Island Journal*. Their focus is on Maine islands.

Island Resources Foundation

Washington DC Office, 1718 P Street N.W., Suite T-4, Washington, DC 20036
202/265-9712; FAX 202/232-0748
The Foundation, established in 1971, is dedicated to the Caribbean islands. Their main office is on St. Thomas, U.S. Virgin Islands (340/775-6225), and they have a Biodiversity Program on St. John's, Antigua (246/460-1740). They have many excellent publications and a super web page: http://www.irf.org/

Islands and Small States Institute

Foundation for International Studies, University of Malta, University Building, St. Paul Street, Valletta VLT 07, Malta.

Tel: 356-248218; Fax:356-230551; e-mail: lbrig@cis.um.edu.mt
Director: Professor Lino Briguglio lbrig@cis.um.edu.mt

The Islands and Small States Institute developed in 1993 from the Islands and Small States Programme, which was established in 1989. Their mission is "to promote research and training on economic, social, cultural, ecological and geographical aspects of islands and small states."

Institute of Island Studies

Harry Baglole, Director, Department of Extension, University of Prince Edward Island
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This is a research, education and public policy institute. They staff the North Atlantic Islands Programme involving Iceland, Isle of Man, Newfoundland, and Prince Edward Island: http://www.upei.ca/~iis/iis.htm. See also their Small Island Information Network page: http://www.upei.ca/~siin/index.html

International Small Islands Studies Association

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Montreal, CANADA H3A 2K6
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The Association is a non-profit organization established in 1992 whose objectives are " to study islands on their own terms, and to encourage free scholarly discussion on small island related matters such as islandness, smallness, insularity, dependency, resource management and environment, and the nature of island life".

APPENDIX C: A MODEL RESOLUTION TO PROTECT GREAT LAKES ISLANDS

We suggest using this resolution when declaring a Protect Great Lakes Islands Day, or otherwise calling attention to the critical importance of protecting these islands.

WHEREAS the governments of the United States and Canada are signatories to the global *Biodiversity Convention* and are committed to the ideal of a *sustainable society*, as is evidenced by the U.S. President's Advisory Council on Sustainable Development and the Canadian National Round Table on the Economy and the Environment;

WHEREAS islands are an overlooked yet integral component in the Great Lakes ecosystem;

WHEREAS islands span a range from natural to highly disturbed conditions;

WHEREAS some islands have ecological conditions not found on mainlands;

WHEREAS islands contain microcosms of human cultures;

WHEREAS people have a special attachment to islands;

WHEREAS islands are particularly vulnerable to development;

WHEREAS islands are the receivers of long-range transport of industrial effluents;

WHEREAS islands serve a great variety of functions for humans and other biological organisms;

WHEREAS islands hold some of the least disturbed, more intact examples of the Great Lakes shoreline ecosystem;

WHEREAS some islands have never had permanent human settlements;

WHEREAS island studies can teach us how to better manage "islandized" mainlands; and

THEREFORE BE It RESOLVED that U.S. and Canadian agencies and organizations provide support for the development of an overall conservation strategy for the islands of the Great Lakes so that we might better understand and protect the biological and cultural integrity of these islands; and

THEREFORE BE IT RESOLVED that U.S. and Canadian agencies and organizations make island ecological, cultural, and socioeconomic research, inventory, monitoring, and other projects a high priority for funding to support the development of a Great Lakes islands conservation strategy.

Individuals who would like a complimentary copy of the executive summary, wish to purchase these proceedings, or receive other information about the islands of the Great Lakes can contact:

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