State of the Lakes Ecosystem Conference 1998

BIODIVERSITY INVESTMENT AREAS
Nearshore Terrestrial Ecosystems

Version 3

Ron Reid
Bobolink Enterprises
Washago, Ontario
Canada

Karen Rodriguez
U.S. Environmental Protection Agency
Chicago, Illinois
U.S.A.

Amy Mysz
U.S. Environmental Protection Agency
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Notice to Readers

This paper on Biodiversity Investment Areas is one of three such papers that were prepared for discussion at SOLEC 98. The idea of Biodiversity Investment Areas originated at SOLEC 96 for the Nearshore Terrestrial Ecosystem. This work has continued and been expanded to include Aquatic Ecosystems and Coastal Wetland Ecosystems. The authors of these papers have drawn information from many experts.

Participants to SOLEC 98 reviewed this document and provided comments, specific information and references for use in preparing this final post-conference version of the paper.

1. Introduction

The SOLEC 96 Land by the Lakes background paper introduced a new idea to Great Lakes managers - the idea that some sections of shoreline have exceptionally high ecological values which warrant exceptional attention to protect them from degradation. These areas, mapped at a coarse scale, were coined Biodiversity Investment Areas - or BIAs in short form.

Like most new ideas, this one is not really new, but rather an extension of previous work and previous thinking in many quarters. But it did garner considerable attention and discussion, and a considerable degree of support. And the concept raised an intriguing question: since the community of agencies with responsibility for managing the Great Lakes has highlighted areas of concern where environmental restoration is a priority, should it also be highlighting areas of special quality - BIAs - where prevention of environmental loss is a common priority?

This report seeks to take the discussion of Biodiversity Investment Areas to the next logical step by looking at each of the 20 shoreline BIAs in more detail, summarizing their values, the individual threats to their security, and their current degree of protection. The authors also provide a brief assessment of each area, and initial thoughts on key protection needs. The tentative boundaries of each BIA are also reviewed and adjusted where appropriate. Vignettes of related local and regional conservation activities are also included, as examples of efforts already underway to protect the values of these areas.

Parallel work is being carried out, documented in other SOLEC 98 background papers, on Biodiversity Investment Areas for coastal wetlands and for aquatic areas. This report focuses largely on nearshore terrestrial values, although some degree of overlap with wetland and aquatic values is inevitable, and perhaps desirable.

Many individuals and organizations assisted in providing information for this report and in reviewing early draft materials; their names are listed in Appendix 1 with our thanks. Their input has been most helpful, particularly in providing local perspectives on areas that they value, and on the threats and degree of health for each BIA. As a result of input received at the SOLEC 98 conference, significant additions have been made to several BIAs.

1.1 Definition and Limitations

Shoreline Biodiversity Investment Areas are *broad areas of shoreline and associated landscape with clusters of exceptional biodiversity values.*

This does not mean that they are pristine. A few BIAs, such as Superior North, have very little disturbance to their natural features and processes. But others, such as Lake St. Clair and Chicago Wilderness, have been substantially altered from their original state, yet retain remnant natural areas and ecological values of exceptional significance.

Biodiversity Investment Areas encompass several concepts. The term "biodiversity" is often defined as including the diversity of life at several levels - the diversity of landscapes at a broad level, the diversity of natural communities, the diversity of wild species, and finally the diversity of genetic material in natural gene pools. Biodiversity incorporates the full range of life, from the microscopic but essential soil bacteria to the soaring eagle, as well as the complex array of landforms that provide habitat for this life.

The concept of "investment" in areas for biodiversity is a recognition that areas rich in life have value, and that they need active support if they are to survive. In some cases, BIAs are still present along the Great Lakes shoreline because of benign neglect, accident of history, or lack of economic motivation to develop other land uses. But the historical pattern is clear - without deliberate management strategies and public policies to preserve the ecological values of shoreline areas, sooner or later those values are degraded as a consequence of incremental changes in land use. Public and private "investment" – in terms of dollars, policy attention, and management – is essential to the long-term health of these ecosystems.

The values that are clustered within individual BIAs could include:

< multiple or outstanding examples of Great Lakes shoreline special communities, such as sand dunes, alvars, prairies, or coastal wetlands;

< concentrations of species of special interest, including rare, threatened and endangered species, Great Lakes endemic species, disjunct species, or colonial birds;

< excellent examples of representation of coastal landforms or typical vegetation and wildlife communities, particularly those in excellent condition or of ususally high quality;

< exceptional levels of natural diversity, including both habitat diversity and species diversity;

< high levels of ecological connectivity, both along the shoreline and to inland or offshore natural features.

1.2 Addressing Other Sites

The identification of shoreline BIAs does not mean that there are no other significant areas of biodiversity along the Great Lakes coast. In fact, numerous other high quality, but smaller, such areas exist. From a basin-wide perspective, however, the emphasis in BIAs is their clusters of biodiversity values which warrant special attention.

At the SOLEC 98 conference and afterwards, several specific suggestions were made for areas which could be considered as potential BIAs, most of them at a somewhat smaller scale than the 20 BIAs recommended in the draft report. These suggested additions might be considered Biodiversity Investment Sites, and incorporated within Lakewide Management Plans to reflect their undisputed importance. Among the sites suggested which could be incorporated in such a category were:

- Clay bluffs and wetlands along the south shore of Lake Ontario from Rochester to Oswego
- The Niagara River corridor
- Wasaga Beach dunes and associated features along the south shore of Georgian Bay
- Scarborough Bluffs and remnant wetlands along northwest shore of Lake Ontario
- Rondeau Bay area on the north shore of Lake Erie
- MacGregor Point and associated areas on the east shore of Lake Huron
- Pinery-Kettle Point area along southern Lake Huron

As well, a number of SOLEC 98 participants suggested that inland features across the Great Lakes basin should also be incorporated into a larger set of Biodiversity Investment Areas. Specific examples mentioned included the Niagara Escarpment and Haliburton Highlands. While this suggestion has merit, it goes well beyond the current nearshore focus of SOLEC.

1.3 Current BIA Activities

This report is intended to be a tool for anyone with an interest in protecting the best of what remains along the Great Lakes shoreline. One way it can do so is by drawing lessons from some BIAs that might be effectively used in the stewardship of others. A few examples are listed here; readers will no doubt find others throughout the report.

< The Environmental Folio developed for the Long Point area by the Heritage Resources Centre of the University of Waterloo is an excellent tool for building local awareness and support. The materials are presented in a user-friendly fashion, they incorporate ecological, economic, and cultural information, and they largely leave readers to draw their own conclusions, rather than advocating any particular solutions.

< The World Biosphere Reserve concept, with its core areas, buffer zones, and zones of cooperation, is already in place for the Long Point and Bruce Peninsula areas (as part of the Niagara Escarpment). This management tool is currently being sought by local organizations for Eastern Georgian Bay, and could be useful in other BIAs as well.

< Coordinated regional planning for the protection and restoration of ecological values within shoreline BIAs is underway in several places. The Chicago Wilderness strategy is a prime example of this kind of regional focus. Regional cooperation and planning is at the discussion stage in the Greater Chequamegon BIA and the Eastern Georgian Bay area. Proposals for a National Marine Conservation Area in the North Superior area employ a similar regional mechanism, but more directed towards aquatic resources. Similar initiatives towards National Marine Conservation Area status are at earlier stages for portions of the West Lake Erie, Eastern Lake Ontario, and Bruce Peninsula.

< In a few instances, special government regulatory or service programs have been established to address areas of special environmental and scenic value, including parts of BIAs. The Niagara Escarpment Plan, which vests land use planning powers in a special provincial Commission and sets a framework for a public parks system, is one such example. The St. Lawrence Parkway Commission and St. Clair Parkway Commission do not control private lands, but provide public recreation and access areas within their areas of interest.

< Recent work on various ecological theme studies has added much to our knowledge about priority areas and conservation needs along the Great Lakes shore and elsewhere, often providing valuable information about various BIAs. For example, the International Alvar Conservation Initiative, coordinated by The Nature Conservancy, will provide a comprehensive analysis of these specialized habitats across the Great Lakes basin, and will highlight the significant role of Mackinac-Manitoulin and several other BIAs. A prairie and savanna theme study for Ontario reinforced the importance of Walpole Island within the St. Clair BIA. A recent report on bedrock shores in Michigan added greatly to understanding of the significance of these communities, and could usefully be extended elsewhere.

< The degree of protection provided within individual BIAs varies greatly, considering public parks and reserves, land acquisition by private conservation organizations, and stewardship by individual and corporate landowners. A national park and several provincial parks have formed the core of natural heritage protection on the Bruce Peninsula. But on nearby Manitoulin, a proposed major land acquisition by non-government conservation groups appears likely to be

more socially acceptable. In some BIAs such as Lake St. Clair, the potential for further land acquisition of natural landscapes is very limited; in others such as Eastern Lake Ontario, there are many opportunities. Strategies for protecting the ecological values of each BIA must be individually developed to meet local needs, with strong local involvement. But in many cases people in one area can learn a great deal from other areas about which strategies have worked well, and their advantages and downsides.

1.4 Next Steps

Participants at SOLEC 98 suggested the following steps for moving forward with the BIA concept:

1. Participants identified a number of strengths and weaknesses in the BIA approaches used for nearshore terrestrial, coastal wetlands, and aquatic areas. There was a strong sense that the three approaches need to be merged to produce a single set of recommended BIAs for the Great Lakes coastal zone.

2. Most participants liked the scale and concepts of BIAs, and suggested that agencies should strive to embed the BIA concept at multiple levels, including within local communities and binational structures. Some concern was expressed that BIA-related initiatives should involve new resources, rather than re-allocations from existing programs.

3. The emerging suite of SOLEC indicators was seen as a valuable tool to help characterize natural systems within BIAs, and refine their identification. The application of indicators could help identify sources of stress and protection priorities within BIAs, as well as developing their role as benchmarks for comparison to other sections of Great Lakes coast.

4. Local stakeholders should be encouraged to participate in processes to develop conservation strategies for each BIA, recognizing the need for adaptive management strategies, and integrating economic, social, ecological and cultural considerations. To assist in developing these strategies, access to community facilitators as well as science contacts is essential.

5. Community-level education and information exchange about BIA values and concerns is needed as a basic step towards implementing protective measures. Scientific information needs to be packaged in a way that is accessible to the public. Successful examples of planning for protection need to be conveyed to people in other BIAs. Similar processes, such as the public processes used to develop Remedial Action Plans, should be examined to see if they can be employed to build local support for the BIA concept.

1.5 Monitoring Progress

Just as it is vital for Great Lakes managers to track progress in restoring degraded areas, it is important to be able to monitor changes in the health and security of Biodiversity Investment Areas. Several of the proposed SOLEC indicators will be especially helpful in achieving this:

Indicator 8132: Nearshore land use intensity

Indicator 8129: Area, quality and protection of special nearshore communities

Indicator 8136: Extent and quality of nearshore land cover

Indicator 8137: Nearshore species diversity and stability

Indicator 8149: Nearshore protected areas

Indicator 8140: Financial resources allocated to Great Lakes programs

Development of these potential indicators is being undertaken through parallel SOLEC 98 background studies and discussions. As well, many of these indicators, and other useful sets of monitoring information, are being developed as part of Lakewide Management Plans, and through the work of the International Joint Commission's Indicators for Evaluation Task Force.

One related initiative which provides a concrete example of how such indicators might be portrayed has been undertaken by The Nature Conservancy Great Lakes Program Office. Using data from the international network of Natural Heritage Programs and Conservation Data Centres, TNC has produced a preliminary status and threats assessment for Great Lakes dune complexes. This methodology shows in graphical form how many of the known good or excellent occurences of this special community type are contained within managed conservation areas, an analysis of their level of protection, and a summary of the incidence of seven categories of threats to their future.

This analysis is based largely on existing information, and could readily be expanded to include most of the other eleven special nearshore communities identified in the SOLEC Land by the Lakes background paper (Reid and Holland, 1997), as well as other elements such as rare species. Repeated every 3-5 years to show changes over time, it would become a valuable record of progress within BIAs and elsewhere along the shoreline. A cooperative program between TNC and other agencies to fund the development of such an indicator system could produce valuable results within a relatively short time frame.

1.6 Report Format

The core of this background report is a description of each of the 20 Shoreline Biodiversity Investment Areas identified through SOLEC 96 and SOLEC 98. For each BIA, we provide a brief overview of ecological features and values, current threats and current degree of protection, and finally an assessment of key protection needs. Readers are encouraged to provide additional information or corrections, and to comment on our analysis of priority needs.

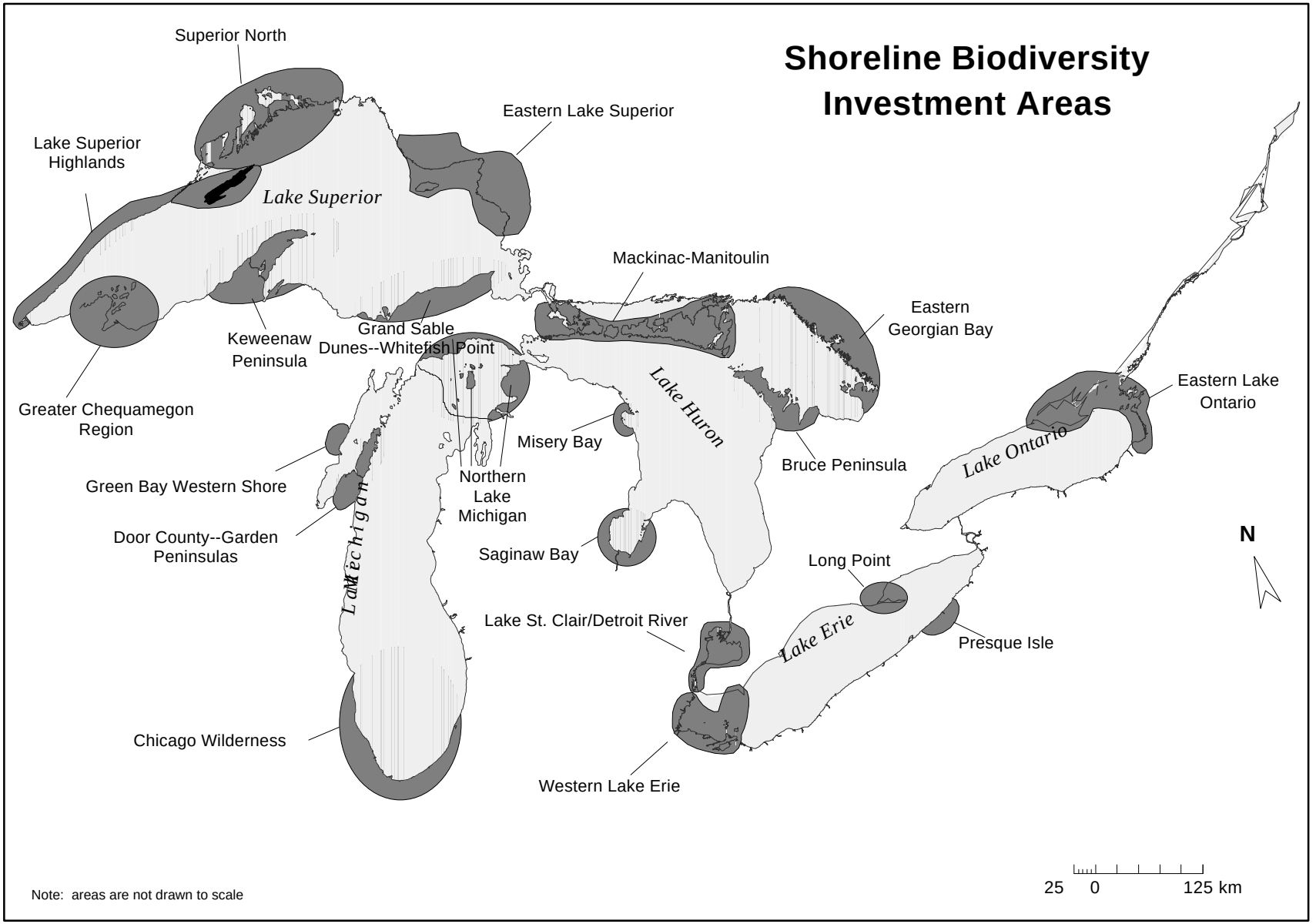

Figure 1 Shoreline Biodiversity Investment Areas

2. Superior North

2.1 Ecological Features and Values

The north shore of Lake Superior from the Sibley Peninsula to the town of Schreiber is a complex mosaic of headlands and islands, with small settlements along the main shore and very limited human presence on the islands. The character of the area is very closely linked to its geology, with diabase-capped mesas and cuestas rising abruptly from the Lake Superior shoreline. The effects of the cold deep lake waters immediately offshore are pronounced in this area. Forests are boreal in nature, dominated by spruce and other conifers, and arctic-alpine plants are found along the rugged coastline.

Among the special ecological features and values of this area are:

Features and values	Typical or significant occurrences
Bedrock beach and bluffs	Shesheeb Point, St. Ignace Island, Channel Islands
Cobble/boulder beaches	Bowman, Paradise, Cobinosh Islands, west side of Sibley and Black Bay peninsulas
Sand beaches	Uncommon, but some on east side of Sibley, Shesheeb Bay, Mountain Bay
Shoreline wetlands	Black Bay Peninsula peatland, fringing wetlands at Granite Point, Hurkett Cove
Bird colonies	Frequent on offshore islands, such as Granite and Gravel Islands in Black Bay
Unusual geological formations	Shoreline funnels on Puff Island; ancient fossils at Rossport; agates on Agate Island; columnar basalt at Grotto Point; Rossport formation bluffs on Channel Islands
Krummholz (wind-stunted vegetation and lichen heath)	Bowman and Paradise Islands
Arctic-alpine flora	Small sites scattered throughout on exposed shorelines
Pictographs	Mouth of Nipigon River, Schreiber Channel
Characteristic wildlife	Several nesting locations for endangered Bald Eagles and Peregrine Falcons; good populations of Timber Wolves, Moose, Black Bear

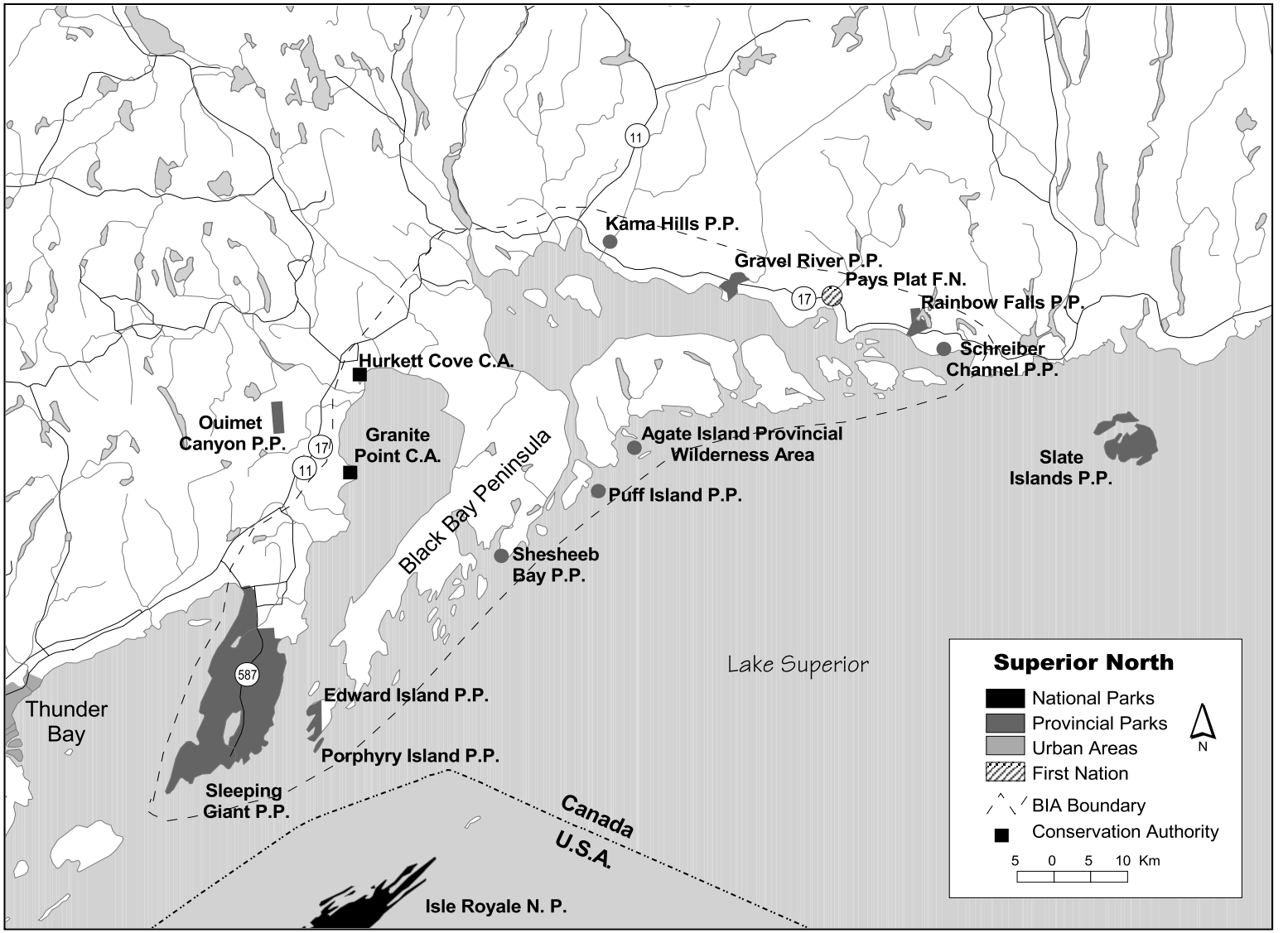

Figure 2 Superior North Biodiversity Investment Area

2.2 Current Threats to Ecological Values

The current degree of stress to natural habitats along the north Superior shore is relatively low. Some industrial logging has occurred on Black Bay Peninsula, and future logging is proposed there. Logging is not currently permitted on the islands. Boating is popular in the area, but this activity is largely serviced from existing settlements, and does not appear to pose a major environmental threat at present. However, increased boating pressure in future may produce environmental stresses related to waste disposal and to temporary camps, saunas, and fire rings along the shore.

Nipigon Bay is designated as an Area of Concern because of industrial pollution from paper mills in the area.

2.3 Current Protection of Ecological Values

A number of protection measures are currently in place along the north Superior area:

Protection Mechanism	Comments
Provincial Parks: Sleeping Giant (Nat. Env.) Porphyry Island (Nature Reserve) Edward Island (Nature Reserve) Shesheeb Bay (Nature Reserve) Puff Island (Nature Reserve) Kama Hills (Nature Reserve) Gravel River (Nature Reserve) Rainbow Falls (Recreation) Schreiber Channel (Nature Reserve) Agate Island (Prov. Wilderness Area)	These parks provide representation of most of the types of shoreline types in the area, together with many special features. Sleeping Giant Provincial Park includes extensive cliff and talus communities, as well as several inland lakes and both exposed and sheltered Great Lakes shoreline. It is especially noted for concentrations of moose, and as a stopover for migrant songbirds. Most of the nature reserves are focused on particular features, including rare plants such as Devil's Club.
Conservation Areas: Granite Point C.A. Hurkett Cove C.A.	The Hurkett Cove conservation area protects one of the few coastal wetlands along this shore.
ANSI Policies: Channel Islands (earth science) Cobinosh Island (earth science) Bowman Island (earth/life science) Paradise Island (earth/life science) Kama Hill (earth science) Black Bay Peninsula Peatland (life science) Pass Lake (earth science)	Some of the ANSIs (Areas of Natural and Scientific Interest) in this area are located on Crown lands, and are managed to protect significant earth and life science features. Others on private land need stewardship approaches to landowners to encourage their protection, since municipal planning controls are sparse in this region.
First Nation Lands: Pays Plat First Nation	This Indian Reserve occupies a small area.
Crown Land Management: Superior north islands	Commercial forestry activities are not currently permitted on any of the islands east of Black Bay Peninsula.

2.4 Assessment

1) Ecological Representation: This area offers good representation of the range of shoreline types typical of the northern Lake Superior region. Typical landscapes and many of the area's special features are represented within the existing protected areas system.

2) Diversity: The highly broken topography and varied bedrock and surficial features within this area contribute to a diverse mix of habitats. As well, the interspersion of islands and peninsulas with the lake waters produces a strong diversity of exposed and sheltered shoreline types.

3) Condition or Quality: Most of the shoreline within this area remains undeveloped, with pristine wilderness conditions on many of the islands. While recreational and tourism use of the area is growing, local residents appear to place a high value on the natural qualities of the whole area (Twynam, Johnston and Payne, 1997).

4) Ecological Connections: The area shows strong east-west connections along the chain of peninsulas and islands, and strong aquatic connections between the lake, sheltered bays, and adjacent rivers. Along the mainland shore, connections to adjacent upland forests are relatively good, but somewhat impaired by the presence of Highway 17 and a rail corridor.

5) Special Features: As noted in the Features and Values table, the Superior North area incorporates many special ecological features, particularly those related to distinctive earth science features. As well, this area is identified as very significant aquatic habitat, providing pockets of sheltered waters for the fish communities of Lake Superior. In addition to recreational sailing and power boating, the area is being increasingly used by canoeists and kayakers. It has considerable tourism potential as a unique and highly scenic wilderness destination.

2.5 Key Protection Needs

While this area has a significant base of parkland in place, it also has the potential for the creation of a truly spectacular mosaic of protected landscapes on Black Bay Peninsula and the string of islands. The offshore sections of this area are currently under discussion as a National Marine Conservation Area, which would add to the security of the full range of its ecosystem components.

Maintaining water quality is a key goal in this area, particularly in the confined waters around the islands and bays which may be more sensitive to local sources of pollution. Given the small population base of the area, the primary water quality stressors are likely to be resource-based industrial plants. Current water quality concerns in Nipigon Bay are being addressed through the Remedial Action Plan.

2.6 Stewardship Vignette

2.6.1 National Marine Conservation Areas

Over the next decade, Canada is committed to creating a system of protected marine ecosystems, representing the full range of aquatic diversity in the country. The program, which is administered by Parks Canada in cooperation with the provincial and territorial governments, includes the Great Lakes. One area under active discussion as a potential National Marine Conservation Area corresponds closely to the Superior North Biodiversity Investment Area, but includes offshore waters south to the international border.

National Marine Conservation Areas are managed for ecologically sustainable use, with considerable flexibility to accommodate local needs and circumstances. Core areas are defined to protect critical habitats, endangered species, and outstanding natural or cultural features. Natural environment zones encourage non-consumptive activities such as research, public education, and recreation. Conservation zones allow for marine transport and renewable resource harvesting.

Some activities are prohibited altogether, including mining, oil and gas exploration, and waste disposal.

In the Superior North area, a local project manager, Gail Jackson, works with a regional committee and a government steering committee to determine whether there is local support and to address issues of concern. While there is support in many quarters for keeping the islands and waters of this area in their natural state, and controlling development carefully, there is also apprehension about possible restrictions on uses within a National Marine Conservation Area.

The process of consultation and discussion around this proposal is encouraging local people to consider its advantages and drawbacks. From a Great Lakes perspective, the eventual designation of Superior North as a National Marine Conservation Area would be a fitting and useful recognition of its unique values.

3. Eastern Lake Superior

3.1 Ecological Features and Values

The easterly shore of Lake Superior is an interesting mix of ancient rocky headlands, wave-swept beaches, and sheltered bays. Its climate, vegetation and wildlife communities are greatly influenced by the presence of the deep cold waters of the lake, with frequent onshore winds.

This area encompasses the transition from the mixed hardwood forests of the Great Lakes - St. Lawrence forest region to the spruces and other conifers of the Boreal forest. Areas near the lake are colder, with delayed springs and cool summers that allow arctic disjunct plants to survive and sustain Ontario's most southerly herds of Woodland Caribou.

Among the special ecological features and values represented in the Eastern Lake Superior area are:

Features and values	Typical or significant occurrences
Sand beaches	Frequent in most sections - Agawa Bay, Sand River mouth, Pic River mouth, Oiseau Bay
Sand dunes	Agawa Bay, Gargantua River mouth, West Sand Bay, Pic River mouth
Bedrock beaches	Bedrock shores are common, ranging from low shelving bedrock to high rocky bluffs.
Cobble/boulder beaches	Cobble beaches, ranging from pebble to boulder size, are frequent, especially on Michipicoten, Montreal, and other offshore islands.
Arctic-alpine disjunct flora	Old Woman Bay area, Michipicoten Island
Other disjunct species	Remnant populations of Woodland Caribou along Pukaskwa coast, Montreal Island
Wildlife concentrations	Frequent bird colonies on offshore islands; migrant waterfowl concentrations in Pic River to Dog River area and elsewhere.

3.2 Current Threats to Ecological Values

Much of the eastern Lake Superior coast is protected by inclusion in national and provincial parks and by remoteness. The only significant stressors at this time are:

a) Recreational Use

Both Pukaskwa National Park and Lake Superior Provincial Park attract large numbers of recreational users. In campground areas and beaches where most visitor numbers are concentrated, some impairment of natural values results.

b) Resource Extraction

Logging and mining are prohibited within park boundaries, although the natural communities within Lake Superior Provincial Park will take considerable time to fully recover from a history of industrial logging. The area along the shore between the two parks is currently licensed for logging, and could also be exploited for new mines or hydro-electric developments in future.

