

## Chapter 3

# Ecosystem Goals, Indicators and Monitoring



Monitoring boat on the St. Louis River.  
Photo credit: Frank Koshere, Wisconsin Department of Natural Resources.

Lake Superior Lakewide Management Plan 2008



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## Chapter 3

# Ecosystem Goals, Indicators and Monitoring

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### 3.0 ABOUT THIS CHAPTER

The Binational Program is committed to the objectives of zero discharge of targeted critical pollutants and to a broader program to restore and protect ecosystem integrity in Lake Superior and its watershed. The Lake Superior vision statement, entitled *A Vision for Lake Superior* (see Chapter 1), expresses this commitment to the Lake Superior ecosystem. The vision statement reflects the diverse pathways and mechanisms by which humans and nature interact within land and water ecosystems, and challenges the inhabitants of the Lake Superior watershed to accept personal responsibility for protecting the Lake and the landscape that sustains it.

### 3.1 ECOSYSTEM GOALS, SUBGOALS, AND OUTCOMES

#### Background

The Lake Superior LaMP contains critical pollutant goals, namely the targeted reduction goals for the nine critical pollutants (see Chapters 1 and 4). Until now, the LaMP and the Superior Work Group have not fully developed similar goals and objectives for the broader ecosystem program. In this chapter, draft ecosystem goals and objectives are presented, as a complement to the critical chemicals goals. These draft goals have undergone public review and comment and are scheduled to be finalized in 2008.

*A Vision for Lake Superior* expresses the desire for, among other things, a watershed where diverse life forms exist in harmony—that is, free of toxic substances that threaten fish, wildlife, and human health, and where wild shorelines and islands are maintained.

The Habitat, Aquatic Communities, and Terrestrial Wildlife Committees, in turn, have put forward a mission to “support intact, diverse, healthy and sustainable ecosystems and the native plant and animal communities that depend upon them.” The committees have described the natural processes that must be present and functioning well in order for a healthy ecosystem to exist, as well as a set of principles that guided, and continue to guide, their work in developing these Ecosystem Goals. These components can be found in the consolidated ecosystem chapter of the Lake Superior LaMP, first published in LaMP 2006.

The Strategic Outcomes that the committees have set in order to preserve, protect, and enhance healthy, sustainable ecosystems, are as follows:

1. Diverse and healthy native plant and animal communities exist in the Lake Superior basin.
2. A program is in place to monitor the abundance, distribution, and health of plant and animal populations and communities in the Lake Superior basin.

3. Species at risk or species of concern are recovered if populations are too low, or controlled if populations are too large.
4. No further extirpation of native species occurs in the Lake Superior basin.
5. No new non-native species will be introduced into the Lake Superior basin.
6. Partnerships among natural resources management agencies, environmental agencies, and non-agency stakeholders are strengthened and broadened.
7. Human activities in the Lake Superior basin mitigate the contribution of greenhouse gases to the environment. Ongoing climate change adaptive management strategies are pursued in the Lake Superior basin.
8. An interagency effort to restore and protect critical habitats will be organized and initiated.
9. Management in the Lake Superior basin is organized and implemented at appropriate watershed scales.

### Lake Superior Draft Ecosystem Goals

In order to achieve the Strategic Outcomes referenced above, the Habitat, Aquatic Communities, and Terrestrial Wildlife Committees worked together over the past two years to refine and revise a set of ecosystem goals. These goals contain strategic outcomes, specific goals, and subgoals that the committees have determined are necessary to achieve and protect a diverse, healthy, and sustainable Lake Superior ecosystem. Although a version of these goals was originally included in the LaMP 2006, revisions were needed to better organize the goals and to accommodate emerging issues like climate change. A public comment period was held to gather input on the draft goals.

The draft goals that were released for public comment can be found in Table 3-1. Once final, the committees intend to work toward the fulfillment of the goals and use them as a tool to track progress. The committees and the Binational Program anticipate that all agencies and organizations around the lake can use these goals as a guide to achieving the shared *Vision for Lake Superior*.



Figure 3-1. Palisade Head from Shovel Point, MN. Photo credit: Carri Lohse-Hanson, Minnesota Pollution Control Agency.

These goals were also shared and coordinated with the Great Lakes Fisheries Commission's Lake Superior Technical Committee. The Lake Superior Technical Committee's draft aquatics Environmental Objectives were integrated in the Habitat and Wildlife Committee's ecosystem goals. The committees will continue to work together to ensure coordination and achievement of mutual goals.

