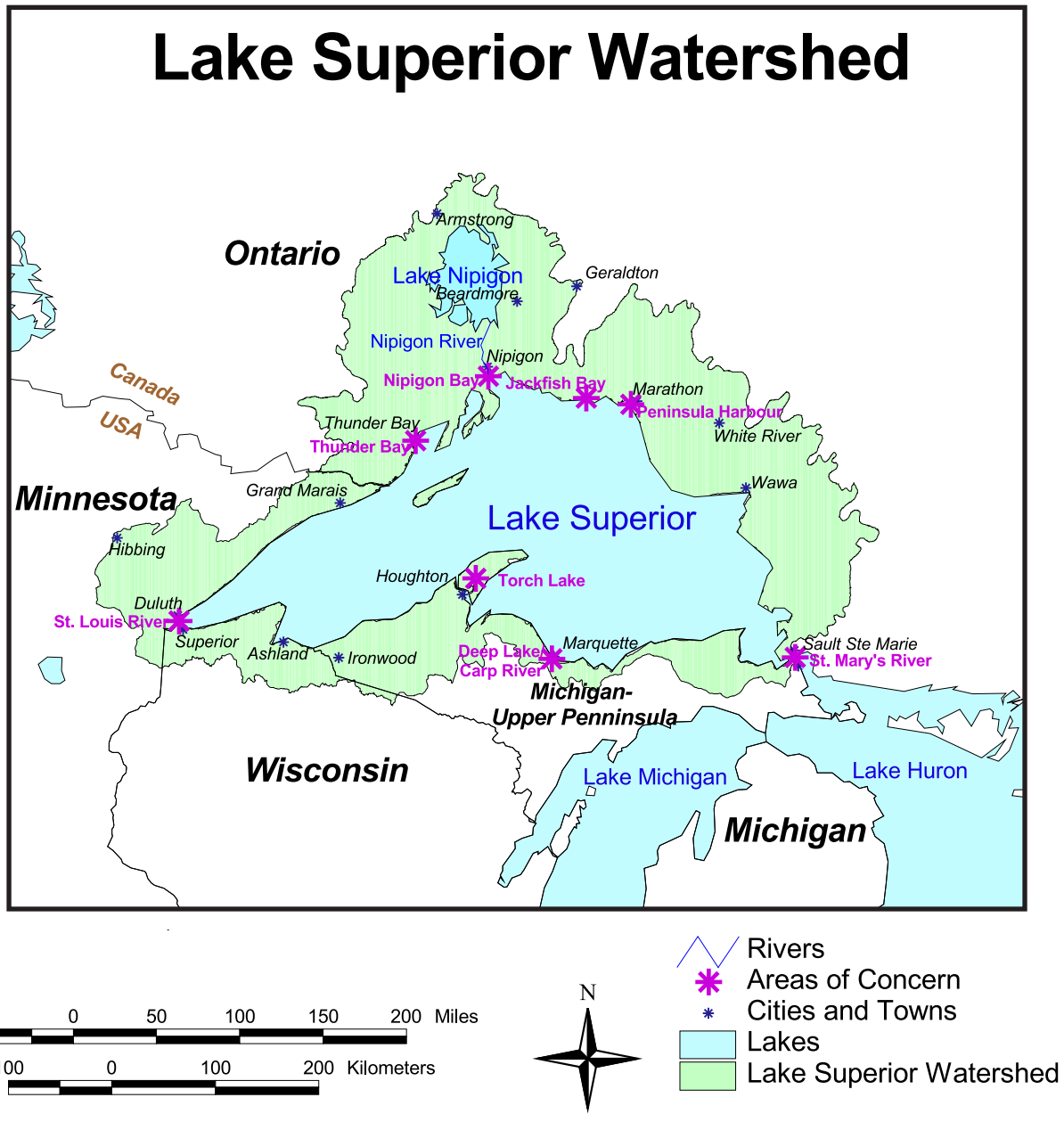
Lake Superior Lakewide Management Plan (LaMP) 2000

SUMMARY EDITION

Lake Superior Binational Program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Lake Superior Lakewide Management Plan 2000
Summary Edition
April 2000

prepared by the Superior Work Group
Lake Superior Binational Program

Lake Superior Lakewide Management Plan (LaMP) 2000 Summary Edition

Lake Superior Binational Program

ISBN 0-662-29008-9
DSS cat. no. En40-594/2000E

Issued also in French under title:
Le Plan d'aménagement panlacustre du lac Supérieur
édition sommaire

2000
Toronto, Canada; Chicago, U.S.A.

Cover photo courtesy of USDA Forest Service, Superior National Forest

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Acknowledgments

The Lake Superior Lakewide Management Plan 2000 was prepared by the Workgroup of the Lake Superior Binational Program with assistance from various other agencies and organizations including the Lake Superior Binational Forum. We would like to thank the seven committees of the Superior Workgroup for their efforts.

Member agencies of the Lake Superior Binational Program are:

1854 Authority
Agency for Toxic Substances and Disease Registry
Bad River Band of Lake Superior Chippewa
Department of Fisheries and Oceans
Chippewa-Ottawa Treaty Fishery Management Authority
Environment Canada
Fond du Lac Band of Lake Superior Chippewa
Grand Portage Band of Lake Superior Chippewa
Great Lakes Indian Fish and Wildlife Commission
Health Canada
Keweenaw Bay Indian Community
Michigan Department of Environment Quality
Michigan Department of Natural Resources
Minnesota Department of Natural Resources
Minnesota Department of Health
Minnesota Pollution Control Agency
Ontario Ministry of Natural Resources
Ontario Ministry of the Environment
Parks Canada
Red Cliff Band of Lake Superior Chippewa
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Forest Service
U.S. Geological Survey
U.S. National Park Service
Wisconsin Department of Natural Resources

Preface

Dear Great Lakes Stakeholders:

We are pleased to present to you the Lake Superior Lakewide Management Plan 2000 in a plain language edition.

The LaMP 2000 is a comprehensive compilation of scientific information and environmental action plans for Lake Superior. Governments will now begin reporting every two years to update the LaMP 2000 and more critically to highlight progress and achievements to restore and protect the Lake Superior ecosystem. Subsequent LaMP reports will provide all of the agencies in our program the opportunity to more fully report activities and accomplishments.

LaMP implementation takes us beyond the information and goal setting stages and into tangible actions for sustainable management of the Lake Superior ecosystem. This work will require partnerships and sharing of expertise among agencies, the private sector and communities.

This spring, Environment Canada and the U.S. Environmental Protection Agency will conduct a series of open houses in selected communities of the Lake Superior basin to publicize the LaMP and to give citizens the opportunity to speak directly with agency staff about their concerns for the lake. Contact will also be made with the business sector of each community to seek their participation.

The full technical report of the LaMP 2000 contains over 1000 pages and is available in electronic and printed formats. Please see the inside back cover for a copy on CD-ROM. The full report can also be found on the Lake Superior Binational Program website at www.cciw.ca/glimr/lakes/superior or www.epa.gov/glnpo/lakesuperior/.

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CHAPTER 1

Introduction

The Lake Superior basin is one of the most pristine and unique ecosystems in North America. Containing the largest surface area of any freshwater lake in the world, Lake Superior has some of the most breathtaking scenery in the Great Lakes, serving as a backdrop to a wide range of recreational and outdoor activities enjoyed by people from all over the world. Sparsely populated even today, Lake Superior has not experienced the same level of development, urbanization or pollution as the other Great Lakes. Federal, state and provincial governments, tribes and First Nations, environmental groups, industry, and the public have taken steps to protect this great legacy for generations to come. This shared partnership is viewed internationally as an excellent example of cooperative binational resource management.

Great Lakes Water Quality Agreement and Lakewide Management Plans

The Great Lakes Water Quality Agreement (GLWQA) between the U.S. and Canada is one of the most significant environmental agreements in the history of the Great Lakes. The agreement commits both Parties to address water quality issues in a coordinated fashion. The Agreement proposes to:

restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes basin ecosystem.

Under the 1987 amendments to the GLWQA, the Parties agree to develop and implement Remedial Action Plans (RAPs) for Areas of Concern and Lakewide Management Plans (LaMPs) for open lake waters. LaMPs are intended to:

- designate critical pollutants
- identify remedial measures to restore 14 identified beneficial uses
- include surveillance and monitoring to track effectiveness of remedial measures
- define threats to human health and aquatic life from critical pollutants

The Lake Superior Binational Program

In 1990 the International Joint Commission (IJC), an advisory body to the US and Canadian governments, recommended that Lake Superior be designated as a demonstration area "where no point source discharge of any persistent toxic substance will be permitted." On September 30, 1991, the federal governments of Canada and the U.S., the Province of Ontario, and the States of Michigan, Minnesota, and Wisconsin responded by announcing the Binational Program to Restore and Protect Lake Superior. Known as the Lake Superior Binational Program (LSBP), the Program identified two major areas of activity:

The Zero Discharge Demonstration Program establishes Lake Superior as a demonstration project to achieve zero discharge and zero emission of nine toxic, persistent, and bioaccumulative chemicals: mercury, total polychlorinated biphenyls (PCBs), dieldrin/aldrin, chlordane, DDT, toxaphene, 2,3,7,8-TCDD (dioxin), hexachlorobenzene (HCB) and octachlorostyrene (OCS). Voluntary pollution prevention is the preferred approach to achieving reduction goals, but enhanced controls and regulations might be necessary to achieve zero discharge. *The Broader Program* recognizes that zero discharge of persistent toxic substances alone will not be sufficient to restore and protect Lake Superior. The Broader Program focuses on the coordination among resource and environmental agencies.

The LSBP recognizes the need for public participation and values a partnership approach to achieving specified goals. The Program encourages commitment from all partners to develop new and innovative approaches to ecosystem management. Citizens of the basin, as partners and stakeholders in the Binational Program, are strongly encouraged to become actively involved.

Organization of the Lake Superior Binational Program

The Lake Superior Task Force consists of senior Canadian and U.S. federal, provincial, state and tribal representatives, who make management decisions related to Lake Superior. The Task Force serves as a steering committee and is responsible for program direction.

The Superior Work Group is comprised of Canadian and U.S. technical experts who represent agencies and organizations that manage Lake Superior water and other resources. The Work Group reports to the Task Force and is comprised of seven committees: critical pollutants, habitat, aquatic communities, terrestrial wildlife communities, developing sustainability, human health and public involvement.

The Lake Superior Binational Forum is a group of 24 Lake Superior citizen volunteers who make recommendations and provide governments with advice and input. Forum members bring perspectives from a variety of community sectors including business, environmental groups, academia and industry. In 1992, the forum endorsed the following vision statement that provides a philosophical framework for the Binational Program.

A VISION FOR LAKE SUPERIOR

As citizens of Lake Superior, we believe…

that water is life and the quality of water determines the quality of life.

We seek a Lake Superior watershed…

that is a clean, safe environment where diverse life forms exist in harmony; where the environment can support and sustain economic development and where the citizens are committed to regional cooperation and personal philosophy of stewardship;

that is free of toxic substances that threaten fish, wildlife and human health; where people can drink the water or eat the fish anywhere in the lake without restrictions;

where wild shorelines and islands are maintained and where development is well planned, visually pleasing, biologically sound, and conducted in an environmentally benign manner;

which recognizes that environmental integrity provides the foundation for a healthy economy and that the ingenuity which results from clean, innovative and preventive management and technology can provide for economic transformation of the region;

where citizens accept the personal responsibility and challenge of pollution prevention in their own lives and lifestyles and are committed to moving from a consumer society to a conserver society; and

where there is greater cooperation, leadership and responsibility among citizens of the basin for defining long-term policies and procedures which will protect the quality and supply of water in Lake Superior for future generations.

We believe that by effectively addressing the issues of multiple resource management in Lake Superior, the world's largest lake can serve as a worldwide model for resource management.

Endorsed by the Lake Superior Binational Forum on January 31, 1992 as an expression of the hearts and minds of all of us

LaMP Documents Produced to Date

Formerly, LaMP reports were submitted to the IJC as specified in the GLWQA when a key stage of work was completed:

Stage 1: When problem definition is complete and critical pollutants are identified
Stage 2: When chemical load reduction schedules are completed
Stage 3: When remedial measures have been selected
Stage 4: When monitoring indicates that the contribution of critical pollutants to impaired beneficial uses has been eliminated.

The Lake Superior Stage 1 LaMP for Critical Pollutants was transmitted to the IJC in September 1995. It used environmental data to identify 22 critical pollutants that: impaired or were likely to impair beneficial uses in the Lake; were likely to affect human health or wildlife because they exceeded chemical yardsticks; or impaired Lake ecosystem objectives. This document also summarized all known data on critical pollutants from point sources throughout the Lake Superior basin.

The Stage 2 LaMP for Critical Pollutants was transmitted in July 1999, and set remediation goals or reduction schedules for nine virtual elimination pollutants. The final targets set in the Stage 2 LaMP were proposed by the Lake Superior Binational Forum and reviewed by agencies and the public.

The Draft Stage 3 LaMP for Critical Pollutants was released for public review and comment in November 1999. It contained pollutant reduction strategies and remedial actions for the nine virtual elimination pollutants established in Stage 2.

Under the Broader Program, work proceeded in two areas between 1991 and 1998 – habitat and sustainability. For habitat, agencies developed ecological criteria to determine important Lake Superior habitat, set up a database of habitat sites, prepared a comprehensive map of important habitat sites and areas, and examined the impact of major pollutant dischargers on habitat. In the area of sustainability, criteria for non-regulatory special designations were developed. One outcome of this work was the Parks Canada project to designate a National Marine Conservation Area for one third of the Canadian waters of Lake Superior.

The Ecosystem Principles and Objectives, Indicators and Targets discussion paper was released in 1995. It set ecosystem objectives for six theme areas and began the process of indicator development.

Ecosystem Components

While initial focus of LaMP work was on reduction of critical pollutants, establishing the Zero Discharge Demonstration Project, and the Broader Program that advanced understanding of habitat and landscapes, work has recently begun in other areas. Partner agencies have developed Lakewide Management Plans for five additional ecosystem themes: aquatic communities, terrestrial wildlife communities, habitat, human health and developing sustainability. Work in these areas is released now for the first time for public comment and review in the Lakewide Management Plan 2000.

Adopting an ecosystem approach has begun a shift from a narrow perspective of managing environmental components like water, air and soil, or a single resource such as fish and trees, to a broader perspective that focuses on managing human uses and abuses of entire watersheds. This approach comprehensively addresses all aspects of the environment and resources within the context of a living system. The vision statement of the Lake Superior Binational Forum recognizes environmental integrity as the foundation for a healthy economy, that development of wild shorelines be conducted in an environmentally benign manner, and that citizens accept responsibility for their lifestyles. Guided by this vision, agencies developed the Ecosystem Principles and Objectives document the Lake Superior ecosystem. Committees of the Superior Workgroup continue to refine objectives and indicators for six theme areas. Below are the current objectives:

General Objective

Human activity in the Lake Superior basin should be consistent with A Vision for Lake Superior. Future development of the basin should protect and restore the beneficial uses described in the Great Lakes Water Quality Agreement.

Chemical Contaminants Objective

Levels of persistent, bioaccumulative, and toxic chemicals should not impair beneficial uses of the natural resources of the Lake Superior basin. Levels of chemical contaminants which are persistent, bioaccumulative, and toxic should ultimately be virtually eliminated in the air, water and sediment in the Lake Superior basin. A zero discharge demonstration program is the primary means for achieving reductions of in-basin sources of contaminants.

Aquatic Communities Objective

Lake Superior should sustain diverse, healthy, reproducing and self-regulating aquatic communities closely representative of historical conditions.