3.3 Current Protection of Ecological Values

A high degree of protection of natural values is in place within the Eastern Lake Superior Area:

Protection Mechanism	Comments
National Park: Pukaskwa National Park	Most of the park area is managed in a wilderness state, with minimal facilities and a trail along the shoreline.
Provincial Parks: Lake Superior (Nat. Env.) Michipicoten Island (Nat. Env.) Michipicoten (Historical)	Lake Superior Park includes active recreational areas along parts of the coastline, but for the most part, these parks are managed to conserve natural resources. Extensive representation of almost all natural values are included within the parks.
Crown Land Management:	Most of the coastal area outside parks is owned by the Province. Only one area outside the parks - the Pic River mouth - has been recognized as an Area of Natural and Scientific Interest. A proposal currently under discussion would create a new protected area to link Pukaskwa and Lake Superior Parks along the shoreline.
First Nation Lands: Pic River Indian Reserve Gros Cap Indian Reserve	These First Nation lands are small, and occupy only short stretches of shoreline.

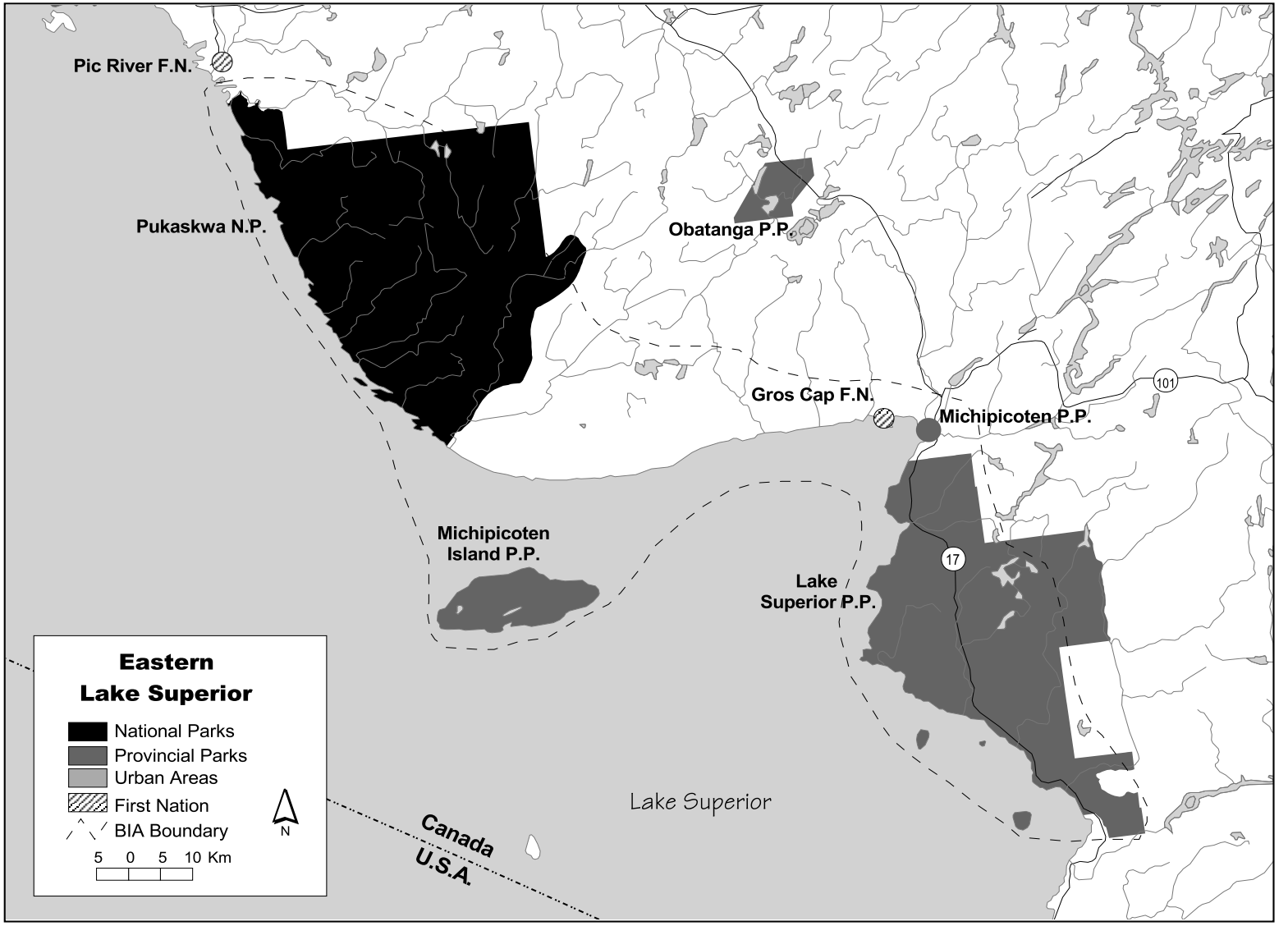

Figure 3 Eastern Lake Superior Biodiversity Investment Area

3.4 Assessment

The ecosystem values of the Eastern Lake Superior area can be summarized as:

1) Ecological Representation: This area provides particularly good representation of sand beaches and dunes, bedrock shores and cobble beaches, and large offshore islands. All of these features are currently well-represented within protected areas. However, representation of aquatic habitats within the lake is relatively poor, since the National Park incorporates only the immediate nearshore (headland to headland) area.

2) Diversity: This area has a relatively high interspersion of different shoreline types, and contributes to the overall biodiversity of the Great Lakes system through its disjunct plant and wildlife communities.

3) Condition or Quality: Much of this area is in an undisturbed wilderness character, with large blocks of protected habitat that will allow natural processes to continue unchecked. The condition of much of Lake Superior Provincial Park has been degraded by past logging, but its forest communities are currently undergoing recovery.

4) Ecological Connections: Shoreline communities are well-connected to backshore forests in a natural state. The connection of the large protected areas in Pukaskwa and Lake Superior parks through a substantial shoreline corridor would greatly enhance the future ecological integrity of this area.

5) Special Features: The eastern shore of Lake Superior is well-known as an area of scenic attraction, both for tourists travelling along the Highway 17 corridor and for hikers, canoeists, and kayakers along the shore. The presence of First Nation rock paintings and other artifacts also adds to the significance of the area.

3.5 Key Protection Needs

Most of this area is currently well-protected. The only major outstanding protection need is to secure a natural corridor linking the two large parks, and providing protection to a scenic and significant stretch of Lake Superior shore.

4. Grand Sable Dunes–Whitefish Point

4.1 Ecological Features and Values

More than 300 feet above Lake Superior, the Grand Sable Dunes sit on top of 100 to 250 feet of glacial outwash. This stunning example of a “perched dune” is a product of the post glacial rise in levels of Lake Superior, which peaked about 5,000 years ago. Recent research reveals evidence of at least eleven different episodes of major dune building activity and periods of relative quiescence, occurring between 5,000 and 500 years ago. These periods of dune building are evidenced by the discovery of soils and old forest floor remnants found buried beneath the sand. Today, the Grand Sable Dunes are five miles long and one mile deep, and appear to be in relatively stable condition.

Research indicates a correlation between lake levels, dune activity and the distribution of dune vegetation. When the lake levels are low, dune activity is low and vegetation begins to stabilize the sand. The vegetation found on the dunes occurs in clumps or patches. As lake levels rise, dune-building occurs. Sand blowing up onto the dunes buries the vegetation and the dunes destabilize. Periods of dune building and stabilization alternate as lake levels fluctuate.

Boreal and mixed hardwood forests lie behind the dunes, providing a variety of habitats for wildlife and rare plant species. A Jack pine ecosystem supports an understory of rare ramshead and calypso orchids and grape ferns. Notable are the globally rare Great Lakes endemic dune thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*), and the prairie dunewort (*Botrychium campestre*). All dunes are fragile and vulnerable ecosystems. A large portion of the Grand Sable Dunes is designated as a research natural area.

Areas adjacent to the Grand Sable Dunes contribute to the ecological features and values of the dunes themselves and the surrounding area. The Grand Sable Dunes are part of the Pictured Rocks National Lakeshore. Pictured Rocks is the country's first national lakeshore, authorized in 1966 to preserve the beaches, dunes, and shoreline cliffs along a 40-mile stretch of Lake Superior. The National Lakeshore's name comes from the mineral stains that streak the 500-million year old Cambrian sandstone cliffs. Groundwater containing iron, manganese, limonite, copper, and other minerals, drips out of the rocks leaving colorful residue.

Grand Island National Recreation Area lies offshore of Pictured Rocks. It is managed as a National Recreation Area as part of the Hiawatha National Forest. The island features a tombolo, a land area joining the north and south, formerly two islands. The island has sandstone cliffs, upland conifers, wet meadows, and swamps. The globally rare peregrine falcon was reintroduced in 1992.

From Pictured Rocks National Lakeshore east to Whitefish Point on Whitefish Bay, the Lake Superior shoreline is a key avian staging area for fall migrations. Migratory habitat is abundant for thousands of raptors, waterbirds, and passerines. Whitefish Point is a designated breeding habitat for the federally endangered Piping Plover.

Tahquamenon Falls State Park on Whitefish Bay south of Whitefish Point is a prime recreation area in Michigan's Upper Peninsula, with spectacular scenery including the falls itself. The State Park is 40,000 acres of undeveloped spruce, hemlock, and cedar forests, the largest old growth northern hardwood forest in Michigan. Large predators, including black bear and bald eagles live here. This is one of only a couple of sand hill crane nesting areas in the Upper Peninsula.

Muskallonge Lake State Park, on the shore of Lake Superior, is a wild place with forests, inland lakes, and cold streams. It is also a favorite park to hunt for Lake Superior agates.

The Two-Hearted River of Ernest Hemingway's Nick Adams stories fame, is a first class trout stream. The river is receiving attention from an active local constituency to preserve water quality.

4.2 Current Threats to Ecological Values

The following threats to the ecosystems described above are not yet severe but are being closely monitored by park personnel.

- *Off-trail trampling due to increased recreational use*. Although access to sensitive areas of the dunes is limited , an increase in visitation will bring disruption to fragile dune systems if people do not stay on the trails.
- *Plant poaching*. Every year park rangers find areas where plants appear to have been dug up. The extent of damage is unknown.
- *Spotted knapweed and baby's breath*. These two invasive, aggressive, non-native species are spreading close to the dunes and are being closely monitored. Spotted knapweed is already present along the roadsides and more heavily used trails at the dunes.

4.3 Current Protection of Ecological Values

Pictured Rocks National Lakeshore, of which Grand Sable Dunes is a part, consists of two zones. The Lakeshore Zone is owned and managed by the National Park Service. The Inland Buffer Zone is a mixture of federal, state, and private ownership. Grand Island National Recreational Area is managed as part of Hiawatha National Forest. Tahquamenon and Muskallonge State Parks are managed as part of Michigan's state park system.

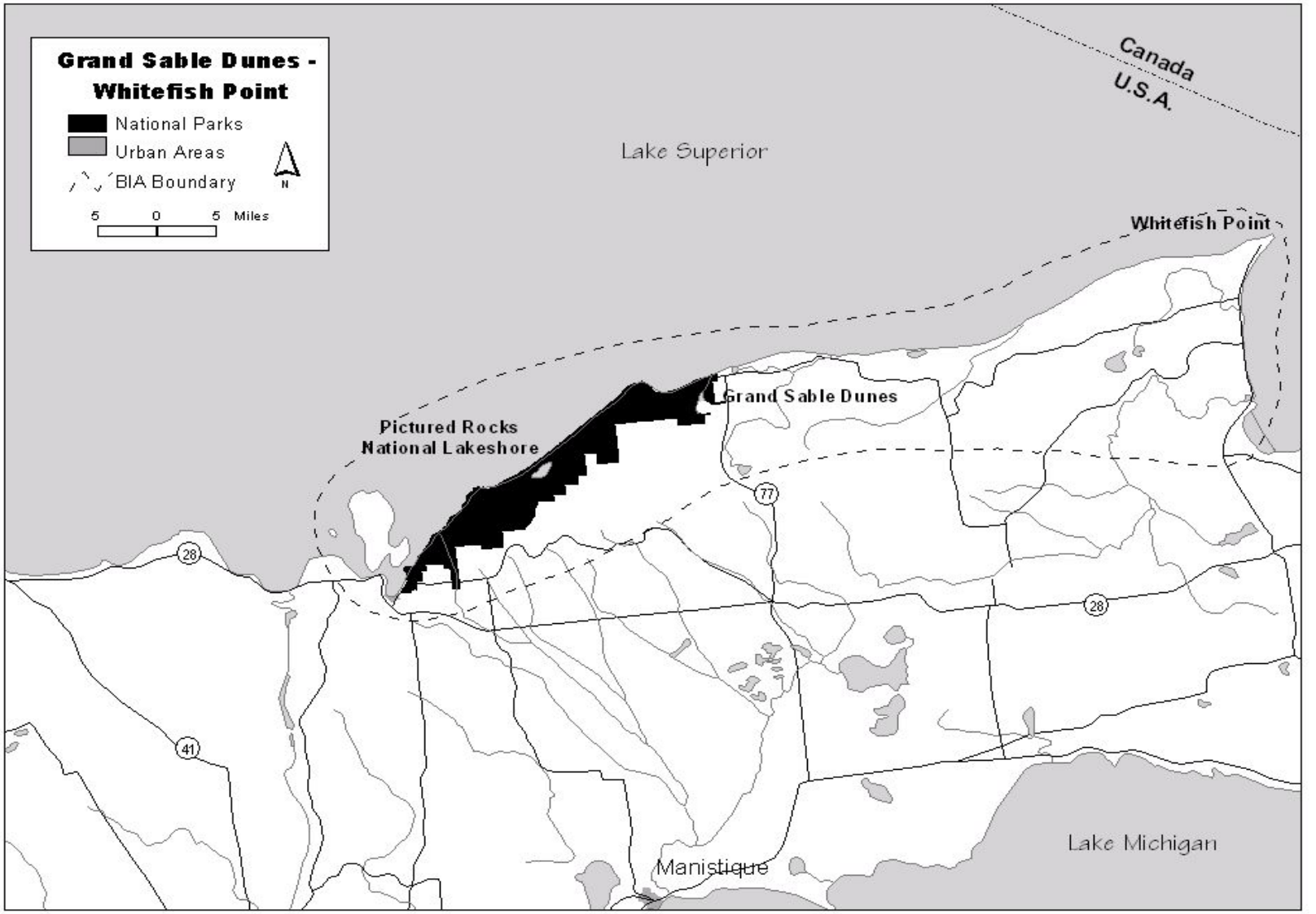

Figure 4 Grand Sable Dunes-- Whitefish Point Biodiversity Investment Area

4.4 Assessment

Park personnel are closely watching the encroachment of spotted knapweed and baby's breath, the presence of which indicates a disturbed ecosystem. Researchers at the dunes are just beginning to study the effects of knapweed on surrounding vegetation. They are also trying to determine if other invasive species are affecting intact areas of the dunes. The rare pitchers thistle, a good indicator of the dynamics of the dunes, is being monitored as is the overall size of pine barrens pockets, which indicate dune stability. Overall, this area is in great ecological shape except for the edges of the parks and along some of the trails which are showing signs of degradation due to park visitors. Informal trails are also contributing to vegetation loss. East of Pictured Rocks, the area is in relatively good condition.

4.5 Key Protection Needs

Three of the four protection needs are research projects which would assist the resource managers in day-to-day preservation and management of the dunes.
- Small mammal, coyote, bear, and bird surveys need to be conducted.
- More needs to be known about the biology of invasive plant species.
- The relationship between lake levels and changes in the dunes is not completely understood and needs to be studied further.

The fourth protection need is related to park visitation.
- People need to be kept off of the most sensitive dune areas by improving walkways, signage, and educational materials that emphasize the sensitivity of the ecosystem.

4.6 Stewardship Vignette

4.6.1 Monitoring the Grand Sable Dunes

Last year the National Park Service began monitoring and mapping the vegetation communities in the most isolated dune areas of the park. They will be looking at changes over time and the correlation with lake levels. Spotted knapweed is also being monitored to help determine whether removal will be needed in order to protect the indigenous plant communities, or whether the encroachment of the dunes will effectively stop the weed from spreading. Monitoring is an important tool for determining management strategies that protect vulnerable and fragile natural resources.

5. Keweenaw Peninsula

5.1 Ecological Features and Values

The Keweenaw Peninsula, on the western end of Michigan's Upper Peninsula, juts out into Lake Superior. It is part of a rocky ridge across the Lake that includes Isle Royale. The volcanic bedrock underlying the peninsula is exposed for approximately 400 miles along the shoreline. The rock was deposited more than 1,000 million years ago during long periods of volcanic activity. The bedrock occurs as part of steeply sloping lava flows, cliffs, and cobble beaches.

The peninsula is forested with second growth northern hardwoods and swamp forests. There are a few lakes and bogs. The igneous and sedimentary ridges and conglomerate bedrock on the western side of the peninsula are rich in copper and other minerals. The vegetation is unusual with many alpine and coastal marsh species.

The bedrock beaches along the Keweenaw shore are considered globally rare natural communities. Several species, including the Heart-leaved arnica (*Arnica cordifolia*), are at their easternmost range. At the tops of the ridges are plants found generally in the west. Stunted white pine, red pine, paper birch, white spruce, and red oak trees are found at the ridge tops clinging to the dry cliffs.

The bedrock shoreline has little vegetation on it due to harsh conditions caused by waves and ice. Hardy lichens, and scattered mosses are predominant. Away from the lake, lichens, mosses, liverworts, herbs, and some woody plants cover the rock. There are seasonal rock pools next to meadows of sedges, and grasses such as blue-joint grass (*Calamagrostis canadensis*). At the edges of small pools of water, rare species such as butterwort (*Pinguicula vulgaris*) might be found. The bedrock community near Copper Harbor includes a rich array of species such as bearberry (*Arctostapholus uva ursi*), common juniper (*Juniperus canadensis*), and the northern bog violet (*Viola nephrophylla*). Near Portage Lake, the habitat s different than at Copper Harbor. There are fewer plant communities found in the cracks of the rock. Arctic alpine disjunct plants are found on calcareous bedrock.

In addition to the ecological importance of the bedrock communities, the Keweenaw Peninsula has historical and recreational value. Keweenaw National Historic Park offers tours of mines, an old military fort, and pioneer human settlements. Outdoor activities such as snowmobiling, hunting, fishing and camping offer visitors a close look at scenic vistas.

5.2 Current Threats to Ecological Values

- *Development*. Second home/cottage development poses a threat in to water quality due to an increase in septic systems. Degradation of surrounding plant communities as a result of an increase in impervious surfaces is a secondary concern.
- *Recreational impacts*. Recreational vehicles and increased foot traffic damages rare and vulnerable vegetation.
- *Deer*. Over-browsing by deer may have an impact on rare plant communities.

5.3 Current Protection of Ecological Values

Much of the Keweenaw Peninsula is in private ownership. Large landowners are mining and forest products companies. Many holdings, particularly along the shoreline, have recently been up for sale.

Fort Wilkins State Park at the tip of the peninsula offers visitors a historical look at the area. The Michigan Nature Association and The Nature Conservancy own several miles of shoreline that have scenic and biological value.

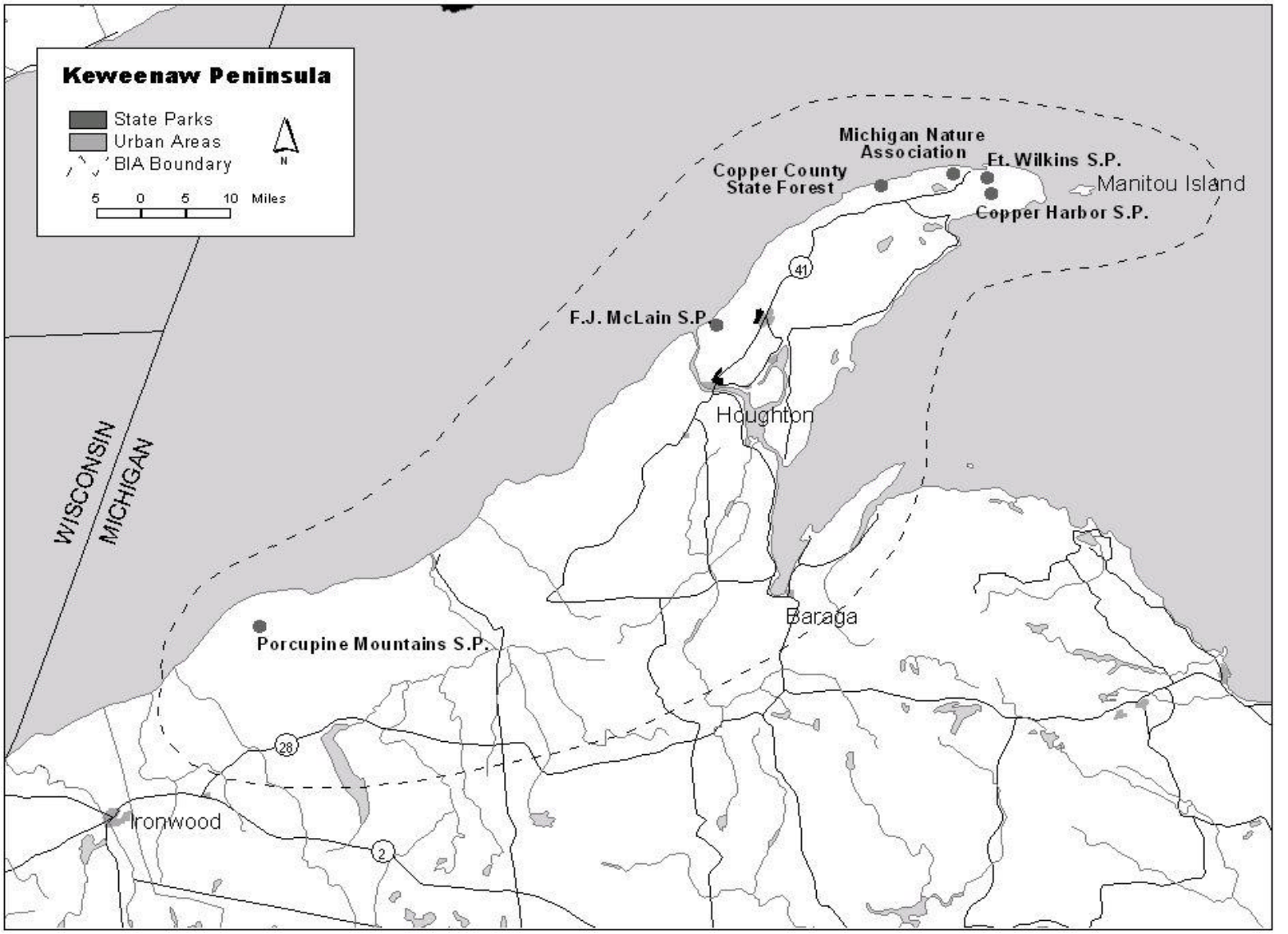

Figure 5 Keweenaw Peninsula Biodiversity Investment Area

5.4 Assessment

Although coming under increasing development pressure, the Keweenaw Peninsula still contains rare examples of bedrock shoreline and significant habitat. The National Historical Park is a cooperative venture that brings the historical importance of the Peninsula to the public. That sense of history includes natural resource use. In addition to education, the park provides protection for ecological resources. In the future, these resources will depend on a coalition of private landowners who recognize the value of their natural resources and who strive to maintain their health.

5.5 Key Protection Needs

In spite of recent work which characterized the bedrock shoreline, much scientific work needs to be done to understand the complexities of the natural communities found there.
- Monitor shoreline vegetation over a long term.
- Increase landowner/visitor awareness of the vulnerability of bedrock natural communities.
- Communicate key ecological threats and communicate to landowners and developers.
- Inventory the shoreline for rare animals.
- Initiate protection measures for sensitive shoreline areas.

6. Greater Chequamegon Region (formerly called Bad River Watershed/Bayfield Peninsula)

6.1 Ecological Features and Values

The Greater Chequamegon Region encompasses the Bad River Watershed, the Bayfield Peninsula and the Apostle Islands. This ecologically diverse area is considered a region because of the partnerships that have formed among local governments, natural resource agencies, and businesses. The partners recognize how culturally, economically, and socially dependent they are on the diverse natural resources of the region and are attempting to preserve the character of the landscape.

The Region's natural resources include boreal and northern hardwood forests, pine barrens, rich coastal marshes, bogs, and freshwater estuaries, rushing rivers and streams, undeveloped inland lakes, sand beaches, spits and dunes, and wild islands. Because these resources are relatively intact, water quality is pretty good all the way to Lake Superior. Sport hunters and fishers enjoy a variety of game species and recreational activities draw visitors year round.

The following places represent the best of the area's natural resources.

The *Apostle Islands National Lakeshore* is comprised of 22 islands in Chequamegon Bay and a narrow strip of mainland shoreline to the north and west of the Red Cliff Indian Reservation. Here one finds boreal forest and hemlock-white pine-northern hardwood forest, as well as sandstone and clay cliffs, and sand spits, dunes, and beaches. The islands are important staging areas for migrating birds and provide habitat for nesting shorebirds.

Sand bars shelter *Bark Bay Slough* and *Lost Creek Bog* on the Lake Superior coast in northern Bayfield County. The sandy beach, remnant white pine boreal forest, and small tamarack-spruce-dotted islands

support a bald eagle nest, seasonal mud flats with feeding areas for shorebirds, muskrat, beaver, and otter habitat, and brook trout streams.

A series of sand spits protect the *Kakagon Sloughs*, a Lake Superior delta formed by three rivers and many creeks. In addition to bogs, sedge meadows, and other wetland communities, the ecosystem includes beaches and floodplain forests. This area is known for its outstanding marsh bird habitat, lake sturgeon use, and wild rice stands.

A 12-mile long sand spit called *Chequamegon Point* protects Chequamegon Bay and the City of Ashland's harbor. Its ridge and swale topography attracts shorebirds including Caspian and common terns.

Kakagon Sloughs and Chequamegon Point are examples of high quality beach, active and forested dune, and estuarine marsh where dynamic ecological processes are intact. These wilderness areas are important for birds. They are also important culturally to the Bad River Tribe as wild rice harvesting, hunting and fishing areas.

6.2 Current Threats to Ecological Values

The partners of the Greater Chequamegon Region are confronting a number of threats to the ecological values of the area's natural resources.

Sand dune, spit and beach areas face human pressures related to recreational use. Major threats are:
- *Removal of woody debris*. People pick up driftwood to burn or for souvenirs. This debris houses microclimates for invertebrates.
- *All terrain vehicles (ATVs)*. ATVs destroy sensitive plant communities. Plants and animals of these areas are vulnerable to erosion caused by repeated vehicular traffic.
- *Pet dogs*. Dogs carry diseases as well as frighten wildlife. Unleashed pets may disrupt animals such as nesting birds or transmit viruses such as parvo virus to other canine-type species.

The slough areas are next to prime development sites. Major threats are:
- *Increased nutrients*. Second home development means septic systems will be installed. Improper maintenance increases nutrients going into the sloughs. This will affect water quality in the sloughs and in the lake.
- *Stabilization of water levels*. Developers and property owners want to protect their coastal properties from shoreline erosion. Shoreline stabilization prevents natural water level fluctuations the sloughs need to function properly.
- *Exotic and invasive species*. Purple loosestrife is an aggressive, non-native plant that threatens the sloughs because it leaves no room for the growth of a variety of native plants. Cattails are a native plant species that crowd out other plants, forming a monoculture instead of a rich variety of species.

The upland areas of the Bad River Watershed and Bayfield Peninsula face numerous threats. They include:
- *Logging*. The effects of clearcutting have a great impact on the upland ecosystems and the downstream sloughs. The conversion of native tree species to deciduous/aspen habitat means snow will melt faster in the spring because deciduous trees have a more open canopy. This faster melt will cause higher amounts of water to flush out and down the stream. Less water will be retained in the soil. Therefore, a change in hydrology, soil, and light conditions will alter the kind of species that can inhabit the area.

- *Deer management*. Managing the landscape for deer means that rare plant communities such as cedar, will be lost to the region due to deer browse. It also means that other animals that do not adapt to aspen or single-species habitats, will not succeed in reproducing.
- *Exotic species*. European buckthorn and garlic mustard are two exotic (non-indigenous) plant species which threaten native plants because they out-compete for light, moisture and nutrients.
- *Roads and road density*. Roads divide wild areas, thus fragmenting movement of animals and plants from one place to another. Plants and animals not accustomed to changing landscapes may perish.
- *Mining*. Mining is a potential threat to the region that would alter the landscape dramatically.

Regionwide, the major threats include:
- *Water level changes.* Changes in water levels resulting from human manipulations may have a negative effect on natural coastal communities, particularly coastal wetlands that depend on seasonal fluctuations.
- *Development.* Regional beauty and charm has led to an influx of new residents who are buying property and building houses and businesses in places that were previously wild, wooded, or maintained as orchards.
- *Toxic pollution.* Pollution from local landfills and from airborne sources is a concern throughout the region. In particular, water resources are at risk.

6.3 Current Protection of Ecological Values

Ecological values are protected in the following designated parks and preserves of the area.
Apostle Islands National Lakeshore
Bad River Indian Reservation
Bark Bay Slough State Natural Area
Big Bay State Park
Chequamegon National Forest
National Natural Landmark
Sandscape Natural Area

In addition to national, state, and tribal protection of resources, local communities recognize the value the natural resources of the area. Steps are being taken to formulate land use plans that sustain ecological communities while considering economic prosperity. The Town of Bayfield Land Use Plan is one example.