**Table 3-1. Ecosystem Goals**

GOAL	SUB-GOAL		OTHER STRATEGIC OUTCOMES ACHIEVED	GOAL TYPE*
<b>Strategic Outcome #1:</b> Diverse, healthy and self-sustaining native plant and animal communities exist in the Lake Superior basin.				
1		Identify and restore native communities where they are degraded.		IG, S
	Subgoal	Inventory and assess impacts to degraded habitats and communities.	2	
	Subgoal	Develop and distribute GIS information on ecosystem types, conditions and trends, including coastal wetlands and riparian acres, and identify where restoration can occur.		
	Subgoal	Develop and put into place a policy that results in zero loss of wetland acres and function.		
	Subgoal	Restore 25% of degraded wetland acres in the Lake Superior basin.		
	Subgoal	Restore or protect 25% of riparian conifer forest acres in the Lake Superior basin.		
2		Identify and protect a system of representative, high quality ecosystems.		IG, S
	Subgoal	Complete comprehensive, systematic biological surveys in the watershed to identify remaining high-quality natural communities.	2, 8	
	Subgoal	Engage landowners as partners in protecting important habitat.		
	Subgoal	Use special designations to protect important habitat on public lands and waters.		
3		Maintain existing genetic diversity and population integrity.		
4		Manage the harvest of plant and animal resources to ensure diverse, healthy, and self-sustaining native plant and animal communities.		
<b>Strategic Outcome #2:</b> A program is in place to monitor the abundance, distribution, and health of plant and animal populations and communities in the Lake Superior basin.				
1		Institute a long-term Lake Superior basinwide program to monitor ecosystem health utilizing standardized methodology.	1, 3	M
	Subgoal	Explore the development of inventory, monitoring, assessment and reporting tool for the basin and how it might be implemented.		
	Subgoal	Develop, test, and implement standardized monitoring protocols, sampling procedures and data handling for ecological indicators to enable Binational Program agencies to report on the status of the basin's ecosystem health.		
		Neotropical Migratory Birds		



GOAL	SUB-GOAL		OTHER STRATEGIC OUTCOMES ACHIEVED	GOAL TYPE*
		Reptiles and Amphibians		
		Soil Invertebrates		
		Medium-Sized Carnivores		
		Fish and aquatic invertebrates		
		Land Use Change		
		Exotic and Invasive Species		
		Rare Resources		
		Culturally Important Resources		
		Over Abundant Species		
		Indicators of Contaminants in the Environment		
	Indicators of Global Climate Change		7	
<p><b>Strategic Outcome #3:</b> Species at risk or species of concern are recovered if populations are too low, or controlled if populations are too large.</p> <p><b>Strategic Outcome #4:</b> No further extirpation of native species occurs in the Lake Superior basin.</p>				
1		Complete comprehensive, systematic biological surveys in the watershed to identify locations of rare plants and animals.		IG
2		Encourage the development and implementation of species recovery plans for species at risk or species of concern.		P
3		Work with partners to develop a common understanding of native species overabundance, and develop and implement plans to control overabundant species.	6	C
4		Encourage the appropriate use of native species for all projects requiring vegetation restoration.	1	
	Subgoal	Develop sources of native plants and seeds in an ecologically appropriate manner throughout the Lake Superior basin for use in vegetation restoration.		S
	Subgoal	Establish standards of native species propagation and use as well as definitions of seed zones.		
	Subgoal	Develop a list of critical native species that are regionally / habitat specific and ecologically appropriate.		