Terrestrial Wildlife Objective

The Lake Superior ecosystem should support a diverse, healthy and sustainable wildlife community in the Lake Superior basin.

Habitat Objective

To protect, maintain and restore high-quality habitat sites in the Lake Superior basin and the ecosystem processes that sustain them. Land and water uses should be designed and located compatible with the protective and productive ecosystem functions provided by these natural landscape features.

Human Health Objective

The health of humans in the Lake Superior ecosystem should not be at risk from contaminants of human origin. The appearance, taste and odor of water and food supplied by the Lake Superior ecosystem should not be degraded by human activity.

Developing Sustainability

Human use of the Lake Superior ecosystem should be consistent with the highest social and scientific standards for sustainable use, and should not degrade it, nor any adjacent ecosystems. Use of the basin's natural resources should be consistent with their capability to sustain the ecosystems identity and functions, should not risk the socioeconomic and cultural foundations of any citizens, nor deny any generation the benefits of a healthy, natural Lake Superior ecosystem. The obligation of local communities to determine their future should be incorporated in any policies directed at the management of natural and social resources in the basin.

What is LaMP 2000?

In the interest of advancing the restoration and protection of the Great Lakes, the Binational Executive Committee (BEC) passed a resolution to accelerate the LaMP efforts by placing more emphasis on taking actions and streamlining our review and approval process. The LaMP 2000 treats the elements of problem identification, selection of remedial and regulatory measures, and implementation as a concurrent integrated process rather than a sequential one. The LaMP 2002 will report on progress as well as identifying additional actions needed to meet our goals.

The BEC also endorsed applying adaptive management to the LaMP process. Adaptive management allows the process to change as needed and to build upon, successes, new information and public input. The LaMP can be adjusted over time to respond to the most pertinent issues facing the lake ecosystem.

Actions, Strategies and Projects

Each of the Lakewide Management Plan 2000 chemical and ecosystem components contains specific actions and projects to help achieve the goals and objectives of the LaMP. Some of these actions have commitments and funding from various state, federal, provincial or tribal agencies. Some high priority actions are still in need of agency commitment or funding. The LaMP 2000 also contains suggested voluntary actions that could be undertaken by our non-governmental partners.

Relationship of the LaMP to Other Initiatives and Efforts

Remedial Action Plans for Areas of Concern

The 1987 amendments to the GLWQA also called for the development of Remedial Action Plans for specific Areas of Concern (AOCs). The primary goal of the RAPs is to restore impaired beneficial uses – both ecological and cultural, in degraded areas within the basin. In the Great Lakes basin 43 AOCs have been identified. In the Lake Superior basin there are eight AOCs: four in Canada, three in the U.S., and one shared binationally along the St. Mary's River.

RAPs and LaMPs are similar in that they both use an ecosystem approach to assessing and remediating environmental problems, focus on 14 beneficial use impairments, and rely on a structured public involvement process. RAPs, however, encompass a much smaller geographic area, concentrating on a single embayment, a single watershed or stretch of a river. Most of the Lake Superior RAPs have a local public advisory committee, with stakeholders providing advice and in some cases undertaking local remediation projects. Most of the beneficial use impairments can be directly related to sources within an AOC, but sometimes the impairment results from a lakewide problem.

Forging a strong relationship between LaMPs and RAPs is important to the success of both. Because AOCs are sometimes point source discharges to the whole lake, improvements in AOCs eventually help improve the entire lake. Expertise about use impairments and possible remedial efforts is often found at the local level, thus cooperation between the two efforts is essential.

Great Lakes Binational Toxics Strategy

Signed between the U.S. and Canada in 1997, the Great Lakes Binational Toxics Strategy (GLBTS) helps provide an overall coordinating effort to reduce and virtually eliminate persistent toxic substances in the Great Lakes basin. The strategy provides a framework for actions to reduce or eliminate persistent toxic substances and establishes reduction challenges for the period 1997 to 2006 for twelve persistent toxic substances including mercury and PCBs.

The strategy is critical to the toxic reduction efforts of the Lake Superior LaMP. The GLBTS can work within national and international frameworks to address out-of-basin sources of toxic substances, an increasingly important source of pollutants to Lake Superior. It can also help coordinate ongoing toxics reduction efforts across the basin and disseminate critical information on successful projects. And, because the GLBTS effort is closely coordinated with the U.S. federal Persistent, Bioaccumulative and Toxic Substances Initiative, it can disseminate current national and international scientific information on Lake Superior critical pollutants. Finally, the ambitious reduction time frames and schedules for virtual elimination of critical pollutants at the basin-wide and national level can help support similar reduction efforts in Lake Superior.

There are positive signs of progress in the Great Lakes that are important for Lake Superior. Canada has exceeded it's 90% challenge reduction in the use, generation and release of alkyl-lead and the United States has met the binational challenge of confirming no-use of alkyl-lead in automotive gasoline. Canada has also met its pesticide challenge that there is no longer use or release from sources that enter the Great Lakes basin of five bioaccumulative pesticides (chlordane, aldrin / dieldrin, DDT, Mirex, and toxaphene).

Conclusion

The chapters that follow contain scientific and technical information, and priority actions and restoration projects that we will be initiating over the next two to three years. The chapters are summaries of the more extensive technically-written LaMP 2000 document which is available on CD-ROM and through our website.
Please refer to the technical document for a complete list of funded and unfunded actions.

CHAPTER 2

Public Outreach and Education

Introduction

All the partners involved in the Lake Superior Lakewide Management Plan, i.e., States, the Province, Federal Agencies and the Tribes, industry, the public and others, have long been committed to an open, fair and significant public involvement process. One of the main goals of the Lake Superior Binational Program is, in fact, to promote meaningful public participation and education so as to ensure that the needs and concerns of the diverse population in the Lake Superior ecosystem are met. This section of the LaMP will briefly describe the efforts that have been made to date to include public input and involvement, and will then detail the anticipated future outreach plans for the LaMP 2000 document.

Public Involvement

A major tenet of ecosystem management is the continuous involvement of the public that is inclusive and respectful of all viewpoints and stakeholders. LaMP 2000 is not an end to this process, but provides an opportunity for full public review and input on what has been developed to date, and ongoing involvement in the revisions and updates to come in future LaMP publications. Public input and support will help ensure the actions recommended in the LaMP are carried out, leading the way to restoring and protecting the Lake ecosystem. The key to public support and the program's success is effective communication between the government agencies and the diverse population of the Lake Superior basin.

With the release of this LaMP 2000 document, the Public Involvement Subcommittee is responsible for gathering comments submitted by the public and ensuring that the proper committees receive the comments in order to take them into consideration. Responses will then be prepared so that those who made submissions will know what happened as a result of their comments. Formal comment on the LaMP document will be received until July 31, 2000. As the LaMP 2000 report is available on our web sites, it is also possible to use the on-line submission form to send your comments to us. They can be found at either www.cciw.ca/glimr/lakes/superior/ or www.epa.gov/glnpo/lakesuperior/. We also plan to set up a page on the web site that will be used to display the comments. This will allow members of the public to review comments already received by the agencies. Information on repositories for the Lake Superior LaMP can be found at the above web site addresses.

Over the coming months, there will be public meetings in the Lake Superior basin to educate stakeholders about the LaMP, receive their input and to encourage actions to improve the ecosystem of the Lake Superior basin. Many of the meetings will be held in local Areas of Concern so that we can continue to better integrate the LaMP and RAP processes.

We invite you to stay involved in the LaMP process after April of 2000. As actions are implemented and evaluated, chapters are revised, new data gathered and analyzed, this information will be placed on our web site and listed repositories (which can be accessed at the web site) for public review and input. Although the LaMP document will not be published again until April of 2002, there will be many opportunities for input and involvement during the two year period.

Public Outreach / Education Efforts to Date

When the Lake Superior Binational Program was first started, public involvement activities were carried out primarily by the Binational Forum. As the Program matured, it became apparent that the government agencies and their partners needed their own separate public outreach mechanism. A separate group, therefore, was formed entitled the Communications/Public Involvement Committee. Over the years, the two groups have worked closely together, complementing each others' efforts to involve the Lake Superior population.

Lake Superior Binational Forum

Since 1991, the Lake Superior Binational Forum has served as the principal public advisory body to the governments responsible for carrying out the IJC's 1990 recommendation that Lake Superior be a demonstration area where no point sources discharge of any persistent toxic substance would be permitted. The purpose of the Forum is to further consultation and participation among government, industry and environmental stakeholders on the restoration and protection of Lake Superior. The Forum is composed of Canadian and American stakeholders representing environmental, Tribal/First Nations, industrial, business, health and academic interests.

The Forum has held various technical workshops since 1991 for the purpose of acquiring necessary background information to help develop proposals for phase-out schedules and reduction recommendations. These recommendations on the nine critical pollutants, for example, may be found in the Stage 2 Lakewide Management Plan. These workshops have been held on mercury, sustainability indicators, PCBs and pesticides, to name a few.

In addition to sponsoring workshops, the Lake Superior Forum has published a number of reports and documents, ranging from assessing public attitudes toward pollution prevention, to providing feedback and comment on Lake Superior ecosystem objectives and principles.

Lake Superior Tour

In the Fall of 1999, The Lake Superior Alliance, an international coalition of community groups, sponsored a series of public meetings around the Lake Superior basin on the LaMP. The main purpose was to outreach to the public on the Lake Superior Lakewide Management Plan and Binational Program in general, and the Stage 3 Chemical Chapter of the LaMP in specific.

Seven public meetings were held in the cities of Thunder Bay, Wawa, Sault Ste. Marie, Marquette, Houghton, Ashland and Duluth. These meetings included speakers from the USEPA, Environment Canada, the Province of Ontario, States, local and regional environmental groups, and the Binational Forum.

In general, the public meetings took the form of government speakers giving a brief history and synopsis of the LaMP, followed by a question and answer session. Findings, issues and questions included the following:

- Overall good acceptance of the LaMP but a perceived need for better integration between government entities at the various levels.
- General unawareness on the part of the public about the LaMP, including such questions as was it regulatory or voluntary; how did it integrate with other ongoing programs; how can local groups participate more fully, and how can groups "sign on" to recommendations.
- Concern that the document was too long and technical, and that there were too many recommended actions on the chemical portion to establish accountability.

Another Lake Superior Tour is planned over the coming months in conjunction with the release of the LaMP 2000 document.

Documents and Press Releases

The Lake Superior Workgroup released two major documents in 1999. In July of 1999, the LaMP Stage 2 Report was released, setting targets and time frames for reductions of critical pollutants to Lake Superior. In November of 1999, a report entitled "Lake Superior: Lakewide Management Plan, Stage 3, Reducing Critical Pollutants", was released. Public comment and input was solicited on the proposed strategies to reduce the nine critical pollutants into Lake Superior. Media advisories/press releases were released to the media and public in Canada and the United States to announce the release of both documents. These chemical reports are available on the web at ww.cciw.ca/glimr/lakes/superior/pubs.html or www.epa.gov/glnpo/lakesuperior/pubs.html .

Activities of the Communications/Public Involvement Committee

The Binational Program has produced various documents and brochures for the purpose of informing and educating the public. These documents include a general informational brochure on the who, what, why and scope of the Binational Program, as well as a brief introduction of each committee on the Lake Superior Workgroup. Each individual committee has also produced fact sheets which outline the goals and objective of the committee, with past and anticipated activities. Contact information for committee co-chairs was listed on each fact sheet as a means to create a direct link to agency representatives.

The Binational Program has developed a traveling display as a means of outreach and education to the general public. This display has been, and will continue to be, used as a means to publicize Lake Superior and the Binational Program at public meetings, seminars, conferences, etc. The display includes a large photographic display of the lake, with space for fact sheets, brochures, and other documents on the lake. The display booth is staffed by members of the Binational Program. In 1999, the display booth was utilized at the Great Lakes Water Quality Forum, hosted by the International Joint Commission in Milwaukee, Wisconsin and at the tour of meetings in the Lake Superior basin, hosted by the Lake Superior Alliance.

The Committee has been revising the Lake Superior Binational Program web site which consists of a home page and the following supporting pages: *What's New*, which includes the most current LaMP report, meeting minutes, and upcoming Lake Superior Binational Program events; *Upcoming Events*, which includes Forum meeting schedules and notices of Lake Superior related workshops and public meetings; *Lake Superior Binational Program*, which defines the program components, the theme committees, and the partners involved in the Binational Program; *Publications*, which consists of a list of Lake Superior related reports and documents that can be read on-line; *How Can I Get Involved?*, which gives a list of topics for public consideration that can be read on-line; *Binational Forum*, which gives a brief definition of the Forum, the Vision statement, membership, upcoming events, meeting minutes, publications, and accomplishments of the Forum; *Other Links*, which gives a list of other related sites that might be of interest to the public; and *FAQs*, which provides a list of questions most asked by the public and the answers.

Future Directions: Post- April 2000 Public Outreach/Education

Based on the reaction of the public to the Stage 3 Chemical LaMP, the partners made the decision to produce a "public friendly" version of LaMP 2000. Members of the public who attended the meetings told us that the Stage 3 report was too technical and too complicated. They said that they would like to see a report written in active prose with use of graphics. This document is the result of those comments.

Another outcome of the tour of meetings in November 1999, was a commitment for a series of "open houses" after the release of the LaMP document 2000. The public indicated that the opportunity to meet with agency staff face-to-face was very helpful to their understanding of the LaMP and that they would like to see more meetings after the release of the LaMP document. As a result, the partners decided that there would be a series of tours, in the form of open houses, held in the Lake Superior basin during the public comment period after the release of the LaMP 2000. These open houses will give agency representatives the opportunity to provide information to members of the public as well as gather comments from the public on the document.

It is intended that the format will consist of a brief presentation about the document, followed by the occasion for attendees to go to booths to meet with members of the various technical committees to discuss the portions of the document that are of specific interest to them. This format, while providing an overall framework and context through the presentation, will allow for one-on-one discussions and information sharing. At the same time it will allow agency members the opportunity to learn the public's reaction to the LaMP document.

As the LaMP 2000 report is available on our web sites, it is also possible to submit comments on-line. For this purpose, we have set up an on-line submission form at either: www.cciw.ca/glimr/lakes/superior/involved.html or www.epa.gov/glnpo/lakesuperior/involved.html.

We also plan to set up a page on the web site that will be used to display the comments. This will allow members of the public to review comments already received by the agencies.

The C/PI committee is also responsible for receiving public comments and channeling them to the appropriate technical committees for consideration and response. A document called a responsiveness summary will be prepared by each technical committee to show the public how their comments were addressed. Another means of communicating with the public on the document, will be a toll-free number where people can call, either to request information or to leave their comments. This number is 1-888-301-LAKE (1-888-301-5253).

A mailing list is being compiled for each of the theme committees (Developing Sustainability, Chemical, Habitat, Aquatic, Terrestrial Wildlife Communities, and Human Health) to keep the public informed of any new developments in the Lake Superior basin and to provide them with the opportunity to comment. The mailing list will include both U.S. and Canadian government agencies; tribal organizations and First Nations; environmental groups and public advisory groups.

Assembling material to inform the public on progress towards restoring and protecting Lake Superior is another role the committee fulfills. In that function, the committee is working on two projects - Success Stories and Frequently Asked Questions - for distribution and inclusion on the web site.

The Binational Program works in partnership with other organizations towards a common goal of a healthy and safe Lake Superior. Success stories enable all to share accomplishments and achievements in the hope that others can learn from those experiences and put environmentally friendly ideas and techniques to work in their area. The stories let citizens know the vast amount of positive change that can occur by working together; and will act as a motivating force to garner both financial and volunteer support. These examples will be gathered and distributed to local media outlets in the Lake Superior basin.