Several pieces of legislation also protect ecological resources. NR102–Wisconsin's Stream Anti-degradation Rules, for example, protect waters upstream.

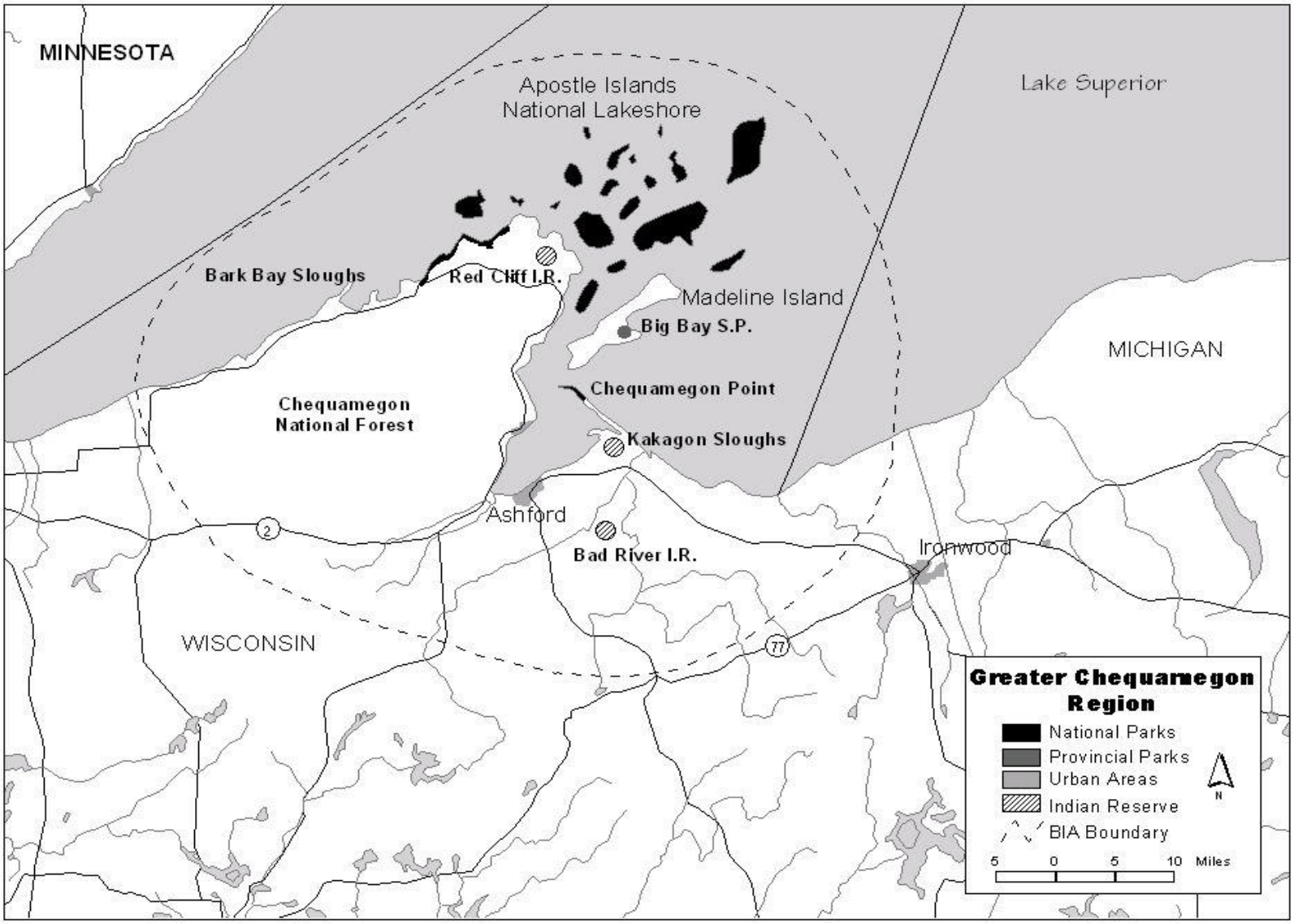

Figure 6 Greater Chequmegon Region Biodiversity Investment Area

6.4 Assessment

The Greater Chequamegon region is in “pretty good” shape ecologically, but it is by no means pristine. One resident characterized it as “pretty good” because the bears come to graze in his fields every spring. Another resident said it is “not as good as it might be” because one can’t build a canoe any longer than 12 feet–the old, tall cedars just aren’t there anymore.

In general, the natural resources in the area have suffered from far less degradation than in other Great Lakes places. As a consequence, the sense of urgency to protect and restore is missing. This may be a big obstacle. Certainly, the land use planning processes in various communities are a major effort which will have great impact on natural resources. People want to do the right thing. However, neither economic tradeoffs nor what the land can support in terms of human development, is well understood.

To complicate matters, there is no system in place to monitor changes in natural resources. Coordination among land conservation agencies is not sufficient to maintain region-wide wholly sustainable, intact, ecosystem functions. Shifting agency priorities make it difficult to effectively develop an overall management plan.

Finally, because the area is in relatively good shape ecologically, it is often bypassed by agencies allocating resources in favor of places needing extensive remediation. The worry is that if few resources are put into protecting places like the Chequamegon Region that are relatively intact, they will very soon suffer from the same stresses as those places which are heavily damaged.

The price of land is a good indicator of the stresses to come. Per acre selling price is rising. One consequence of a shift in population dynamics is that a low impact lifestyle may no longer be possible. Subsistence farmers, independent loggers, retirees living off the land can no longer pay for the land by maintaining a sustainable lifestyle.

People move to the area from the city to “get their own piece of heaven.” As a consequence, although they may have a high conservation ethic, they need to learn about proper natural resource management. With more and various user groups coming into the area, it makes it tough to preserve natural resources without dollars for both protection and education.

6.5 Key Protection Needs

Although the Chequamegon Region is in pretty good shape ecologically, the list of key protection needs is long:

- Intensive natural resource monitoring coordinated among land management agencies is needed so that trends are well documented.
- More dollars should be spent in the Region for resource protection.
- Local businesses and residents must find land use planning that protects natural resources to be economically meaningful.
- Federal agencies need to take a more pro-active approach to resource management. This might include testing new technologies, working with businesses, projecting changes to the region from global warming.
- Because the year-round population is increasing, water quality issues are projected as a problem for the near future. More dollars must be put into land use planning.

- Upland areas were once heavily logged but could be on the road to recovery. Restoration is required for hemlock and white pines because few seed sources are left.
- Visitation to sensitive areas is rising yearly. Attention should be given to protecting the most highly sensitive places.
- Although toxic contaminant levels in some birds have been decreasing, they are still elevated. Work must continue, especially in the area of air deposition, to reduce contaminants.
- Although many groups are working together to protect local natural resources, their messages may not be getting to the regular community of people. A regional outreach effort needs to be initiated.

6.6 Stewardship Vignette

6.6.1 Town of Bayfield Land Use Plan

The Town of Bayfield, nestled on the northern tip of the Bayfield Peninsula, is a premier vacation spot in the Great Lakes. Rolling hills and valleys overlook a spectacular vista of the Apostle Islands and the deep, cold expanse of Lake Superior. Shoreline cliffs and sea caves, sandstone outcrops, wetlands, and woodlands which cover 80% of the Town's 56,753 acres, are the result of glacial activity between 10,000 and 3 million years ago.

The tourist economy has burgeoned over the last two decades with multi-season activities such as hunting, hiking, camping, kayaking, skiing, and dogsledding. Town officials and residents recognized that a land use plan was necessary to preserve the character of the region, including both cultural characteristics such as the orchards and agricultural lands, and natural resource features such as the diverse lakeshore.

A nine-member Town of Bayfield Zoning & Planning Advisory Committee developed a set of goals and objectives that will guide future development. Public input was sought by means of a Land Use Survey of all residents of the Town. More than 80% of the respondents felt it is important "to preserve and protect the unique characteristics and natural resources of the Town," and that "efforts should be taken to protect the Town's existing agricultural lands which support its unique fruit/orchard industry." With much public input, future land uses were mapped out.

The philosophy put forward is "to encourage growth and development in a manner that protects and preserves the beauty and integrity of the Town's environment...the basis of our quality of life." The Land Use Plan will serve as a basis for regulatory decisions and a guide for local officials.

7. Lake Superior Highlands

7.1 Ecological Features and Values

The shoreline of the Lake Superior Highlands is rugged with cliffs and waterfalls. Adjacent to the rocky shore with its fast-flowing rivers are different types of forests. The original white pine, white spruce, and balsam fir mixed with sugar maple, oak and white cedar forests were logged in the last century and have been replaced in part by trembling aspen-paper birch forests. Stands of northern hardwood forests, upland northern white-cedar forests, and forested bogs of black spruce still remain. These forests are

fragmented by roads and forest harvest but to a much less degree than in other parts of the Great Lakes. Altogether, there are 38 different forest community types.

The area is notable for its large mammals and its birds. Moose, black bear, wolf, pine marten, fisher, and occasionally, lynx use this as a migration corridor. In the winter, the frost-free season is longer than inland, giving migrating animals time to move.

The cliffs are good bat hibernation sites because of the lake's moderating effect. The rock outcrops both on the land and on the islands provide good colonial waterbird nesting sites.

The entire shoreline is of great importance as a migration route for raptors and non-raptors such as blue jays, nighthawks, and warblers. Air currents are created by the lake, and by the ridge and valley topography. Each year in the fall, people gather on Hawk Ridge in Duluth to watch the migration. Tens of thousands of birds fly over in the span of a week. The diversity of forest types that includes coniferous and deciduous trees and shrubs provides a variety of niches for interior forest bird species. This area may have the greatest diversity of breeding songbirds in North America.

Rare plant communities, such as arctic-alpine disjuncts, are found hanging to the cliffs or on secluded, weather beaten islands such as the Susie Islands. Plants such as bearberry (Arctostaphylos uva-ursi) and the insect-eating round-leafed sundew (Drosera rotundifolia), in addition to hundreds of lichen species, are normally found in the arctic. After the last glacier retreated, however, these rare plants were left behind in isolated communities.

A quarter mile offshore, the lake is deep and cold. The resulting fog provides important moisture to the highlands and the lakeshore. The arctic disjunct plants are acclimated to the moist conditions.

The water quality of the rivers is good. When it rains, the rivers run high and flashy, moving quickly to the lake down rocky slopes and waterfalls. These rivers are habitat for anadromous fish. The mouths of the rivers are important for fish concentrations and waterfowl. Sturgeon, coaster brook trout, steelhead and others spawn in the river mouths. The Knife River harbors half of all the anadromous fish in Minnesota.

Isle Royale, an archipelago 50 miles long and 9 miles wide off the coast of northern Minnesota-Ontario, has a rocky, moist shoreline lined with white spruce and balsam fir. On the dry, rocky ridge running through the center of the island are birch, aspen, or treeless rocky outcrops. Black spruce swamps, numerous lakes and ponds, and streams course through the center. The island is populated with moose and two small packs of intensely-studied wolves.

The geologic uniqueness of the Highlands influences the overall ecology of the area. Bluffs and outcrops result in cobble and stone beaches, which are habitat for hardy vegetation.

This is one place where people and nature can connect. One can experience the sense of connection between land and lake partly because of the geology. The image is of a big lake with big waves crashing onto seemingly unchanging rock.

7.2 Current Threats to Ecological Values

Until recently, the Lake Superior Highlands have been protected from human disturbance by their inaccessibility and harsh climate. More tourists are now enjoying the wildness and beauty of the region

as well as a variety of all-season recreational sports. The ecological values listed above are now threatened by:

- *Second home/cottage developments*. Shoreline land prices are increasing. More vacation homes and resorts are being built per acre. This is the greatest overall threat to the landscape.
- *Recreational use*. Construction of new marinas, harbors, and the straightening, flattening, and widening of highways to accommodate tourist traffic all contribute to the fragmentation of ecosystem. There are conflicts between boaters and backpackers on Isle Royale. Increased foot traffic in parks, particularly off trail, damages vegetation.
- *Deer*. Deer populations are extremely high in the Highlands, especially during winter months. As spring arrives, there is not enough vegetation available to sustain these large populations and they tend to over browse, causing damage to some trees and shrubby plants. Over time, this reduces forest diversity. There is a debate about how deer are managed in the parks in the Highlands. Should the land be managed for the vegetation or for deer? If managed for deer, the native vegetation such as white pine and hemlock will not regenerate sufficiently.
- *Changes in forest composition*. An expansion of paper and pulp mills over the last 5-7 years has led to planting and harvesting of fast growing trees such as aspen. The numbers and types of trees harvested have also increased due to the changing industry. Fragmentation of the forest due to development and the subdivision of land does not allow for sustainable harvesting and may impact large mammal populations. The stands of old growth forests are important areas for wildlife. Conversion to different forest types through timber management practices and as a result of deer browsing, will result in a change of forest species. Forest interior birds may be most affected.
- *Airborne pollution*. Atmospheric deposition from industry may have an impact on environmental quality.

7.3 Current Protection of Ecological Values

The ecological values of the Lake Superior Highlands are protected primarily within publically owned parks. The parks listed below are arranged by category of park, which is related to their missions.

Historical: Historic parks protect historically and culturally significant locations. Since topographic features often played a role in attracting humans because of their utilitarian values, they may have historic significance.
Grand Portage National Monument
Split Rock Lighthouse State Park
Tower Souden State Park
Jay Cooke State Park

Recreational: These intensively-used parks are usually small and located near coastal waterfalls and canyons. Picnic grounds, scenic overviews, foot trails, and fishing access are popular with summer tourists. Inland, the state trail covers 150 miles and is used for day hiking, backpacking, horseback riding, ski touring and snowmobiling.
Judge C.R. Magney State park
Cascade River State park
Temperance River State Park
Gooseberry Falls State Park
North Shore State Trail

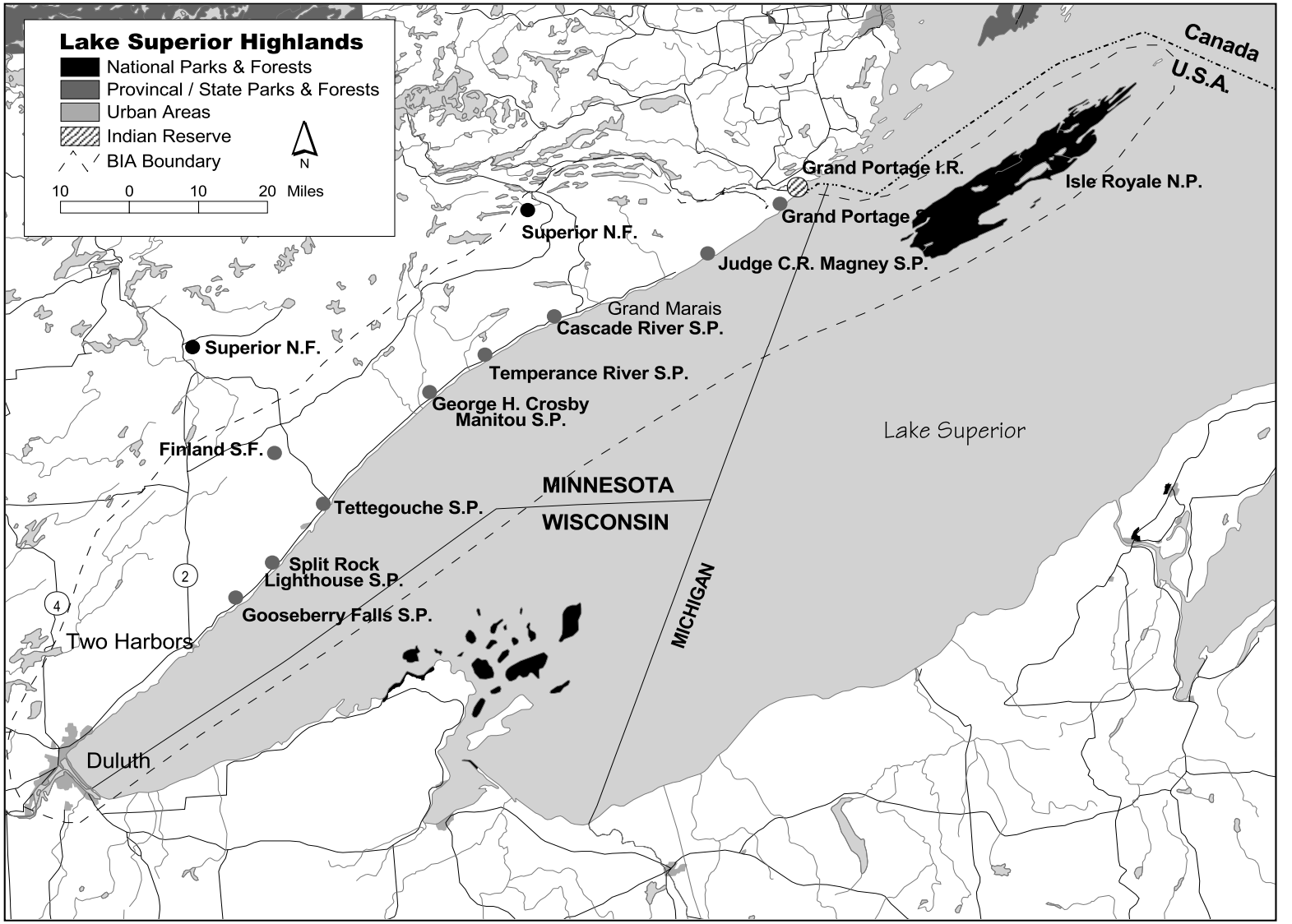

Figure 7 Lake Superior Highland Biodiversity Investment Area

Natural Environmental: These are large parks with a variety of natural shoreline features as well as remote inland forested slopes, valleys, rivers and lakes.
George H. Crosby-Manitou State Park
Tettegouche State Park

National Park: The only national park is Isle Royale. It is accessible by boat or by seaplane and is frequented by sailboaters, kayakers, and backpackers. A new management plan is currently under review.

National Forest: Lake Superior National Forest manages for timber production. Within the forest are potential research natural areas that represent ecological variety.

County Parks: Lake, Cook, and St. Louis Counties own considerable land. They are primarily being used for timber production and recreation.

Non-governmental Organizations: The Nature Conservancy owns Suzie Island and has helped establish and expand Tettegouche State Park. Other private groups, such as the Wolf Ridge Environmental Center, are managing their lands for biodiversity and recreation.

Grand Portage Indian Tribe: The Tribe manages land at the northern tip of the Lake Superior Highlands area. Several areas around the Reservation are set aside for preservation of natural resurces. Natural resources staff members manage and conduct research on moose, grouse, wild rice and a variety of fish species.

7.4 Assessment

Overall, the ecology of the Lake Superior Highlands is healthy as evidenced by the continued presence of large mammals, the hawk migrations, and the high songbird diversity. Development, changes in forest composition, an increase in tourism, and the accumulation of local problems such as an increase in urban runoff to streams, however, are beginning to have negative effects.

Forest management practices seem to be pushing toward younger forests. At the same time, however, other activities such as forester training in ecosystem based management may offset these practices.

Local communities are interested in securing the park system in order to protect resources. They are beginning to participate in resource planning and development within their own communities.

The Nature Conservancy, with the Minnesota Department of Natural Resources and many other local organizations, are establishing the Lake Superior Highlands as an area commanding resource protection. Over the next years, ecoregional planning will be done to assess the natural resources and begin implementing protection measures.

7.5 Key Protection Needs

- Studying multi-seasonal satellite images would convey changes in tree species. The amount of aspen cover as opposed to self-sustaining old growth forest would indicate great changes in composition.
- Monitor interior forest birds as an indicator of forest health.

- Monitor amphibians as an indicator of water quality.
- Monitor the size of lots along the lake. Changes in housing density will mean more impervious surfaces, more runoff, less native vegetation, less animal habitat, more fragmentation, resulting in alteration of the shoreline.
- Assemble pertinent data about the Lake Superior Highlands in one location on the Internet.
- Conduct training sessions in planning for conservation at the site level.
- Highlight aspects of biodiversity that are precious and in danger, so specific issues raised can be better understood. Use common language and illustrations to improve conservation awareness.
- Collect more data on stream and lake biota.

7.6 Stewardship Vignette

7.6.1 Adopt -A-Trout

The Grand Portage Indian Reservation is using a unique way to familiarize local children with the ecology of the lake, the tributaries, and the fish that live there. As part of a program to restore coaster brook trout to Lake Superior, the children adopted a trout. The coaster brook trout was an important part of the Lake's ecosystem long ago. Overfishing, depletion by the predatory, non-indigenous sea lamprey, as well as erosion due to clearcutting upstream, all contributed to the decline of the fish. Tiny radio transmitters were planted on trout grown in the Tribe's hatchery. The children tracked their adopted trout to see whether they would survive in the wild. Success of the reintroduction will be due to protection of the upper watershed and control of the lamprey.

8. Mackinac-Manitoulin

8.1 Ecological Features and Values

The Mackinac-Manitoulin area includes a small section of mainland around the Straits of Mackinac, and a series of large islands (Drummond, Cockburn, Manitoulin) stretching to the east. Manitoulin is the largest island within a freshwater setting in the world. Almost all of this area is based on limestone bedrock, often with shallow overburden, but with the contact line with the Canadian Shield lying immediately to the north. A northerly extension of the Niagara Escarpment arcs through the area, creating steep-sided hills and bluffs facing northwards, with the land sloping gently southwards into Lake Huron.

While agricultural and forestry activities have taken place within this area for over a century, it retains one of the richest mosaics of high-quality natural habitats within the Great Lakes basin. It is particularly rich in natural shoreline features, including alvars, sand dunes, coastal marshes and fens, and bedrock shores, since development pressures have been relatively light in the past. Manitoulin has most of its population in small towns and villages including Little Current, Gore Bay, and Wikwemikong. About half of its population is Aboriginal people living on reserves. The other islands have no large urban centres.

Almost all of the land base on Manitoulin and the other Canadian islands within this BIA are in private or First Nation ownership. Drummond Island and the Mackinac area include substantial areas of State lands, as well as private lands.

One of the most remarkable aspects of this BIA is the presence of long stretches of undeveloped Lake Huron shoreline, retaining the original wild character of this setting. Among the special ecological features and values in the Mackinac-Manitoulin area are:

Features and values	**Typical or significant occurrences**
Alvar pavements, shrublands, and grasslands	Misery Bay, Belanger Bay, Quarry Bay, Lynn Point, Christina Bay, Strawberry Island, La Cloche Islands, Clapperton Island, Maxton Plains
Shelving bedrock shores	Frequent along south shore, notable areas include Frechette Point, Lynn Point, South Baymouth to Michael's Bay
Cobble beach	Common along north shore, such as Sucker Creek area, Maple Point, Chamberlain Point, east shore of Wikwemikong, Drummond Island
Sand beaches and swales	Uncommon, but occurs at Michael's Bay, Providence Bay, Sand Bay on Cockburn Island
Sand dunes	Excellent examples on Great Duck Island, Western Duck Island, Wagosh Bay on Cockburn Island, Carter Bay
Wetlands	Significant shoreline wetlands include Rushy Cove, Lake Wolsey, Wagosh Bay, Strawberry Island; shoreline fen at Christina Bay and Misery Bay; many interior wetlands, notably Hog Lake - Maple Lake, Drummond Island, Bios Blanc Island, Government Island
Limestone pavement with raised sand beaches	Cinder Point, Cockburn Island
Colonial waterbirds	Frequent colonies of common terns, gulls, caspian terns, herons
Migratory birds	Important stop-over for migratory birds, especially shoreline areas and points, interior fields for migrant Sandhill Cranes
Limestone cliffs and talus	Along north side of Manitoulin - West Bay, Gore Bay, Mudge Bay, Vidal Bay, Cape Robert; also Marblehead on Drummond Island
Post-glacial lake shorelines	Particularly well-represented on Cockburn Island; also on Duck Islands, West Bay, Michael's Bay

8.2 Current Threats to Ecological Values

The complex natural values of Manitoulin Island and the Mackinac area are threatened in some localities by several land-use practices:

a) Second Home/Cottage Developments

A growing number of cottage subdivisions are taking up shoreline areas of Manitoulin, especially on interior lakes and along parts of the south shore. Alvar and sand dune habitats appear to be particularly at risk.

b) Recreational Use

In a few areas, the recreational use of all-terrain vehicles is a serious risk to sensitive natural communities, particularly sand dune and alvar areas.

c) Resource Extraction

Most of the forested lands within this area are subject to periodic logging, including damaging high-grading on some private lands. Some habitats are also threatened by limestone quarrying, such as the large commercial operations based on the La Cloche Islands. Significant alvar habitats at Belanger Bay are also threatened by a proposed quarry. Other alvar habitats on the La Cloche Islands are being adversely affected by commercial operations to collect landscaping boulders, causing extensive rutting and drainage disruption.

d) Shoreline Highways

Marshes and dune communities which depend on natural water level fluctuations are impacted by highways and roads which cut through, altering hydrology and habitat quality.

8.3 Current Protection of Ecological Values

Protection of natural landscapes is very limited within this area, especially on Manitoulin Island. The following land ownership and planning categories provide some protection:

Protection Mechanism	Comments
Provincial Parks and Conservation Reserves: Misery Bay (Nature Reserve) Blue Jay Creek (Cons. Reserve) Mac's Bay (Cons. Reserve)	These areas protect significant alvar and sand beach/dune habitats along Manitoulin's south shore. Blue Jay Creek protects part of the ridge and swale system at Michael's Bay.
ANSI and Wetland Policies: Fossil Hill ANSI Great Duck Island ANSI Great La Cloche Island ANSI McLean's Mountain ANSI Sheguiandah Archaeological Site ANSI	All of the ANSIs currently identified on Manitoulin are selected on the basis of earth science features, and are at a "candidate" stage. Life science studies to identify representative areas for protection need to be completed. Wetland areas on Manitoulin are subject to policies developed for northern Ontario, which are more permissive of development than provincial policies for the settled areas south of the Canadian Shield.
Local Planning Policies: Les Cheneaux Islands	Land use planning initiatives are beginning to look at the relationship between natural resources and economic well being of the community.

Protection Mechanism	Comments
First Nation Lands: Wikwemikong Unceded F.N. Ojibways of Sucker Creek F.N. Sheguiandah F.N. West Bay Indian Reserve F.N. Sheshegwaning Indian Reserve F.N. Cockburn Island Indian Reserve F.N.	First Nation lands encompass extensive sections of Great Lakes shoreline and many significant natural features. As well, other significant areas such as the North Channel islands and other islands surrounding Manitoulin are currently under land claim. The Wikwemikong First Nation has been especially active in developing sustainable resource use practices.
National Parks/Forests/ Wildlife Refuges: Hiawatha National Forest Government Island Wilderness Area Harbor Island National Wildlife Refuge Horseshoe Bay Wilderness Area Mackinaw Wilderness Area	National forests, wildlife refuges and wilderness areas are critical in protecting large tracts of shoreline containing Great Lakes endemic and rare species.
State Parks/Forests/Wilderness Areas: DeTour State Park Horseshoe Bay Wilderness Area Lake Superior State Forest Mackinaw Island State Park Mackinaw State Forest Straits State Park	State parks, forests, and wilderness areas have management strategies which vary from designation to designation. Biodiversity values are being defined and strategies developed to protect significant sites.
Local Land Trusts/Non-governmental Agencies: Marquette Island Maxton Plains	Organizations such as The Nature Conservancy and Little Traverse Conservancy have protected more than 4,000 acres and seven islands through fee acquisition and conservation easement. The Nature Conservancy has designated Northern Lake Huron as one of its “Last Great Places.”