GOAL	SUB-GOAL		OTHER STRATEGIC OUTCOMES ACHIEVED	GOAL TYPE*
	Subgoal	Educate citizens in the Lake Superior basin about the importance and appropriate use of local native plants in restoration and landscaping projects.		
5		Inventory the extent of exotic, invasive species and implement control measures.		IG
	Subgoal	Complete an inventory and control plan for priority exotic species at the scale of the Lake Superior basin.	6	P
	Subgoal	Encourage all agencies to develop and implement treatment programs for priority species.		S
<b>Strategic Outcome #5:</b> No new non-native species will be introduced into the Lake Superior basin.				
1		Establish and implement best management practices for a range of activities (e.g., forestry, recreation, intra-lake shipping) to prevent the introduction and spread of exotics.	4	P,S
2		Develop a guidance document for agencies' vegetation restoration for projects in the Lake Superior basin.	6	C
<b>Strategic Outcome #6:</b> Partnerships among natural resource management agencies, environmental agencies, and non-agency stakeholders are strengthened and broadened.				
1		Develop information and educational material to assist local land use decision makers in implementing Binational Program goals through land use planning.	9	C
	Subgoal	Have a Binational Program educator on staff to present material to local governments and decision makers highlighting linkages between land use and ecosystem health.		C
2		Support appropriate public and technical fora to provide opportunities for researchers, resource managers and the public to exchange information.	8	C
3		Inform and educate senior decision makers about how their actions move the Lake Superior basin toward "A Vision for Lake Superior."		C
	Subgoal	Develop a communications plan.		
	Subgoal	Implement the communications plan.		
4		Complete a film about Lake Superior.		C
<b>Strategic Outcome #7:</b> Human activities in the Lake Superior basin mitigate the contribution of greenhouse gases to the environment. Ongoing climate change adaptive management strategies are pursued in the Lake Superior basin.				
1		Understand the impacts of climate change and the limits to the ability to predict and model these impacts on specific ecosystems and local regions.		IG

GOAL	SUB-GOAL		OTHER STRATEGIC OUTCOMES ACHIEVED	GOAL TYPE*
	Subgoal	Continue to refine climate change models so as to develop specific predictions for the Lake Superior basin.		
	Subgoal	Develop model projections of changing water levels for Lake Superior.		
	Subgoal	Model impacts on wetlands and other habitat types under future water level regimes for 20 years, 50 years, 75 years, and 100 years in the future.		
	Subgoal	Predict changes to terrestrial and aquatic ecosystems based on climate change predictions.		
	Subgoal	Develop predictions of the impacts of climate change on keystone biota in the lake and the basin as a whole.		
2		Review and revise Conservation and Restoration Plans in the basin as required based on the climate scenarios developed in the goal above.	1	P
3		Help Lake Superior basin stakeholders adapt to climate change impacts.		
	Subgoal	Help stakeholders to adapt to climate change impacts by facilitating assessment of infrastructure vulnerabilities and capacity.		
4		Make Lake Superior a net carbon reduction area that reduces greenhouse gas emissions.		S
	Subgoal	Facilitate basin collaboration on activities to reduce carbon emissions.		
	Subgoal	Encourage governments around the basin to set greenhouse gas emission reduction targets.		
	Subgoal	Encourage U.S. cities to sign onto the US Mayors' Climate Protection Agreement.		
<b>Strategic Outcome #8:</b> An interagency effort to restore and protect important habitat will be organized and initiated.				
<b>Strategic Outcome #9:</b> Management in the Lake Superior basin is organized and implemented at appropriate watershed scales.				
1		Support the development and implementation of ecologically based integrated watershed management plans for priority watersheds within the Lake Superior basin.	1, 2	P, S
	Subgoal	Identify watersheds that have existing watershed plans.		
	Subgoal	Develop a list of watersheds that need a new or revised plan.		
	Subgoal	Prioritize watershed list.		
	Subgoal	Work with local governments/groups to develop watershed plans for 25% of the highest priority watersheds in need of a new or revised plan.		

GOAL	SUB-GOAL		OTHER STRATEGIC OUTCOMES ACHIEVED	GOAL TYPE*
	Subgoal	Work with local governments/groups to develop watershed plans for 50% of the highest priority watersheds in need of a new or revised plan.		
	Subgoal	Work with local government/groups to develop watershed plans for 75% of the highest priority watersheds in need of a new or revised plan.		
	Subgoal	Work with local governments/groups to develop watershed plans for 100% of the highest priority watersheds in need of a new or revised plan.		
2		Develop and maintain a unified, binational GIS database that includes current basinwide data and decision support models needed for watershed management at a scale and in a format that supports Lake Superior basin planning and watershed management.	6	IG, P
	Subgoal	Develop formal agreements for data sharing, participation and support.		
	Subgoal	Establish a mechanism to maintain shareable data once collected.		
<b>Strategic Outcome # 10: Air and water quality are restored and protected and soils are conserved.</b>				
1		Restore and maintain natural hydrologic processes, including groundwater.		
2		Eliminate contaminants at levels that impact plants and animals, including humans.	3	
3		Protect oligotrophic conditions in nearshore and offshore waters and restore and protect water quality in embayments and tributaries.		