Another means of providing information on progress of the Lake Superior Binational Program is in the form of Frequently Asked Questions. The committee will put together a collection of these questions and post questions and answers on the binational web sites. These may also be provided to media outlets as information pieces.

Conclusion

The partners involved in the Lake Superior Binational Program feel that these activities will meet the objectives of informing and educating the public about the program, involving the public in the decision-making process, and educating and motivating stakeholders into action. These agencies are mindful that involvement by people representing a wide range of interests is essential to the success of the Lake Superior Binational Program. Public input and support will help ensure that actions recommended in the program are carried out, leading the way to restoring and protecting Lake Superior.

Table 1 Public Involvement Projects and Lead Agencies

Project Title/Actions	Lead Agency/ Funding Source
Coordinate the Lake Superior Tour 2000 – which consists of the opportunity for agency representatives to provide information to members of the public, as well as gather comments from the public on the LaMP 2000 document and the Binational Program.	Environment Canada, U.S. Environmental Protection Agency and U.S. states with the help of other organizations
County Government education and outreach.	U.S. EPA

If you would like to be added to our mailing list, please contact:

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CHAPTER 3

Reducing Critical Pollutants

Introduction

Although Lake Superior remains the most pristine of the Great Lakes, it is threatened by chemicals that do not break down in the environment and are harmful to fish and other forms of life. These chemicals can build up in concentration as larger organisms eat smaller organisms which in turn have eaten food containing these contaminants. These substances can be transported long distances in the atmosphere and end up in the lake. Toxic contaminants also come from local sources that contribute pollutants to both air and water. The pollutants come from many areas: they are generated in the production of energy; the handling of wastes; as industrial by-products; and they are found in or created by the products we use.

In 1990, the International Joint Commission challenged the governments of Canada and the United States to develop a Zero Discharge Demonstration Program for Lake Superior. In response, the two federal governments, together with the states of Minnesota, Michigan, and Wisconsin and the province of Ontario, created the Binational Program to Restore and Protect the Lake Superior basin in 1991. The program includes a Zero Discharge Demonstration Project for nine toxic chemicals: mercury; PCBs; Aldrin/Dieldrin; Chlordane; DDT/DDE; Toxaphene; Dioxin; HCB; and, OCS.

Table 2 Lake Superior Pollutant Reduction Targets

Pollutant	Goal for Lake Superior Environment	Reduction Schedule
Mercury	Virtual Elimination	60% reduction by 2000 80% reduction by 2010 100% reduction (zero discharge/zero emission) by 2020 (applies to in-basin sources) (1990 base line)
PCBs	Virtual Elimination	Destroy accessible/ in-control PCBs 33% destruction by 2000 60% destruction by 2005 95% destruction by 2010 100% destruction by 2020 (1990 base line)
Aldrin/Dieldrin Chlordane DDT/DDE Toxaphene	Virtual Elimination	Retrieve and destroy all canceled pesticides in the basin by 2000
Dioxin HCB	Virtual Elimination	80% reduction by 2005 90% reduction by 2010
OCS		100% reduction by 2020 (1990 base line)

By convention, dioxin is measured and reported as toxic equivalents (TEQ).

Virtual Elimination: What is it and what will it take?

The goal of eliminating nine toxic chemicals from the Lake Superior ecosystem to the greatest extent possible is referred to as "virtual elimination". The first step toward this goal is to prevent the release of the nine chemicals from sources within the Lake Superior basin.

This program encourages a societal commitment and focuses on human activities that use or generate these pollutants. The issue is not simply how much chemical is legally permitted or can be detected in a discharge, but whether these chemicals are generated at all.

The key to achieving zero discharge is pollution prevention. If these chemicals are not used in processes or products anywhere in the basin, they cannot be released to the environment. This means more than installing better technology at the "end of the pipe" of a factory or mill. To protect Lake Superior, chemical reduction strategies need to have broad public support.

The Lakewide Management Plan for Lake Superior

The LaMP for chemical pollutants began in 1992. The first two stages of the LaMP, describing the status of pollutants in the Lake Superior ecosystem and setting reduction schedules for critical pollutants, have been completed. This chapter summarizes the third Stage, which identifies actions to reduce critical pollutants. While many of these activities have already begun, some of the activities described in this report will be started in the next two to three years.

Guiding Principles

The agencies of the LSBP have developed a set of principles to guide the load reduction schedules and activities to meet them.

- The parties of the Binational Program commit to move beyond the status quo (i.e., activities that go beyond regulatory compliance will be encouraged). Progress is more than meeting current regulations. Progress in some sectors will be difficult to quantify. Qualitative descriptions of progress will also be needed.
- The reduction schedules are planning targets for the entire basin and are not schedules for specific facilities, sectors, jurisdictions or sources.
- The endpoint of the load reduction schedules is zero discharge. The approach is staged reductions.
- The reductions will be achieved through maintenance of regulatory standards and through source reduction, new technologies, material substitution, pollution prevention, recycling, education and awareness programs, and development of new waste disposal and pollutant destruction capabilities. The pollution prevention approach is the preferred strategy.
- The LaMP addresses all in-basin sources. Other mechanisms will deal with out-of-basin sources.
- In going beyond regulatory control requirements, the solutions cannot create social or economic situations that regionally disadvantage the residents of the Lake Superior basin. Actions taken to fulfill the schedules must be consistent with a sustainable economy.
- The reduction of pollutants will not be based on removal from the Lake Superior basin to other basins (transference). In-basin solutions are preferred.
- Approaches are to be characterized by flexible implementation.
- While voluntary reductions are encouraged, incentives must also be developed to support the implementation of these approaches. Actions do not necessarily need to be legally-driven.
- Delivery of the Lake Superior Binational Program goes beyond the agencies directly involved. Other agencies and other parties have a role.
- The Lake Superior Binational Forum and other stakeholders are to be consulted on a continuous basis.
- The targets described in the LaMP for Critical Pollutants support the other theme areas of the Lake Superior Binational Program (human health, sustainability, habitat, aquatic and terrestrial communities, and communications).

The LaMP 2000 approaches pollutant reductions within the broader context of social, economic and ecological sustainability. The process is complex and not limited to eliminating a specific chemical in the environment or rehabilitating a single stream. At the very least, we must conserve existing resources in the basin so that our descendants can enjoy the same quality of life as the present generation, if not a qualitatively better standard of living. Any plan for developing sustainability must be flexible and responsive to changes The true measure of a sustainable society is on the scale of generations rather than years. The reductions cited below track one decade of progress.

Progress Toward Virtual Elimination

Since 1990, releases of the nine designated chemicals have declined in the Lake Superior basin for the following reasons:

1. Reduction efforts by facilities in the basin
2. New technology
3. Federal and regional regulations
4. Facility closures

The Chemicals: Progress Over the Last Decade and What is Needed to Meet the Next Milestones

Mercury

Mercury is a naturally occurring metallic element that is easily transported over large distances via the atmosphere. Through a process called methylation, bacteria convert mercury to a form (methyl mercury) that can bioaccumulate in plants and animals. Methyl mercury is neurotoxic and is one of the chemicals prompting sportfish consumption advisories for Lake Superior. The metallic form is used in many products and applications, including batteries, thermometers, electrical switches, barometers, fluorescent lamps, pharmaceuticals, laboratory chemicals, pesticides, preservatives, pigments, fireworks, aluminum electroplating, and industrial electrolysis. Mercury is also released inadvertently by various industrial processes involving combustion, ore processing, or manufacturing.

The major sources of mercury from within the Lake Superior basin are ore processing, electrical generation using coal and purposeful use of mercury in products. Between 1990 and 1999, mercury discharge, emission, and disposal within the Lake Superior basin have decreased by roughly 60 percent, meeting the year 2000 reduction milestone. Closure of two ore processing facilities in the basin has significantly reduced mercury air emissions. Mercury content in commercial and consumer products has decreased by 80 percent as a result of bans on mercury fungicides and preservatives in paints as well as decreasing mercury content in batteries. The next mercury milestone in the Lake Superior basin is an 80 percent reduction by 2010.

Intentional use of mercury in processes and products is the source of much of the mercury released from incineration and municipal sources. Important reductions from these sources have taken place between 1990 and 1999. A fifty percent reduction from municipal and industrial sources and the mining and energy sectors is still needed in order to meet the Lake Superior mercury goal for 2010.

Strategies aimed at reducing intentional use of mercury include product stewardship and purchasing policies. In the mining sector, voluntary agreements and mercury emission control technologies offer the greatest potential for mercury reduction. Short term strategies for mercury from energy production target energy conservation. Long term strategies include control technologies and alternatives to coal.

PCBs

Polychlorinated biphenyls (PCBs) have also caused fish consumption advisories in Lake Superior. Across the Great Lakes basin, PCBs have been associated with reproductive problems in bald eagles and other fish-eating animals. PCBs are widely distributed because they are easily transported in the atmosphere.

The manufacture and new uses of PCBs were banned in the late 1970s. PCBs were never commercially produced in Canada, but significant quantities were imported and are still being used in electrical equipment. Both the United States and Canada continue to permit the operation of PCB-containing electrical equipment that was in use before the manufacturing ban. The LaMP reduction goals call for 100 percent destruction of existing PCBs in the Lake Superior basin by 2020. This also includes the clean up of PCB-contaminated soils and sediment.

Canadian facilities have made substantial progress in destroying PCB-contaminated equipment and materials. While the major utilities and some industrial facilities in the U.S. portion of the basin have made substantial progress in replacing and disposing of their PCB-contaminated transformers and capacitors, small utilities and other industrial facilities must begin to more aggressively identify and decommission their PCB-contaminated equipment. There is no complete inventory for PCBs in the U.S. part of the Lake Superior basin. Canada maintains an up-to-date inventory of in-use, in-storage and destroyed PCBs.

Pesticides

Dieldrin/aldrin, chlordane, DDT, and toxaphene are organochlorine pesticides. Uses and sale of these pesticides were canceled in the U.S. and Canada in the 1970s and 1980s. These pesticides are persistent and bioaccumulate in the food chain. Currently, chlordane and toxaphene are responsible for fish consumption advisories.

One of the program goals is to retrieve and destroy all remaining stockpiles of the canceled pesticides in the basin by 2000. Lake Superior strategies for pesticides include continued or expanded collection opportunities coupled with public outreach.

Dioxin, HCB, OCS

Dioxin is a term for a class of chemicals that have related structures and toxicities. The most toxic chemical of this class is 2,3,7,8-tetrachloro-dibenzo-p-dioxin (2,3,7,8-TCDD). Generally, concentrations of other chemical forms of dioxin are expressed relative to the toxicity of 2,3,7,8-TCDD and reported as toxic equivalents (TEQ). Dioxin levels have prompted fish consumption advisories in Lake Superior.

Unlike mercury and PCBs, dioxins are not deliberately produced or used, but instead, are by-products of other activities. These include incineration, fuel combustion, metal smelting, petroleum refining and other industrial processes.

The 1990 estimates indicate that most of the dioxin produced in the Lake Superior basin was released to the atmosphere. Contaminated soils and sediment were the next largest category for dioxins in the basin. Small incinerators used at apartment buildings, nursing homes, schools, grocery stores, and similar facilities produced most of the dioxin released to the atmosphere. Since 1990, most of these small, inefficient incinerators have been shut down. However, while many dioxin sources are now under control, "backyard burning" of solid waste by some households and small businesses continues and this can be a significant source of dioxin compounds.

The dioxin emission estimates for 1990 and 1999 indicate that the in-basin emissions have declined by 75 to 95 percent, thereby making significant progress towards achieving the 2005 and 2010 goals for the Lake Superior basin.

The available data for hexachlorobenzene (HCB) and octachlorostyrene (OCS) are too limited to confidently predict the change in releases from sources in the Lake Superior basin since 1990. What little data are available suggest that some of the major sources of dioxin, such as incineration, are also sources of HCB and OCS. Control of dioxin emissions sources will likely result in corresponding reductions of HCB and OCS.

Actions for the Next 2 to 3 Years

Progress on pollutant reductions requires commitment on many levels: local, state, provincial, federal and tribal governments, industry, trade associations and individuals. The following is a summary of the strategies and actions of the Lake Superior Binational Program partner agencies in the short term. Please consult Chapter 4 of the LaMP 2000 document for a complete listing of actions.

Table 3 Chemical strategies	
MERCURY	
Mercury Strategy 1:	Encourage voluntary reductions of the use, discharge and emission of mercury.
Mercury Strategy 2:	Develop incentives to reduce mercury.
Mercury Strategy 3:	The mining and electric utility sectors must reduce mercury by half in order to meet the 2010 milestone.
Mercury Strategy 4:	Mercury-bearing products must be reduced in order to halve the amount of mercury in products by 2010.
Mercury Strategy 5:	Proper identification, collection and disposal of mercury-bearing products in the basin.
Mercury Strategy 6:	Regulations, Compliance, and Enforcement
Mercury Strategy 7:	Remediation of mercury contaminated sediments.
PCBs	
PCBs Strategy 1:	Encourage voluntary reductions of the use and storage of PCBs.
PCBs Strategy 2:	Untested equipment must be tested and the inventory must be kept current.
PCBs Strategy 3:	Decommissioning, removal and destruction of PCBs.
PCBs Strategy 4:	Government agencies to undertake PCB training programs.
PESTICIDES	
Pesticides Strategy 1:	Collection of remaining stockpiles of banned pesticides.
Pesticides Strategy 2:	Engage other programs that deal with banned pesticides.
Pesticides Strategy 3:	Educate residents about the use of pesticides.
DIOXIN, HCB, OCS	
Dioxin Strategy 1:	Encourage voluntary reductions of the discharge and emission of dioxin/HCB/OCS.
Dioxin Strategy 2:	Develop incentives to reduce dioxin/HCB/OCS.
Dioxin Strategy 3:	Pollution prevention is the preferred approach to inhibit the formation of dioxin/HCB/OCS in incineration.
Dioxin Strategy 4:	There is a continuing role for the pulp and paper industry to play in dioxin reductions.
Dioxin Strategy 5:	Identify sources of dioxin/HCB/OCS.
STRATEGIES THAT APPLY TO MULTIPLE POLLUTANTS	
General Strategy 1:	Lake Superior goals must be taken into account by other programs.
General Strategy 2:	Sites contaminated by the nine designated chemicals must be identified and cleaned up.
General Strategy 3:	Pollution prevention is the preferred approach to achieving the goal of zero discharge.
General Strategy 4:	Lake Superior communities must be supported in their pursuit of the zero discharge demonstration program and encouraged to share their expertise to help others protect the lake.

Table 4 Critical Pollutants Actions and Lead Agencies	
Committed Actions	**Project Leads**
Environmental Actions	
voluntary agreements	EC, EPA, MI, MN, ON WI
health care voluntary agreements	BR, EC, EPA, MI, MN, ON, WI
energy audits or conservation programs	BR, EPA, MI, MN, ON, WI
remove mercury and PCBs from schools	BR, EPA, MI, MN, ON,WI
partner with dental associations	BR,EC, MI, MN, ON
collection of household hazardous wastes	BR, EC, EPA, FDL, KBIC, MI, ON, RC, WI
voluntary pulp and paper agreement	EC, ON
encourage PCB destruction	EC, EPA, ON
complete remediation at two Area of Concern, Torch Lake, (MI) and St. Louis River, (MN), by the end of FY 2005	EPA
Information Actions	
PCB use and disposal training	BR,EC, EPA, MI, MN, ON
burn barrel outreach	BR, EPA, FDL, MI, MN
scientific determination on regulation of mercury emissions from electric utilities by December 2000	EPA
promote mercury awareness in schools	EC

Key to acronyms:

- **EC** **Environment Canada**
- **EPA** **United States Environmental Protection Agency-Region 5 (USEPA)**
- **MI** **Michigan Department of Environmental Quality (MDEQ)**
- **MN** **Minnesota Pollution Control Agency (MPCA)**
- **ON** **Ontario Ministry of Environment (OMOE)**
- **WI** **Wisconsin Department of Natural Resources (WDNR)**
- **BR** **Bad River Band of Lake Superior Chippewa**
- **FDL** **Fond du Lac Band of Lake Superior Chippewa**
- **GP** **Grand Portage Band of Lake Superior Chippewa**
- **KBIC** **Keweenaw Bay Indian Community**
- **RC** **Red Cliff Band of Lake Superior Chippewa**

Monitoring

The LaMP proposes the strategies and actions that agencies, businesses, and citizens would be required to take in order to reduce and eventually eliminate the load of critical pollutants to Lake Superior. In addition to implementing these actions, pollutant sources and ambient pollutant levels in Lake Superior should also be monitored to assess progress in achieving the goals of the LaMP.