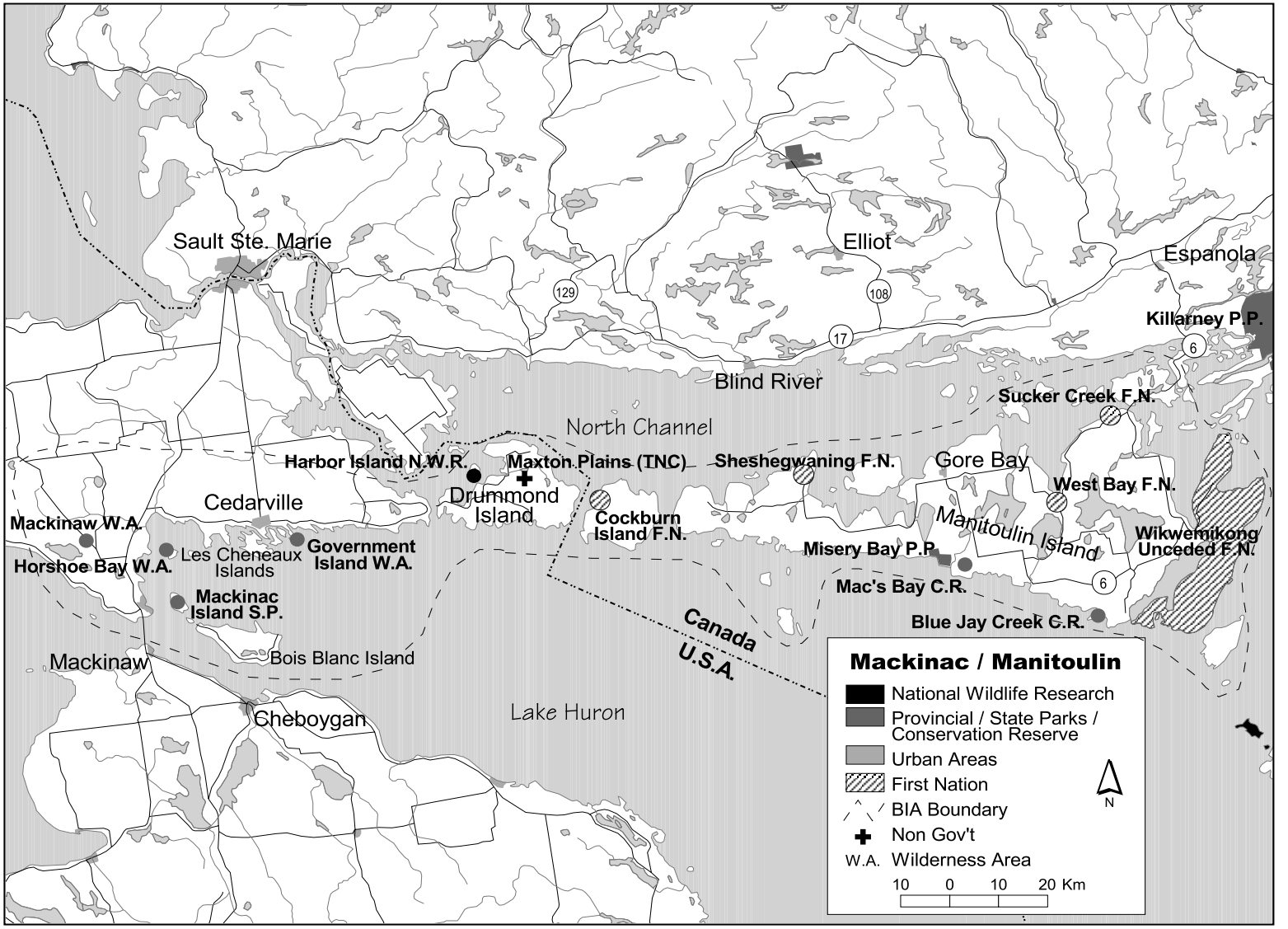

Figure 8 Mackinac/Manitoulin Biodiversity Investment Area

8.4 Assessment

The ecosystem values of the Mackinac-Manitoulin area can be summarized as:

1) Ecological Representation: This area provides excellent representation of limestone bedrock and cobble beaches, alvars, limestone cliff and talus, sand beach and dune communities, and post-glacial shoreline features. Only a few of these special features are captured within a protected areas system.

2) Diversity: The great diversity of landform types within this area has produced a rich diversity of habitats and species. The lack of protected areas and protective policies throughout much of the area is gradually placing this diversity at risk.

3) Condition or Quality: In part because of the relatively low population base of this area, many of its natural areas remain in unusually good condition. This is especially evident in the wide range of outstanding alvar and oak savannah habitats, but also in beach and dune shoreline features. Cockburn Island is thought to have the most complete series of post-glacial lake shoreline features anywhere on the Great Lakes basin (Environmental Applications Group, 1981). However, the quality of some of these natural areas is being impaired by shoreline developments, ATV use, and industrial activities.

4) Ecological Connections: Most sections of shoreline within this area are well-connected to extensive backshore forests or other natural habitats, providing a continuum of ecological connections. Wolves, for example, move from Canada across the St. Mary's River and winter in the Hiawatha National Forest.

5) Special Features: Habitats within this area shelter a substantial number of rare species, including such Great Lakes endemics as Lakeside Daisy, Pitcher's Thistle, Houghton's Goldenrod, and Dwarf Lake Iris. Its wildlife includes large colonies of several species of birds on offshore islands, and populations of rare molluscs and other invertebrates. Manitoulin in recent years is becoming known as a birdwatching destination, with spring displays of Sharp-tailed Grouse and other western birds, and fall congregations of thousands of Sandhill Cranes.

8.5 Key Protection Needs

The Manitoulin area has suffered in the past from a relatively low degree of attention to protection of its natural heritage, and to local resistance to protective measures which might interfere with traditional activities. As well, much of the western end of the island is in corporate ownership, without organized municipal planning and oversight. A key need on Manitoulin is the gradual development of a system of protected areas, both public and private, that engender local support.

The Wikwemikong Unceded First Nation and other bands manage significant natural landscapes on Manitoulin, and have already undertaken some conservation activities. Continued discussions with these First Nations to assist in identifying and protecting key natural sites would be beneficial.

In the United States, the islands and the shoreline are undergoing changes due to an increase in development. Les Cheneaux residents and islanders, for example, recognize that to preserve the character of their community and lifestyle, they need to protect local natural resources. Extensive land use planning is underway that encourages economic development while protecting the natural resources that draw visitors to the area. There is a need for similar land use planning in other parts of the region.

8.6 Stewardship Vignette

8.6.1 The International Alvar Conservation Initiative

Alvars are specialized habitats based on flat shallow limestone, often with puddles of flooding from poor spring drainage, and very hot dry conditions in summer. This combination of wet and dry inhibits the growth of most trees, and allows a unique mix of habitats with many rare plants, molluscs, and insects. While a few alvars are found around the Baltic Sea, about 95% of them occur within the Great Lakes basin. Most alvar types are globally imperiled.

In 1996, The Nature Conservancy's Great Lakes Program Office began a three-year international initiative to document and evaluate the occurrence of alvars within the basin, and to answer key questions about their management. About 45 researchers, agency staff, and non-government representatives from Canada and the U.S. joined in the initiative, producing an explosion of new information and new energy on alvar conservation.

Most of the nine alvar community types identified through the initiative occur within the Mackinac-Manitoulin area, including many sites of exceptional quality. Maxton Plains on Drummond Island is the world's largest example of Little Bluestem alvar grassland. Belanger Bay and Misery Bay on Manitoulin have excellent examples of open pavement alvar and alvar shrublands. La Cloche Island has very large areas of several alvar types, including Tufted Hairgrass wet alvar grassland.

As well as documenting the significance of these sites and many others, the Alvar Initiative sponsored research on the role of soil moisture, fire, land use history, and grazing. This improved understanding of alvar ecology will lead to improved management of alvar sites in future. Private land stewardship, to encourage landowners to appreciate and preserve their alvar habitats, is now underway in Manitoulin and elsewhere. New international linkages among conservation groups have also been formed to work on opportunities to conserve key sites through acquisition or other means.

Beyond the immediate benefits to alvar conservation, the International Alvar Conservation Initiative stands as a model of basin-wide planning that could well be adapted for other habitat types in the future.

9. Eastern Georgian Bay

9.1 Ecological Features and Values

The Eastern Georgian Bay area includes an extensive archipelago of low-lying rocky islands and the adjacent mainland that is greatly dissected by bays, channels, and inland lakes. Acidic, gneissic bedrock from the Precambrian era is exposed throughout most of the area, with only a few pockets of deeper sandy soils. Many of the smaller 30,000 islands are barren rock, with only a few stunted pines. Further inland (to approximately Highway 69), the pine is mixed with sparse open stands of red oak and red maple, with other hardwoods appearing in areas of deeper soils.

In many places, the exposed rock is sculpted by the effects of glaciation, and water-washed by past glacial lakes. The area's climate is strongly affected by the frequency of winds off Georgian Bay, which moderates summer temperatures and creates heavy winter snowfalls.

The whole of Eastern Georgian Bay includes only one large town, and a very low density of road access. Among its special ecological features and values are:

Features and values	**Typical or significant occurrences**
Sand beaches	Uncommon, but larger beaches at Killbear, Beausoleil Island
Gneissic offshore islands	Very abundant, in all shapes and sizes, throughout
Limestone islands	Uncommon - Quarry Island, N. and S. Limestone Islands
Quartzite ridges	Killarney area
Estuarine marshes	Only large example is Matchedash Bay, at south end of area, smaller example at Naiscoot River mouth
Other wetlands	Frequent fringing wetlands in more sheltered waters e.g. Potato Island, north of Bayfield Inlet; frequent wetlands in inland swales, from submergent marsh to treed swamps
Cobble beach	Sparse, occurs in Parry Sound area, west side of Beausoleil Island
Coastal gneissic rocklands	Throughout, with gently sloping bedrock beaches
Rare species	Ontario stronghold for Eastern Massasauga rattlesnake, Prairie Warbler, White-fringed Orchid and other regionally-rare plants
Disjunct species	Frequent occurrence of Atlantic coastal plain species
Great Lakes coastal species	Kalm's St. John's Wort, Yellow Flax, Prairie Loosestrife, Northern Meadow Spike-moss, Bird's-eye Primrose, Pringle's Aster, Tall Cordgrass, sedge *Carex garberi*
Wildlife concentrations	Frequent bird colonies on offshore islands; greatest known diversity of reptiles and amphibians in the province

9.2 Current Threats to Ecological Values

The natural values of Eastern Georgian Bay are threatened in some localities by three stressors:

a) Second Home/Cottage Development

Cottage development has occurred along many sections of privately-owned shoreline, particularly in the southern sections of the area. Road-accessed cottage development is concentrated around such centres as Honey Harbour, Moose Point, Parry Sound and Britt. Boat-accessed cottages, both on islands and the mainland shore, are especially frequent in the more southern sections, and their numbers are increasing steadily. With increased road access to additional sections of the shoreline, demand for cottage developments is likely to explode.

b) Recreational Use

Eastern Georgian Bay is a very popular destination for recreational boating, including both powered boats and sailboats. A growing number of marinas to service this industry are found clustered at road access points. Conflicts between mooring boaters and resident cottagers are becoming more frequent in some sheltered bays. An increasing number of sea kayakers are also making use of this area, and some of the interior areas and sheltered bays, such as McCrae Lake, are popular with canoeists and wilderness campers. The few sand beach areas are heavily used for recreational swimming and camping, resulting in a loss of their natural habitat values.

c) Water Quality

Water quality is excellent in most parts of the BIA, but the cumulative effects of septic systems, grey water from boats, and tributary inputs could reduce that quality in future. This has already happened in the enclosed waters of Severn Sound, at the southern end of the BIA, which has been designated as an Area of Concern. Remedial measures there are proving effective, and there is hope that Severn Sound may be "delisted" relatively soon. An emerging issue with respect to water quality and biodiversity in the area is fish farming, with several operations established with little regulatory control. Captive fish farming raises several issues, such as oxygen depletion in nearby waters, pollution from feces and antibiotics, and genetic contamination of native fish stocks by escapees.

9.3 Current Protection of Ecological Values

A number of protection measures are currently in use along Eastern Georgian Bay, including protective land ownership and several planning approaches:

Protection Mechanism	Comments
National Parks: Georgian Bay Islands National Park	Protects significant sections of gneissic bedrock, cobble and sand beaches, offshore islands, fringing wetland, habitat for several rare and disjunct species and wildlife concentrations.
Provincial Parks: O'Donnell Point (Nature Reserve) Massassauga Wildlands (Nat. Env.) Limestone Islands (Nature Reserve) Killbear (Natural Environment) Sturgeon Bay (Recreation) French River (Waterway) Killarney (Wilderness)	These parks provide good representation of most of the area's special features, including coastal gneissic rocklands and quartzite ridges, and habitats for rare, disjunct and coastal species. Several of the parks are relatively large, providing extensive core protected areas and opportunities for wilderness experiences.
Private Nature Reserves: Nature Conservancy of Canada Georgian Bay Land Trust Foundation	NCC currently owns three nature reserves in the Musquash River and Point au Baril areas. GBLTF owns four reserves, including several islands, in the Blackstone Lake, Point au Baril, San Souci, and Go Home Bay areas.
Other Lands with Special Status: Matchedash Bay Provincial Wildlife Area	The significant wetlands at the head of Matchedash Bay are currently under acquisition through a cooperative venture coordinated by the Eastern Joint Habitat Venture.
First Nation Lands: Moose Point Indian Reserve F.N. Parry Island Indian Reserve F.N. Shawanaga Indian Reserve F.N. Naiscoutaing Indian Reserve F.N. Henvey Inlet Indian Reserve F.N. Point Grondine Indian Reserve F.N.	These six Indian Reserves include significant stretches of Georgian Bay shoreline, with many of the natural features characteristic of the area.
ANSI and Wetland Policies: Few wetlands evaluated. Significant wetlands include: Matchedash Bay Potato Island - Quarry Island Naiscoot River Mouth ANSI designations incomplete. Candidate Natural Heritage Areas include: Philip Edward Island Naiscoot River Mouth Franklin Island Musquash Channel Islands	The natural heritage values of provincially significant wetlands and ANSIs are required by provincial policy to be considered as part of any planning decisions. The Natural Heritage Areas are being proposed for protective status through the provincial Lands for Life program, identified on a similar basis as ANSIs. Other Natural Heritage Areas have been identified by the District Municipality of Muskoka, and are recognized in municipal planning documents.

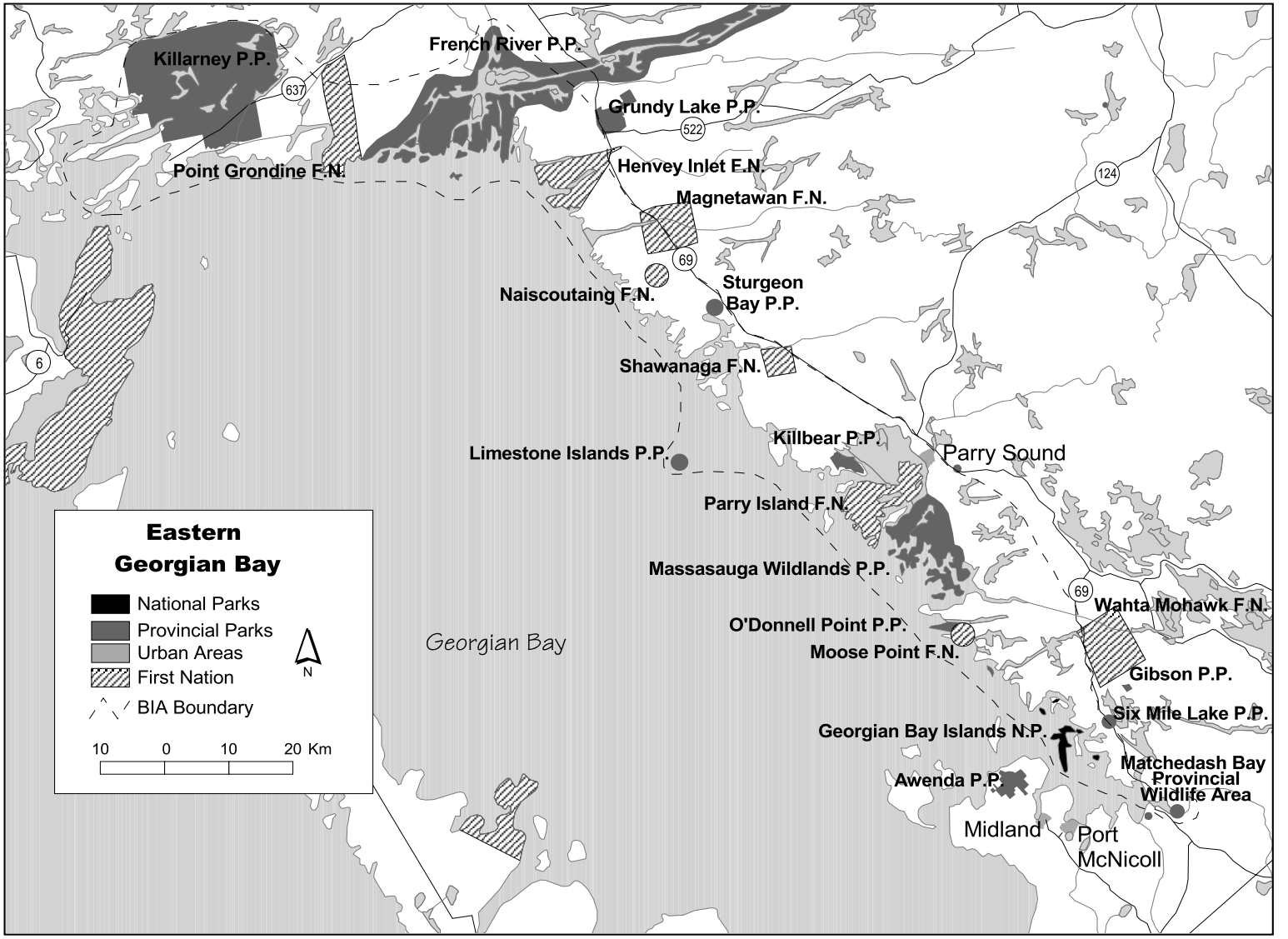

Figure 9 Eastern Georgian Bay Biodiversity Investment Area

9.4 Assessment

The ecosystem values of Eastern Georgian Bay can be summarized as:

1) Ecological Representation: This area offers especially good representation of coastal gneissic rocklands and associated islands, along with a range of special features. Typical landscapes and most of the area's special features are well-represented within the current protected areas system, and the proposed additions through the Lands for Life program will strengthen that representation.

2) Diversity: While the landform types within the Eastern Georgian Bay area are relatively consistent, they are unique in the Great Lakes context, and so add diversity to the basin as a whole. Species diversity is particularly high in the southern section of the area, particularly for reptiles and amphibians.

3) Condition or Quality: Major sections of shoreline within this area remain undeveloped and roadless, and have been preserved more-or-less intact in their original condition (although historical logging has taken place in most areas). The continued increase in cottages and boats is the major threat to this wilderness quality, particularly since this area is relatively close to major urban centres.

4) Ecological Connections: Most sections of shoreline are well-connected to extensive backshore forests and wetlands. This connectivity is enhanced by the frequent pattern of long bays and channels extending inland from the shore. There is also considerable north-south connection parallel to the shore, with the shallow waters and islands serving as a movement corridor for fish and migrant birds. For some of the threatened species in this area, such as Eastern Massasauga Rattlesnake, habitat fragmentation in future could pose a threat to maintaining viable populations.

5) Special Features: As noted in the Features and Values table, the Eastern Georgian Bay area incorporates many special ecological features. Some, such as sand beaches, are limited in extent and under heavy recreational pressure. Other features, such as colonial nesting areas, are vulnerable to disturbance. A closely-related special feature is the scenic attractiveness of this area, which supports a growing number of tourism operations, and formed the basis for much of the work of Canada's premier artists, the Group of Seven. This attractiveness is also vulnerable to excessive shoreline development and motorboat use.

9.5 Key Protection Needs

Eastern Georgian Bay has in place a significant base of parkland and other protected landscapes, and a legacy of public lands which can respond to other protection needs if identified. Perhaps the most significant need at this stage is a strategy to better link the existing areas, especially along the shoreline area. For example, proposals have been made to link Killarney park to the French River park along Philip Edward Island; similar initiatives might in future link O'Donnell Point to the Massasauga Wildlands protected area and southwards to Georgian Bay Islands National Park. The Greater Ecosystem Approach being promoted by Georgian Bay Islands National Park has developed a conceptual linkages map from Parry Sound to Midland for discussion purposes, which is a very useful beginning in this regard.

Discussions should be encouraged with First Nation bands along the shore to identify key ecological features on their lands and appropriate protective measures.

Maintaining water quality is also an important issue within this area. Water quality is of special concern in relatively confined waters such as Severn Sound, which has been the subject of a Remedial Action Plan. However, a cautious approach to development to ensure that water quality is maintained is necessary throughout the area. Policies and programs to deal with septic systems, grey water from boats, and fish farming operations need to be periodically reviewed and assessed to ensure their effectiveness.

9.6 Stewardship Vignette

9.6.1 Georgian Bay Littoral Biosphere Reserve

Virtually all of the people who work in the eastern Georgian Bay area, who own cottages there, or who visit place a high value on its scenic qualities and its wildness. Now a far-sighted group of these people, led by the Georgian Bay Association, are working on strategies to try to ensure that future generations have the same opportunity to experience those values.

They began with the recognition that the status quo, which largely ignored the special nature of the coast and islands, was no longer acceptable. As major highways from the urban areas to the south are improved, new waves of development pressure are expected. The southerly parts of the area are already under stress - the fishery is showing signs of stress, conflicts between user groups are increasing, municipalities are struggling to cope. If the traditional pattern of piecemeal development continues, these pressures will soon overtake the entire coastal area.

In 1996, a concept paper called “the Littoral” was published, which laid out a new vision for the area, based on the idea of sustainability. This vision involves the creation of a strategic regional plan which includes three components:

- the creation of an economic development strategy based on sustainable development and eco-tourism;
- an ecological management plan which identifies and protects key ecological areas, develops and assesses water and land use plans, and monitors key indicators of ecosystem health; and
- a consultation strategy to create two-way communication amongst all stakeholders.

This regional plan would be used to guide future planning decisions in the area, and as a basis for an application to UNESCO for Biosphere Reserve status for the eastern Georgian Bay area. While the development of this plan is still in its early stages, the concept appears to have broad support from municipalities, resource managers, and community groups. It may well become a model of how to conserve biodiversity and foster sustainable development at the regional level.

10. Bruce Peninsula

10.1 Ecological Features and Values

The Bruce Peninsula is the northern extension of the Niagara Escarpment landform into the waters of Lake Huron and Georgian Bay. This finger of limestone and dolomite bedrock is tilted, so that its westerly shore dips gradually into Lake Huron, with extensive shallows and islands. The eastern shore is fringed by ragged cliffs, with deep water just offshore. The Bruce Peninsula has been modified by glaciation and post glacial lakes, and even now the effects of Lake Huron and Georgian Bay on local

climate are pronounced. Lake effects moderate summer temperatures, delay spring warming, and create heavy winter snowfalls, with resulting effects on vegetation communities and wildlife.

The Bruce Peninsula is an outstanding mosaic of shoreline types and other natural habitats, with a diversity and quality not often seen elsewhere in southern Ontario. Among the special ecological features and values represented are:

Features and values	Typical or significant occurrences
Sand beaches	Sauble Beach, Black Creek (Singing Sands), Dorcas Bay, Cape Croker + several smaller beaches
Sand dunes	Sauble Beach, Cameron Lake Dunes
Limestone bedrock beaches	Pike Bay, Stokes Bay, Johnston Harbour, Baptist Harbour
Limestone cobble beaches	Cabot Head, Barrow Bay, Hope Bay shingle spit
Limestone cliffs and talus	North shore, Cape Chin, White Bluff, Gun Point, Cape Dundas
Limestone alvars	Especially along west shore, also Cape Croker
Limestone islands	Fishing Islands, Tobermory islands, Colpoy Bay islands
Unconsolidated shore bluffs	Cape Rich claybanks
Rich shoreline fens	Oliphant, Howdenvale Bay, Dorcas Bay
Other wetlands	Rankin Lake, Eastnor Swamp, Whiskey Still Marsh, Slough of Despond, etc.
Interior forests	Largest extent of nearly continuous forest in southern Ontario
Old-growth white cedar	On limestone cliffs and some alvar sites
Rare species	Especially orchids, ferns, Eastern Massasauga rattlesnake
Disjunct species	Western plants (prairie spp. on Cape Croker, etc) and birds, black bear, fisher
Bird nesting colonies	Chantry Island supports 7 species of colonial nesting birds plus nesting waterfowl
Migrant birds	Shoreline concentrations of loons, grebes, waterfowl, inland and island stopovers of passerines

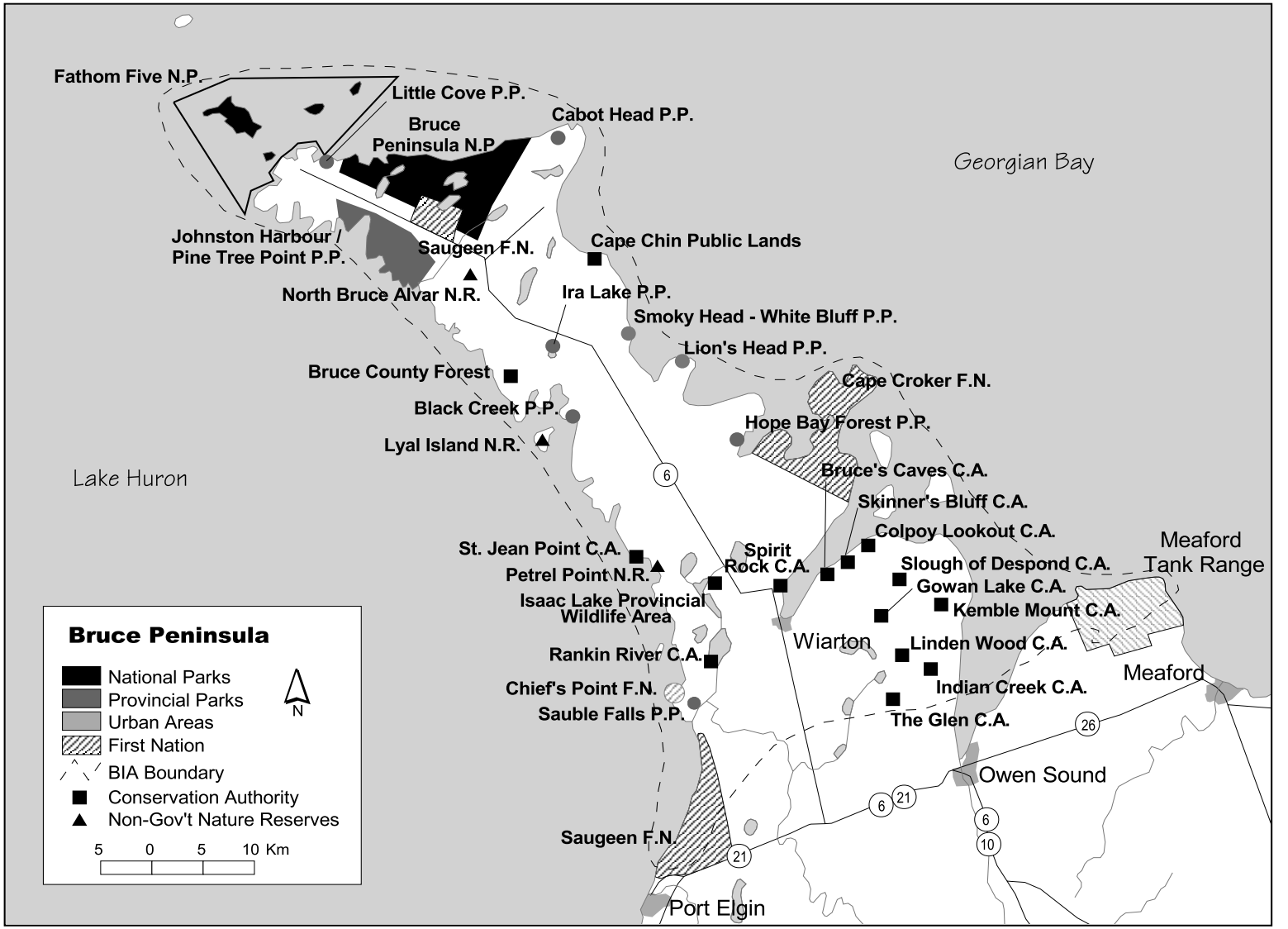

Figure 10 Bruce Peninsula Biodiversity Investment Area

10.2 Current Threats to Ecological Values

The natural values of the Bruce Peninsula are threatened in some localities by three stressors:

a) Second Home/Cottage Developments

Cottage subdivisions now occupy much of the accessible shoreline area along the western edge of the peninsula, with new developments continuing. Development along the eastern shore, which is physically constrained by the Niagara Escarpment, tend to be concentrated in nodes, with more extensive cottaging areas along Colpoys Bay and Owen Sound Bay. Some of the interior lakes are also heavily developed, and residential or second-home development on rural lots is becoming commonplace in much of the Peninsula's forested interior.

These developments and the associated infrastructure (roads, utility corridors) have fragmented large natural areas and often cut off shoreline areas from the backshore interior forests. This has led to an increase in edge communities at the expense of interior habitats, loss of habitats and species diversity in some areas, and the spread of exotic species. As well, the karst drainage or wetland conditions associated with most shoreline areas makes the Bruce Peninsula vulnerable to groundwater pollution from septic systems. The village of Tobermory, for example, recently installed a water system in response to this problem.

b) Tourism and Recreational Use

Large numbers of day users particularly affect sand beach habitats, causing the removal of native plants and reducing the value of these habitats for shorebirds. Some sections of the Bruce Peninsula National Park see substantial day use by hikers and campers, and sections of the Bruce Trail are heavily used. In some sensitive areas such as Dorcas Bay, disturbance of significant flora has been caused in the past by irresponsible wildflower photographers. Rock climbing on Escarpment cliffs can also damage the natural flora in this unusual habitat.

c) Logging

Much of the private land on the Peninsula is periodically affected by selective logging. Poor logging practices associated with high-grading of hardwood stands or harvest of cedar posts causes habitat damage in some locations.