\*Goal types: P – Planning  
M – Monitoring  
IG – Information Gathering  
S – Stewardship  
C – Communications

## 3.2 INDICATORS AND ASSESSMENT

### State of the Great Lakes Reporting

Since 1998, U.S. EPA and Environment Canada have coordinated a biennial assessment of the ecological health of the Great Lakes ecosystem using a consistent set of environmental and human health indicators. The Great Lakes indicator suite has been developed and continues to be refined by experts as part of the *State of the Lakes Ecosystem Conference* (SOLEC) process.

The SOLEC process was established by the governments of Canada and the U.S. in response to requirements of the *Great Lakes Water Quality Agreement* (GLWQA) for regular reporting on progress toward GLWQA goals and objectives. Since the first conference in 1994, SOLEC has evolved into a two-year cycle of data collection, assessment, and reporting on conditions and the major pressures in the Great Lakes basin. The year following each conference, a State of the Great Lakes report is prepared, based on information presented and discussed at the conference and post-conference comments.

Each State of the Great Lakes report presents the compilation, scientific analysis, and interpretation of data about the Great Lakes basin ecosystem. It represents the combined efforts of many scientists and managers in the Great Lakes community representing federal, tribal/First Nations, state, provincial and municipal governments, non-government organizations, industry, academia, and private citizens.

The contents of the State of the Great Lakes reports provide information to decision-makers at all levels and in all sectors of government, private sector, and the public in order to inform policy choices and decision-making, as well as to influence personal choices leading to a healthier Great Lakes basin ecosystem.

The *State of the Great Lakes 2007* provides assessments of 61 of approximately 80 ecosystem indicators and overall assessments of the categories into which the indicators are grouped: Contamination, Human Health, Biotic Communities, Invasive Species, Coastal Zones and Aquatic Habitats, Resource Utilization, Land Use-Land Cover, and Climate Change. Within most of the main categories are sub-categories to further delineate issues or geographic areas.

Authors of the indicator reports assessed the status of ecosystem components in relation to desired conditions or ecosystem objectives, if available. The SOLEC process focuses on basinwide assessments, but in order to make the indicator reports more relevant to lake managers, the authors were asked to assess the indicators on a lake-by-lake basis, where possible. For many indicators, ecosystem objectives, endpoints, or benchmarks have not been established, and for these indicators, complete assessments are difficult to determine. Five status categories were used:

1. **GOOD** – The state of the ecosystem component is presently meeting ecosystem objectives or is otherwise in acceptable condition.
2. **FAIR** – The ecosystem component is currently exhibiting minimally acceptable conditions, but it is not meeting established ecosystem objectives, criteria, or other

- characteristics of fully acceptable conditions.
3. **POOR** – The ecosystem component is severely negatively impacted, and it does not display even minimally acceptable conditions.
  4. **MIXED** – The ecosystem component displays both good and degraded features.
  5. **UNDETERMINED** – Data are not available or are insufficient to assess the status of the ecosystem component.

Four categories were also used to denote current trends of the ecosystem component:

1. **IMPROVING** – Information provided shows the ecosystem component to be changing toward more acceptable conditions.
2. **UNCHANGING** – Information provided shows the ecosystem component to be getting neither better nor worse.
3. **DETERIORATING** – Information provided shows the ecosystem component to be departing from acceptable conditions.
4. **UNDETERMINED** – Data are not available to assess the ecosystem component over time, so no trend can be identified.

Table 3-2 shows the indicators within the Great Lakes suite, organized by categories, with the latest assessment in the columns on the right. Lake Superior assessments are highlighted by a dark, thick border.

Future work between SOLEC organizers and lake managers could see better coordination in the use of indicators. Since each of the Great Lakes is unique, there will be a requirement for lake specific indicators; however, for common basinwide issues, SOLEC can provide leadership and support in indicator development and assessments.

Additional information about SOLEC and the Great Lakes indicators, along with the full indicator reports, are available at [www.binational.net](http://www.binational.net).