Work is needed to develop a coordinated monitoring program that will enable the LSBP agencies to evaluate progress toward the Lake Superior goals. This effort should include source monitoring to determine and track releases of toxic pollutants as well as environmental monitoring for the Lake Superior ecosystem.
In addition to environmental and source monitoring for critical pollutants, research is needed on important questions related to toxic substances and their fate in the Lake Superior ecosystem. Research needs will be addressed in future iterations of the LaMP.

Monitoring Strategy

The EPA and EC will lead efforts to develop a coordinated monitoring strategy for the Lake Superior basin. All of the LSBP agencies will assist in the development of the monitoring strategy and seek resources for implementation. The monitoring strategy will be peer reviewed and presented in LaMP 2002.

CHAPTER 4

Human Health

Introduction

Water quality is significant to people in many ways. We need water to drink, we want to have water to play in, and we depend on water to provide a home for many of the things we eat. When water is contaminated by chemicals or micro-organisms, our health can be at risk. Recognizing this, the Great Lakes Water Quality Agreement requires Lakewide Management Plans to assess and address the threat to human health by environmental contaminants.

A primary ecosystem objective for the Lake Superior basin, is that *human health should not be at risk from contaminants of human origin*. For this to be true, the following objectives must be met:

- Fish and wildlife should be safe to eat
- Water quality should be protected where it is good, and improved where it is not
- Surface waters and groundwater should be safe to drink after normal treatment
- All water should be safe for total body contact activities
- Air quality should be protected where it is good, and improved where it is not
- Soils should not present a hazard to human health

What is Human Health?

The World Health Organization defines human health as "a state of complete physical, mental and social well-being, and not merely the absence of disease". When we think about human health, all aspects of well-being need to be considered - physical, social, emotional and spiritual. Exposure to environmental contaminants is only one of many factors that can contribute to the state of our health:

- our physical environment - where we live, work & play
- heredity - traits we inherit from our parents & ancestors
- lifestyle - smoking, drinking, diet, sleep patterns, exercise
- occupation
- social and economic environment - education, income level

What are Environmental Contaminants?

When addressing water quality, contaminants are generally grouped into two categories: chemical pollutants such as PCBs and Mercury; and micro-organisms like bacteria and viruses. Out of hundreds of chemicals present in the Lake Superior environment, nine have been identified as pollutants targeted for virtual elimination (see Chemical LaMP). These pollutants remain in the environment for a long time and tend to build up in the food chain. Diet, including fish consumption, contributes over 95% of human exposure to these toxic chemicals. These chemicals have caused developmental defects, cancer, and other chronic diseases in laboratory animals, fish, and wildlife and this raises concern about their effects on human health.

Demonstrating health effects in people from long-term low- level exposure to Persistent, bioaccumulative and toxic (PBT) chemicals typically found in the Great Lakes region poses a challenge for researchers. Health effects from frequent low-level exposure to these chemicals may be subtle, when contrasted with overt forms of toxicity such as liver disease and cancer; and it may be difficult to separate effects due to environmental exposure from other factors such as smoking and alcohol consumption. The weight of evidence approach utilizes the available information from wildlife and controlled animal experiments and epidemiological studies of humans. The use of wildlife data assumes that animals can act as sentinels for adverse effects observed in humans. For example, wildlife studies have

revealed evidence of developmental effects. Studies of human populations exposed to environmental contaminants have reported an increased risk of some cancers, adverse pregnancy outcomes, developmental problems from in-utero exposure, sensory loss, and immunologic effects. These studies suggest that human health is at risk from exposure to critical pollutants. The potential long-term effects have implications for future generations, and should remain a priority for public health investigation. Continued reductions in the level of persistent pollutants in the environment and the initiations of public health prevention/intervention efforts are the most effective long-term solution to minimizing health risks to people.

Who is at Risk?

People living in the Lake Superior basin come from a broad range of cultural backgrounds. Some groups, people who eat a lot of fish for instance, may have greater exposure to contaminants than the general population. This can lead to increased risk of adverse health effects. Other groups such as the elderly, women of child-bearing age, nursing infants, children, and persons with weak immune systems, may be more susceptible to the effects of chemical pollutants.

In the Lake Superior basin, Native Americans/First Nations are one cultural group at increased risk of exposure to environmental contaminants. Because this group has a strong relationship with its physical environment through spiritual, medicinal, hunting, gathering and fishing traditions, its population has a higher potential of exposure. For example, Native American/First Nations communities in the Great Lakes have much higher fish consumption rates and may consume other foods or substances that are potential sources of exposure.

Drinking Water

Clean drinking water is essential to good health. More than 800,000 people depend on the waters of Lake Superior and surrounding area for drinking, cooking, bathing, and other household uses. The Great Lakes Water Quality Agreement identifies restrictions on drinking water consumption, taste and odour problems as issues that need to be addressed through Lakewide Management Plans.

Outbreaks of illness related to the use of drinking water are rare and the populations affected are small. The drinking water in the Lake Superior basin is of good quality. It must be emphasized that while treatment is effective, source water protection is the key to maintaining safe drinking water supplies.

What is Being Done to Protect Public Health?

The U.S. EPA requires public water supplies to be monitored for bacteriological, inorganic, organic, and radiological contaminants and, in Canada, the Federal Department of Health has Guidelines for Canadian Drinking Water Quality.

What Needs to Be Done?

- create awareness among health professionals and the public of drinking water analyses and what the drinking water guideline values mean
- monitoring and corrective measures to reduce and eliminate contaminants in treated water
- develop a mechanism for the collection of data on incidences of disease from drinking water
- create electronic databases on untreated and treated water
- collect detailed information from small public water systems and private wells
- collect and standardize data for taste and odour problems

Recreational Water

The Great Lakes are an important resource for body contact recreational activities like swimming, sailboarding, and diving. The major human health concern for recreational waters is microbial contamination by bacteria, viruses and protozoa. Chemical pollutants may also pose health risks but exposure to disease causing microorganisms is a greater risk. One of the objectives of the Great Lakes Water Quality Agreement is that recreational waters should be substantially free from bacteria, fungi, and viruses that may produce human diseases and infections.

Research efforts are largely focused on conducting studies to better establish the relationship between disease and the presence of micro-organisms in the water. Although there have been sporadic outbreaks of illness related to the use of recreational water, it must be emphasized that the affected populations are small.

Many sources or conditions can contribute to contamination:

- heavy rains may cause combined or sanitary sewers to overflow
- on-shore winds can stir up sediment or sweep bacteria in from contaminated areas
- animal/pet waste may be deposited on beaches or washed into storm sewers
- agricultural and stormwater runoff in rural and wilderness areas (manure)
- direct discharges of sewage (recreational and commercial vessels)
- malfunctioning private treatment and sewage systems

What is Being Done to Protect Public Health?

- Federal Department of Health has national Guidelines for Canadian Recreational Water Quality
- U.S. Environmental Protection Agency established the BEACH Program in 1997 to reduce the risk of waterborne illness at beaches and recreational waters
- Regional Public Health Units/Health Departments monitor beach water quality and warn bathers of potential health risks
- Local health authorities investigate illnesses resulting from public beaches

What Needs to be Done?

- develop a waterborne disease surveillance system
- develop tests to more rapidly evaluate water quality before exposure occurs
- assess the effects of combined and sanitary sewer overflow discharges to recreational waters
- gather data on disease causing organisms in shallow beach waters
- better understanding of health risk from inhaling contaminated water spray
- identify sources of contamination and take steps to remove them

Chemical Contaminants in Fish

Fish are low in fat, high in protein, and may have substantial health benefits when eaten in place of high-fat foods. However, harmful chemicals such as mercury, PCBs, and toxaphene tend to build up in the food chain of fish. Fortunately, fish from the Lake Superior basin generally have low levels of chemicals and their consumption does not cause acute illness, but continued low level exposure to these chemicals may result in adverse human health effects. People need to be aware of the presence of contaminants in sport fish, and in some cases take action to reduce exposure to chemicals while still enjoying the benefits of catching and eating fish.

Most people in the Lake Superior basin do not exceed guidelines for fish consumption, but there are some people who are at risk. These include those who: eat a lot of fish; regularly eat large predator fish; eat fish from highly contaminated waters; or eat a large amount of fish over a short period of time. In addition, pregnant women, the developing fetus and young children are also at greater risk. As a rule, groups at higher risk of exposure have been the focus of studies and educational efforts. Although very low levels of PCBs and other chemicals are found in breast milk, the benefits of breast-feeding are well established, and mothers are advised to breast-feed their babies unless cautioned by their local health care provider to reduce or to stop.

What is Being Done to Protect Public Health?

Fish consumption advisory programs are well established in the Lake Superior basin. Both state and provincial governments provide information to guide consumption of sport-caught fish based on human health risk. This information is communicated to the public in a variety of ways. Annual or biannual publications give specific consumption advice; special populations are targeted through factsheets in immigrant languages and low-literacy fact sheets; and press releases and public presentations reach local public health agencies and health care providers.

What Needs to be Done?

Barriers to communication of fish consumption advice need to be bridged. People who fish a lot feel confident and familiar with the risks and may not be interested in hearing about advisories or are skeptical because they have not seen any apparent effects. There may be barriers of literacy and access, such as with new immigrants. Economic barriers may exist for subsistence fishers. Cultural barriers also exist regarding choice of fish species, releasing fish, and cooking and cleaning practices.

Studies to promote these aims are underway. They focus on:

- improving the effectiveness of fish consumption advisories
- testing contaminants in commercially-sold Lake Superior fish
- tracking tribal fish consumption
- using maps to show mercury content in walleye in inland lakes in MI, WI, and MN
- better understanding of what fish people are eating, and their awareness about fish advisories
- measure levels of contaminants in human tissues to quantify exposure in people eating large amounts of Great Lakes fish

In all efforts, it is important to take into account the benefits of eating fish as fish consumption advisories are developed.

Conclusion

Protection of human health in the Lake Superior basin should focus on four key areas:

- reduction of contaminants to the Lake Superior ecosystem (Virtual Elimination beginning with the Zero Discharge Demonstration Program)
- monitoring contaminant levels in the environment and in human tissue to help determine the extent of exposure
- support continued research into the linkages between environmental contaminants and human health outcomes
- communicating health risks and how to minimize them

While public health advisories and other guidelines can be followed to protect human health from current environmental exposures, continued reduction in the level of environmental contaminants is the most effective long-term solution.

Table 5 Human Health Projects and Lead Agencies	
Project	**Lead Agency/ Funding Source**
Improve Effectiveness of Fish Consumption Advisories for Mercury Contaminated Sport Fish Project	WI U.S. EPA funded
Increase Awareness of Great Lakes Fish Consumption Advisories among Women of Childbearing Age	Great Lakes States ATSDR funded
Fish Consumption Study	GLIFWC
Qualitative Risk/Benefit Analysis of Fish Consumption	U.S. EPA OST
Preparation and Implementation of Protection Plans for Water Supply Intakes on Lake Superior	Great Lakes States and U.S. EPA
Promote the use of E. Coli testing and methods over fecal coliform (training video distribution).	U.S. EPA
Development of effective modeling/monitoring to better estimate/predict beach/water exceedences.	U.S. EPA, Health Canada
Exposure and health effects research: epidemiological research into the relationships between beach/water indicators and health outcomes. Research on the interstitial zone.	U.S. EPA, USGS, Health Canada
EPA will be developing policies to ensure that states and tribes adopt the currently recommended Ambient Water Quality Criteria for Bacteria - 1986 and make the transition to monitoring for E. coli and enterococci indicators rather than total coliforms or fecal coliforms.	U.S. EPA
EPA will also develop a national inventory of digitized beach maps which will be linked with locations of pollution sources through a Geographic Information System.	U.S. EPA
EPA is proposed to conduct research to determine pathogen occurrence and indicator relationships associated with wet weather flows.	U.S. EPA
U.S. EPA is developing and supporting efforts related to the protection of recreational waters, which may include training in new methods, other technology transfer opportunities, and guidance implementation. The EPA is currently in the process of developing National Guidance for Recreational Beach Managers, which will be used as a guidance tool for public health officials and other recreational water quality monitoring officials to reduce the risk of disease to users of recreational waters through improvements in water monitoring and public notification programs. A training video for Recreational Beach Managers is expected to be completed and distributed by mid-year, 2000.	U.S. EPA

Key to acronyms:

- **ATSDR** **Agency for Toxic Substances and Disease Registry**
- **GLIFWC** **Great Lakes Indian Fish and Wildlife Commission**
- **U.S.EPA OST** **U.S. Environmental Protection Agency Office of Science and Technology**
- **USGS** **United States Geological Survey**
- **WI** **Wisconsin**

CHAPTER 5

Important Habitat in the Lake Superior Basin

Introduction

Habitat is the natural home of an animal or plant. When habitat is healthy and diverse it is most likely that the species that live there will also have healthy populations. Habitat in the Lake Superior basin supports high quality, diverse plant and animal communities and remains in good shape despite past modifications and current stresses. However, stresses such as forest fragmentation and chemical contaminants are having great effect on some species and, combined with the introduction of non-native species (see Chapter 9), substantial changes in the species that make up some natural communities have taken place.

As part of the effort to prepare a Lakewide Management Plan for habitat, the Lake Superior Binational Program endorses the following objective:

To protect, maintain and restore high-quality habitat sites in the Lake Superior basin and the ecosystem processes that sustain them. Land and water uses should be designed and located compatible with the protective and productive ecosystem functions provided by these natural landscape features.

Lake Superior Basin Habitat Types

The Lake Superior basin contains a wide variety of habitat types including aquatic (see Chapter 7), terrestrial (see Chapter 6), islands, shorelines, wetlands, and inland lakes.

Islands

Island habitats contribute significantly to the biodiversity of the basin and have been identified as a special ecological community type. Lake Superior is a very cold lake with few nutrients. The often harsh microclimates of its exposed shoreline sometimes creates conditions suitable for populations of plants normally found only in arctic or alpine regions. Fortunately, many of the islands in Lake Superior enjoy protected area status.

Shorelines

Lake Superior shorelines provide a wide range of habitat that is substantially different from adjacent inland areas. Distinctive physical structures such as sand spits, bluffs, cobble beaches, cliffs, mud flats, sand beaches and low banks offer unique environments for a variety of plant and animal species. Shoreline habitat also plays a critical role for migrating wildlife and shorebirds. Unfortunately, human influences and manmade structures also tend to concentrate in or near shoreline habitat features used by wildlife.

Wetlands

Wetlands often form the link between the mainland and Lake Superior. They provide habitat for fish and wildlife, protect shoreline areas from erosion, buffer runoff following storm peaks and contribute to the diversity of habitat types in the basin. Coastal wetlands make up 10% of the Lake Superior shore, mostly associated with protected bays, estuaries and barrier beach lagoons. The stretch of shoreline from Duluth to Marble Point, Wisconsin has perhaps the most abundant and richest coastal wetlands on Lake Superior.