10.3 Current Protection of Ecological Values

A wide array of protection mechanisms are currently in use on the Bruce Peninsula, including protective land ownership and several planning approaches:

Protection Mechanism	Comments
National Parks: Bruce Peninsula National Park Fathom Five National Marine Park	Protects significant sections of limestone cliff and talus, bedrock and cobble beaches, small sand beaches and dunes, limestone islands and alvars, wetlands, old growth cedars. Proposed park area for BPNP only partially in place. Ecosystem Integrity Monitoring Program currently being implemented, and an Ecosystem Conservation Plan for the Greater Bruce Ecosystem, encompassing a large area surrounding the National Park, is under development.
Provincial Parks: Sauble Falls (Recreation) Black Creek (Nat. Env.) Ira Lake (Nature Reserve) Johnston Harbour-Pine Tree Point (Nature Reserve) Little Cove (Nature Reserve) Cabot Head (Nature Reserve) Smoky Head-White Bluff (Nature Reserve) Lion's Head (Nature Reserve) Hope Bay Forest (Nature Reserve)	These parks provide good representation of Niagara Escarpment and shoreline features, particularly limestone cliff and talus, bedrock and cobble beaches, and rare species habitats. They also include a few significant wetland sites, a scattering of alvar sites, and examples of limestone forest types. With the exception of Sauble Falls and Black Creek, these parks are primarily passive in nature, with few active uses.
Conservation Authority Lands: The Glen Management Area Indian Creek Management Area Lindenwood C.A. Gowan Lake C.A. Kemble Mount C.A. Slough of Despond C.A. Skinner's Bluff C.A. Colpoy Lookout C.A. Bruce's Cave C.A. Spirit Rock C.A. St. Jean's Point C.A. Rankin River C.A.	Conservation Authority lands provide small amounts of shoreline protection, but include substantial tracts of wetland and Niagara Escarpment lands not far inland. In some cases, recreational use of these lands or resource management activities such as periodic logging may conflict with natural heritage protection.
Private Nature Reserves: Lyal Island Petrel Point North Bruce Alvar	The Federation of Ontario Naturalists and Nature Conservancy of Canada have both been active in acquiring ecologically significant properties. Their holdings include shoreline fen, limestone island, and alvar pavement habitats.
First Nation Lands: Saugeen Indian Reserve Chief's Point Indian Reserve Cape Croker Indian Reserve	The three Indian Reserves include long stretches of Lake Huron and Georgian Bay shoreline, with areas of sand beach, limestone cobble, limestone bedrock shore, and fringing wetland. Extensive areas of second-growth forest area associated with the Reserves, as well as alvars and some prairie elements.

Protection Mechanism	Comments
Other Lands with Special Status: Cape Chin Public Lands Bruce County Forest (Miller Tract) Rankin Lake Provincial Wildlife Area Department of National Defence (Meaford Tank Range) Chantry Island Migratory Bird Sanctuary	Cape Chin and the Bruce County Forest include extensive areas of conifer and mixed forest. Rankin Lake has a mix of significant wetland and upland habitats, including drumlin formations. The Meaford Tank Range has excellent representation of abandoned glacial shoreline features cut into a shale bank, along with a diversity of modern shoreline, wetland, and forest features. Chantry Island (off Southampton) has been identified as the most important Migratory Bird Sanctuary in Ontario south of James Bay.
Niagara Escarpment Plan Includes Georgian Bay shoreline from Colpoys Bay north to Tobermory (excluding Cape Croker I.R.)	The Plan implements Provincially-mandated development controls through the Niagara Escarpment Commission. Development is especially restricted in Escarpment Natural and Escarpment Protection designations, but continues within Escarpment Recreation Areas and Minor Urban Centres. The Niagara Escarpment area, including sections within the Bruce Peninsula, has been designated as a Biosphere Reserve under UNESCO. As well, it receives special attention under the Ontario Niagara Escarpment Monitoring Program.

Protection Mechanism	Comments
ANSI and Wetland Policies Provincially significant ANSIs and wetlands not included within public lands listed above include: Sucker Creek-Cape Rich ANSI Cape Croker ANSI Barrier Island ANSI Cape Hurd-Baptist Island ANSI Corisande Bay Wetland Zinkan Island Cove ANSI Sadler Creek Wetland Miller Lake/Spring Creek ANSI Cabot Head ANSI (eastern section) Stokes Bay Wetland Greenough Harbour Wetland Pike Bay Wetland Sucker Creek Wetland Howdenvale Wetland Red Bay Wetland Complex Fishing Islands Wetland Complex Oliphant Wetland Chief's Point Wetland	ANSIs (Areas of Natural and Scientific Importance) are selected on the basis of their ability to represent the natural diversity of their site district, and the quality of their natural features. Wetlands are evaluated on their hydrological, biological, and social features. Most of the ANSIs and wetlands within private hands are located along the western shore of the Bruce Peninsula. While Provincial policies requires that planning decisions have regard for their values, they are only partially protected from development activities.

10.4 Assessment

The ecosystem values of the Bruce Peninsula can be summarized as:

1) Ecological Representation: This area provides particularly good representation of limestone cliffs and talus, limestone bedrock, sand and cobble beaches, rich shoreline fens, unconsolidated shore bluffs, and limestone islands. Most of its special features are at least represented within the protected areas system; some features such as limestone cliff and talus are very well protected.

2) Diversity: The diversity of shoreline and landscape types, and of natural communities and species, is exceptional within this area. While the current stresses are impacting ecological diversity, the risk of declining diversity in the short term appears relatively small.

3) Condition or Quality: While virtually all of the Bruce Peninsula has been disturbed to some degree by past human activities, especially logging, a substantial number of natural areas of unusually high quality remain intact. This is especially notable in such features as old-growth white cedars on cliffs and alvars, in the lengthy stretches of undeveloped shoreline on the upper Peninsula, and in the off-shore islands. However, ongoing second home developments, increasing recreational access and use, and continuing high-grading of hardwood forests are affecting the quality of some of these areas, especially sand beach and dune areas, and limestone bedrock shorelines.

4) Ecological Connections: Significant sections of Bruce Peninsula shoreline are well-connected to extensive backshore forests, and provide a continuum of natural habitats. However, in many other places, a ribbon of shoreline or backshore development has severed that connection, and the stresses of second home development continue this trend. These stresses are especially evident along the western coastline of the Peninsula. In a broader context, the Bruce Peninsula acts as an important north-south landscape corridor, incorporating a series of smaller river corridors that are primarily east-west in orientation.

5) Special Features: As noted in the Features and Values table, the Bruce Peninsula is well-known as a locale for rare plants and disjunct species, especially those associated with limestone cliffs, alvars, rich shoreline fens and other wetlands. Its wildlife includes large nesting colonies of several species of birds on offshore islands and populations of the Eastern Massasauga rattlesnake, an endangered reptile. The habitat of many of these species is shrinking in response to the stresses of second home developments. The Bruce Peninsula is also an outstanding scenic and recreational resource, with many visitors attracted to its parks, natural landscapes, and the Bruce Trail which guides hikers along the limestone cliffs.

10.5 Key Protection Needs

The Bruce Peninsula has been host to a diverse mix of public and private land protection initiatives, in recognition of its wealth of natural heritage features. However, some protection initiatives are currently incomplete, notably the Bruce Peninsula National Park and Fathom Five National Marine Park, as well as the Provincial and conservation authority parks system associated with the Niagara Escarpment Plan. A resumption of capital spending to bring high-priority properties into public ownership, or some new source of non-government funding directed towards the same goal, is a key need if these initiatives are to fulfill their potential.

While the Biosphere Reserve concept is a good framework for linking conservation of biodiversity with community actions, research and monitoring, and demonstration projects of sustainable development, on the Bruce Peninsula the Reserve is narrowly defined to include only the linear Escarpment strip. A broader configuration, to incorporate the full spectrum of natural core areas and surrounding landscapes, would provide an improved basis for future projects. Private stewardship actions could also be promoted more vigorously on the Bruce Peninsula, including land trusts, conservation easements, and landowner agreements.

As well, several very significant sites, including First Nation lands and the Meaford Tank Range, are informally protected by current management practices, but have no formal mechanism for long-term protection of key features. Participation in discussions to identify appropriate protection techniques for these areas should be encouraged with the Canadian Department of National Defence, and with the Saugeen and Cape Croker First Nations.

10.6 Stewardship Vignette

10.6.1 Lyal Island: Preserving a Microcosm of the Bruce

Dozens of islands crowd the wind-swept waters off the western shore of the Bruce Peninsula. Lyal Island, the largest of these at 754 acres, will now be preserved in its natural state, thanks to the efforts of two conservation organizations and the generosity of several private donors.

Like most conservation success stories, this one has its twists and turns. The Federation of Ontario Naturalists (FON) had long been aware of the natural attractions of Lyal Island - shoreline shingle ridges and dolostone pavements, rich dry and wet meadows, forests and wetlands including a peatland pond. At least 90 species of plants occurring on the island are considered significant, and its diverse wildlife includes the Eastern Massasauga rattlesnake, an endangered species. Remarkably, the island has no development at all, except for an automatic navigation light and one abandoned cabin. In many ways, it is a microcosm of the ecosystems of the western side of the Bruce Peninsula, but without the cottages.

A London, Ontario radiologist and naturalist, John Agnos was so taken by the island's natural qualities that he decided to set up a foundation to purchase it. Before he could do so, however, he died tragically in a car accident. But when the island's long-time owner, Asa Danard, approached the Nature Conservancy of Canada (NCC) about acquiring the property, Mr. Agnos' dream had a second chance at success.

Mr. Danard agreed to sell the property for substantially less than its market value, and the NCC entered a partnership agreement with the FON to find the remaining funds needed. And in late 1996, the goal of preserving the island came full circle when Dr. Agnos's two sisters provided a generous donation to allow their brother's dream to be fulfilled.

Lyal Island is now in the ownership of the Federation of Ontario Naturalists, and will be managed as a nature reserve. Fittingly, it will be known as the Dr. John Agnos and Asa Danard Sanctuary, in memory of the people who inspired this conservation achievement.

11. Saginaw Bay

11.1 Ecological Features and Values

Wet prairie remnants and the last of the Saginaw Bay marshes that originally lined the shoreline of Michigan provide a rare glimpse of what was once large interrelated ecological communities. The rich Lake Huron fishery was the result of this complex of marshes and prairies. Much of the original prairies and marshes were drained for farmland in the last century. A few small globally imperilled lakeplain prairies, coastal marshes, oak savannas, and swamp forests are all that remain.

Less than one percent of the original lakeplain prairie survives. More than 19,000 acres of the coastal marshes were lost since the mid-1800s. Still, this is an important area for shorebirds, waterfowl, and songbirds. Many varieties of ducks nest in the remnant marshes. This area is home to many threatened and endangered species as well as several disjunct bird populations. Rare wildflowers such as the tall green milkweed may be found in the prairies. The marshes and adjacent offshore shoals are important spawning habitat for fish.

All of these coastal communities are dependent on changing lake levels. Both the marshes and the prairies depend on natural fluctuations of the lake and the water table to maintain soil moisture and photosynthesis activity. Currently, the sites are fragmented and the hydrology has been disrupted. In addition, Saginaw Bay is an Area of Concern due to the impacts to water quality of heavy industry and agriculture in the watershed.

11.2 Current Threats to Ecological Values

- *Point and non-point source pollution*. Agriculture and industry have contributed to pollution in the marshes. Municipal sewer overflows contribute to nutrient problems in the Bay. Water quality issues are of grave importance to the health of marsh plants and animals. Better sewage treatment and a focus on point and non-point pollution sources has helped improve water quality. - *Fragmentation*. There are more than 30 marsh and prairie sites along the coast of significance ecologically. They are separated by urban, agricultural, and industrial development and therefore difficult to manage in a coordinated fashion.
- *Exotic species*. Purple loosestrife has invaded the marshes to the detriment of native plants. Beetles are being tested as a possible control. Zebra mussels have colonized the bay and are spreading into the shallow wetland areas, colonizing the base of bullrushes. Colonization dynamics are being studied.
- *Changes in hydrology*. Alteration of hydrology in the watershed by installing dykes and draining for agriculture has caused flooding and disturbed the functioning of coastal marshes and prairies.

11.3 Current Protection of Ecological Values

The remaining coastal marshes and prairies are protected by a number of wildlife areas, game areas, a state park, and a national wildlife refuge:

State Wildlife Areas: Quanicassee, Nayanguing Point, Fish Point, Wildfowl Bay
State Game Area: Tobico
State Park: Bay City
National Wildlife Refuge: Shiawassee

The Saginaw Bay Watershed Initiative Network is a conservation fund made up of thirteen public and private organizations. It's focus is on sustainable development and projects include developing a birding network and education for the public about local natural resource values. It is broken down into several task forces looking into specific issues throughout this AOC including land use, sustainability, agricultural pollution prevention and improving habitat.

A "corn stubble" project has just begun in the agricultural areas of the Saginaw Bay watershed. Farmers are being asked to leave corn stubble in their fields as a food supply for birds. This is being run by the local resource conservation and development agency, Pheasants Forever, Ducks Unlimited and other interest groups.

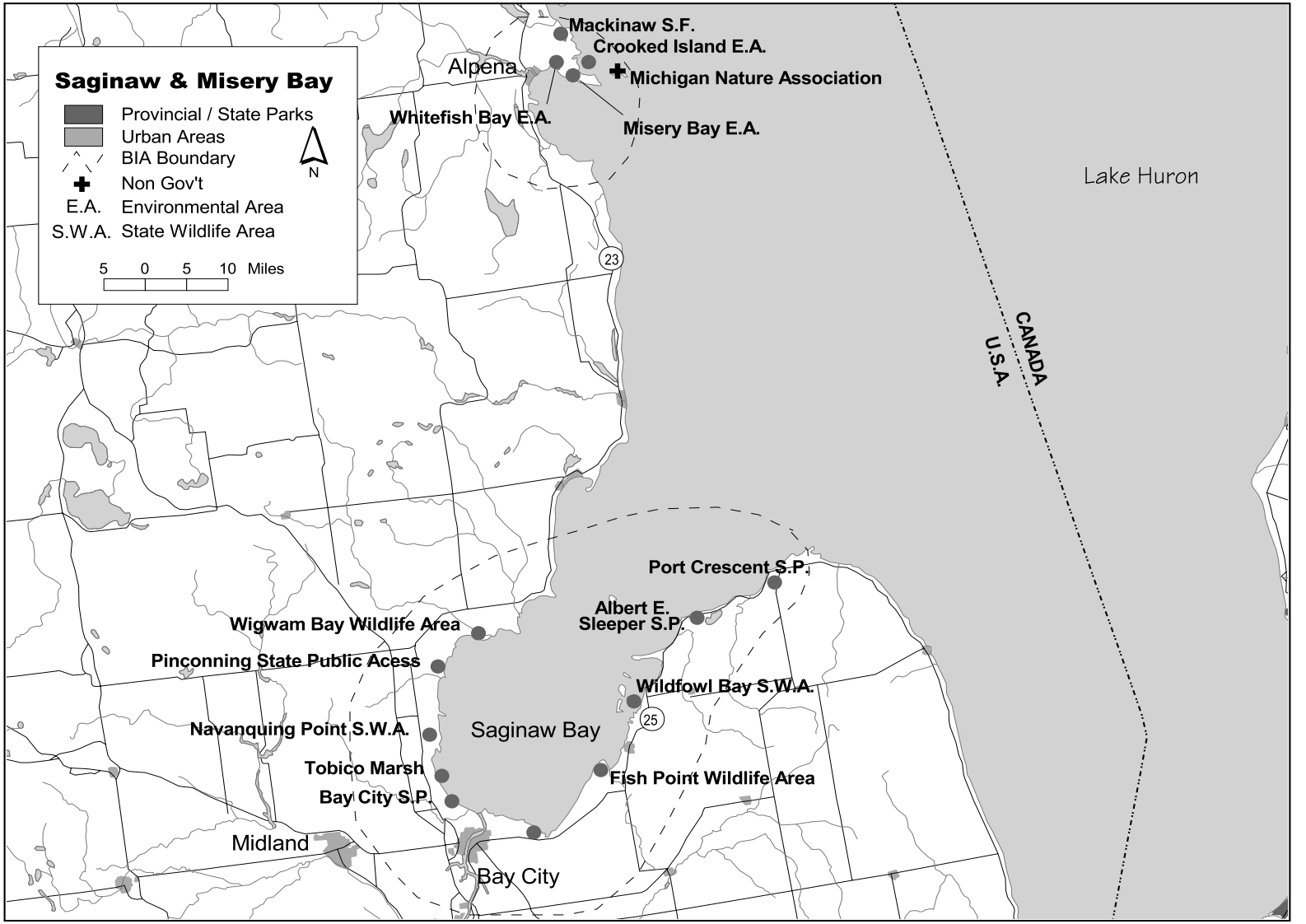

Figure 11 Saginaw and Misery Bay Biodiversity Investment Areas

11.4 Assessment

Less than 100 acres of lakeplain prairie is left along the shoreline. Coastal marshes have faired somewhat better. However, both are fragmented and water level fluctuations disrupted. Ownership is primarily the state, which manages for game, not necessarily for biodiversity.

Better sewage treatment and a focus on point and non-point pollution sources has helped improve water quality. Combined with control of dredging operations into the lake, some of the marsh areas appear to be improving. Some improvements have occurred along the Saginaw River near Bay City. Land that was previously used as junkyards has been converted to city parks along the river. More people are coming to the area to enjoy the waterfront.

A group of students and staff at the University of Michigan is modeling land use and trying to project long term effects from various impacts, such as population and nutrient loadings.

The Saginaw Basin Land Conservancy was recently organized to purchase and own lands for protection and restoration purposes. There have already been unsolicited offers for easements and land donations from interested private parties. Partnerships for the Saginaw Bay Watershed is a multipurpose grassroots organization made of citizens, commercial groups and local governments which serve as a general resource for information and education. They conduct water quality testing, do tree plantings, and work with local governments to advocate and enhance environmental protection efforts.

The fate of the area's fragile coastal marshes and remaining prairies depends on innovative and concerned farmers, who will weigh economic and environmental issues when instituting any changes in practices. It also depends on how well the state manages its preserves, with a major challenge being the fragmentation of sites. Finally, it depends on how the public involves itself in the issues of protection and restoration. Involvement can come about through participation in the local land trust, educational opportunities, or becoming familiar with and acting on issues of resource management.

11.5 Key Protection Needs

- The agencies need to better understand natural resource issues and how to better describe to the public the benefits of protection and restoration of marsh and prairie communities. Education efforts should focus on wise use of all natural resources and relate those resources to citizen interests.
- Continued improvement of water quality and quantity will improve the health of ecosystems and biota.
- Information is needed to determine overall health and trends of the wetlands in the area.
- Site fragmentation is a key issue which will require innovative problem solving in order to begin to manage in a coordinated fashion.
- Zoning laws need to be improved to focus more on conservation and resource sustainability.

12. Misery Bay

12.1 Ecological Features and Values

The Misery Bay Macrosite is a peninsula jutting out into Lake Huron. Thunder Bay, on the Michigan side, and Misery Bay, on the lake side, have coastal marshes rich in flora and dependent on the natural

fluctuation of Great Lakes water levels. The edges of the marshes, wet meadows, northern fens, and conifer swamps are habitat for rare species such as the dwarf lake iris (*Iris lacustris*). Shoals adjacent to the marshes, and the islands off the Misery Bay coastline provide nesting habitat for many avian species. Birds nesting in in the area include threatened Common terns (*Sterna hirundo*), Caspian terns (*Sterna caspia*), and Red shouldered hawks (*Buteo lineatus*), as well as Black-crowned night herons (*Nycticorax nycticorax*), Double crested cormorants (*Phalacrocorax auritus*), Great blue herons (*Ardea herodias*), and two species of gulls. Bald eagles (*Haliaeetus leucocephalus*) are also found here, but are not known to nest in the immediate area. Misery Bay is an important neotropical migrant bird site as well. Approximately 213 migratory bird species are known to use this area as a stopover site during migration seasons.

The shoreline is etched with cliffs, karst features and a large spring coming from a sinkhole in the bay, apparently an outlet of an underground river. The spring flows through a gypsum deposit 500 feet below the surface. The spring is large enough to prevent a portion of the bay from freezing in the winter. These conditions allow submersed aquatic plants to grow along the shallow shoreline, providing an important food source for the large number of waterfowl and other birds using the area. Sand dunes are located near the tip of the peninsula. Some of these dunes are active, but most are soil covered and vegetated, which indicates a stable dune ecosystem.

At the southern end of the peninsula is a mature stand of red pine. Many of the plants growing in Misery Bay are dwarfed, and some have a brownish appearance. They also tend to regenerate more slowly than would normally be expected, which might be a result of impaired plant decomposition. The reasons for these conditions are unknown, but may be influenced by the soils, which are highly calcareous due to the underlying limestone bedrock.

The numerous small islands located off the Misery Bay shoreline contain a diversity of ecological communities including wetlands, sandy beaches, cobble beaches, dune and swale complexes and forests. Alvar vegetation, Reindeer moss, Houghton's goldenrod, Kalm St. John's wort and sand bar willows are among the unique plant communities found on these islands.

12.2 Current Threats to Ecological Values

- *Development*. Occurring just north of Misery Bay on the coast and in scattered areas throughout the peninsula, residential and commercial development may present a threat to the coastal communities, particularly the marshes. Although current pressures are not intense, they are increasing, and there is great potential for further expansion of development activities.
- *Industry*. A limestone quarry near Whitefish Bay may have an impact on aquatic organisms and the water quality of the bay. A kiln dust pile from an old cement plant has eroded into the bay, but not enough is known about its current or potential impacts. An incinerator at the plant may be having an impact on air quality.
- *Marina development*. Only one small marina exists on the peninsula, however, additional development would affect the marshes and the bird populations.
- *Shoreline modification*. Seawalls, dredging, and sedimentation have the potential to alter the shoreline significantly.
- *Recreational use*. Increased use of off-road vehicles (ORVs) may damage sensitive habitats. The shallow shoreline, coastal marshes, nearshore fish spawning habitats, and other fragile shoreline habitats may be damaged by boat wakes.
- *Cats and dogs*. Increased development often results in an increase in pets, which tend to prey on avian species.

- *Sewage treatment*. Increased development will require new drainage and septic systems to prevent water contamination.
- *Deer*. The deer population is high, causing depletion of vegetation. Greater deer populations are the result of a changing forest composition. Clear cutting and poor regeneration of trees, such as White cedar, leaves open areas and good habitat for deer to browse.

12.3 Current Protection of Ecological Values

Most of the area is in private ownership. A small part of the peninsula is under the management of Mackinaw State Forest. Thunder Island is owned and used by the U.S. Coast Guard; however, ownership is expected to be transferred to the U.S. Fish and Wildlife Service. Scarecrow Island is owned and managed by the U.S. Fish and Wildlife Service. Gull Island is owned and maintained as a nature preserve by the Michigan Nature Association. Whitefish Bay, Misery Bay, and Crooked Island are designated state Environmental Areas.

12.4 Assessment

Overall, the Misery Bay area is in good ecological shape. Neotropical birds such as the American redstart inhabit Thunder Bay Island, an indicator of a healthy island with little human disturbance. Avian species in general appear to be healthy, with few crossed bills in evidence. Bald eagles, on the other hand, though present, have not nested here since the 1970s. The shoreline forests are in good shape, with a predominance of cedar, balsam, white spruce, and white pine. Deer are becoming populous in the few areas that have been extensively logged. A concern is that an increase in development may adversely impact sensitive ecosystems and migratory bird populations.

12.5 Key Protection Needs

- Maintain protection of offshore nesting bird colonies and buffer the islands during bird nesting periods.
- Protect fragile shoreline habitats from human impacts such as ORV and boat traffic.
- Prevent shoreline modifications such as additional marinas or sea walls which alter ecosystems that depend on natural water level fluctuations.
- Regulate limestone quarrying and the related cement plant in regard to water and air quality.
- Research the population trends and reproductive success of fish-eating birds.
- Conduct overall inventories of plant and animal species, and acquire more habitat information for assessing trends and impacts.
- Provide information to individual landowners about the ecological importance of the peninsula and islands.
- Promote education and awareness on sustainable development and ways to minimize the ecological impacts of development.
- Develop ecotourism. Provide opportunities to observe and learn about the great scientific and educational values of the area.
- Obtain more information on hydrology and soils to better understand their impacts and relationship to the natural features, and ecological communities and species associated with the peninsula.

13. Northern Lake Michigan

13.1 Ecological Features and Values

Off the coast of Little Traverse bay in Lake Michigan are 11 islands known as the Beaver Island Archipelago, or simply, the "Michigan Islands". They provide significant habitat for shoreline species such as colonial nesting birds, including the rare Piping plover. They are also important stopover sites for migratory birds. The complete array of natural landscapes found on the mainland are found on the islands too including dunes, perched dunes, sand, gravel, and cobble beaches, boreal forest, hardwood forests, and cedar swamps. Three species endemic to the Great Lakes, dune thistle (*Cirsium pitcherii*), dwarf lake iris (*Iris lacutris*), and Houghton's goldenrod (*Solidago houghtonii*), are found along the shorelines. Michigan monkey flower (*Mimulus glabratus var. michiganensis*), Lake huron tansy (*Tanacetum huronense*), calypso orchid and other state threatened and endangered species are scattered around the islands. Because they are isolated and better protected, these communities and species are healthy and flourish here. These conditions give the islands great potential as research sites. Native Americans, for example, are conducting research on Garden Island.

Beaver Island, the largest of the Michigan Islands, has unique ecological communities. They include cobble and sand beaches, sand bars, fens, marshes, bogs, conifer swamps, old growth forests, and beach-maple and oak woodlands. High Island contains the greatest biodiversity. Garden Island has reverted from pioneer agriculture to old growth forest.

Some of these islands are rich in cultural heritage. Garden Island in particular is important to some Native Americans, and they continue to use plants from the islands for medicinal purposes. Beaver Island was previously settled by Mormons, as well as fishers and farmers. Today, the islands are used for hiking, bird watching, fishing, hunting, and wild berry and fruit picking. Beaver Island is the only island that is actually developed and has a year-round population. The other islands are either uninhabited or have only a few residents.

Directly east of Beaver Island, at the northern tip of Michigan's lower peninsula, is a thin peninsula called Wilderness State Park. This dune and interdunal wetland area is rich in Great Lakes endemic species such as Pitchers thistle, Houghton's goldenrod, and Lake Huron tansy. The Piping Plover nests in relative isolation here.

On the northern shores of Lake Michigan, from the Straits of Mackinac to Manistique, the shoreline is sand dune and beach. Great Lakes endemic species like those found in Wilderness State Park also occur here.

13.2 Current Threats to Ecological Values

- *Development*. New second homes, especially on Beaver Island, are increasing as are recreational vehicles (Rvs) and motor homes, the result of a new, more spacious ferry. This is causing fragmentation of ecological communities along the shoreline.
- *Recreational use*. An increase in boaters and jet skiers to the islands is having an impact on shoreline vegetation and on nesting birds. Trash dumping is common on several well-frequented islands. There is pressure from snowmobile and ORV groups to be allowed access to High and Garden Islands. Tourist season is usually highest during sensitive times of the year, such as mating and nesting seasons.

- *Spotted knapweed*. This invasive non-indigenous species is beginning to impact the dune communities of Beaver Island.
- *Oil/toxic chemical spills*. Because the islands are located near a major shipping route, there is potential for contamination from oil or toxic spills.

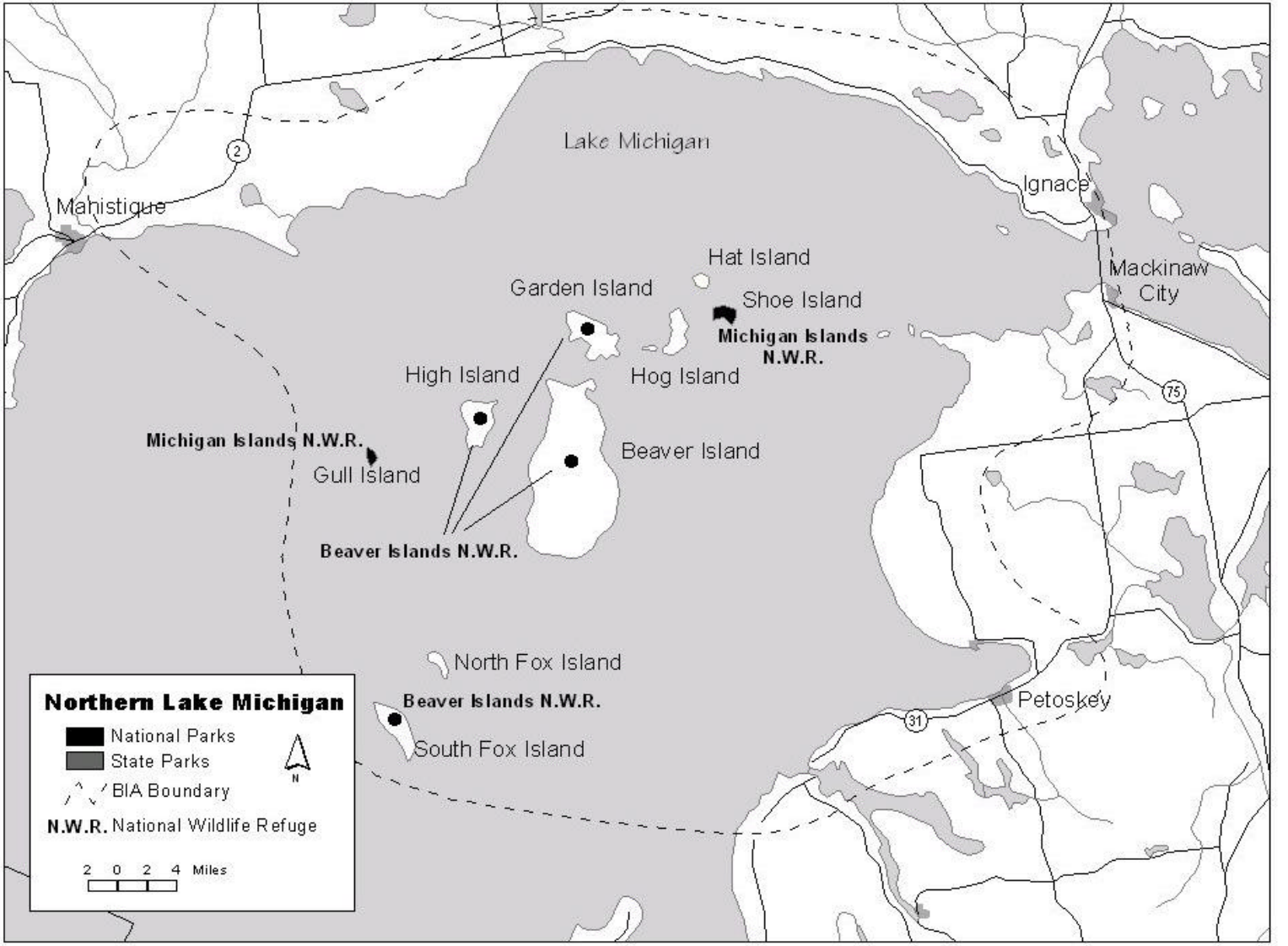

Figure 12 Northern Lake Michigan Biodiversity Investment Area

13.3 Current Protection of Ecological Values

Five of the islands, Garden, High, Gull, South Fox, and Hog, are part of the Beaver Islands Wildlife Research Area. They are owned by the state and federal governments. The Michigan Nature Association also owns a nature sanctuary on Gull Island. Hat Island is owned and managed by The Nature Conservancy. Four of the Islands, North Fox, Squaw, Whiskey, and Shoe, are privately owned. Except for a small state forest, Beaver Island is privately owned. Some of these private lands have been set aside as preserves. For example, Little Sand Bay and Barney's Bay are owned by the Little Traverse Conservancy, and Central Michigan University owns a portion of Millers Marsh. Additionally, St. James Township has purchased about 100 acres to be set aside for conservation. Wilderness State Park is part of Michigan's state park system.