**Table 3-2. State of the Great Lakes 2007 Indicator Assessments**

*State of the Great Lakes 2007 Indicator Assessments*

CONTAMINATION						
ID #	Indicator Name	2007 Assessment (Status, Trend)				
		Lake				
		SU	MI	HU	ER	ON
<b>Nutrients</b>						
111	Phosphorus Concentrations and Loadings	open lake	?	→	?	→
		nearshore	?	?	?	?
7061	Nutrient Management Plans	2005 Report				
<b>Toxics in Biota</b>						
114	Contaminants in Young-of-the-Year Spottail Shiners	→	?	→	→	→
115	Contaminants in Colonial Nesting Waterbirds	→	→	→	→	→
121	Contaminants in Whole Fish	→	→	→	→	→
124	External Anomaly Prevalence Index for Nearshore Fish	?	?	?	◆	◆
4177	Biologic Markers of Human Exposure to Persistent Chemicals	?				
4201	Contaminants in Sport Fish	→	→	→	→	→
4506	Contaminants in Snapping Turtle Eggs	?	?	?	?	?
8135	Contaminants Affecting Productivity of Bald Eagles	→ 2005 Report				
8147	Contaminants Affecting the American Otter	? 2003 Report				
<b>Toxics in Media</b>						
117	Atmospheric Deposition of Toxic Chemicals	PCBs & others →				
		PAHs & mercury ◆ & →				
118	Toxic Chemical Concentrations in Offshore Waters	?	?	?	?	?
119	Concentrations of Contaminants in Sediment Cores	→ & ?				
4175	Drinking Water Quality	◆				
4202	Air Quality	→				
9000	Acid Rain	→ 2005 Report				
<b>Sources and Loadings</b>						
117	Atmospheric Deposition of Toxic Chemicals	PCBs & others →				
		PAHs & mercury ◆ & →				
4202	Air Quality	→				
7065	Wastewater Treatment and Pollution	Progress Report				
9000	Acid Rain	→ 2005 Report				

Status				Trend				
	Good	Fair	Poor	Mixed	→	◆	←	?
Not Assessed	Good	Fair	Poor	Mixed	Improving	Unchanging	Deteriorating	Undetermined

Note: Progress Reports and some Reports from previous years have no assessment of Status or Trend

State of the Great Lakes 2007 Indicator Assessments

BIOTIC COMMUNITIES						
ID #	Indicator Name	2007 Assessment (Status, Trend)				
		Lake				
		SU	MI	HU	ER	ON
<b>Fish</b>						
8	Salmon and Trout	→	→	→	→	◆
9	Walleye	?	?	◆	◆	◆
17	Preyfish Populations	→	←	←	←	←
93	Lake Trout	→	←	→	◆	←
125	Status of Lake Sturgeon in the Great Lakes	?→	?→	?→	?	→
4502	Coastal Wetland Fish Community Health	Progress Report				
<b>Birds</b>						
115	Contaminants in Colonial Nesting Waterbirds	→	→	→	→	→
4507	Wetland-Dependent Bird Diversity and Abundance	?	←	←	←	←
8135	Contaminants Affecting Productivity of Bald Eagles	2005 Report				
<b>Mammals</b>						
8147	Contaminants Affecting the American Otter	2003 Report				
<b>Amphibians</b>						
4504	Wetland-Dependent Amphibian Diversity and Abundance	?	◆	←	←	◆
7103	Groundwater Dependent Plant and Animal Communities	2005 Report				
<b>Invertebrates</b>						
68	Native Freshwater Mussels	2005 Report				
104	Benthos Diversity and Abundance - Aquatic Oligochaete Communities	◆	←	◆	←	◆
116	Zooplankton Populations	◆	?	?	?	?
122	<i>Hexagenia</i>	?	?	?	↔	?
123	Abundance of the Benth Amphipod <i>Diporeia</i> spp.	◆	←	←	←	←
4501	Coastal Wetland Invertebrate Community Health	2005 Progress Report				
<b>Plants</b>						
109	Phytoplankton Populations	2003 Report				
4862	Coastal Wetland Plant Community Health	◆	◆	←	◆	◆
8500	Forest Lands - Conservation of Biological Diversity	?				