Inland Lakes

Almost 7000 inland lakes dot the Lake Superior watershed. They form an important link in the hydrological cycle. They also contribute to the diversity of aquatic habitats in the basin. Despite degradation by mine effluent, tailings and other contaminants, altered water levels due to damming, impacts of logging and road construction, the status of habitat in inland lakes is generally very good.

Stresses to Habitat

Impacts to plant and animal habitat come from a variety of human activities, both direct and indirect. Some of the most important stresses to habitat in the Lake Superior basin are:

- changes in forest composition
- forest fragmentation
- loss of forest cover
- road building
- pollution
- nutrient loading
- sedimentation
- introduced species
- recreational use
- commercial, industrial and private shoreline developments
- off-road vehicles, snowmobiles and personal watercraft
- dams and water diversions
- lake level management
- dredging
- over browsing by deer

Protected Areas

Much of the Lake Superior basin is sparsely populated. Large portions of the basin are publicly held land B about 46% in the U.S. and 90% in Ontario. Of this, approximately 17% is comprised of parks and similar protected areas including Wilderness Class National and Provincial Parks, Wilderness Areas, and State Parks. In the last few years significant steps have been taken to enlarge protected areas. Ontario's Living Legacy for instance, identifies many areas for new or enlarged parks. A component of this initiative, the Great Lakes Heritage Coast, recognizes the internationally significant natural, cultural, scenic, and recreational values of the Lake Superior shoreline stretching across the Canadian shoreline from the Pigeon River to Sault Ste. Marie, Ontario.

Despite this high level of protection there is more to be done. Gaps in the core protected areas in the Lake Superior basin remain for both terrestrial and aquatic habitat. Continued effort is needed to identify new areas for protection to increase ecological representation of natural regions.

Areas that Need Protection

Important habitat types that need additional work can be described at several spatial scales. They include important ecosystems, communities and species-specific habitats. The following types of habitat warrant particular attention in the Lake Superior basin:

- unfragmented and old growth forests
- nationally significant ecosystems
- coastal shore or wetland ecosystems
- areas that support high biological and ecological diversity
- habitats that contribute to maintaining ecosystem integrity B like buffers and corridors
- wildlife and plant habitats rare in the Lake Superior basin or globally
- plant and wildlife habitats that occur only in the Great Lakes basin
- outstanding representatives of the natural ecosystem
- habitat for vulnerable, endangered, threatened, or special concern species

- habitat required for conservation of migratory wildlife
- spawning and nursery grounds for reptiles, amphibians, fish, or aquatic invertebrates
- colonial nesting bird nesting sites
- habitat that contributes to the conservation of species most at risk from human activity
- habitats that support species that provide important ecological functions such as nutrient cycling or chemical detoxification

Species of Concern

When habitat is lost, reduced or altered, species risk losing their homes. Several categories are used to describe species at risk:

Extinct - no longer exists anywhere
Extirpated - no longer existing in part of its natural range
Endangered - facing imminent extinction or extirpation
Threatened - likely to become endangered if limiting factors are not reversed
Vulnerable (Canadian term) or *Special Concern* (U.S. term) - of concern because it is uncommon, has unique or highly specific habitat requirements, or is particularly sensitive to human activities or natural events and deserves careful monitoring.

The following species from the Lake Superior basin represent some examples that fall into the above categories in at least one state or province or have economic or cultural importance that has been impaired. This list does not include all rare species or species of concern in the Lake Superior basin, but does provide a representative sample.

Birds

bald eagle
black tern
common tern
merlin
osprey
peregrine falcon
trumpeter swan
yellow rail

Mammals

Canada lynx
eastern pipistrelle bat
eastern small-footed bat
gray wolf
northern myotis bat
pine marten
wolverine
woodland caribou

Fish

American brook lamprey
arctic grayling
blackfin cisco
coaster brook trout
kiyi
Ives Lake cisco
lake sturgeon
Nipigon tullibee
northern brook lamprey
shortjaw cisco
shortnose cisco
silver lamprey
Siskiwit Lake cisco

Plants

Houghton's goldenrod
Lake Huron tansy
pale moonwort
Pitcher's thistle
pointed moonwort

Invertebrates

beach dune tiger beetle
dune cutworm
Lake Huron locust

Reptiles and Amphibians

Blanding's turtle
wood turtle

Habitat Projects Completed or Underway

People throughout the basin generally understand that mammals, plants, birds, and other species need safe, protected areas in which to live. Involvement in habitat related projects has been widespread and thousands of people from many areas have participated: government agencies - federal, state / provincial, and municipal; tribal and intertribal agencies; townships; clubs of all sorts; schools; individuals and individual landowners; private industries; health units; counties; and many more. The following five categories list some of the projects and successes they have achieved.

Habitat Restoration and Rehabilitation projects improve habitat features or processes and benefit native plant or animal communities or species. Projects have included: wild rice seeding, wetland restoration, dam removal, creation of embayments, shoreline alteration, treatment of bacterial contamination at beaches, and building a better breakwall.

Special Designations and Acquisition projects include activities that protect habitat features or processes through designating lands as protected areas, management areas, or other formal designation. Private lands acquired for public agency management to protect or restore important habitat are also included. Projects have included: Keweenaw Threatened, Keweenaw Preserved, St. Louis River Riparian Land Acquisition and Stream Bank Protection Project.

Watershed Management and Forest Stewardship projects include efforts on a broad scale to establish and implement watershed wide or landscape level goals to protect important habitat. Projects have included: watershed partnerships and education projects, Remedial Action Plans (RAPs), the Ecosystem Projects Shoreline Management Plan, water management plans, the Minnesota Point Protection Project, and the Central Lake Superior Watershed Partnership which involves stakeholders from nine Lake Superior watersheds.

Monitoring, Assessment and Inventory projects provide key information to improve management decisions, prioritize actions, and identify important habitat areas. Projects have included: fish habitat mapping, natural resource inventories, habitat plans, marsh monitoring, and sea lamprey control.

Education and Public Involvement projects focus primarily on education and public involvement. Projects have included: Keeping Nature in Your Community Workshops, Adopt-A-River Programs, Minnesota's Lake Superior Coastal Program, community education about non-point pollution and exotic species, community clean-ups of waterfronts, Deer Marsh Wetland Protection, the Great Lakes Aquarium, Citizen Lake Monitoring Program, Partners for Fish and Wildlife, and the Northern Great Lakes Visitor Center in Ashland, Wisconsin.

Information Gaps & Data Needs

Despite the hundreds of projects already complete, many more strategies and projects are needed to help identify, protect or restore habitat features and the ecological processes that sustain them. The scale of the Lake Superior basin necessitates long term commitments in management and coordination. The following principles guided the Habitat Committee in recommending needed projects:

I. Land use planning and regulation in the Lake Superior ecosystem should eliminate or avoid destructive land-water linkages and foster healthy land-water linkages.
II. Long-term consequences of incremental or cumulative landscape change, habitat destruction, and habitat fragmentation should be anticipated and avoided through research and planning.
III. Crucial importance of nearshore, shoreline and wetland aquatic habitats in Lake Superior should be addressed through efforts to identify, protect and restore key sites for reproduction and rearing of fish, water birds, mammals, and other wildlife and plants.
IV. Coordination and support of restoration / rehabilitation and protection efforts for priority sites is vital.
V. Outreach and education to promote partnerships and strong participation from non-governmental organizations, stakeholders and other public groups is critical.

Some Recommended Projects

Habitat Restoration and Rehabilitation

- design and implement projects to address lost ecosystem functions at degraded sites
- implement actions to reduce and eliminate sources of stress to important terrestrial and aquatic habitat sites
- implement habitat recommendations contained in federal threatened and endangered species recovery plans
- implement habitat recommendations contained in the Great Lakes Fishery Commission's fish community objectives and rehabilitation plans
- identify important riparian and nearshore terrestrial habitats and develop and implement plans to protect and restore riparian zones, environmental corridors, and buffer zones
- implement habitat recommendations contained in the North American Waterfowl Management Plan
- provide opportunities for researchers, resource managers and citizens in the Lake Superior basin to identify restoration goals and priorities, network, and generate new ideas strategies
- implement habitat recommendations of the Great Lakes Panel on Aquatic Nuisance Species

Special Designations and Acquisition

- apply special designations protections for areas of identified important habitat

Watershed Management and Forest Stewardship

- incorporate protection and restoration of important habitat into land use plans
- restore and protect conifer forests in appropriate upland and stream corridors
- develop inland lake watershed management plans for inland lakes supporting significant biological diversity or important habitat
- implement conservation actions recommended in watershed plans, reservation Integrated Resource Management Plans, Lake Management plans and eco-regional conservation plans
- develop and implement site conservation plans for known sites of important habitat

Monitoring, Assessment and inventory

- complete habitat assessment and aquatic community surveys to identify important habitat sites in tributary streams and inland lakes
- assess impacts to habitat at a basin wide scale from current and historic sources of degradation
- complete Natural Heritage Inventories / Biological Surveys to identify high-quality natural communities and rare plant and animal locations
- develop and maintain a comprehensive database of habitat information including Geographic Information System data
- institute a long-term, basin wide sampling program to implement habitat indicators

Education and Public Involvement

- develop riparian guidelines for long term ecological maintenance and distribute, promote and train local governments, industries and certification groups in guideline use
- provide information to local governments and landowners about links between land use, aquatic communities and ecosystem health – a potential suite of incentives could be used to encourage healthier land-water linkages.
- focus attention on environmental issues through education related to restoration, rehabilitation and maintenance
- produce a motion picture or IMAX film on Lake Superior

Conclusion

Supporting a wide variety of activities to identify, protect and restore important habitat sites and critical ecological functions is key to improving the Lake Superior ecosystem. Efforts to fill information gaps, develop regional understanding and consensus on the status and trends of habitat conditions, and restore lost ecosystem functions are all needed to continue progress.

Table 6 Habitat Projects and Lead Agencies

Project Title	lead agency
Marsh reclamation - Thunder Bay	OMNR
Cypress River Rehabilitation	OMNR
Biological Survey of North Shore Highlands Subsection	MN DNR
Lake Superior Habitat Coordination	MN DNR
Aquatic community survey in Michigan tributaries	MI DNR
The Central Lake Superior Watershed Project	CLSWP
Purple loosestrife and exotic plant control	GLIFWC
Piping plover critical habitat designation	U.S.FWS
Whittlesey Creek restoration	U.S.FWS
Coordination of Superfund remediation and restoration with LaMP and RAP partners	U.S. EPA
Complete remediation at Torch Lake and St. Louis River Superfund sites by 2005	U.S. EPA
Work with LAMP/RAP partners to provide outreach and education on brownfields redevelopment to local land use planners and decision makers	U.S. EPA
Complete GIS maps of U.S. shoreline that include important habitat data by 2001	U.S.EPA

Key to acronyms:

- **OMNR** **Ontario Ministry of Natural Resources**
- **MI DNR** **Michigan Department of Natural Resources**
- **MN DNR** **Minnesota Department of Natural Resources**
- **CLSWP** **Central Lake Superior Watershed Partnership**
- **LSHC** **Habitat Committee of the Lake Superior Binational Program**
- **GLIFWC** **Great Lakes Indian Fish and Wildlife Commission**
- **FWS** **United States Fish and Wildlife Service**
- **U.S.EPA** **United States Environmental Protection Agency**

CHAPTER 6

Terrestrial Wildlife Communities

Introduction

The terrestrial wildlife communities chapter specifically concerns itself with species that live on or near land. In keeping with A Vision for Lake Superior, the Terrestrial Wildlife Communities Committee seeks to create "a clean, safe environment where diverse life forms exist in harmony." Much of the work being done is complemented by the work of other committees, particularly the Habitat Committee. Working to ensure healthy wildlife communities by improving habitat means that a healthy environment is created not just for wildlife but also for people.

A terrestrial wildlife community is an assemblage of plants and animals that co-exist and function on or near land. They interact with one another in thousands of ways to create an ecosystem. A healthy terrestrial wildlife community will include many populations of plants and animals that produce enough young to remain sustainable, and are fluctuating in natural cycles relative to one another. A good diversity of native plant and animal species are found and genetic diversity is maintained. A balance of predator prey relationships are found and natural cycles of energy transfer are present. Terrestrial wildlife communities are indicators of the habitat present, as well as environmental quality.

Mission, Principles & Goals

The mission of the Binational Program for terrestrial wildlife communities is *to support a diverse, healthy, and sustainable native wildlife community in the Lake Superior basin*. Work is guided by the following principles:

- Encourage disturbances that are within natural variation.
- Manage land and wildlife populations using practices that mimic natural variation.
- Understand the relationship between wildlife and disturbance.
- Keep wildlife species free of contamination.
- Encourage the use of native species in all remedial projects.
- Prevent and control the spread of undesirable exotic species.
- Educate the public to integrate the values of wildlife in economic development.
- Meet the restoration needs of wildlife communities.

Goals will be met when:

- There is a diverse, healthy, and sustainable native wildlife community in the Lake Superior basin.
- There is a wildlife community-based program to monitor the health of ecosystems in the Lake Superior basin.
- Species at risk/concern (federally threatened and endangered) are recovered.

Status and Health of Terrestrial Wildlife

Habitat changes on the landscape, as well as harvest and management of select species, have created some dramatic changes in wildlife communities over the past 150 years. As habitat changes, populations shift from common to rare or from rare to common. Large-scale logging in the late 1800s and early 1900s resulted in altered habitats that created some dramatic changes in wildlife species seen. As we manage and continue to alter the landscape, wildlife communities shift as well.

Mammals

Mammals in the Lake Superior basin have seen greater changes than any other group of terrestrial organisms. Because many mammalian species have been harvested for food and pelts, dramatic changes in community structure and abundance have occurred. Some species have become so abundant in certain areas that they are harming their surrounding environment. Differences in abundance and diversity of species from south to north has led to different management efforts between Canada and the United States.

Birds

Although little information has been compiled on a basin-wide level, there is considerable information available for songbirds, loons, bald eagles, and colonial waterbirds. Because the Lake Superior basin is heavily forested, the composition, size, and structure of forests strongly affects songbird species' diversity, abundance, and productivity. Lake Superior forests provide important habitat for migratory songbirds, so the management of forests in the basin could be critical to migratory songbird conservation.

Amphibians and Reptiles

Prior to the last 10 to 15 years, amphibians and reptiles were seldom considered in management and conservation efforts. As a result, historical population data is very limited. Ranges of species are often created from museum collections and records. There are approximately 17 species of amphibians and 14 species of reptiles in the Lake Superior basin. Since scientists worldwide began focusing on declining amphibian populations in the early 1990s, new efforts to monitor populations and study the effects of human influences have created an increased awareness and concern for amphibians and reptiles.

Invertebrates

Terrestrial and aquatic invertebrates make up about 90 percent of the nearly one million species of animals in the world. Insects are the most varied group of invertebrates and may have the largest collective biomass of all terrestrial animals in the world. However, within the Lake Superior basin, little information is available on the status and trends of insect or terrestrial invertebrate populations.

Plants

Green plants form the base for all animal life, but the term wildlife has traditionally been used to refer to animals only. It is evident from the long list of rare and endangered plants in the Lake Superior basin that for every threatened animal there are two or more endangered plants. The importance of plants to animal survival must be recognized and factored into the equation of wildlife conservation.