13.4 Assessment

Although there is minor degradation on the shoreline due to the impacts of development and recreational boaters, the islands are in good shape ecologically. They are largely untouched because of their isolation and difficulty to reach. Piping plovers have decreased over the last few years, mostly on Beaver Island, but the causes are unknown. The islanders would like to keep the islands wild and are somewhat surprised and concerned that development has increased rapidly on Beaver Island in particular. With the new ferry service allowing easier access for people, freight and larger vehicles, the character of the island may change. The number of new homes being built each year is an indicator of the pace of development. Protection efforts could be measured by balancing the amount of additional ecologically sensitive areas being preserved in public ownership.

The northern Lake Michigan shoreline is bordered by scenic State Route 2 which sustains heavy traffic in the summer months. Much of the shoreline is privately owned, and shoreline development is occurring.

13.5 Key Protection Needs

- Local communities and individual landowners need to be given information about the ecological importance of the islands and the coastal lands, as well as developing and managing land in a sustainable manner.
- Research needs to be conducted on the impacts of threats to the ecosystem, such as recreational activities and invasion of non-native species.
- The islands are known to have significant biodiversity values but need to be inventoried, then monitored for changes and trends.
- Monitoring efforts might be focused on bald eagles, piping plovers, other migratory and colonial nesting birds, small mammals, and various types of vegetation sensitive to fragmentation, such as pitchers thistle. Information on changes in communities and habitats such as wetlands would also be valuable.
- Information is needed for a better understanding of the local ice conditions and how they impact the island ecosystems.

13.6 Stewardship Vignette

13.6.1 Beaver Island Botanical Bunch

About three years ago, a group of island property owners organized to help protect local native plants. They contacted local developers and asked to be informed of new buildings to be built so they could make sure there would be no damage to the flora. If construction is imminent on a site where there are native plants, the Bunch conducts a plant rescue, digging up and replanting in appropriate sites. Most important is their effort to inform realtors and builders about sensitive and rare plants, where they exist, and their growing requirements. This active approach has helped maintain a friendly working relationship among developers and environmentalists and protected many plant species.

14. Chicago Wilderness

14.1 Ecological Features and Values

Southern Lake Michigan is a land of people and nature. Home to 12 million people, the region extends from southeast Wisconsin to Northwest Indiana. It is the transportation crossroads of the Nation, embracing the City of Chicago, its suburbs, and a diverse Northwest Indiana industrial complex. It is also home to approximately 1,600 plant species with names like nodding wild onion (the native Americans named Chicago after this plant), big bluestem grass, the hoary puccoon, a bright, yellow-orange flowering plant of the oak savannas; endangered butterflies such as the federally endangered Karner blue; and ecological communities, such as lakeplain prairie, sand dune, and oak savanna. Many of these species and communities are found nowhere else on the globe. They are, in fact, so rare that they are in danger of disappearing. For example, less than one-hundreth of one percent of Illinois' tallgrass prairies, and even smaller fragments of natural oak savannas, remain, which makes these grassland and woodland communities considerably more endangered than the tropical rain forest. That's why it's called "Chicago Wilderness."

The people of the region are committed to protecting the wild plants and animals of the southern Lake Michigan region. The understanding that little is left of the landscape that existed before European settlement spurs the preservation of remnants for future generations. The landscape has been transformed by vast urban and industrial development, pollution, introductions of non-indigenous or exotic species, and an unprecedented demand for recreational space. All factors have contributed to reducing the populations of indigenous or native plants and animals.

People recognize the special qualities of the species and ecological communities that remain. Without the prairies we would not have the deep, rich soils to grow grains that feed much of the world. The oak savannas and floodplain woodlands, with their thick grasses and flowers, protect the streams from eroded sediments. Wetlands once covered the Chicago area. They act as a sponge during heavy rain, thus helping to protect drinking water - Lake Michigan - from polluted runoff. The sand beaches and dunes provide shelter and food for migratory songbirds on their way from Canada to the tropics.

14.2 Current Threats to Ecological Values

The Chicago Wilderness Region is complex and therefore has a complex array of threats. Following are three general threats that apply to all of the more than 200 sites in the region.
- *Fragmentation*. Remnant sites are small, often no more than a few acres in size. It is not unusual to find two sites, once historically part of a large tract, now separated by miles of houses, roads, and industrial development. Management of widely distant sites may be by different agencies having different goals. The functioning of fragmented sites is often marginal and highly susceptible to further degradation.
- *Exotic species*. Every site in the Chicago Wilderness complex of sites suffers from exotic species invasions which threaten the small and vulnerable remnant ecological communities. In oak savannas and woodlands, garlic mustard and European and glossy buckthorn crowd out tree sprouts and the grassy groundcover. White sweet clover out-competes native prairie plants. Purple loosestrife, reed canary grass, and Phragmites are difficult to keep from becoming the dominant vegetation to the exclusion of native plants in wetland areas.
- *Pollution*. Because the region is in the most urbanized and industrialized area of the Great Lakes basin, water, air, and soil pollution pose grave concerns to ecological communities. Two Areas of Concern, Waukegan Harbor and Grand Calumet River/Indiana Harbor Ship Canal, are within Chicago Wilderness.

14.3 Current Protection of Ecological Values

Although the landscape is dominated by people, more than 200,000 acres of wild areas are in "protected" status, that is, owned by a variety of organizations whose missions include preserving biological diversity. The Indiana Dunes National Lakeshore, for example, is federally owned, and Indiana Dunes State Park and Illinois Beach State Park are state owned. Cook County, Illinois and collar counties, on the other hand, support extensive forest preserve districts, created in the early 1900s by far-sighted landscape architects such as Jens Jensen, Frederick Olmsted, and Daniel Burnham. Lake County, Indiana has established a network of parks which have both recreational and conservation goals. Private organizations own several preserves. The Nature Conservancy, for example, manages Chiwaukee Prairie in southeast Wisconsin and Ivanhoe Dune and Swale in Northwest Indiana. The Shirley Heinze Environmental Fund has acquired numerous small pieces of vacant land near the Indiana Dunes National Lakeshore and is managing these properties for biodiversity.

Two Remedial Action Planning (RAP) processes are in progress in this biodiversity investment area. Waukegan Harbor's impairments are due to domestic waste treatment and industrial discharges. Parts of the harbor have been cleaned up. The Grand Calumet River/Indiana Harbor Ship Canal Area of Concern has all 14 beneficial uses impaired. At this writing, the Stage 2 document has been completed.

Chicago Wilderness is sponsored by the Chicago Region Biodiversity Council, public and private agencies and organizations who are dedicated to preserving the last and best remnants of Midwestern plant and animal communities. The Biodiversity Council is, in turn, supported by other organizations and thousands of volunteers who assist in managing the lands. This pool of expertise and knowledge has been a powerful asset in protection and restoration activities. Several activities are worth mentioning. A full color publication, *Chicago Wilderness, An Atlas of Biodiversity*, was published and is being distributed widely. With federal dollars, a small grants program has been initiated to assist partners in their restoration work. A biodiversity recovery plan is being written and will be the blueprint all natural resource landowners adhere to when making management decisions.

14.4 Assessment

In spite of severe threats to the ecosystems of the Chicago Wilderness region, both the level of cooperation by agencies and organizations and the participation and understanding of the general public, will result in the protection of significant areas of biodiversity. The region is, then, doing well in its efforts to protect and restore biodiversity. The Chicago Wilderness story is a remarkable story that underlines the importance of coordination, partnerships, and creativity.

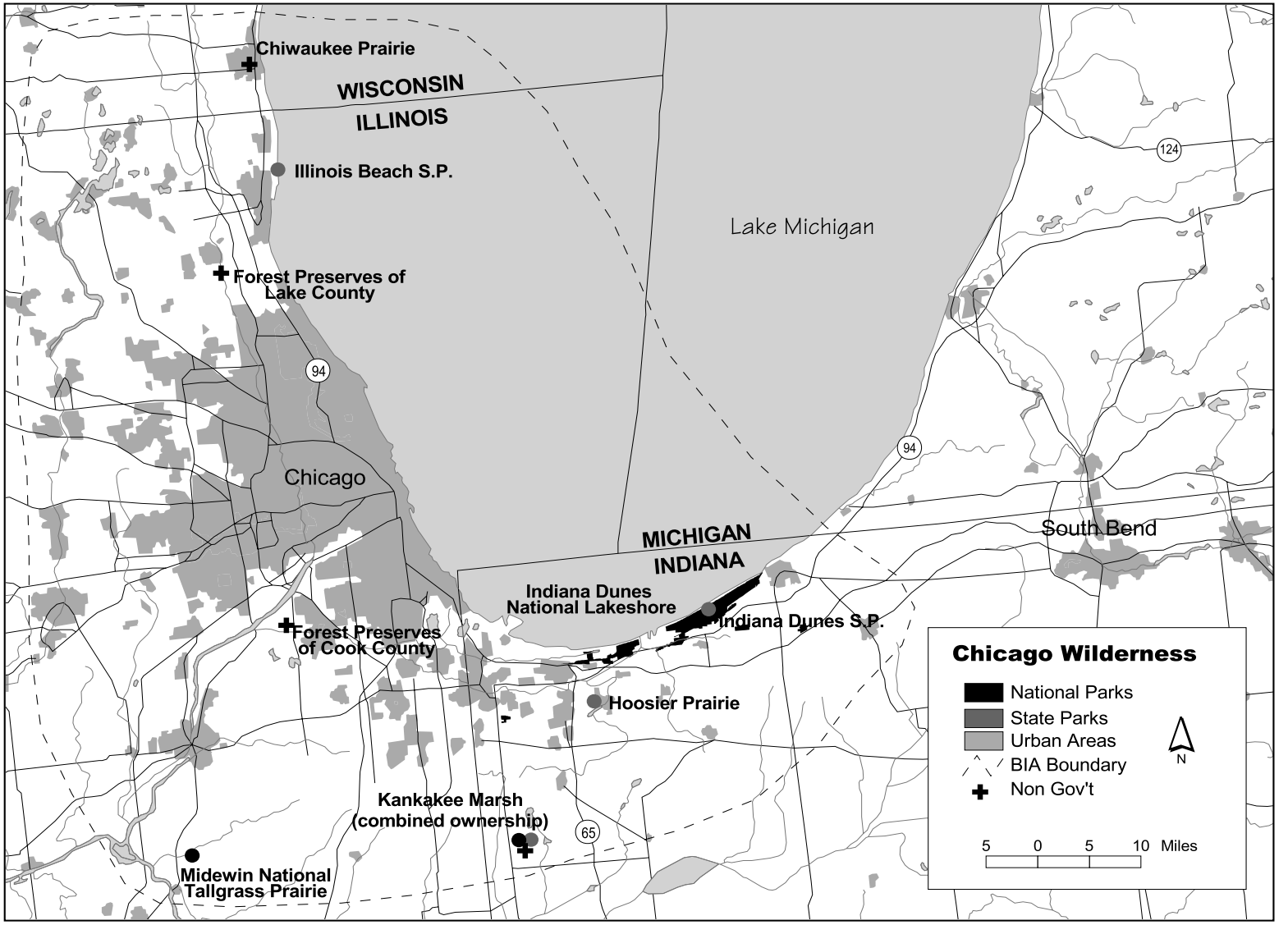

Figure 13 Chicago Wilderness Biodiversity Investment Area

14.5 Key Protection Needs

- Continued research into ecosystem functioning within urban landscapes.
- Continued education and outreach into the community at large.
- Continued protection of intact sites.
- Continued restoration of degraded habitats.
- Continued cooperation among the 61 Chicago Wilderness partners.

14.6 Stewardship Vignette

14.6.1 Chicago Region Biodiversity Council

The Chicago Region Biodiversity Council is a collaborative effort by 34 conservation organizations and agencies to restore, protect, and preserve the Chicago Wilderness, land that includes globally significant, rare native plants and animals. Although the Council coordinates the daily business of Chicago Wilderness, the total number of member organizations is 67 and includes local, state, and federal governmental agencies, research and educational institutions, landowners, and conservation groups. The Council is organized around teams of scientists, educators, land managers, and citizens pursuing conservation projects, including restoration of damaged woodlands and wetlands, management of prairies and dunes, and monitoring of plant and animal populations.

What does this impressive group of organizations actually hope to accomplish? The Council's key goals challenge members to document the natural communities of the region, including the plants and animals that live there; prevent loss of habitat by promoting planned development; help restore natural communities on public and private lands; inform the public and decision makers about the world-class natural resources in the region and the need for protection; and offer opportunities for area residents to be involved in Chicago Wilderness efforts and activities.

The Chicago region is one of a handful of metropolitan areas in the world that have a high concentration of globally significant natural communities. Happily, the Chicago Region Biodiversity Council is working to help Chicago Wilderness flourish.

15. Door County and Garden Peninsula

15.1 Ecological Features and Values

The Door County and Garden Peninsulas lies on a dolomite ridge which is part of the Niagara Escarpment, the same geologic formation that extends to Niagara Falls. They are biologically rich. Natural communities include sand beaches, dunes, ridges and swales, estuarine marshes, boreal forests, and bedrock beaches. The marshes are important spawning areas, the islands serve as shorebird nesting spots, and the forests provide habitat for interior bird species. The waters of Green Bay and Lake Michigan support a valuable fishery for whitefish. Cherry and apple orchards are famous in the region. The landscape is beautiful, with indented shorelines, points jutting out into the lake, sea caves, rocky points with sand bays, and beaches scattered along the coast.

Rare plants such as the Dwarf lake iris and numerous species of orchids are found here. Rich, calcareous fens are home to state listed plant species. The Mink River estuary on the Door Peninsula is critical habitat for fish spawning.

The Niagara escarpment is a refugium for ice-aged snails and for red and white cedars that are more than 250 years old. The white cedars grow on old rock outcrops and rock faces. They are true old growth forests.

The extensive karst topography along the peninsula influences water quality and contributes to the high density of caves found in this region.

15.2 Current Threats to Ecological Values

-*Development*. Shoreline development is fairly extensive throughout the county and is increasing in areas not previously impacted. Water quality, habitats and natural features are likely to be adversely impacted as a result. Tree clearing on the escarpment for homes and for driveways depletes the bedrock of moisture. The most aesthetically pleasing home sites are in biologically rich areas. Development is also increasing in rural areas, impacting the rural landscape and depleting the open spaces that people value.
-*Dock construction*. On the Green Bay side of the Door Peninsula, requests for permits to construct docks have increased. A recent impact assessment suggests that docks disrupt nearshore coastal processes, currents, movement of littoral drift, affect aquatic invertebrates and macroinvertebrates, spawning, and nursery grounds.
- *Fragmentation*. Ridge and swale topography presents special problems. Development occurs on the ridges. Culverts are put in, disrupting hydrology to the swales. As a result, the processes that make dune and swale ecosystems unique are fragmented. The majority of the peninsula is not in protected status, so there is great potential for further fragmentation of the landscape.
-*Groundwater contamination*. Manure storage, agricultural runoff and thousands of aging and malfunctioning septic tanks are contributing to polluted groundwater. Because of the bedrock, laying sewer and water lines is difficult and costly. Extensive karst topography creates a close connection between surface water and groundwater, and contributes to groundwater contamination problems.
- *Deer*. There are fewer places to hunt on the peninsula. As a result, the deer population is rising and the deer are retreating to the refuges, causing damage to rare vegetation.

15.3 Current Protection of Ecological Values

Currently there are three active land trusts in Door County. Ridges Sanctuary is focused in the Bailey's Harbor area and has been active in land acquisition. They own the best example of ridge and swale ecosystems in the country. The Door County Land Trustees has a broad mission that includes ecologically important areas as well as open space. Although they do not own much land, they concentrate on buying conservation easements and have purchased development rights in some areas. The Nature Conservancy is concentrating on buying land in five project areas. Once purchased, the land may be transferred to other land management agencies.

In addition to land trust acquisitions, five state parks (Newport, Peninsula, Potawatomi, Rock Island, and Whitefish) and two state wildlife areas are located on the Peninsula. These parks protect shoreline properties. The state Ice Age trail begins here. County and municipal parks are scattered throughout the

peninsula. Federal properties include lighthouses, wildlife rookeries, and several islands (Hog, Spider, Heart of Rock, Plum). The University of Wisconsin owns several tracts of land near Bailey's harbor. It is managed in conjunction with the Ridges Sanctuary and offers the land as an outdoor classroom for public use. About five to ten percent of the land in the county is publically owned, the rest is mostly developed.

The Garden Peninsula is less populated and not as accessible to tourist traffic as the Door County Peninsula. Fayette State Park is in public ownership. The rest of the peninsula is privately owned.

15.4 Assessment

Whitefish Dunes State Park is the only place on the peninsula where the sand beach and dune system is dynamic and healthy, and is not cut off from the lake. The rest of the coastal shoreline--the dune and ridge and swale ecosystems--are truncated from the lake and stabilized. There are still rare plants and animals and beautiful features found on the peninsula, although all large predators are gone. The lowland cedar swamps are not yet developed. However, the upland sugar maple, beech, hemlock, and white pine tracts are slowly being lost to development. The one large tract still left in Peninsula State Park is not reproducing well due to heavy deer browsing.

Door County Peninsula seems to be quickly becoming a museum piece or a garden instead of a place with fully functioning ecosystems. The trend appears to be an increase in shoreline development with a consequent loss of natural shoreline.

Although there may be signs of degradation in the County, there are also signs of improvement. Some reports indicate that songbirds area declining, and certain plants and animals are being displaced. On the other hand, waterfowl populations may be be increasing, and cormorants have been successfully reintroduced to the point that they are now considered a nuisance by some people. Additional research is required to gain a better understanding of these trends.

General assessments are being conducted on the species using the nearshore areas and how those areas area being impacted by stressors. This will provide some baseline data and direction for more detailed future research.

The people of the area realize the natural resources are at risk. Attempts are being made to protect critical areas before it's too late. For example, recently, a large group of private citizens, environmental groups, and representatives from state and local governments evaluated the current protection efforts in the county (including environmentally and culturally sensitive areas) and located critical places that were not adequately protected. They discovered about six corridors running north-south through Door County, encompassing several thousand acres, that have not received protection attention in the past, but are prime focus areas. These areas contain a variety of natural features including upland forests, natural springs, wetlands, migratory corridors and endangered plants and animals. Some simply represent high quality natural areas and others have water quality issues. They are in the process of refining the list of areas and determining next steps. Similar efforts are underway with other partnership groups and local communities. In the process of gathering information on the county's resources for this effort and other protection activities, it was discovered that some of the local citizens had a wealth of information on a variety of species and natural features found throughout the peninsula. Some of these citizens are conducting their own research and observations on species such as the red shouldered hawk, and other birds in general.

15.5 Key Protection Needs

- Identify and monitor endangered plant and animal populations, such as the Heinze emerald dragonfly, the dune thistle, or interior breeding birds, in order to define the quality of natural areas.
- Fill in baseline data gaps, such as for macroinvertebrates and rare snails, spawning and nursery areas.
- Monitor long term natural resource trends.
- Use aerial photos to indicate degree of fragmentation over time.
- Make information more accessible and easy to use for day to day decisions.
- Put more land into protected status, whether public or private.
- Assess how well current protection programs and efforts are doing.
- Develop and enforce zoning laws that support sustainable development.
- Implement an aggressive program to eliminate sources of groundwater contamination.
- Improve communication between various stakeholders so they can help each other address common issues and enhance protection efforts in a sustainable manner that incorporates all local concerns and interests.

15.6 Stewardship Vignette

15.6.1 Door Property Owners, Inc.

The mission of the Door Property Owners is, "To provide a forum for the discussion of land use issues and to advocate for development which is sensitive to the Door Peninsula's natural, scenic, cultural and aesthetic resources." This collaborative group is confronting development and zoning issues in Door County in creative ways. They were instrumental in the efforts mentioned above for identifying protection needs in the county. They have also played a key role in developing and organizing the Door County Stewardship Council, a new organization being set up to open communication and enhance cooperation efforts between all interest groups and public and private organizations in the county. The Council is still being formed and is expected to formalize in October 1998.

It will provide a forum for all stakeholders to work together towards achieving a shared vision of balancing environmental preservation with economic vitality. This vision will be realized by developing and achieving goals, and addressing and resolving issues throughout the county. They will be looking at the system holistically and considering the long term impacts of land use activities. All Council members will receive training in how to better communicate and learn from each other so they can lead their communities in working through common issues while respecting different viewpoints, interests and values. Previously formed public-private task teams will be incorporated into the Council. These task teams were formed to address specific issues such as protection of wetlands, preservation of natural and scenic areas, zoning, and conservation development. One of their recent accomplishments was to reduce by 50% the zoning ordinance allowing the development density of multi-unit resorts and condos.

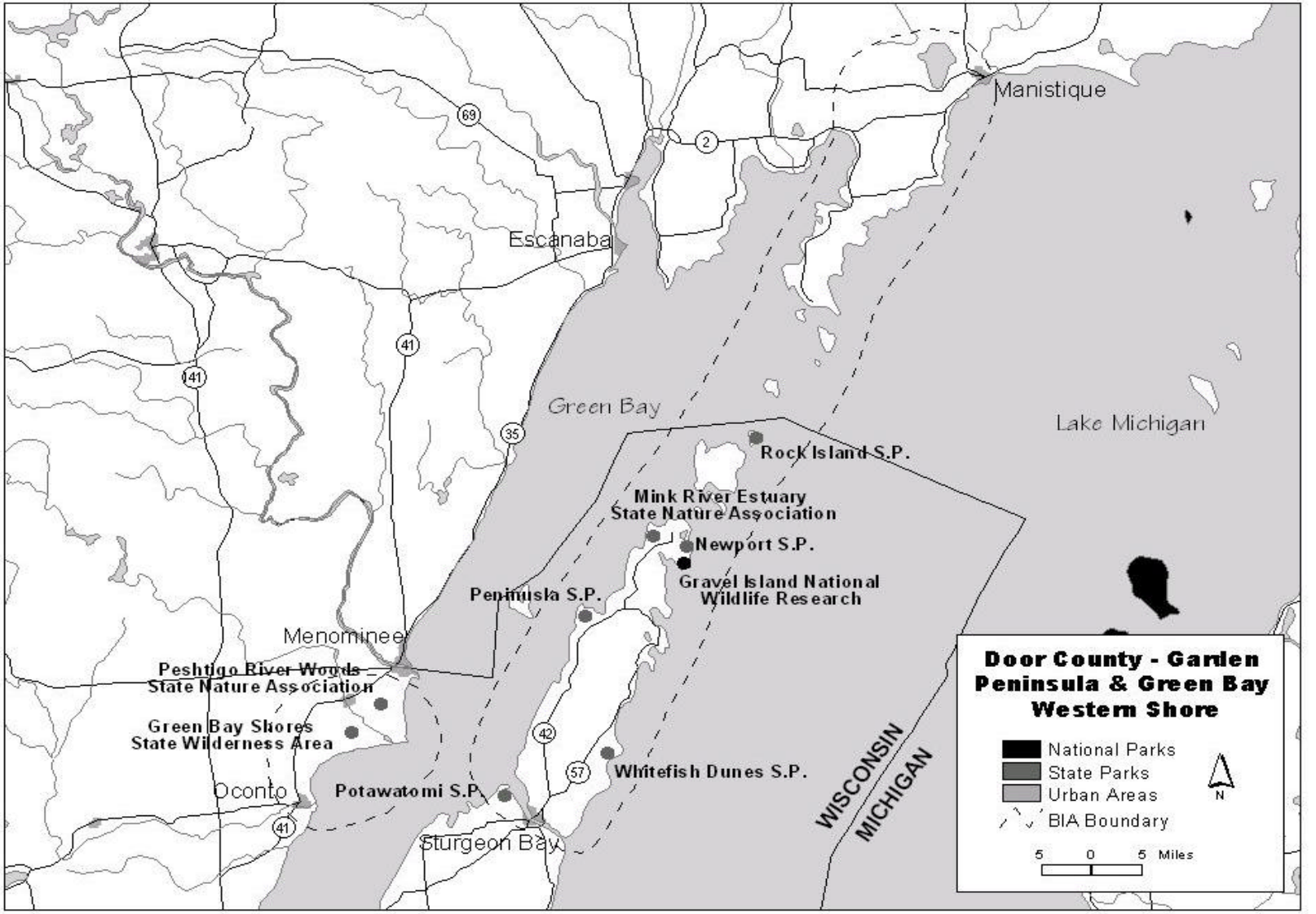

Figure 1 4 Door County–Garden Peninsulas and Green Bay Western Shore Biodiversity Investment Area

16. Green Bay Western Shore

16.1 Ecological Features and Values

The western side of Green Bay is rich with marsh life, floodplain forest, and northern dry-mesic forest communities. Bald eagles recently nested here and Red-shouldered hawks reside in the woods. The wetlands are extensive and include wet prairies and sedge meadows.

This is an important area for colonial nesting birds. Common terns (*Sterna hirundo*) and Forster's terns (*Sterna forsteri*) last nested here in the late 1970s due to high lake levels. Forsters terns and Caspian terns (*Sterna caspia*) do leaf and feed here as do double-crested cormorants (*Phalacrocorax auritus*).

16.2 Current Threats to Ecological Values

- *High water levels*. The water levels of Green Bay and Lake Michigan have an impact on the biota of the marshes and the wet prairies and sedge meadows, as well as the bird life inhabitating these areas.
- *Agricultural runoff*. Surrounding land use is agricultural. Contaminated runoff will have an impact on the chemistry of the marshes as well as the wildlife.

16.3 Current Protection of Ecological Values

The rivers are protected by Wisconsin's Stream Antidegradation Rules (NR 102). The Green Bay Shores State Wildlife Area and the Peshtigo River Woods State Natural Area protect the natural communities in this small, but important biodiversity investment area.

16.4 Assessment

This is an important area for waterfowl which has been disturbed at various times in recent history. Presently, water levels and agricultural runoff are the greatest concerns. The Department of Natural Resources has been restoring parts of the rivers in order to improve the quality of habitat for fish communities. Continued work will improve habitat for birds as well.

16.5 Key Protection Needs

- Monitor bird nesting populations.
- Determine water quality of the bay and streams and its impact on marsh, wet prairie, and sedge meadow birds and fish.

17. Lake St. Clair/Detroit River

17.1 Ecological Features and Values

The Lake St. Clair area is set within a low-lying flat clay plain, with very little topographic relief. The lake is relatively shallow, with occasional drops in winter water levels caused by ice jams upstream. Except for the delta area at the northern end of the lake, shorelines have been extensively modified by dykes or sea walls. Extensive wetlands which originally occurred around the lake have been drained for agriculture or urban development, and shoreline residential or commercial development is present around much of the lake.

Despite this degree of past impact, the remnant natural habitats which remain around Lake St. Clair have a high degree of significance. The globally imperilled Great Lakes marshes and lakeplain prairies are key resources of the St. Clair Flats. Together, with the adjacent oak openings, also globally imperilled, these three systems create an especially unique ecosystem. The St. Clair Delta, located largely on Walpole Island First Nation lands, is a mosaic of wetland, prairie, and oak savanna habitats without equal in the Great Lakes basin. In addition to extensive, high quality cattail marshes, this site contains over 100 nationally and provincially rare plant species, and many significant species of birds, mammals, herptiles, and butterflies. The wetlands provide valuable waterfowl nesting and staging habitats, fish spawning areas, and nesting sites for colonial birds. Lake St. Clair and its connecting rivers serve as an essential migratory staging area for dabbling and diving ducks, geese, and tundra swans, with well over 1 million waterfowl using the area each year.