Status				Trend				
	→	◆	←	→	◆	←	?	
Not Assessed	Good	Fair	Poor	Mixed	Improving	Unchanging	Deteriorating	Undetermined

Note: Progress Reports and some Reports from previous years have no assessment of Status or Trend



State of the Great Lakes 2007 Indicator Assessments

COASTAL ZONES									
ID #	Indicator Name	2007 Assessment (Status, Trend)							
		Lake							
		SU	MI	HU	ER	ON			
<b>Nearshore Aquatic</b>									
4861	Effect of Water Level Fluctuations	?				2003 Report			
8131	Extent of Hardened Shoreline	←				2001 Report			
<b>Coastal Wetlands</b>									
4501	Coastal Wetland Invertebrate Community Health					2005 Progress Report			
4502	Coastal Wetland Fish Community Health					Progress Report			
4504	Wetland-Dependent Amphibian Diversity and Abundance	?	◆	←	←	◆			
4506	Contaminants in Snapping Turtle Eggs	?	?	?	?	?			
4507	Wetland-Dependent Bird Diversity and Abundance	?	←	←	←	←			
4510	Abundance of the Benthic Amphipod <i>Diporeia</i> spp.	◆	←	←	←	←			
4861	Effect of Water Level Fluctuations	?				2003 Report			
4862	Coastal Wetland Plant Community Health	◆	◆	←	◆	◆			
4863	Land Cover Adjacent to Coastal Wetlands					Progress Report			
<b>Terrestrial</b>									
4861	Effect of Water Level Fluctuations	?				2003 Report			
8129	Area, Quality and Protection of Special Lakeshore Communities - Alvars	?				2001 Report			
8129	Area, Quality and Protection of Special Lakeshore Communities - Cobble Beaches	←				2005 Report			
8129	Area, Quality and Protection of Special Lakeshore Communities - Islands					?			
8129	Area, Quality and Protection of Special Lakeshore Communities - Sand Dunes					2005 Progress Report			
8131	Extent of Hardened Shoreline	←				2001 Report			
<b>AQUATIC HABITATS</b>									
ID #	Indicator Name	2007 Assessment (Status, Trend)							
		Lake							
		SU	MI	HU	ER	ON			
<b>Open Lake</b>									
111	Phosphorus Concentrations and Loadings	?	→	?	?	→			
118	Toxic Chemical Concentrations in Offshore Waters	?	?	?	?	?			
119	Concentrations of Contaminants in Sediment Cores		→	&	?				
8131	Extent of Hardened Shoreline	←				2001 Report			
<b>Groundwater</b>									
7100	Natural Groundwater Quality and Human-Induced Changes					2005 Report			
7101	Groundwater and Land: Use and Intensity					2005 Report			
7102	Base Flow Due to Groundwater Discharge				←				
7103	Groundwater Dependent Plant and Animal Communities					2005 Report			
		Status			Trend				
		Good	Fair	Poor	Mixed	→	◆	←	?
		Not Assessed				Improving	Unchanging	Deteriorating	Undetermined
Note: Progress Reports and some Reports from previous years have no assessment of Status or Trend									

State of the Great Lakes 2007 Indicator Assessments

HUMAN HEALTH									
ID #	Indicator Name	2007 Assessment (Status, Direction)							
		Lake							
		SU	MI	HU	ER	ON			
4175	Drinking Water Quality	◆							
4177	Biological Markers of Human Exposure to Persistent Chemicals	◆							
4200	Beach Advisories, Postings and Closures	?	?	◆?	?	?			
4201	Contaminants in Sport Fish	→	→	→	→	→			
4202	Air Quality	→							

INVASIVE SPECIES									
ID #	Indicator Name	2007 Assessment							
		Lake							
		SU	MI	HU	ER	ON			
<b>Aquatic</b>									
18	Sea Lamprey	→ 2005 Report							
9002	Non-Native Species (Aquatic)	◆	←	←	←	←			
<b>Terrestrial</b>									
9002	Non-Native Species (Terrestrial)	?							

Status					Trend			
					→	◆	←	?
Not Assessed	Good	Fair	Poor	Mixed	Improving	Unchanging	Deteriorating	Undetermined
Note: Progress Reports and some Reports from previous years have no assessment of Status or Trend								