Factors Threatening Wildlife Communities

Habitat Changes

Habitat changes have a significant impact on terrestrial wildlife. Nearly 85 percent of the land in the Lake Superior basin is forested. Current forest management practices have resulted in a mosaic of forest landscapes with many temporary boundaries, and large blocks of unbroken mature forest are rare. Natural processes, such as fire, are limited by human intervention and are not currently used as a management tool in most areas. Because of this limitation, some agencies are managing forests to mimic natural disturbances. Decline and loss of wetlands and surrounding upland habitat affects species dependent on these areas. Habitat destruction and change, compounded by other factors such as contaminants, can have a devastating impact on wildlife communities. In addition, loss of corridors linking important areas and loss of plant diversity through invasion of exotic species, further threaten existing communities.

Environmental Quality

Environmental quality plays a significant role in the health of wildlife communities. Environmental contamination from toxic chemicals introduced into the environment in the mid-1900s nearly eliminated top carnivores such as bald eagles and cormorants. Populations of some affected species have recovered well, but these chemicals cause health problems that include reduced hatching success, deformed embryos and hatched young, and a variety of other abnormalities. The effect of contaminants on mammals and amphibians remains relatively unknown and is being studied.

Human Activities

Direct human interference, including harvest and management of selected species, has caused dramatic changes in wildlife communities over the past 150 years. Many mammalian species have been stressed by overharvesting. For species that are of interest to hunters and trappers, management programs have traditionally focused on providing populations for harvest and not on the overall ecosystem. But ecosystem management is now being tested and used by agencies and organizations throughout the basin. This has begun to create a focus on all wildlife species.

To achieve a healthy ecosystem that includes a healthy terrestrial wildlife community, human caused stresses must be managed. To achieve such management, people who live in and use the Lake Superior basin must understand and value healthy wildlife communities.

Recommended Strategies

As a society, we have begun to understand what needs to happen in the Lake Superior basin to provide a healthy, sustainable, native wildlife community. But there is still much to be done. Meeting the mission and goals for terrestrial wildlife communities in the Lake Superior basin requires that a number of broad strategies be addressed.

The following recommended strategies present a range of opportunities with emphasis on an ecosystem approach. The projects focus on collaborative efforts, non-traditional species, and species for which little is known. Many proposed projects related to inventory and monitoring strategies reflect the need for this work. See a sample of these projects at the end of this chapter. The strategies will be implemented not only through actions of participating agencies and organizations of the Lake Superior Binational Program, but also through partnerships with individuals and other organizations.

Planning – What should the landscape look like to sustain terrestrial wildlife communities?

A. Develop action-oriented regional and watershed-scale management plans. Support the implementation of recommended protection and restoration actions.

B. Encourage land use planning efforts targeted at protecting and restoring wildlife while maintaining economic viability of local communities.

C. Foster understanding of the relationship between individual (personal, organizational, and government agency) land use decisions and cumulative effects on ecosystem integrity. Compile best management practices conducive to sustainable terrestrial wildlife.

D. Plan and implementation actions that considers all ecosystem components. Demonstrate positive results of basin-wide, landscape-scale planning and collaboration.

Contaminants – What is too much?

A. Support contaminant load reduction efforts, track contaminants within "best bet" wildlife species, and encourage the development of biological indicators for air quality monitoring.

Inventory – What is the status of terrestrial wildlife communities in the Lake Superior basin?

A. Inventory all levels of the biotic community, assess wildlife needs and develop actions for protection, maintenance, and restoration, with priority attention to groups for which little is known.

B. Inventory exotic, invasive terrestrial wildlife species and implement actions to prevent, remove, or control.

C. Develop, test, and implement monitoring protocols, sampling procedures, and data handling for identified high priority "best bet" indicators. Network this monitoring and compile the information long-term and basin-wide.

D. Beyond "best bet" indicators, develop an integrated, community-based wildlife program to monitor ecosystem health.

Conservation and Management-Restoring Healthy Communities

A. Conduct assessments and implement conservation strategies for important terrestrial wildlife species and communities.

B. Evaluate restoration projects and restoration ecology research that addresses terrestrial wildlife in order to link successes to specific restoration features and future needs.

C. Protect, enhance, and restore species of concern such as caribou, moose, colonial waterbirds, boreal owl, northern goshawk, white pine, and hemlock.

D. Encourage the use of native species for all projects requiring vegetation restoration.

E. Identify population issues and implement recovery actions for threatened and endangered species.

Conclusion

A significant amount of work by government agencies and numerous other organizations have taken place to inventory, monitor and manage terrestrial wildlife, but little has been done to connect all this work within the Lake Superior basin. The Binational Program will pioneer an effort to work together and to connect with other interests in the basin.

Much work has been done and much work continues in support of the strategies to protect and restore the health of terrestrial wildlife communities in the Lake Superior basin. Continuing to track successes will provide indicators of progress toward the goals for terrestrial wildlife communities.

Table 7 Terrestrial Wildlife Community Projects and Sponsors	
COMMITTED ACTIONS	**CURRENT PROJECT LEADS & FUNDING SOURCES**
Environmental Actions	
A. Whittlesey Creek National Wildlife Project	USFWS, DU, ALC, TU, others.
B. Upper Peninsula of Michigan	BMIC, GLIFWC, TNC, WPBO, KBIC, Village of L'Anse, Ottawa NF, NRCS, Pvt. Land Owners, UPRCD
C. Population Monitoring of Otter and Mink and their Roles as Biosentinels	Bad River Tribe, WI DNR
D. Rare Plant/ Community Surveys	OMNR (NHIC)
E. Baseline Inventory of Amphibians and Evaluation of Catastrophic Deformities	NPS
F. Loon Watch	SOEI, Northland College, MI LPA
G. Exotic Plant Contro	GLIFWC, EPA
H. Trumpeter Swan reintroduction	Ottawa NF, KBIC, MSU, USCG, MI DNR, USFWS, UPPCO
I. Woodland Caribou Study	OMNR, Laurentian University, Forest industry

Key to acronyms:

- **ALC** **American Land Conservancy**
- **BMIC** **Bay Mills Indian Community**
- **DU** **Ducks Unlimited**
- **EPA** **Environmental Protection Agency**
- **GLIFWC** **Great Lakes Indian Fish and Wildlife Commission**
- **KBIC** **Keweenaw Bay Indian Community**
- **MSU** **Michigan State University**
- **MI DNR** **Michigan Department of Natural Resources**
- **MI LPA** **Michigan Loon Preservation Association**
- **NF** **National Forest**
- **NPS** **National Park Service**
- **NRCS** **Natural Resource Conservation Service**
- **OMNR** **Ontario Ministry of Natural Resources**
- **OMNR (NHIC)** **Natural Heritage Information Center**
- **SOEI** **Sigurd Olson Environmental Institute**
- **TNC** **The Nature Conservancy**
- **TU** **Trout Unlimited**
- **UPPCO** **Upper Peninsula Power Company**
- **UPRCD** **Upper Peninsula Recreation, Conservation and Development**
- **USCG** **United States Coast Guard**
- **USFS** **United States Forest Service**
- **USFWS** **United States Fish and Wildlife Service**
- **WI DNR** **Wisconsin Department of Natural Resources**
- **WPBO** **Whitefish Point Bird Observatory**

CHAPTER 7

Aquatic Communities

Introduction

Aquatic communities includes a variety of fish species as well as microscopic plant and animal life. The specific makeup of these communities will vary depending on such factors as water depth, water temperature, water quality and the type of lake bottom. Aquatic communities are important because they are indicators of the overall health of a lake, river or stream. When aquatic habitat is contaminated by chemicals, impacted by urban development, mining or logging operations, or inhabited by nuisance species, the organisms that depend upon that habitat may be at risk.

The Lake Superior Lakewide Management Plan supports a broad ecosystem approach that focuses on managing human uses and abuses of watersheds, and addresses all resources within the context of a living system. This work is guided by a set of ecosystem objectives. The Aquatic Communities ecosystem objective states that:

Lake Superior should sustain diverse, healthy, reproducing and self-regulating aquatic communities closely representative of historical conditions.

The prospect for achieving the ecosystem objective is very good. The fish species populations and aquatic community assemblages of Lake Superior are more representative of conditions prior to the substantial disturbances associated with European settlement of the basin than conditions in the other Great Lakes. Lake Superior continues to provide, overall, good habitat for indigenous species such as lake herring and lake trout that are self-sustaining and abundant in Lake Superior, whereas in the other Great Lakes these two species are either absent or in very low abundance. Indigenous fish species greatly outnumber non-indigenous fish species in Lake Superior, and there are more naturally-reproduced lake trout in Lake Superior than the total number of lake trout in all the other Great Lakes combined.

The Aquatic Committee works cooperatively with the Great Lakes Fishery Commission's Lake Superior Committee. Among other activities, the Lake Superior Committee coordinates management of fish resources in Lake Superior and develops goals to help guide management and the structure of future fish communities in the lake. Since the Lake Superior Committee deals primarily with issues relating to fish, little information about other aquatic organisms is addressed in the Aquatic Community section. In the future, the Aquatic Communities Lakewide Management Plan for Lake Superior will include assessment of these other organisms.

Aquatic Habitat in Lake Superior

Aquatic habitat in the Lake Superior basin is classified into five basic types, each providing a home to unique forms of aquatic life. Each type contains habitat critical for spawning and reproduction and other habitat important for feeding and living when not spawning. Destruction of habitat is the principal stress to the aquatic community of Lake Superior, but a substantial number of monitoring programs, with long-term funding commitments, are in place to evaluate aquatic ecosystem health and measure aquatic ecosystem response to management actions.

Offshore Habitat

Forms roughly 75% – 6.3 million hectares – of the total surface area of Lake Superior and includes all waters deeper than 80 metres. Containing nearly all the habitat for siscowets and humpers (forms of lake trout found only in Lake Superior), chubs, and deepwater sculpin, the fish community is relatively simple and includes adult lean lake trout, burbot, Pacific salmon, sea lamprey, deepwater ciscoes, and lake herring.

Key Stresses
- atmospheric deposition of contaminants
- dumping or discharges from vessels
- exotic species

Projects Underway
Deepwater Predator Surveys to determine the relative abundance and biology of predator fish.

Nearshore Habitat

The open water portion of Lake Superior less than 80 metres deep. These roughly 1.9 million hectares provide most of the habitat for lean lake trout, lake herring, and lake whitefish and also include fish species such as siscowets, burbot, Pacific salmon, round whitefish, rainbow smelt, ninespine sticklebacks, trout-perch, pigmy whitefish, and longnose and white suckers.

Key Stresses
- atmospheric deposition of contaminants
- dumping or discharges from vessels
- industrial effluents in areas of concern
- exotic species
- over-exploitation
- mining

Projects Underway
- Fish Community Surveys to monitor trends in abundance and size and age structure of fish species important as food for predators and humans.
- Spring Lake Trout Assessment Fishery to understand population dynamics and the potential impact of lamprey and fishing activities on lake trout populations throughout the lake.
- Summer Lake Trout Gill Net Surveys to measure abundance and status of lake trout populations prior to the time they enter sport and commercial fisheries.
- Angler Creel Surveys to annually estimate sport fishery harvest and effort.
- Development of Population Models of lake trout for evaluating fish community objectives, sea lamprey control, and sustainability of the fish community on a lake-wide basis.
- Keweenaw Interdisciplinary Transport Experiment in Lake Superior (KITES) to understand storm influence on biological, geological, and chemical material along the Keweenaw Peninsula.

Embayment Habitat

Includes the large bays of Lake Superior that are part of the nearshore habitat, subject to tide-like fluctuations, but exhibit unique physical properties from the main lake because they are partially protected. Embayments can be natural or man-made and include coastal wetlands, bays, harbours, and estuaries. Because embayments are warmer and more productive, fish communities are more diverse. In addition to fish that live in nearshore habitat, embayments contain such fish species as walleye, smallmouth bass, yellow perch, rock bass, northern pike, lake sturgeon, johnny darters, emerald shiners, longnose dace, sand shiners, bullheads, carp, and other fishes.

Key Stresses
- petroleum emissions and spills
- atmospheric deposition of contaminants
- industrial effluents in areas of concern
- dumping or discharges from vessels
- exotic species
- over-exploitation
- loss of wetlands
- land-use practices
- urban development
- sedimentation
- shoreline development

Projects Underway

- Chequamegon Bay Fish Community Survey to monitor the status and trends in abundance of important fish species.
- Lake Sturgeon Surveys to assess movement, age, growth, and relative abundance.
- Upper St. Mary's River Fish Community Survey to monitor trends in abundance of important fish species and to manage fisheries for walleye.
- St. Louis River Estuary Fish Community Study to monitor trends in abundance of ruffe and the indigenous fish community.

Tributary Habitat

Includes all rivers and streams – a minimum of 3,300 kilometres -- that flow into Lake Superior. Many fish from other habitats spend part of their life in tributaries, but for brook trout, burbot, lake sturgeon, suckers, Pacific salmon, mottled sculpin, and sea lamprey, tributaries provide critical habitat.

Key Stresses

- industrial effluents in areas of concern
- hydroelectric facilities
- barrier dams
- loss of wetlands
- land-use practices
- exotic species
- timber harvesting
- mining
- agricultural practices
- urban development
- sedimentation

Projects Underway

- Juvenile Lake Sturgeon Studies on the Bad River to obtain distribution, movement, biological characteristics, and habitat condition information.
- Brook Trout Rehabilitation Programs to develop captive brook trout brood stock from wild populations to provide fish for rehabilitation stocking efforts.
- Surveys of Ruffe and Native Fishes to monitor long-term changes in fish communities.
- Surveillance for Ruffe to locate new populations and describe their age and size composition, and to assist in monitoring the voluntary ballast water management plan implemented by the Great Lakes maritime industry.
- Sea Lamprey Index Surveys to monitor numbers of adult sea lampreys in 13 tributaries.
- Stream Habitat Assessments to develop an index of the relative condition of each watershed in Michigan's Lake Superior basin.
- Lake Sturgeon Population Assessments in Canadian Tributaries to collect baseline population information in the Kaministiquia, Black Sturgeon, and Nipigon rivers.
- Lake Sturgeon Habitat Utilization Study to document seasonal distribution and movement patterns of adult and juvenile lake sturgeon and to identify and quantify critical spawning, nursery, rearing, and foraging habitats and migration routes.

Inland Lakes

Bodies of water separate from Lake Superior, but within the drainage basin. Inland lakes exhibit a wide range of habitat conditions that are influenced by the geology of the surrounding area. Inland lakes contain a wide variety of fish communities from cold lake trout lakes to warm-water ponds. Lake Nipigon is the largest inland lake in the Lake Superior basin and a significant water source for Lake Superior.

Key Stresses

- shoreline development
- timber harvesting
- agriculture
- contamination through runoff
- mining
- atmospheric deposition of contaminants
- urban development
- sedimentation
- industrial effluents in areas of concern
- hydroelectric dams
- loss of wetlands

Projects Underway

- Coldwater Lakes Ecosystem Monitoring to experimentally evaluate the effects of logging on lake ecosystems, and provide information about the effectiveness of shoreline buffer strips in preventing those effects.

Habitat Improvement & Protection

Generally, nearshore and offshore habitat types in Lake Superior are of sufficient quantity and quality to allow achievement of fish community and environmental objectives. Tributaries, embayments, and inland lakes incur more habitat loss, therefore, achievement of fish community or environmental objectives for species like lake sturgeon, walleye, and brook trout may be more difficult. Current actions to improve and protect habitat in the Lake Superior basin include:

- establishment of a National Marine Conservation Area by Parks Canada to preserve biological diversity, maintain the integrity of marine ecosystems, encourage marine research and monitoring practices, and protect critical habitat of depleted, threatened, rare or endangered species
- discussions with timber harvesters to increase protection of streams, lakes, and wetlands
- acquisition of remaining undeveloped shorelines, fish spawning areas, and wetlands
- restoration activities within already established Areas of Concern
- ongoing research to evaluate the effects of timber harvesting on boreal forest lakes and streams
- standardized rapid assessment guidelines to identify stressed fish populations
- negotiation of a water level agreement on the Nipigon system to reduce water level impacts
- protection of watershed health through land acquisition, stream habitat improvement in critical areas, and fishery regulations

Actions Plans

Basic biological and ecological information about aquatic community structure, function and habitat is needed before restoration of the Lake Superior ecosystem can occur. Lack of information is as much an impediment to restoring the health of aquatic communities as habitat destruction. The four projects listed below are considered high priority for funding and are designed to increase understanding of the link between fish community dynamics and habitat. These projects are intended to gather information rather than remedy ecosystem problems.