Other natural habitats around the lake are smaller and more isolated. Most of the former marshlands along the east shore of the lake have been converted to agriculture, but pockets of dyked and undyked marsh remain, in many cases maintained by private hunt clubs. Along the southern shore, several small wetlands remain, including one behind a small barrier beach at Ruscom Shores. These wetlands are well-known to birdwatchers as reliable areas to find nesting rails and western species such as Yellow-headed Blackbirds. The southern shore also has small areas of natural shoreline with low vegetated banks and narrow sand beaches, such as the one at St. Clair Beach. An excellent example of remnant tall grass prairie is located in the southern section of the City of Windsor, in Ojibway Prairie Provincial Park.

The Detroit River, which links the St. Clair flats and Lake St. Clair delta to Lake Erie, is a significant migration route for fish, waterfowl, butterflies, raptors, and non raptors. It contains remnants of coastal marshes and lakeplain prairies, which provide important habitat for a diversity of migratory and resident species. Several islands in the Detroit River and the river's unique ecology as a connecting channel make this American Heritage River significant. Belle Isle, three-miles long, is the most heavily used island in the United States. Created wetlands on the island are adjacent to an old historic area and a public aquarium. Grosse Ile Island offers opportunities for bird watching. Grassy Island contains Wyandotte National Wildlife Refuge. Humbug Marsh is a nesting, resting, and feeding island for birds such as the Great blue heron, egrets, bald eagle, and raptors as well as a stopover for migratory birds. It is the only coastal wetland left on the U.S. side of the Detroit River, and makes up the only undeveloped mile along the river. The southern portion of the Detroit River is internationally known as the #1 hotspot for walleye fishing.

Having been identified as an Area of Concern by the International Joint Commission, The Detroit River has a Remedial Action Plan (RAP). The 1996 Stage 2 RAP Report identified Belle Isle, Grassy Island

(Wyandotte National Wildlife Refuge) and Humbug Marsh as three of five key habitat protection and restoration sites.

17.2 Current Threats to Ecological Values

The Lake St. Clair/Detroit River area has been heavily impacted by land use change and other human activities in the past. One result is the ecological isolation of many of the remnant natural habitats that remain, cut off from connections with other natural areas by intensive agriculture or by urban developments. Over the long term, this isolation may be the most important threat to the ecological integrity of these habitats, as their biodiversity gradually becomes impoverished with little opportunity for natural restoration.

Other threats to the biodiversity of the Lake St. Clair/Detroit River area include deterioration associated with excess nutrients and sediments feeding into the lake from tributary rivers, water and air pollution, erosion and wave damage from the passage of freighter ships, and the effects of exotic species such as Purple Loosestrife and Zebra Mussels.

The wake from boat traffic and jet skis impacts waterfowl habitats, fish habitat, and duck nesting.

Marina development, bulkheads, and sea walls are impacting shoreline habitats. Additional hydrologic modifications such as dikes, water level controls and other management techniques have impacted the natural system. Drains along added roadways have contributed to the lowering of the water table, making it difficult for some native species to survive and allowing exotics to take over.

Finally, the remaining natural habitats are under constant economic pressure for conversion to intensive agriculture or urban uses. This threat applies to both private lands and to First Nation lands, where the prospects of employment and economic benefits from alternate land uses will always have to be weighed against the traditional values of natural habitats. Of the 32 miles of the Detroit River, 31 are developed and the land adjacent to the last undeveloped place, Humbug Marsh, is proposed for development.

17.3 Current Protection of Ecological Values

Protection Mechanism	Comments
National Wildlife Areas: St. Clair N.W.A. St. Clair Flats Wildlife Refuge Wyandotte N.W. R.	Protects key area of remnant marshland within several dyked cells and as open marsh on the delta.
Provincial and State Parks: Peche Island (Recreation) Algonac State Park St. John's Marsh Ojibway Prairie (nature reserve)	Peche Island is a small island off Windsor; includes some natural habitat with 12 nationally rare plant species. Algonac includes some areas of marshland. Ojibway Prairie provides relatively extensive remnants of tall grass prairie communities.
Conservation Areas: Tremblay Beach C.A. Ruscom Shores C.A. Metropolitan Beach Park	Protect small sections of barrier beach, coastal wetland habitats. Metropolitan Beach Park is the most heavily used public beach on the lake, and is managed primarily for recreation.
Wetland/ANSI Policies: St. Clair Marshes (life science ANSI, sign.wetland) Tremblay Beach Marsh (significant wetland) Walpole Island Marsh (significant wetland)	By provincial policies, the natural heritage values of these areas are to be considered in all planning decisions.
First Nation Lands: Walpole Island First Nation	Includes highly significant marshlands, prairie, oak savanna, habitat for many rare species. The First Nation operates a Natural Heritage Centre and is developing ecotourism opportunities.

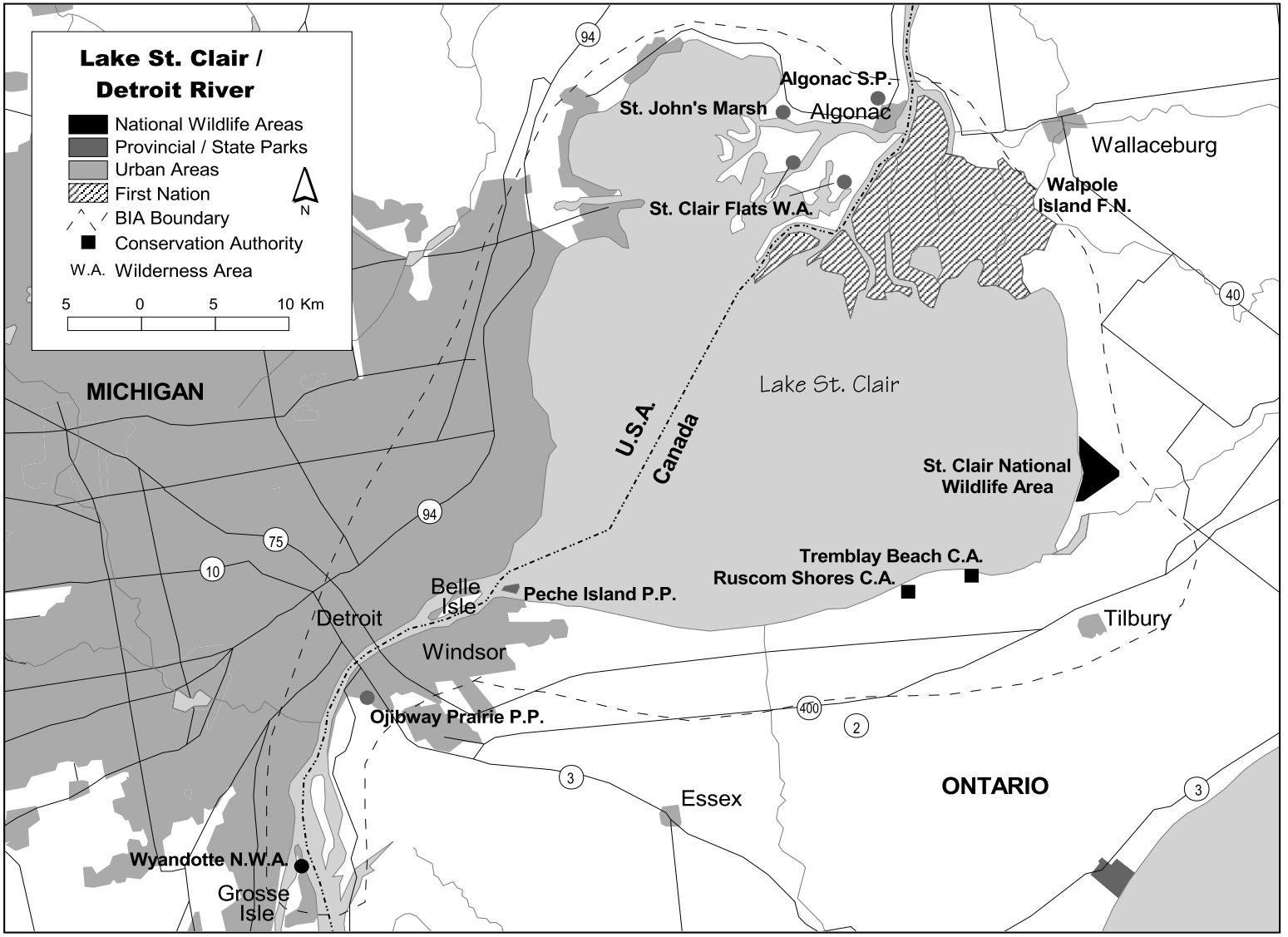

Figure 15 Lake St. Clair / Detroit River Biodiversity Investment Area

17.4 Assessment

The Lake St. Clair area provides good representation of Great Lakes delta features, coastal marshlands, and lakeplain prairie and savanna communities. While the diversity of communities present is fairly limited, their species diversity is relatively rich, including a large number of rare or endangered species. The habitats within First Nation lands or formal protected areas are generally in good condition Although restoration efforts have helped improve conditions to some degree, the region as a whole must be considered degraded from its original condition.

Several species appear to be recovering in the Detroit River. For example, the burrowing mayfly has recently made a comeback. Juvenile Lake sturgeon were recently found near the mouth of the Detroit River, possibly indicating renewed water quality. Additional research is needed to characterize current populations and understand the causes and implications of this recent discovery. Wild celery, a dominant submersed plant in the Detroit River and the preferred food of migrating waterfowl, decreased significantly from 1950 to 1985, as did the populations of many migrating ducks. However, it appears that wild celery has been recovering over the last several years, and duck populations have increased tremendously, possibly due to increased in water clarity. Research is currently being conducted to determine the status of wild celery compared to historical records.

A variety of indicators could be used to determine ecological impacts to the area. For example, a growing number of permits for new construction indicates pressure on sensitive areas, particularly wetlands. The number of boats driving at high speeds near wetlands and other ecologically sensitive areas indicates impacts to those areas. There are not enough resources to patrol no wake areas near key sites. Improvements in protection efforts could be identified by the increased acres of protected wetlands or increased miles of nature trails or greenways.

17.5 Key Protection Needs

Given the prominence of the Lake St. Clair delta area as an outstanding natural feature, set within an ecoregion that has relatively little high-quality natural landscape remaining, the protection of the delta area must be a high priority. To a large extent, the nature and extent of protection will be determined by the Walpole Island First Nation through their land management activities. The First Nation should be provided every possible assistance in continuing to develop appropriate protection mechanisms, and in extending their ecotourism programs as a compatible form of economic development.

Elsewhere, there are few opportunities to protect additional natural landscapes within this Biodiversity Investment Area (BIA), because of the intensity of land use around the lakeshore. Long-term securement of the private hunt club marshes along the eastern side of the lake, perhaps through conservation easements or other forms of agreement, is an important need. The eastern shore also offers the best potential for habitat restoration to re-connect and extend existing protected areas. Ducks Unlimited, in cooperation with the Canadian Wildlife Service and other agencies, is currently investigating the potential for such projects.

Efforts should be expanded throughout this region to work with state and local governments and landowners to restore natural processes, promote sustainable development, and support ecotourism. In areas already highly developed, efforts should be focused on protecting or restoring the last remaining remnants of natural areas, such as Humbug Marsh.

Because of the large number of endangered and threatened species within this area, emphasis should be placed on monitoring their status, and on developing and implementing recovery plans for species and communities at risk. Long term changes and trends in the Great Lakes marshes, lakeplain prairies and oak openings also need to be monitored, as does surface water quality.

Widely available and distributed educational materials and programs should emphasize the fact that individual actions have an impact on the environment (i.e. household hazardous waste disposal, runoff, boats, snowmobiles), but steps can be taken to minimize the impacts.

The extensive development throughout this BIA places a lot of pressure on the sewage and stormwater drainage systems. Improvements need to be made on those systems in order to handle increasing demands and prevent contamination via leakages and overflows.

17.6 Stewardship Vignette

17.6.1 City of Trenton Linked Riverfront Parks

Citizens are providing support for development of fish and aquatic habitat in the Detroit River as part of a city and park redevelopment project in Trenton, Michigan. Rather than limiting riverbank stabilization to conventional sheet piling, gravel and cobble habitat will be designed and installed to demonstrate the feasibility of creating fish habitat in conjunction with urban park development. This aquatic habitat demonstration project is an important aspect of the larger long range City of Trenton Linked Riverfront Parks Master Plan.

18. Long Point

18.1 Ecological Features and Values

The Long Point area on the north-central shore of Lake Erie, including a section of the adjacent Norfolk Sand Plain, is one of the most diverse and valuable mosaics of remaining natural habitat in the southern Great Lakes basin. In some ways, its value is summed up by its list of designations: A World Biosphere Reserve, a RAMSAR site under the Convention on Conservation of Wetlands of International Importance, two National Wildlife Areas, provincially significant wetlands, and Areas of Natural and Scientific Interest.

The primary feature of the biodiversity investment area is Long Point itself, the longest sand spit on the Great Lakes, consisting of a series of finger-like dunes and inlets formed over the past 3000 years. On the sheltered side of the point, a complex mosaic of wetlands has formed. The habitat diversity of Long Point Bay is further enhanced by a smaller beach and marsh feature at Turkey Point, and by abundant submerged vegetation in the bay itself.

The result is an internationally important area for migrating birds. About a quarter of North America's Tundra Swans stop over in the Long Point area during spring migration. Hundreds of thousands of ducks use this as a spring and fall staging area. The Point and other nearshore areas are a major migration corridor for songbirds and shorebirds. Bats, dragonflies, and butterflies also use the Point as part of their seasonal migration route.

Some sections of the Long Point area have important forest stands; the sandy soils and ravines support forest cover at about 18% of the watershed area. These forests have been gradually increasing since the 1950s, in response to changing agricultural practices and reforestation programs. This region supports the highest degree of forest cover anywhere within the deciduous forest zone in Canada.

This combination of abundant wetlands and forests has created an exceptional richness of wildlife in the area. 34 species of herpetofauna (reptiles and amphibians) occur within the area, including significant populations of extremely rare species. A similar richness in mammals, plants, and invertebrates has been documented through local natural areas inventories. Long Point Bay and the associated wetlands and streams also provide significant habitats for a rich diversity of fish species.

Bird life shows a similar diversity. According to Ted Cheskey (in Nelson and Wilcox,1996), "the Long Point area is perhaps the richest and most interesting area for birds in southern Ontario and all of the Great Lakes basin." He attributes this to a combination of rich and healthy forest and marshland bird communities, and high numbers of forest interior species, species preferring uncommon and restricted habitats, species at the northern edge of their range, and rare species.
Long Point also has one of the highest winter bird occurrences anywhere in eastern Canada, and is an important staging and feeding area for many species in spring and fall. The Long Point Bird Observatory has been based in the region for many years, and operates several bird banding stations in the area.

18.2 Current Threats to Ecological Values

For the most part, the Long Point area is rural in character, with the town of Port Rowan and scattered villages providing the only population concentrations. However, it is not immune from impacts due to land use change.

An analysis of land cover change in the Long Point area shows that agricultural lands in the area increased from 53% in 1955 to 57% in 1990, while forest cover also increased slightly. Wetland area along the north shore of Long Point Bay decreased by almost a third over the same period, from 22% to 15% of the study area (in Nelson and Wilcox, 1996).

While some of this wetland loss is attributed to higher water levels, other important factors are agricultural drainage and cottage and marine development with associated dredging. These appear to continue to be the major threats to the future health of the Long Point wetlands, as the cumulative effects of ongoing small-scale projects continue to mount.

Within forested areas, the primary threat appears to be fragmentation of the large blocks of forest that support many sensitive species. This fragmentation is also a gradual, cumulative process, caused by house building within natural areas, intensive logging, and the expansion of agriculture into forests. Intensive logging of conservation authority forests, to provide revenues to offset cutbacks in provincial grants, has become commonplace and controversial within this area in recent years.

Water quality within Long Point Bay and its tributaries is also an issue of concern, with high nutrient levels contributing to eutrophic conditions. The sources of nutrients include private septic systems in rural and cottage areas and runoff from agricultural areas.

18.3 Current Protection of Ecological Values

Protection Mechanism	Comments
National Wildlife Areas: Big Creek Marsh N.W.A. Long Point N.W.A.	These two areas protect substantial areas of marshland, sand beach and dune, and associated communities. Public access is restricted.
Provincial Parks: Long Point P.P. (Recreation) Turkey Point P.P. (Rec.) Several other provincial crown land areas occur north of Turkey Point and in the St. Williams Forestry Station.	While these parks see heavy recreational use, they also protect some wetland habitats and rare species.
Conservation Areas: Lee Brown Marsh C.A. Rowan Mills C.A. Backus Woods C.A. Vittoria-Sowden C.A. Fisher Cornell C.A. Norfolk C.A. Hay Creek C.A. The Long Point Region Conservation Authority also owns a number of other "forestry properties" within the Long Point area.	These conservation areas provide public access and varying degrees of protection to a range of wetland and forest habitats. Lee Brown Marsh is adjacent to the Big Creek Marsh N.W.A., and forms part of a very significant wetland complex. Backus Woods is the largest and best quality example of deciduous woodland in Ontario, with mature forest communities and many rare species.
Private Nature Reserves: Spooky Hollow Sanctuary	Sections of significant old-growth deciduous forest with many rare species have been acquired by the Hamilton and Norfolk Naturalists Clubs.
Wetland and ANSI Policies: South Walsingham Sand Ridges (life science ANSI) Big Creek Floodplain (life science ANSI) Turkey Point (wetland, life science ANSI)	This list does not include other ANSIs and significant wetlands located within the protected areas noted above. Provincial policies require that the natural heritage values of ANSIs and wetlands on private land be considered as part of any planning decisions.
World Biosphere Reserve: Long Point World Biosphere Reserve	While this designation has no regulatory force to control land use, it assists communication, education and research efforts among agencies, non-government organizations, and the community.

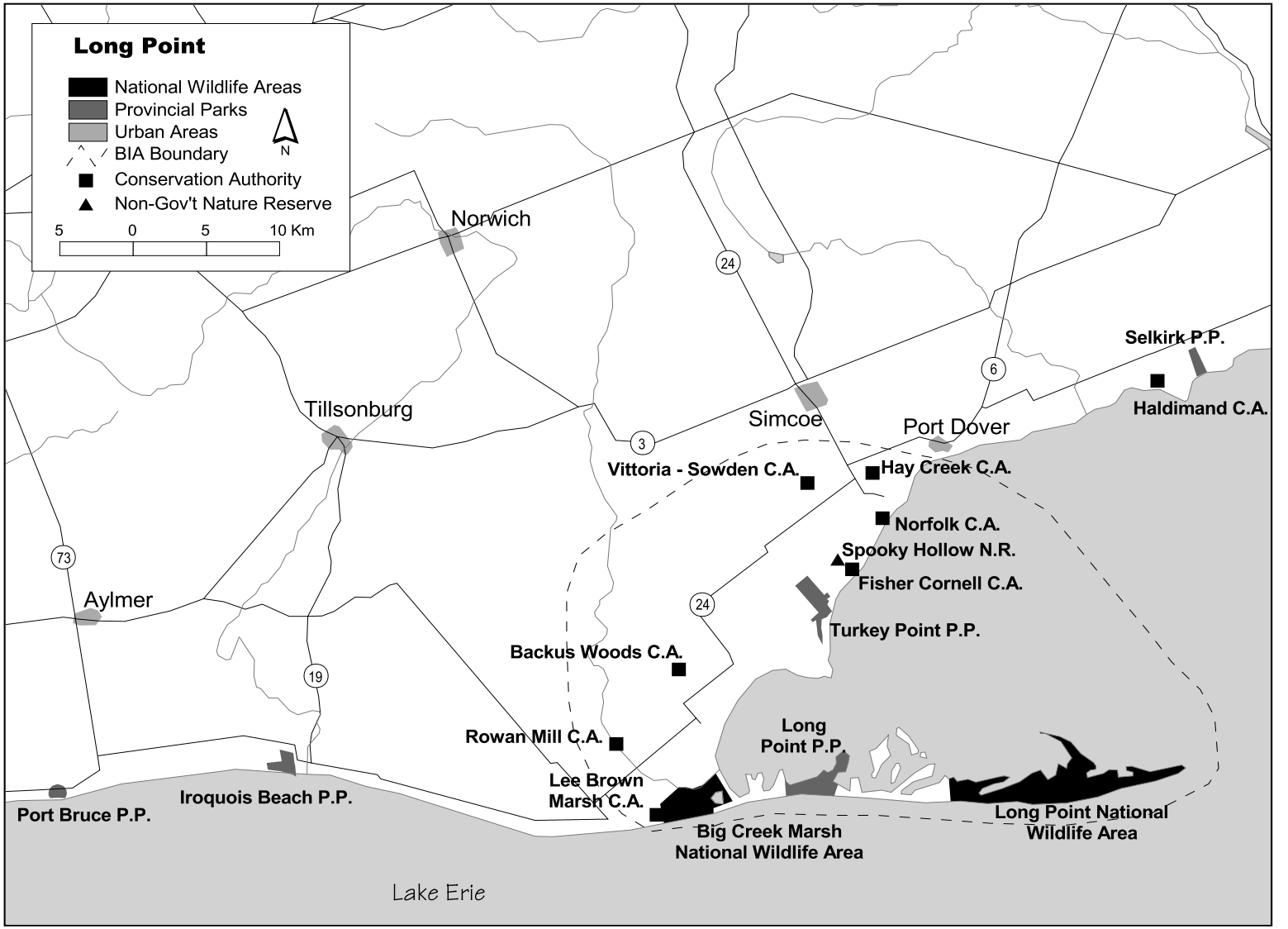

Figure 16 Long Point Biodiversity Investment Area

18.4 Assessment

The Long Point BIA contains a mosaic of natural heritage features of international, national and provincial significance. Substantial portions of these features are protected in public ownership, with other important areas receiving a lesser degree of protection through conservation authority ownership, planning policies, and private stewardship. However, the Long Point area is still undergoing a gradual loss of ecological values through the cumulative effects of logging, rural housing, cottage and marina construction.

In recent years, this area has had the advantage of coordinated efforts to document and protect its ecological integrity through several mechanisms. The Heritage Resources Centre of the University of Waterloo has focused attention on the Long Point area through a series of student projects and publications. A local committee has been formed to promote projects associated with the Long Point World Biosphere Reserve, and the Long Point Basin Land Trust has recently been formed to acquire lands of special natural significance. These citizen efforts highlight a growing public awareness of the importance and value of the natural resources of this area.

18.5 Key Protection Needs

Perhaps the most important need in the Long Point BIA is to translate growing public awareness into a more determined effort by the local municipalities, conservation authority, and other agencies to protect their natural heritage from cumulative losses. This could involve the allocation of greater funding from provincial and municipal sources to offset logging revenues from conservation areas, to support enforcement of provincial land use planning policies including no net loss of wetlands, and to expand remedial programs for agricultural erosion and faulty septic systems.

Some restoration activities have begun in the Norfolk Sand Plain area, based on a landscape-level analysis of core natural areas and key corridors among them. As part of the Long Point Environmental Folio, Karen Beazley and Gordon Nelson proposed candidate restoration demonstration areas in four areas - near Port Rowan, north from Turkey Point, and in two sections of Big Creek valley (in Nelson and Wilcox, 1996). Some native forest and prairie restoration work has been initiated in these areas, but this is only a small beginning to address an important need.

18.6 Stewardship Vignette

18.6.1 Long Point Environmental Folio

The Long Point area has the good fortune of being the subject of a recent research project conducted by the Heritage Resources Centre of the University of Waterloo. From 1992 to 1996, the Centre carried out a series of background studies on the environmental, historical, and land use characteristics of the Long Point area. Information from these studies and other relevant sources has been assembled into an Environmental Folio, designed to “give people the information that they need to understand and make better decisions about environment and development in the Long Point area”.

The Folio is a set of sixteen individually bound chapters suitable for keeping in a three ring binder. The chapters provide an information summary for a wide range of topics - from geomorphology and human history to birds and mammals and fish to land cover change and water quality and shoreline flooding.

The text is written to be accessible by anyone with an interest, and each chapter includes maps, charts and photos to illustrate their meaning.

Dr. Gordon Nelson, the Study Director, sees this as a model that could be put to good use in other areas. By assembling information from disparate sources into a useful format, and addressing key information gaps, the Folio provides a strong basis for increasing local understanding and assisting with improved and informed decision-making. Encouraging local people and agencies to cooperate on creating their own Environmental Folio could be a positive and useful starting point for protection activities in many other Biodiversity Investment Areas.

19. Presque Isle

19.1 Ecological Features and Values

Presque Isle Peninsula is a 3,200-acre recurved sand spit which juts out seven miles into Lake Erie. Created after the last glacier receded, this unique ecosystem is registered as a National Natural Landmark because of its sand dunes and marshes. The Peninsula, a major stopover for migratory birds and waterfowl, includes bluffs, northern hardwood forest, savanna, dunes and beaches, and different types of wetland. More than 1,800 different plant and animal species occur on site.

In addition to its great ecological importance for Lake Erie, Presque Isle has great historical importance. More than 30 historical sites represent events from Iroquois and Erie occupation, military occupation by the French, British, and Americans, and Commodore Perry's naval base during the War of 1812.

Today, Presque Isle is a recreational park. Miles of sand beaches and hiking and biking trails draw many visitors year round. A series of offshore breakwater lines the lake side of the peninsula to protect the beaches from erosion.

Presque Isle Bay is an Area of Concern. Use impairments are due to sediment contamination. A Remedial Action Planning process is currently in progress.

19.2 Current Threats to Ecological Values

- *Offshore breakwalls* and *marinas* may be disrupting the process of longshore sediment transport that naturally erodes and replenishes sand beaches.
- *Beach raking* to accommodate sun bathers is depleting important food sources for migrating birds and driftwood and debris, habitat for insects.
- *Exotic species* such as purple loosestrife are invading the ecosystems, posing management problems.
- *Recreational overuse* threatens to erode sensitive areas within the park.
- *Deer populations* are high. Browsing threatens new tree seedlings and rare vegetation.

Figure 17 Presque Isle Biodiversity Investment Area

19.3 Current Protection of Ecological Values

The peninsula is owned and managed by the State of Pennsylvania as a state park. A small bird sanctuary at the end of the peninsula is restricted but this is not always strictly enforced. The rest of the peninsula is open to the public for recreational purposes.

19.4 Assessment

Human pressures on the ecosystems of this rare park are great and threaten to disrupt ecological processes such as longshore transport of sediment and important migratory bird habitats. The effects the offshore breakwaters will have on sand transport, and therefore, the constant changing of the spit, are not entirely known. Beach raking, additional recreational development along the beaches, and recreational use limit the usefulness of the area's value for wildlife. Damage from deer and exotic species invasions threaten the functioning of ecosystems.

An effort is being made to control exotic species using herbicides and mechanical removal. The Presque Isle Partnership recognizes the immense ecological value of the peninsula to Lake Erie and is working with the state to maintain a balance between ecological values and recreational benefits.

19.5 Key Protection Needs

- Control exotic and problem species.
- Thoroughly inventory species and ecological communities and update management plans to protect and restore them.
- Assess human impacts to ecosystems and mitigate for them.

19.6 Stewardship Vignette

19.6.1 Presque Isle Partnership

The Presque Isle Partnership is a non-profit association at Presque Isle State Park. Members include local businesses, environmental groups, and colleges and universities. The goal of the partnership is to work with state park staff to develop a comprehensive plan to deal with invasive species in the park. Detailed vegetation maps are being created along with an outline of possible control methods. Brochures describing the problem of invasive species will be produced and distributed to the more than 4 million yearly visitors, as well as to local schools.

20. Western Lake Erie

20.1 Ecological Features and Values

Shoreline areas surrounding the western basin of Lake Erie include a large number of biologically diverse sites, set within the mildest and most southerly section of the Great Lakes basin. The hot, humid summers and mild winters characteristic of this area creates suitable conditions for many species of

plants and wildlife associated with the deciduous forest region stretching to the south. As a result, oak-hickory forests are the dominant forest type, with many southern species such as Hackberry and Kentucky Coffee-Tree.

The diversity of habitats in the area is enhanced by its diversity of landforms. While much of the surrounding landscape is poorly-drained clay plain, now largely converted to agriculture, areas of outwash sand occur along the north shore of the lake. These landforms support a variety of remnant forest types, such as the high-quality Black Oak - Pin Oak forests found at Cedar Creek near the Essex County shoreline. Small prairie and savanna remnants are also found scattered throughout this area, a part of the local ecology which reflects a warmer climatic period in the past.

On the Lake Erie islands and on Marblehead Peninsula just to the south, limestone bedrock outcrops come to the surface, creating distinctive and biologically rich habitats. This includes several alvar sites, such as Stone Road Alvar on Pelee Island, a unique complex of meadows, prairies, savanna and woodland on thin soils that shelters over 100 species of rare flora and fauna. The Marblehead Peninsula has remnants of alvar habitat that supports a population of Lakeside Daisy, a Great Lakes endemic species that is globally endangered.

Coastal processes have also added to the diversity within this Biodiversity Investment Area. Point Pelee is a large and active sand spit and foredune complex created by the action of lake waves, enclosing an extensive marsh and significant forest areas on older sand deposits. This pattern is repeated on a smaller scale at Lighthouse Point and Fish Point on Pelee Island. In other areas such as along the Big Creek and Hillman marshes, coastal processes maintain sandy barrier beaches with wetland habitats behind. Coastal wetlands are also associated with the estuaries of many of the creeks and rivers feeding into the western basin.

Shore bluffs of varying heights also occur in a few places, but almost all of these areas have been modified in some way to attempt to control their rapid rate of natural erosion (often with less than full success). Shoreline dykes are common in some sections, often in association with pumping to allow agricultural use of former wetland areas, such as the extensive historical wetland that occurred between Point Pelee National Park and Hillman Marsh.