State of the Great Lakes 2007 Indicator Assessments

LAND USE - LAND COVER						
ID #	Indicator Name	2007 Assessment (Status, Trend)				
		Lake				
		SU	MI	HU	ER	ON
<b>General</b>						
4863	Land Cover Adjacent to Coastal Wetlands	Progress Report				
7002	Land Cover/Land Conversion	?	?	?	?	?
7054	Ground Surface Hardening	2005 Progress Report				
7101	Groundwater and Land: Use and Intensity	2005 Report				
<b>Forest Lands</b>						
8500	Forest Lands - Conservation of Biological Diversity	?				
8501	Maintenance and Productive Capacity of Forest Ecosystems	?				
8503	Forest Lands-Conservation & Maintenance of Soil & Water	?	?	?	?	?
<b>Agricultural Lands</b>						
7028	Sustainable Agriculture Practices	2005 Report				
7061	Nutrient Management Plans	2005 Report				
7062	Integrated Pest Management	2005 Report				
<b>Urban/Suburban Lands</b>						
7000	Urban Density	?				
7006	Brownfields Redevelopment	→				
7054	Ground Surface Hardening	2005 Progress Report				
<b>Protected Areas</b>						
8129	Area, Quality and Protection of Special Lakeshore Communities - Alvars	? 2001 Report				
8129	Area, Quality and Protection of Special Lakeshore Communities - Cobble Beaches	← 2005 Report				
8129	Area, Quality and Protection of Special Lakeshore Communities - Islands	?				
8129	Area, Quality and Protection of Special Lakeshore Communities - Sand Dunes	2005 Progress Report				
8164	Biodiversity Conservation Sites	Proposed Indicator				

Status				Trend				
	Good	Fair	Poor	Mixed	→	◆	←	?
Not Assessed	Good	Fair	Poor	Mixed	Improving	Unchanging	Deteriorating	Undetermined

Note: Progress Reports and some Reports from previous years have no assessment of Status or Trend

State of the Great Lakes 2007 Indicator Assessments

RESOURCE UTILIZATION									
ID #	Indicator Name	2007 Assessment (Status, Trend)							
		Lake							
		SU	MI	HU	ER	ON			
3514	Commercial/Industrial Eco-Efficiency Measures					2003 Report			
7043	Economic Prosperity					2003 Report			
7056	Water Withdrawals					2005 Report			
7057	Energy Consumption					2005 Report			
7060	Solid Waste Generation					?			
7064	Vehicle Use					←			
7065	Wastewater Treatment and Pollution					Progress Report			

CLIMATE CHANGE									
ID #	Indicator Name	2007 Assessment (Status, Trend)							
		Lake							
		SU	MI	HU	ER	ON			
4858	Ice Duration on the Great Lakes					←			

Status					Trend			
					→	◆	←	?
Not Assessed	Good	Fair	Poor	Mixed	Improving	Unchanging	Deteriorating	Undetermined
Note: Progress Reports and some Reports from previous years have no assessment of Status or Trend								

### 3.3 MONITORING PROGRAMS AND INVENTORIES

#### 3.3.1 Cooperative Monitoring of Lake Superior

The Great Lakes Binational Cooperative Monitoring Initiative is above and beyond the routine monitoring programs that agencies normally conduct. It is a binational effort that focuses on one lake each year, with the goal of filling key information gaps as identified through the LaMPs. The program complements and builds on existing monitoring and research projects being conducted on the lake in the same year. Each lake, therefore, goes through a cooperative monitoring cycle every five years.

#### Lake Superior Cooperative Monitoring Programs

In 2005 and 2006, Lake Superior was the focus of the Cooperative Monitoring Initiative, addressing key information needs identified by the Lake Superior Work Group. Numerous agency and academic scientists from both the U.S. and Canada participated by providing input to the design of the programs, and by conducting sampling, laboratory analysis, and data interpretation. Although some of the results of the Cooperative Monitoring Initiative are available (such as the Lower Food Web study results, as presented in Chapter 6) data are still being analyzed and reports prepared.



Figure 3-2. In 2005-2006, Lake Superior was the focus of the Great Lakes Cooperative Monitoring Initiative, a binational effort that targets one lake each year to fill key information gaps, as identified through the LaMPs. Photo credit: Frank Koshere, Wisconsin Department of Natural Resources.

#### 3.3.2 Inventories of Monitoring Programs

**Binational Executive Committee Great Lakes Monitoring Exchange** The Great Lakes Binational Executive Committee (BEC) identified the need for a binational, basinwide inventory of monitoring programs, to raise awareness of ongoing activities, promote collaboration, and identify monitoring gaps. The Great Lakes Monitoring Exchange now provides links to nearly 30 monitoring programs that sample in the Lake Superior basin. This inventory contains programs conducted by organizations in Canada and the U.S. The Great Lakes Monitoring Exchange can be found at <http://binational.on.ec.gc.ca/bec/intro-e.cfm>.