Acoustics Project

Development of a standardized lakewide monitoring program to evaluate status of the pelagic fish community of Lake Superior. Trends in abundance of key aquatic species like lake herring, exotic species, and predators are needed to evaluate ecosystem and fishery management objectives.

Habitat Mapping

Identification and quantification of critical habitat for fish species that are key indicators of ecosystem health and fish community stability.

Rehabilitation of Lake Sturgeon

Estimates of population abundance of lake sturgeon in historic spawning streams and quantification of sturgeon spawning habitat. Historically, lake sturgeon were abundant in nearshore and tributary habitat in Lake Superior, but habitat destruction, hydroelectric development, and over-fishing cause lakewide population collapse early in the twentieth century.

GIS Based Maps of Fish Habitat

Add fish habitat data to the Habitat Committee project to develop GIS-based habitat maps of the Lake Superior basin.

Table 8 Aquatic Communities Projects and Lead Agencies

Project	Lead Agency/ Funding Source
Identification of Lake Sturgeon Spawning Habitat	OMNR, Environment Canada, GLIFWC, U.S. EPA CEM
Juvenile Lake Sturgeon Habitat Requirements	USFWS, U. S. Dept. of Interior, GLIFWC, BRNRD
Rehabilitation of Lake Sturgeon	RCFD, GLNPO, BRNRD, USFWS, U.S. Dept. of Interior
Rehabilitation of Brook Trout	USFWS/USGS, U. S. Dept. of Interior, MiDNR, Trout Unlimited, National Park Service, and RCFD
Rehabilitation of Lake Trout	MnDNR, Federal Aid for Sport Fish Restoration, WiDNR, WI funding from sale of trout and salmon stamps, MiDNR, OMNR, Provincial, RCFD, U.S. Dept. of Interior , COTFMA, KBIC
Lake Trout Model Development	COTFMA/GLFC, GLFC Coordination Funds, USFWS Restoration Act, OMNR, UW-Stevens Point
Ruffe and Native Fish Surveillance	USFWS/USGS-BRD and U. S. Dept. of Interior
GIS Based Maps of Fish Habitat	Habitat Committee and U.S. EPA CEM

Key to acronyms:

- **BRNRD** **Bad River Natural Resources Department**
- **COTFMA** **Chippewa/Ottawa Treaty Fishery Management Authority**
- **GLIFWC** **Great Lakes Indian Fish and Wildlife Commission**
- **GLNPO** **Great Lakes National Programs Office**
- **MI DNR** **Michigan Department of Natural Resources**
- **MN DNR** **Minnesota Department of Natural Resources**
- **OMNR** **Ontario Ministry of Natural Resources**
- **RCFD** **Red Cliff Fisheries Department**
- **U.S. EPA** **CEM United States Environmental Protection Agency Coastal Environmental Management**
- **USFWS** **United States Fish and Wildlife Service**
- **USGS-BRD** **United States Geological Survey - Biological Resources Division**
- **UWSP** **University of Wisconsin Stevens Point**

CHAPTER 8

Developing Sustainability

Introduction

When risks associated with environmental problems in the Lake Superior basin are considered, rarely do we look beyond fixing existing problems – watersheds can be rehabilitated, people can be held accountable, or air can be purified and the threat seems to go away. However, in order to ensure that history does not repeat itself, a more fundamental puzzle must be solved: how shall we sustain our society so that the Lake Superior of tomorrow is healthy as well?

The main reason to pursue a Lakewide Management Plan for Lake Superior is because people have concluded that our actions in the past and present potentially harm our future use of the Lake. If we assume that humans and nature can coexist in harmony and that we need not choose between having a sound economy versus having a healthy environment, those living in the Lake Superior basin must begin to develop a sustainable society. We need to find a way to balance the use of available resources in the watershed with the sort of living conditions we seek to maintain or improve upon. And, in a sustainable society, it is not enough to simply guarantee that the natural and social environment is preserved for our benefit; we need to consider future generations as well.

Defining Sustainability

Essentially, planning for sustainability in the Lake Superior basin involves making decisions about where we want to be compared with existing conditions. At the very least, we must conserve existing resources so that our descendants can enjoy the same quality of life as we do. In order to predict how we may best ensure sustainability, we need to bear in mind a variety of issues:

- What is or is not sustainable at a given point in time may not be the same in the future because we cannot control all of the social and environmental factors that sustain lifestyles. Plans for developing sustainability must be flexible and responsive to change.

- The environment, economy, and social structure of a region are interdependent – policy that prefers one over others will result in the collapse of all three. Social, economic, and environmental needs must receive equal footing in planning for and identifying progress toward sustainable lifestyles.

- Developing and measuring sustainability requires attention to how society and the environment change over the span of many years. The true measure of a sustainable society is on the scale of generations rather than years.

- We need to encourage and respect diverse perspectives about how society will progress toward sustainability. Effective policy depends on a political consensus that favours long-term advances over short-term benefits.

Moving Towards Sustainable Lifestyles

Our efforts to promote sustainability in the Lake Superior basin have, thus far, been guided by the following general objective:

Human use of the Lake Superior ecosystem by all people in the watershed should be consistent with the highest social and scientific standards for sustainable use. Land, water and air use in the Lake Superior ecosystem should not degrade it, nor any adjacent ecosystems. Use of the basin's natural resources should not impair the natural capability of the basin ecosystem to sustain its natural identity and ecological functions, nor should such use place at significant risk the socioeconomic and cultural foundations for any

group of citizens in the watershed, nor should we deny current and future generations the benefits of a healthy, natural Lake Superior ecosystem. Policies directed at the wise management of natural and social resources in the basin should not usurp the right of local communities to determine their future within the guidelines established by existing statutes and regulations. Technologies and development plans that preserve natural ecosystems and their biodiversity should be encouraged.

To facilitate our progress toward sustainability, we have chosen to focus on a relatively small suite of indicators:

A *Reinvestment in the Natural Capital of the Basin* indicator helps us to monitor the balance between what is extracted from the basin with what is returned to the land and society, and promotes projects that facilitate an equitable balance in the future. Such measurements include: amount of sustainable forestry; extent of watershed management or restoration programs; native fisheries and wildlife stocking; exotic species control and native plant repatriation; reclamation of mining operations and industrial sites; and replacement of wetlands and biotic diversity.

A *Quality of Human Life Index* indicator incorporates a range of social indicators, which help us to track how natural and social forces in the basin impact citizens' lifestyles. Such standards include: incidence of crime; demographics of migration (especially loss of extended families in the basin); demand for social services; transportation infrastructure status; extent of recreational and cultural opportunities; citizen involvement in decision making; public access to lakeshores; and population density.

A *Resource Consumption Patterns* indicator considers the types and quantities of resources that are consumed in the basin with particular focus on energy production and consumption, water availability and use trends, and waste stream loadings. This indicator includes: availability of recycling programs; amount of forest and mining resources that remain in the basin; types and quantities of electric power generation; quality and volume of aquifers; amount of and stressors related to tourism; depletion of wildlife and fisheries; landfill capacity and incineration volume; degree of urban sprawl; and loss of native flora.

An *Awareness of the Capacity for Sustainability* indicator helps us appreciate what people are learning in schools, organizations and the media and to assess how growing awareness is reflected in social conduct. Here, the criteria include: depth of environmental and sustainability education curricula in schools; promotion of resource conservation programs; incorporation of ecological design into building codes; extent of zoning regimes; popular support for environmental regulations; community outreach programs by natural resource agencies; and media coverage of sustainability-related issues.

Various Economic Vitality Measures provide a baseline overview of the economy, so projects can be implemented to demonstrate sustainable alliances between environmental and economic sectors in the basin. The standards include: per capita income; cost of living; extent of poverty; local employment trends; regional trade balance; diversity of community economies; facilitation of transitional economics; value-added industry; and regional or local tax bases.

How Sustainable are we at Present?

The Lake Superior Binational Program has recently begun gathering baseline measurements regarding the present status of basin-wide sustainability. In this case, we have mostly examined a wide range of existing databases to determine how we could observe trends in sustainability without creating new indexes or gathering new data. The project has a goal of identifying 15 to 20 measures as primary sustainability indicators, based on: availability of data now and in the future; the suitability of the measures in their present form; and their overall value as indicators of the human aspects of ecosystem health.

Based on a preliminary review of the incomplete database, it seems that a variety of social and economic conditions could threaten the long-term sustainability of the basin. In particular, a relatively depressed regional economy may be fostering conditions that work against incorporating sustainability principles into daily life and further encourage ill-advised consumption of basin resources. Data suggest, however, that other demographic forces may influence the adoption of more benign technology and improved land use planning. For example:

- The average educational background of basin residents seems to cultivate pro-sustainability values, but the relative impoverishment of the region may encourage continued consumption of resources that exceeds replacement rates. To compensate, we must find ways to enhance the regional economy in ways that balance social and environmental needs.

- Relatively lower cost of living in the region, combined with a seemingly higher quality of life, may attract more and more immigrants to the region, thereby placing greater stress upon natural and social systems to the detriment of sustainability. To protect agricultural and recreational lands, land use planning must take into account newcomers' inclinations to develop homesites and services beyond the existing suburban fringe.

- As more people move into undeveloped countryside, greater pressure will be placed on transportation and service infrastructures. With rising levels of poverty and lowered tax-bases, less effort may be directed at conservation-oriented measures such as mass transit and the use of environmentally benign energy sources. It is imperative that innovative technologies be adopted to off-set citizen tendencies to live for the present.

- The general population of the Lake Superior basin is aging and may become more amenable to accepting lifestyle changes that promote sustainability. It is important to promote sustainability among this population as we also focus on teaching younger generations to use the land wisely.

At this time, any conclusions regarding the status and prospect for basin-wide sustainability in the Lake Superior region must remain tentative and be further tested in the future. Such will obviously require us to generate and analyze a wider range of data over time, as well as carefully cross-reference various types of information. Also, much of our data at present deal with economic concerns and we should be wary of over-emphasizing economic sustainability over social and environmental components in the sustainability triad, even though the regional economy is a necessary component of sustainability in the basin.

Strategies for Future Initiatives

In addition to collection of socioeconomic and attitudinal data in the basin, we have proposed a series of additional projects. Some of the projects will measure indicators that can be considered gauges of sustainability in the region to assess whether we are moving toward or away from sustainable lifestyles. Other projects are levers, or attempts to manage and change behavior to better promote sustainability.

Gauges to Measure the Understanding and Incorporation of Sustainability

Sustainable Forestry Practices Inventory compares and contrasts sustainable forestry practices in the basin and creates a system by which processes can be assessed in light of basin-wide sustainability of forest resources.

Community Awareness Review will formally survey basin residents and initiate person-to-person dialogue about sustainability issues through the use of community-based facilitators.

Reviewing the Status of Sustainability Education will gain a better picture of how sustainability principles are being incorporated into environmental education programs in the basin.

Levers to Promote Basin-wide Sustainability

Communicating Economic Values aims to increase visibility and demonstrate economic importance of natural resource systems in the basin for improved resource decision making by generating approximate economic values for resources in the Lake Superior ecosystem.

Teaching the Value of Economic Instruments identifies the usefulness of economic instruments – user fees, pollution charges, permit trading programs, performance bonds – in the basin.

Promoting Water Conservation builds upon Canadian efforts by expanding the toilet replacement rebate and water use audit programs currently underway in Thunder Bay.

Marketing Waste Reduction and Energy Efficiency will develop an information and assistance campaign tailored to alerting small businesses, health care organizations, and educational systems in the basin to various energy and waste assistance programs.

Facilitating Mercury Reduction emphasizes the importance of thermostat, button battery, and fluorescent lamp recycling.

We also intend to pursue a number of other projects in the next two years:

- Complete the Baseline Sustainability Indicators project.
- Commence new gauges and levers initiatives.
- Co-host sustainability forums.
- Engage media campaigns for public outreach.
- Build the capacity of communities to focus on sustainability on a day-to-day basis.

Conclusion

It is not an easy task to create consensus and move society to the adoption of enlightened action. The complexity of fostering sustainability can lead to an inappropriate reliance on quick-fix, end-of-pipe solutions, rather than dealing with identification, monitoring, and remediation of more serious shortcomings located up stream in society itself. Even though the idea of sustainability has long provided a foundation for the Lake Superior Binational Program, how we should go about facilitating sustainable practices on the ground has been more problematic. To promote lifestyle changes and policies necessitates consideration of a variety of issues that go beyond mere pollution prevention: to produce a truly sustainable society means that we must grapple with issues that are more general in scope. Though progress has been made, we are still a long way from promoting a full range of social and economic initiatives that will make for a sustainable future.

Table 9 Sustainability Projects, Sponsors, and Funding

Commited Actions	**Current Project Leads & Funding Sources**
Environmental Actions	
A. Teaching the Value of Economic Instruments	Environment Canada (partial funding)
B. Promoting Water Conservation	Thunder Bay 2002 (partial funding)
C. Mercury Reduction	USEPA and Thunder Bay 2002 (partial funding)
Information Actions	
A. Baseline Sustainability Indicators	MTU (CEM funding)
B. Sustainable Forestry Indicators	USDA Forest Service (partial funding)

Key to acronyms:

- **CEM** **Coastal Environmental Management Program**
- **MTU** **Michigan Technological University**
- **USDA** **United States Department of Agriculture**

CHAPTER 9

Aquatic Nuisance Species

Introduction

The invasion of aquatic habitats by non-native species is an increasing concern in the Great Lakes basin. Non-native species, also known as non-indigenous and exotic species, are those that do not naturally exist in an environment and have been introduced by human activity, either intentionally or unintentionally. Introduction of species has occurred through a variety of sources including ballast water carried in international commercial vessels, the building of canal systems within the Great Lakes basin, fish stocking practices, angling, recreational boating, aquarium releases and gardening. The rate of introductions has increased – nearly a third of the non-indigenous organisms now found in the Great Lakes have been introduced since the opening of the St. Lawrence Seaway in 1959. Once introduced, non-indigenous species spread inland, frequently by way of barges, recreational watercraft, bait buckets, fish stocking, automobiles (purple loosestrife) and other human-assisted transport mechanisms.

Aquatic nuisance species (ANS) have both ecological and economic impacts – commercial fishing, agriculture, tourism, sport fishing, recreation, utilities and more. They have seriously altered and disrupted Great Lakes ecosystems because parasites and predators that act as natural controls in their native habitat are not present here. Aquatic nuisance species have the ability to out-compete native species for food and habitat, and in the most severe cases, can displace native species to some degree.

Important Aquatic Nuisance Species

Non-native species that may threaten the integrity of the Lake Superior ecosystem include:

- alewife
- Eurasian Ruffe
- Eurasian water milfoil
- purple loosestrife*
- rainbow smelt
- round goby
- rusty crayfish
- sea lamprey*
- spiny waterflea
- white perch
- zebra mussel

*There is a known threat from sea lamprey and purple loosestrife. The impact of the other species remains unknown.

What is Being Done?