The smaller islands within the lake provide habitat for colonial birds, and for such endangered reptiles as the Lake Erie Water Snake. Another endangered species, the Bald eagle, nests in several shoreline areas, even though the very limited forest cover remaining on the mainland has led to a somewhat impoverished community of breeding birds. The area is very important to migrant birds, however. Point Pelee is world-renowned as a birdwatching area during spring migration, and it also acts as an important fall corridor for songbirds, bats, butterflies, and other insects. The Holiday Beach area is becoming an important location for hawk-watching during migration, and migrant shorebirds and waterfowl are found in many locations.

On the Lake Erie lakeplain lies a 130 square mile region in Lucas, Henry, and Fulton Counties of Ohio is known as the Oak Openings. Post-glacial beach ridges and swales sustain black oak savanna, oak woodland, and wet prairie communities. The savanna and prairie communities are considered globally rare. These communities are maintained by two processes, periodic fire and dry sandy soils. Fire eliminates woody vegetation. The understory of the oaks is a lush grassland. Today, remnants need aggressive management to remove woody vegetation, conduct prescribed burns, and protect native species. The Toledo Metroparks and The Nature Conservancy maintain preserves in the area. Together, these preserves comprise one of the few ecosystem scale oak savanna/prairie landscapes in the Midwest.

In sum, despite the pressures of intensive land use, the Western Lake Erie area retains an excellent mosaic of remnant natural habitats and a diverse and distinctive mix of species.

20.2 Current Threats to Ecological Values

Much of the land base within this BIA has very high value for intensive agriculture; as a result, less than 4% of Essex County remains in forest cover, and similar degrees of habitat loss can be seen on the American side of the lake. In addition, this area is heavily influenced by the urbanizing influence of Detroit, Windsor, Monroe, Toledo and Sandusky, including the indirect effects of such near-urban facilities as pits and quarries, utility corridors, and recreation areas. All but a small fraction of the alvar habitats on the Marblehead Peninsula, for example, have been removed by quarrying. Another example is the preserves of the Oak Openings, which are under pressure from urban development.

The major threat facing this area, then, is the further loss of remnant natural areas, and the further isolation of those that are protected in their natural state. The effects of this isolation on biodiversity can be readily seen by looking at amphibian and reptile populations - even Point Pelee, one of the largest protected areas in the region, has lost at least 9 species of these sensitive indicators.

A further threat associated with intensive land use is water quality, particularly in the tributary streams and rivers which carry large amounts of nutrients, sediments, and associated pollutants into the lake. This can cause habitat deterioration in estuarine marshes, as well as contributing to loadings within the lake itself. The Maumee River Area of Concern is focusing on impairments that are the result of agricultural runoff, combined sewer overflows, and contaminated sediments. A Remedial Action Planning process is in place to deal with these water quality problems.

Exotic species also pose a threat to the integrity of natural areas, causing the loss of natural biodiversity. Zebra mussels, Purple loosestrife, Garlic mustard, and many other exotics are present in abundance within the BIA, and pose constant management problems.

Because of the proximity of large human populations, recreational pressure on natural habitats is another stress. This stress is particularly felt in beach and dune areas such as those on Point Pelee, but trampling by anglers and other recreational visitors also occurs in almost any waterfront setting.

20.3 Current Protection of Ecological Values

A wide array of protection mechanisms are currently in use in the Western Lake Erie area, including:

Protection Mechanism	Comments
National Park: Point Pelee N.P.	Protects an excellent sand spit and foredune complex, with extensive wetlands and many rare species. Outstanding birdwatching area.

Protection Mechanism	Comments
Provincial and State Parks: Wheatley P.P. (recreation) Lighthouse Point P.P. (nature reserve) Fish Point P.P. (nature res.) East Sister Island P.P. (nature reserve) Maumee Bay State Park Crane Creek State Park Catawba Island State Park East Harbour State Park Kelleys Island State Park South Bass State Park	These parks protect significant stretches of natural shoreline, associated forests and wetlands, and endangered species such as Blue Racer snakes.
Conservation Areas/Wildlife Areas/State Nature Reserves: Holiday Beach C.A. Cedar Creek C.A. Hillman Creek C.A. Kopegaron Woods C.A. Stone Road Alvar C.A. Metzger Marsh Toussaint Pickerel Creek Willow Point Little Portage Lakeside Daisy Sheldon Marsh	These areas, managed by the Essex Region Conservation Authority in Canada and the State Department of Natural Resource in Ohio, include significant wetland sites at Holiday Beach and Hillman Creek, forested sites, and alvar habitats.
Private Nature Reserves: Stone Road Alvar Nature Reserve Toledo Oak Openings (Metroparks) Kitty Todd Preserve	This Pelee Island site was purchased by the Federation of Ontario Naturalists, and is managed cooperatively with adjacent conservation authority lands. Prescribed burning has been used to restore alvar and savanna habitats. Kitty Todd is owned and managed by The Nature Conservancy.

Protection Mechanism	Comments
ANSI and Wetland Policies: Mann's Marsh (wetland) Big Creek Marsh (wetland, life science ANSI) Lypps Beach (wetland) Oxley Poison Sumac Swamp (wetland, life sc. ANSI) Fox Creek (wetland) Harrow Site Eskers (earth science ANSI) Cedar Creek (life sc. ANSI) Middle Island (life sc. ANSI) Stone Road Prairie (life science ANSI) Sturgeon Creek (wetland) Point Pelee (wetland, life science ANSI) Hillman Marsh (wetland) Wheatley Two Creeks (wetland)	These areas are recognized by provincial policy statements as significant, and their natural heritage values must be considered in any planning decisions.
National Wildlife Refuge/Research Reserve: Ottawa Cedar Point West Sister Island Old Woman Creek	Wildlife refuges are managed by the U.S. Fish and Wildlife Service.

20.4 Assessment

The Western Lake Erie area provides good representation of sandspit and foredune features, barrier beach and estuarine wetlands, oak savanna, lakeplain prairie, and limestone island features. Major sections of these features are in public ownership, and managed to protect their ecological values. Other shoreline features such as unconsolidated bluffs are not well-represented within the protected areas system.

While existing protected areas are isolated from each other and have suffered some impairment, they tend to be exceptionally diverse in their flora and fauna, and often in good to excellent condition overall. However, the region as a whole exhibits a very low percentage of natural landscapes and poor ecological connections. Some decline in biodiversity has already been observed, and the risk of long-term species loss appears high. Already many species are listed as vulnerable, threatened or endangered, and that number appears likely to increase in future.

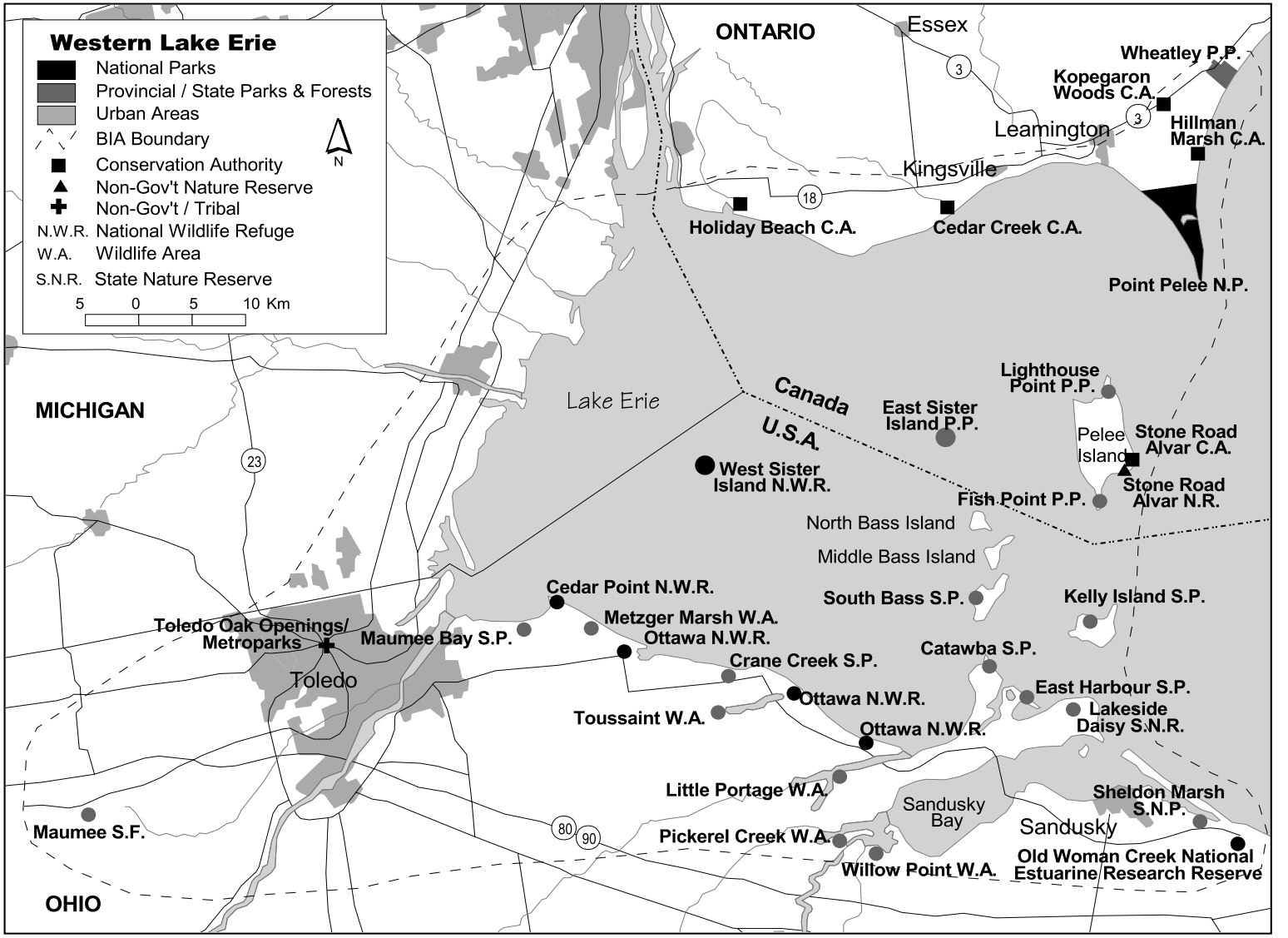

Figure 18 Western Lake Erie Biodiversity Investment Area

20.5 Key Protection Needs

In response to the land use pressures surrounding this area, a key need is long-term securement of as much of the remaining natural habitat as possible. While many of the best areas are now in public hands, there are still opportunities to acquire other significant sites. A regional ecosystem planning strategy, whose development is being coordinated by The Nature Conservancy, should help to highlight specific opportunity areas.

A second key need is the restoration of connecting corridors where possible among the protected core areas. For example, proposals have been made to restore a wetland corridor linking Point Pelee wetlands with the Hillman Creek Marsh to the north. Other corridors might emphasize stream valleys. The essex Region Conservation Authority and Parks Canada have been working on the creation of a regional Biodiversity Conservation Strategy for the Essex region, which will identify specific high priority restoration and enhancement opportunity areas, including strengthening of core areas and establishment of new corridors and linkages.

Active management to address exotics and visitor pressures is already underway in some protected areas, notably Point Pelee and Stone Road Alvar. However, more attention to these stresses will be needed in these and other areas in future.

Proposals for a National marine Conservation Area on the Canadian side of the western basin of Lake Erie would assist in protecting the lake bottom and islands within this BIA. There appears to be considerable local support for this concept, and further feasibility studies could be underway in the near future. Discussion of a complementary U.S. designation could make this an outstanding bi-national protection effort.

Finally, building public awareness, support, and involvement in biodiversity conservation is a key challenge in the Western Lake Erie area. Some excellent beginnings have been made, through such programs as the International Countryside Stewardship Exchange, the efforts of the Pelee Island Heritage Centre to develop ecotourism, and the involvement of Kelley Island residents in alvar restoration. But much remains to be done to make a broader range of local residents aware of the ecological values of this area, and to enlist their involvement in conservation activities.

20.6 Stewardship Vignette

20.6.1 Ecoregional Prioritization in the Maumee Lake Plain

The Nature Conservancy (TNC) is undertaking to build a conservation vision in the Maumee Lake Plain of Western Lake Erie. Through a process called ecoregional prioritization, TNC will determine exactly where their conservation efforts need to be focused by determining threats to key sites and the potential resources to protect them. Part of the process includes filling gaps in existing biological information, databases to ensure that conservation decisions are based on credible scientific information, designing site-specific conservation strategies for key biodiversity sites, and translating these strategies into on-the-ground protection activities.

21. Eastern Lake Ontario

21.1 Ecological Features and Values

The shoreline and adjacent lands around the eastern end of Lake Ontario have an exceptional range of natural habitats and ecological features. This area encompasses substantial areas of shallow limestone bedrock as well as the shallow Shield rocks of the Frontenac Axis, along with agricultural areas based on deeper soils. Many kinds of shoreline features are well-developed, including impressive beach and dune systems, shoreline wetlands, and bedrock and cobble shores of several types. Lake effect winter snow cover is relatively heavy, adding to Lake Ontario's effect on local ecology. Natural vegetation is diverse, with specialized elements such as Pitch Pine, and frequent southern elements such as Shagbark Hickory.

Although this area is long-settled and has heavy tourism use, only Kingston is a significant urban presence on the waterfront. Other smaller towns and villages such as Brighton, Gananoque, Clayton and Sackett's Harbour are located within the area, and cottage or second-home strip developments, along with year-round primary residences, have taken up parts of the shoreline. However, much of the area remains largely in a rural or natural condition. Watertown, NY is located just inland of the eastern shoreline.

In Jefferson, and Oswego Counties of New York, the eastern shore of Lake Ontario is protected by a bay/marsh/dune/barrier beach ecosystem. This is significant migratory habitat for shorebirds, raptors, passerines, and waterfowl. Black terns (Chlidonias niger), Common terns (Sterna hirundo) and the Northern harrier nest and forage in the marshes. Jefferson County also contains occurrences of alvar grassland and calcareous pavement barrens communities.

Among the special ecological features and values of this area are:

Features and values	Typical or significant occurrences
Baymouth bar/barrier beach	Wellers Bay, Sandbanks, Outlet Beach, Wolfe Island Big Sandy Bay, Amherst Island Long Point Bay, Deer Creek, Sandy Point, Lakeview Marsh, El Dorado/Black Pond
Sand beach and dunes	Presqu'ile, North Beach, Sandbanks, Outlet Beach, Wellers Bay, Big Sandy Bay; some areas include significant wet panne habitats between the dunes, Deer Creek, Sandy Pond, Lakeview Marsh, El Dorado/Black Pond
Cobble beach	Presqu'ile, Huyck's Point, Point Petrie
Shelving limestone beach	Wellington, El Dorado
Limestone bedrock bluff	Halfmoon Point, McMahon Bluff, Cape Vasey, Stony Point
Shield bedrock beach or low bluff	Common throughout St. Lawrence Islands east of Howe Island
Limestone alvar	Chaumont Barrens, Limerick Cedars
Coastal islands	Range from relatively large - Amherst, Wolfe, Wellesley - to thousands of smaller offshore islands
Bird colonies	High Bluff Island, Main Duck Island, Black Ant Island, Ironsides Island
Migratory waterfowl staging	Presqu'ile Bay, Featherbed Shoals off Cape Vincent, Eel Bay, Lake of the Isles; beach areas often significant for migrating shorebirds as well; In New York "waterfowl concentration areas" include Lakeview Marsh and Sandy Pond. Shorebird areas are El Dorado/Black Pond, Lakeview Marsh, Sandy Pond.
Songbird migration corridor	Many species appear to follow the chain of islands from NY State to the south shore of Prince Edward County, then to Presqu'ile Peninsula; island and nearshore habitats may be important rest sites during inclement weather. In New York, raptor migration concentrations at Derby Hill, and the entire eastern Lake Ontario shoreline.
Coastal wetlands	Frequent throughout the area in sheltered waters
Historic shipwrecks	Especially numerous around Simcoe Island, False Duck Islands, Main Duck Island, Sandy Pond, Selkirk Shores, others can be enumerated by Oswego Maritime Foundation

21.2 Current Threats to Ecological Values

The primary threat to the ecological values of this area is closely linked to its attractiveness for recreational uses. This results in several major stresses, which appear to be ongoing and increasing in intensity:

< Second home and residential developments along shoreline areas, including on many of the islands. This pressure is especially intense in the St. Lawrence Islands area, but it is present across the entire shoreline. For example, development on Wolfe Island has been limited in the past largely by the ferry capacity, but if demands for a new bridge are met, intense development pressures will occur on the island's shorelines.

< Development of marinas and other commercial facilities such as campgrounds and trailer parks in nearshore areas. Recreational boating is a very popular pastime within this area, and service facilities for boating are very common, especially in the more sheltered waters of the bays and inlets, and along the St. Lawrence.

< Over-use of public recreational areas, especially beach and dune areas which are heavily impacted by summer users and sometimes by development of visitor facilities such as picnic and parking areas.

< Water level controls, which particularly affect shoreline wetland habitats, but also impact on all shoreline types. Long-term regulation of water levels in Lake Ontario has reduced the cyclical extremes that occur naturally, and has held mean water levels at a slightly higher level. This is reducing the diversity and health of wetland communities, with ongoing loss of quality inevitably occurring if current policies continue. As well, some individual wetlands have been modified by Ducks Unlimited to increase waterfowl production by controlling water levels. While this management improves habitat for some marsh species, it damages naturally functioning ecosystems, and is of particular concern in those significant wetlands that have been selected as ANSIs because of their representation values.

< Quarrying poses a potential threat to the alvar communities.

21.3 Current Protection of Ecological Values

The following protection measures are currently in place along the Eastern Lake Ontario shore:

Protection Mechanism	Comments
National Parks: St. Lawrence Islands National Park Rideau Canal	The national park land base includes parts of Grenadier Island, Hill Island, and smaller islands. As part of the Rideau Waterway, Parks Canada owns a major part of Cataraqui Marsh, Main Duck and Yorkshire Islands, and the Prince Edward Point lighthouse. A potential National Marine Conservation Area is under study for the waters off the south shore of Prince Edward County including Main Duck Island.

Protection Mechanism	Comments
Provincial/State Parks: Presqu'ile (Nat. Environment) North Beach (Recreation) Sandbanks (Nat. Environment) Timber Island (Nature Reserve) Grass Point State Park Wellesley Island State Park Southwick Beach State Park Selkirk Shores State Park Keewadin State Park Cedar Point State Park Westcott Beach State Park	While the land and water area protected within these parks is relatively small, they do incorporate highly significant ecological features. For example, Ontario's Presqu'ile Provincial Park protects provincially significant dune and panne, old growth forest, and coastal wetland features, is well-known as a viewing area for migrant birds and butterflies, and sponsors natural heritage interpretation and restoration programs.
National Wildlife Areas: Wellers Bay NWA Prince Edward Point NWA Scotch Bonnet Island NWA	These wildlife areas protect habitats of importance to migrant and staging birds.
Conservation Areas: Little Bluff C.A. Lemoine Point C.A. Little Cataraqui Creek C.A. Sandy Pond Beach Natural Area Ashland Flats WMA Deer Creek Marsh WMA Lakeview Marsh WMA Black Pond WMA Dexter Marsh WMA Perch River WMA	While these conservation areas provide sites for public recreation, they also provide a degree of protection for varying shoreline types. WMA= Wildlife Management Area
Private Nature Reserves: Chaumont Barrens Nature Reserve Limerick Cedars Nature Reserve Amherst Island Nature Reserve El Dorado Preserve Rainbow Shores Preserve Selkirk Fen Preserve	The Chaumont Barrens and Limerick Cedars reserves, purchased by The Nature Conservancy, protect key alvar sites in New York State. The Amherst Island reserve, owned by the Kingston Field Naturalists, is managed primarily for shorebirds.
Other Lands with Special Status: Point Petre Military Reserve	This site, owned by the Department of National Defence, includes a significant section of limestone bedrock and cobble beach shoreline.

Protection Mechanism	Comments
ANSI Policies (private land sites): Cape Vasey Escarpment (life science) Amherst Bay Dunes and Marshes (life science) Bloomfield Beach (earth science) McMahon Bluff (earth/life science) Pigeon Island (life science) Millhaven Stromatoporoids (earth science) Big Sandy Bay (earth/life science) Beauvais Point (life science) Mount Fitzsimmons/Landon Bay (earth/life science)	Where these Areas of Natural and Scientific Interest occur on public lands, they are managed to maintain their natural values. On private land, their values are considered through the land use planning system if a major change in land use is proposed.

Protection Mechanism	Comments
Significant Wetland Policies (not including publicly owned sites): Presqu'ile Bay wetland (part) Dead Creek Marsh Wellers Bay wetland Pleasant Bay wetland Huycks Bay wetland West Lake wetland East Lake Marsh South Bay Marsh Big Sand Bay wetland Cressey Swamp Amherst Island/Long Point wtlnds Bath Point wetland Parrots Bay wetland Wolfe Is. Sand Bay wetland Wolfe Is. Reeds Bay wetland Wolfe Is. Big Sandy Bay wetland Madoma Marsh Lawless wetland Pitts Ferry wetland Grass Creek wetland Cassidys Bay wetland Oak Point wetland McDonell Bay wetland Barrett Bay wetland Bayfield Bay Marsh Button Bay wetland Miller/Dodge Bay wetlands Johnson Bay wetland Willowbank Marsh French Creek Marsh Grindstone Island wetlands Whitehouse Marsh Murray Islands wetlands Landon Bay Marsh Ivy Lea wetland complex Point Vivian Marsh Goose Bay Marsh Cranberry Creek Marsh Crooked Creek Marsh Wilson Bay Marsh Sage Creek Marsh Butterfly Swamp North and South Sandy Ponds Cranberry Pond	Within Ontario, provincially significant wetlands are protected by a planning policy which must be considered when changes in land use are proposed.

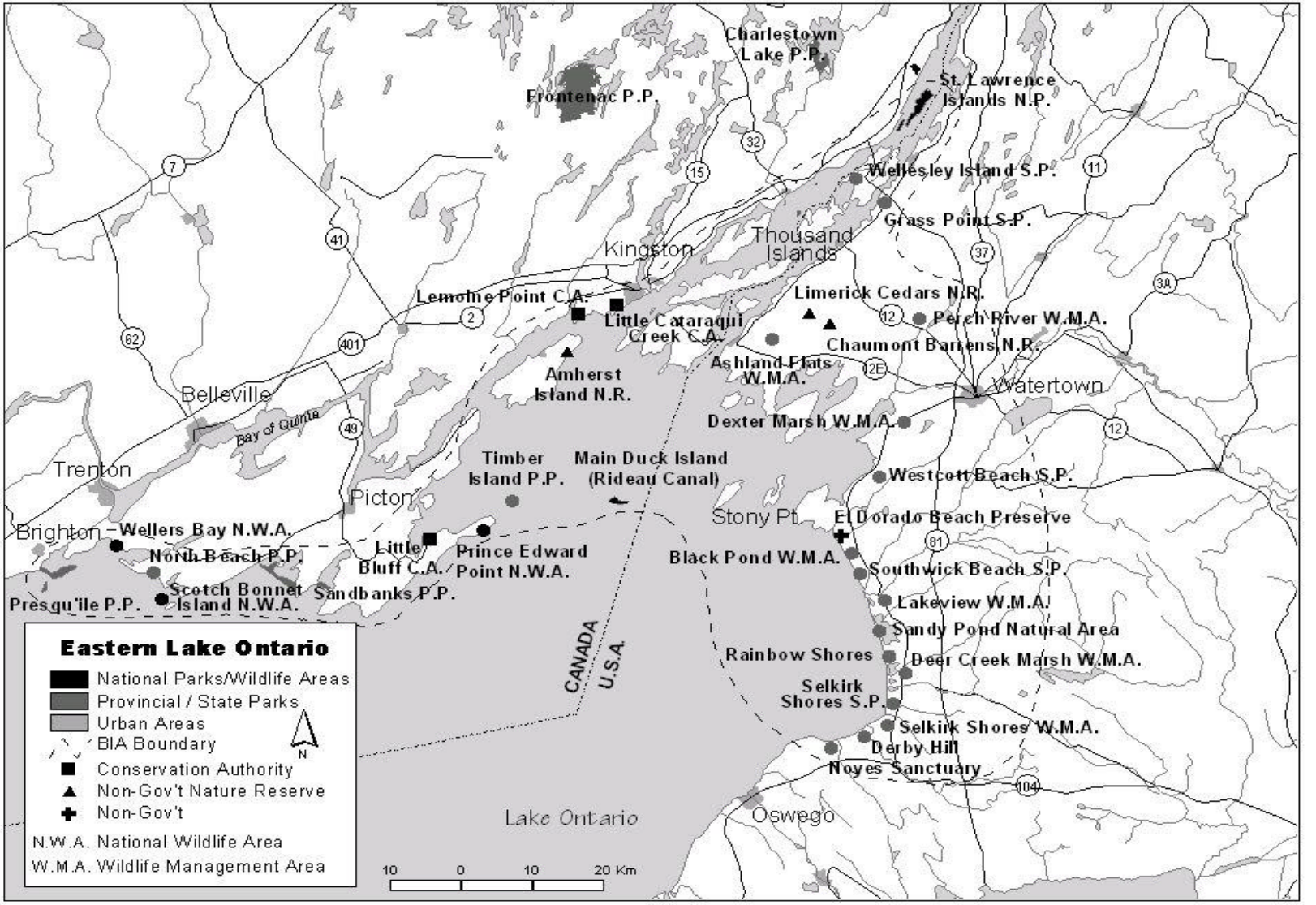

Figure 19 Eastern Lake Ontario Biodiversity Investment Area

21.4 Assessment

1) Ecological Representation: This area offers excellent representation of a wide range of shoreline types and communities, including sand beach/dune systems, cobble/pebble beach types, various bedrock shore types, and several types of coastal wetland communities. Some examples of most of these types are included within the current protected areas system, although their extent is fairly limited.

2) Diversity: The range of landform types within this area, and the way in which land and water are strongly interspersed, has created a strong diversity of natural communities and species as well.

3) Condition or Quality: Many sections of the biodiversity investment area have been significantly altered by a long history of human uses, and their condition is degraded. For example, most of the woodlands in private ownership have been repeatedly logged. Areas of former farmland now regenerated into shrublands are common in many parts. However, a large number of individual natural heritage sites are still in good condition, adding substantially to the quality of the biodiversity investment area as a whole.

4) Ecological Connections: The area shows strong patterns of connection east-west along the chain of peninsulas and islands and into the St. Lawrence River. As well, the wetlands and other natural areas along the eastern end of the lake provide good north-south connectivity. Several lakeshore areas, including Presqu'ile Peninsula and Prince Edward Point, are well-known as migrant bird staging areas, providing broader regional connections for wildlife movement. This area also forms a key part of the Algonquin-Adirondack corridor concept, which promotes the securing of a broad landscape-level natural corridor linking these two core areas.

5) Special Features: As noted in the Features and Values table, Eastern Lake Ontario has many features of interest, both ecological and geological. Only a small percentage of these sites are completely protected; some of the remainder have protective policies which may be only partially effective over time. As well, it is an area of considerable scenic attractiveness, with high recreational and tourism appeal.

21.5 Key Protection Needs

Despite the wealth of natural features still intact in Eastern Lake Ontario, conservation efforts there have been relatively small-scale, and largely oriented to specific sites. Given the ongoing recreational pressures on this landscape, securing a more comprehensive system of protected natural areas should be considered a priority.

This system should incorporate both public and private lands, and make use of the initiative of local land trusts, the Ontario Dune Coalition, and other government and non-government organizations. Private land stewardship, particularly within the many wetland sites in this area, should play a key role in future conservation.

Particular attention should be focused on natural shoreline areas with multiple values. For example, several sites on Amherst Island and the west shore of Prince Edward County provide complexes of sand dunes and barrier beaches, associated wetlands, and nearby upland habitats which together provide sites of exceptional interest for conservation.

This area also needs improved regional coordination of conservation efforts, reaching across the international border. The efforts of the Ontario Dune Coalition to address threatened sites along the coast in New York state provide a useful model, but at this point there is no similar regional body on the Canadian side of the BIA.

21.6 Stewardship Vignette

21.6.1 The Ontario Dune Coalition

The Ontario Dune Coalition has one main concern: the stabilization of dunes on the eastern shore of Lake Ontario. The more than 30 organizations who are members have several objectives. First, they assist in stabilizing the dunes as natural systems. Second, they are developing measures to maintain dune stability. Finally, They hope to encourage public use which is in keeping with their dune protection goals.

The Coalition's activities are numerous and varied. One private landowner is growing a native beachgrass to be used in dune restorations. Dune stewards walk the dunes, greeting visitors and helping them to understand the importance of staying on trails and telling stories about dune animals and plants. Brochures and interpretive signs informs visitors about dune and wetland ecology. Walkovers and boardwalks have been constructed to limit access to newly vegetated and sensitive dunes. All activities are designed to decrease visitor impacts in sensitive areas while improving access to the beaches.

For more than a dozen years the members of the Ontario Dune Coalition have been working to stabilize, restore and protect the dunes of eastern Lake Ontario. By improving access for the public, educating users, providing technical assistance, and coordinating research, the dunes have not disappeared. They are healthier and richer ecologically and as a consequence, enjoyed and appreciated by more people each year.

22. Appendix 1

22.1 Acknowledgements

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