**Great Lakes Commission Environmental Monitoring Inventory** The Great Lakes Commission web site provides information on a large array of monitoring programs, including monitoring programs for air, water, and landscapes.<sup>1</sup> The Environmental Monitoring Inventory for the Great Lakes contains over 200 records of environmental monitoring programs pertaining

<sup>1</sup> Great Lakes Commission Data and Monitoring web site: [www.glc.org/monitoring](http://www.glc.org/monitoring).

to the Lake Superior basin. Both Canadian and American monitoring programs are included in this inventory.<sup>2</sup>

### 3.4 DECISION SUPPORT SYSTEMS

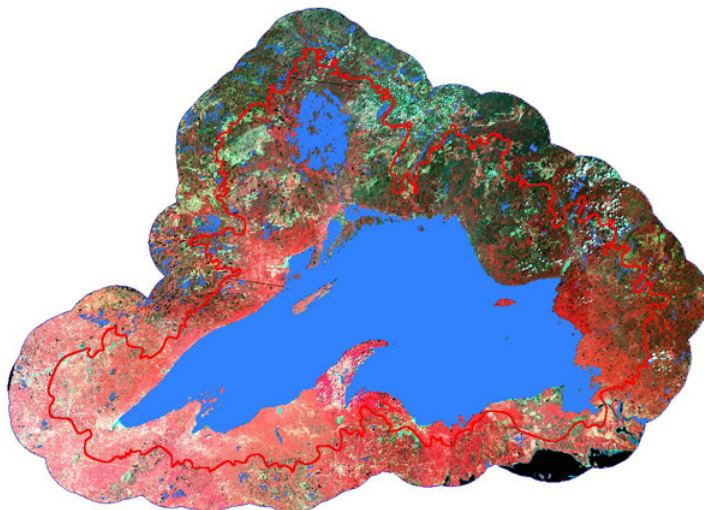
#### 3.4.1 Lake Superior Decision Support System

The Lake Superior Decision Support Project was initiated by the Lake Superior Binational Program and designed by scientists at the University of Minnesota's Natural Resources Research Institute (NRRI).<sup>3</sup>

This system offers a variety of online and downloadable maps of the Lake Superior basin and links to a number of GIS resources pertinent to Lake Superior. In 2006, GIS resources for important habitat sites and areas were added to the decision support system.

In 2007, the US EPA Great Lakes National Program Office provided funding to the NRRI to create a system of fine resolution and nested watersheds across the Lake Superior basin, to add data layers that describe environmental and human disturbance gradients (both point and non-point sources) within the watersheds, to provide a tool for using the watershed information in designing monitoring programs and to identify information on reference (least impacted) and degraded watersheds and coastal regions. The project will develop tools to allow users to scale data appropriate to their sampling domain, incorporate stressor information into analyses, and disseminate information through the Lake Superior Decision Support System. At the time of this report, this project is ongoing. Thus far, high resolution elevation data have been assembled for the Lake Superior basin (10 meter resolution for the U.S. and 20 meter for Canada). High resolution hydrologic data are being assembled for both the U.S. and Canadian sides of the Lake Superior basin.

Figure 3-3. The Lake Superior Decision Support Project offers online maps displaying a variety of data, including climate, census, city lights, land use/cover, habitat sites/areas, forest types, Landsat satellite image (at right), and elevation. Photo credit: The Lake Superior Decision Support Project.



<sup>2</sup> Great Lakes Commission Great Lakes Monitoring Inventory and Gap Analysis web site: [www.glc.org/monitoring/greatlakes](http://www.glc.org/monitoring/greatlakes).

<sup>3</sup> Lake Superior Decision Support Project web site: [www.nrri.umn.edu/lsgis](http://www.nrri.umn.edu/lsgis).

### 3.4.2 Lakeviews

Progress on the *Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem* (COA) “Coordination of Monitoring, Research and Information Management” Annex has led to the development of “Lakeviews,” a system of distributed databases linked by web services and mapping technologies that serves as a discovery, access, visualization, and decision support tool for information regarding trends in environmental quality.

“Lakeviews” is designed to provide easy access to environmental information using an interactive mapping tool. The system provides a snapshot of environmental programs. The application employs web services to dynamically pull information from distributed sources created by various government departments and partner organizations. Because of the flexibility offered by this design, the application is highly customizable in terms of form, content, and functionality. With the architecture already in place, the current focus is on content development—helping information custodians and their clients understand what web services are, how to develop them, how to use them, and why they are so beneficial.