A number of federal programs have been implemented to check the negative impact of non-native species in the Great Lakes. Foremost is the Non-Indigenous Aquatic Nuisance Prevention and Control Act (NANPCA), which provides federal legislative support for programs aimed at prevention and control. Under this program, the Great Lakes became the first area to impose ballast water regulations. Under the authority of the Act, other programs to help prevent and control the spread of aquatic nuisance species have been established: the Aquatic Nuisance Species Task Force, comprehensive state management plans and the Great Lakes Panel on Aquatic Nuisance Species. In 1996, the NANPCA was re-authorized through the National Invasive Species Act, and in 1999, U.S. President Clinton reinforced the need to stop the further introduction of non-indigenous species when he signed the Invasive Species Executive Order.

Other programs to help stem invasion by non-indigenous species include the Great Lakes Action Plan for the Prevention and Control of Aquatic Nuisance Species, the Great Lakes Ballast Water Technology Demonstration Project, U.S. and Canadian Coast Guard programs, and tribal programs. In an effort to have ballast water more stringently regulated, the Pacific Environmental Advocacy Center filed a petition with the U.S. Environmental Protection Association requesting a repeal of its exemption of ballast water from National Pollutant Discharge Elimination System regulation under the Clean Water Act.

Other programs include:

- Minnesota Sea Grant Program
- National Aquatic Nuisance Species Clearinghouse
- The Sea Grant Non-indigenous Species Site
- The National Zebra Mussel Training Initiative
- Great Lakes Sea Grant Network
- Exotic Aquatics and Zebra Mussel Mania Traveling Trunk Program
- Citizen Monitoring Program
- Purple Loosestrife Biocontrol Project
- Exotic Species Day Camp for Educators

Management activities for aquatic nuisance species have four distinct components:

- educational outreach
- detection and monitoring efforts
- prevention activities
- research and control activities

Each of these components contains a variety of measures that should be undertaken. Of particular concern is the need to design and implement effective ballast management programs and resolution of the "no ballast on board" issue.

Experts disagree about the relative importance of prevention and control. Effective control in aquatic systems is often impossible, but the impact of aquatic nuisance species merits an attempt. Although partial success has been achieved in control programs for sea lamprey and purple loosestrife, it is generally agreed that prevention is best. Once a species invades a new habitat, it is virtually impossible to remove it. This need for adequate prevention explains the emphasis on restricting and regulating ballast water discharges.

Recommendations

Additional efforts must be explored and implemented to stop further introduction and spread of non-indigenous species. Such efforts should include:

1. Develop strategies to reduce the likelihood of the invasion of ANS.

- Better identification of possible future invaders.

2. Maximize the effective functioning of prevention and control programs already in place.

- develop a detailed inventory/online clearing house of all aquatic nuisance species with biological information, behavior and previous ecological impacts
- clarify agency roles, including the role of the Great Lakes states in helping to prevent and control nuisance species
- implement a system to reduce duplication of effort for optimal use of agency resources
- encourage interjurisdictional cooperation and information sharing
- develop and incorporate short-term management practices applicable to fully-loaded vessels in Coast Guard ballast management regulations for the Great Lakes

3. New technology to deal with the threat of aquatic nuisance species.

- Collection of baseline data on fish communities to detect impact of introduced species
- Surveillance sampling to detect new colonizations
- Public information and education programs to encourage reporting and reduce transport and possession of nuisance species
- Cooperation between fish management agencies and maritime and bait industries, the U.S. and Canadian Coast Guards, the U.S. Army Corps of Engineers, and other non-traditional partners in the effort to prevent the introduction and spread of ANS
- Promote greater resilience in aquatic communities by restoring and protecting habitat, and through careful deliberation of stocking and harvest regulation.

4. Develop priorities for dealing with ballast water issues.

- Develop clear and concise biological standards for ballast tanks and discharge of ballast water
- Focus on best practical technology for ballast water control
- Devise a short-term plan for dealing with the No Ballast on Board (NOBOB) issue
- Require that newly built ships incorporate technology to deal with the ballast water problem
- Ensure that U.S. and Canada work together on ballast water management, regulation and enforcement

5. Manage other aquatic species that affect the abundance of ANS.

6. Develop strategies for ANS species whose abundance can be controlled by human intervention.

CHAPTER 10

Atmospheric Deposition of Pollutants of Concern

This chapter presents an overview of scientific and program information relevant to the problem of atmospheric deposition of pollutants into the Great Lakes. The information generally cover the entire Great Lakes basin and focuses on Lake Superior wherever possible. Policy recommendations for dealing with out-of-basin pollutant sources are also included.

Introduction

Despite improvements in water quality, the Lake Superior ecosystem is still recovering and it is necessary to address the atmospheric contribution to ensure long term protection of health and the environment. Evidence gathered over the last three decades conclusively shows that toxic chemicals released into the air can affect regions great distances from their point of emission. Some of the early scientific studies of air deposition are described below:

- PCBs, and pesticides including toxaphene, a chemical banned in the U.S. in 1982 were found in the fish in an island lake on Lake Superior. Toxaphene was used widely in the southeastern U.S. until the mid 70's. Levels of airborne toxaphene are still highest in the southeastern U.S. and decline with distance towards the Great Lakes and north Atlantic. The implication is that airborne toxaphene was probably transported from the southeastern U.S. cotton belt.
- Since 1991, the Integrated Atmospheric Deposition Network (IADN) has recorded elevated levels of PCBs, PAHs, lead and a number of chlorinated pesticides in rainfall and the atmosphere on each of the Great Lakes.
- A series of studies of Wisconsin lakes indicate that the air is a major contributor of mercury to these lakes – finding a direct relationship between increases in air deposition of mercury and higher levels of mercury in fish.
- Atmospheric deposition of DDT, toxaphene, HCB, and PCB in the Great Lakes region, as measured in peat cores, are consistent with the U.S. production and use history of these chemicals. Recent sources are likely in Mexico and Central America.

Research results from many other studies bear similar testimony. Of note is the finding that PCBs and other persistent organic pollutants (POPs) – many of them out of use since the 1970s – have become widely distributed in the environment and that the atmosphere is a global pathway. POPs can be measured and continue to cycle between air, water, soil and living things even after their manufacture, use and emissions have stopped.

In order to quantify the total atmospheric load, both long-range and local sources must be considered. The relative importance of each depends on the pollutant and the lake. For Lake Superior, long range transport of pollutants is thought to be of greater significance than local sources.

Transport distances depend on the characteristics of the chemicals and source emissions as well as weather patterns. Scientists have long recognized the basic processes by which air pollutants can enter rivers, lakes, and other water bodies.

1. *Release:* sources include i) point sources, such as industrial smokestacks or any other fixed location that releases pollutants; ii) area sources, such as pesticide applications on agricultural fields, and iii) mobile sources, such as exhaust from automobiles. Natural sources include forest fires and volcanic activity.
2. *Airborne Transport:* distance traveled can depend on weather conditions and the chemical and physical properties of the pollutant.
3. *Deposition:* occurs when pollutants settle to the earth – on their own, or through precipitation into a lake. Soil runoff and tributaries in the watershed comprise an additional source.

Current Understanding

Despite the difficulties posed by the scale of the problem, there is growing understanding of the science of atmospheric deposition. For mercury, lead, dioxins/furans and other banned and restricted use substances, both emission and the number of anthropogenic sources have declined. Despite these declines, atmospheric deposition continues to be a significant contributor of pollutants to the Great Lakes.

Below is a selection of recent findings. Detailed information together with scientific references can be found in Chapter 11 of the technical LaMP 2000.

- Atmospheric deposition of lead, cadmium, PCBs, DDT/DDE, and dieldrin to the Great Lakes is declining. For some of the banned pesticides however levels have remained relatively unchanged or have increased in recent years.
- In Lake Superior, over 80% of PCBs and dioxins/furans entering the Lake are from atmospheric inputs
- Air deposition is the major contributor of mercury to the Great Lakes. Atmospheric deposition fluxes in the Great Lakes were estimated to be almost an ten times higher than the pre-industrial North American average.
- Modeling results estimate that approximately 75% of airborne deposition to the Great Lakes originates in neighboring states and provinces. For Lake Superior 40% of dioxin deposition comes from sources between 400 - 700 kilometres.
- Between 1982-1993, lead emissions in the Great Lakes region has declined at a rate of 6.4% per year-resulting from the phase-out of leaded gasoline in automobiles.
- Lake Superior is the only Great Lake for which deposition from the atmosphere is the dominant input of the pesticide atrazine.
- Since the cancellation of toxaphene in the early 1980s, water concentrations in Lake Superior have steadily declined. Both transport and a local source in the Lake Superior/Michigan area may be responsible for the relatively high levels still present in the fish in Lake Superior.
- Data indicate that concentrations of dioxins/furans and PCBs, in the Great Lakes are declining, while lead, cadmium, mercury, and polycyclic aromatic hydrocarbons concentrations are still too variable to show trends.
- DDT and DDE, dieldrin and chlordane are expected to fall below current detection limits in the atmosphere between 2010 and 2020. HCH and HCB are projected to be eliminated in the atmosphere by 2030 and 2060, respectively. Because of their persistence, concentrations of these chemicals in water and soil will not be eliminated by these dates. Nevertheless, these estimates indicate that reduction and restriction strategies are having the intended effect.
- Canceled or restricted pesticides are still transported to the Great Lakes. Their sources include other countries where these substances are still used. Evaporation from soils and resuspension of contaminated sediments are also on-going sources.

International and National Efforts to Reduce Air Toxics

Many international, national, basin-wide and local efforts are currently underway to address the complex and multifaceted problem of hazardous air pollutants. Some of these programs are highlights below.

International Efforts

The North American Agreement on Environmental Cooperation between Canada, Mexico and the U.S. came into force in 1994. North American Regional Action Plans (NARAPs) were published for PCBs, DDT, chlordane and mercury in 1996. The NARAPs contain goals and management strategies for mercury, DDT and Chlordane. Other substances being considered for NARAPs are HCB, dioxins and furans, lindane and lead.

The other notable international effort is the negotiation of the Persistent Organic Pollutants (POPS) conducted under the Convention on Long-Range Transboundary Air Pollution (LRTAP) adopted by the United Nations Economic Commission for Europe.

The Great Lakes Binational Toxics Strategy provides a framework for dealing with persistent toxic substances in the Great Lakes basin – targeting nearly the same subset of critical pollutants as the Lake Superior LaMP, with a particular focus on the sources that impact the Great Lakes. The Binational Strategy can help the Lake Superior LaMP leverage resources to better address atmospheric deposition in a variety of international fora.

United States Regulatory Programs to Reduce Air Toxics

For a comprehensive listing of U.S. legislation relevant to air toxics please refer to Chapter 11 of the technical LaMP 2000 that includes standards and initiatives for stationary, mobile, combustion and area sources and health risks.

The Clean Air Act
Amended in 1990, the Clean Air Act (CAA) adds a phased approach to regulate air toxics which reflects the mandates under the CAA to first develop technology-based air toxics regulations and then subsequently to implement a more risk-based program. Other sections of the CAA call for study of specific types of air toxics problems including a focus on persistent pollutants that bioaccumulate in the environment.

- Coordination Initiatives – The Persistent Bioaccumulative Toxics (PBT) Initiative seeks to further reduce the risks from existing and future exposure to persistent, bioaccumulative pollutants. The Clean Water Action Plan (CWAP), another inter-agency strategy, seeks to address the remaining obstacles to the Clean Water Act's original goal of fishable and swimable water for all Americans.

Canadian Instruments for Managing Hazardous Air Pollutant (HAPs)

The Canada-wide Accord on Environmental Harmonization establishes a common vision, objectives and principles to govern the partnership between the federal, provincial and territorial governments. Three Sub-Agreements have been developed, dealing with environmental inspections, environmental standards, and environmental assessment, respectively.

The Accord will help to ensure that the management of HAPs is coordinated on a national basis. In particular, the Canada-Wide Environmental Standards Sub-Agreement will allow for the development and implementation of national standards and guidelines for HAPs.

The process for developing Canada-Wide Standards (CWSs) includes the following phases:

- Phase 1: Priority Setting: The priority-setting phase identifies which substances will be selected for the development of a CWS. The current CWS priorities are particulate matter, ground-level ozone (being addressed with particulate matter), benzene, dioxins/furans, mercury and petroleum hydrocarbons.
- Phase 2: Standards Development: CWSs will be developed using a risk-based approach and a Conceptual Risk-Based Framework has been drafted which ties together the scientific, technical, and socio-economic factors involved in developing and implementing CWSs. CWSs are currently being developed for the above-noted substances.
- Phase 3: Implementation: Each government will be responsible for implementing CWSs in its own jurisdiction, with the goal of effective, efficient and harmonised implementation. The governments will report to the public on progress towards achieving the agreed-on standard.

The development of CWSs for particulate matter, dioxins/furans and mercury will contribute to Canada's ability to meet the United Nations Protocol obligations.

A more comprehensive listing of Canadian federal and provincial legislation can be found in Chapter 11 of the technical LaMP 2000.

Science Development

Canada and the U.S. have invested in a scientific framework necessary to link atmospheric deposition with water quality. The following initiatives are being undertaken by government agencies for sources and emissions, atmospheric measurements and modeling. Most of them apply to the entire Great Lakes region.

- Great Lakes Regional Air Toxics Emissions Inventory This project conducts a periodic emissions inventory of toxics pollutants from point, area, and mobile sources in the eight Great Lakes States and Ontario. Managed by the Great Lakes Commission, the project is a partnership between the eight states, the province, and the U.S. EPA. The objective of the project is to present researchers and policy makers with detailed source and emission level data. More information is available at http://www.glc.org/air/air3.html

- Identification of sources of banned and current use pesticides to the Great Lakes - atmospheric measurements are being made in those regions which are potential sources. This assessment includes studies on the air-to-soil transference patterns of these pesticides and whether the pesticide levels seen in the Great lakes basin are the result of fresh or historical emissions. These studies are being conducted by Environment Canada and are sponsored by the U.S. EPA Toxic Substances Research Initiative [TSRI] and the Great Lakes Program.
- Coal-fired utility and smelter emissions contribute to mercury levels in the basin. Measurement of mercury in industrial emissions is being conducted using research aircraft in southern Ontario and northern Quebec. These measurements are part of a joint Government/Industry/University research program on Metals in the Environment [MITE] and are being sponsored by the Toxic Substance Research Initiative, the Mining Association of Canada and Ontario Hydro.
- Integrated Atmospheric Deposition Network (IADN) - A joint U.S./Canada monitoring network designed to assess the trends of atmospheric deposition of PCBs, chlorinated pesticides, PAHs, and trace metals. There are five master station sites on the Great Lakes and a number of satellite sites including downtown Chicago and several in Ontario.
- In addition to IADN, the spatial and temporal variation in the atmospheric levels of various substances is being described by the use of passive samplers which analyze levels over extended periods. This will be implemented at existing measurement stations throughout the basin.
- Fugitive mercury emissions from non-combustion sources in the Great Lakes region (FuME Study) - This study's objective is to assess speciated mercury emissions from non-combustion sources in the Great Lakes region. This will include measurements of fugitive air emissions, organo-mercurials, airborne reactive gaseous mercury, surface emissions from contaminated soils, and an examination of mercury in annular tree rings near these sources.
- Mercury methods development for investigating sources, transport, and deposition in the Great Waters - A two year mercury monitoring program at 10 sites in the Great Lakes basin. The information acquired from this project will be used to further refine sampling methods, examine environmental factors influencing mercury deposition and air/water exchange, and investigate the major source areas and types of deposited atmospheric mercury in the region.
- Identification of atmospheric mercury sources in the Great Lake states through an ambient monitoring program - The objective of this study will be to identify and characterize mercury sources within the Great Lakes states and using two state-of-the-art, continuous mercury vapor ambient air analyzers. Data will be shared among the eight Great Lakes states
- Transport and deposition of atmospheric mercury and mercury compounds in the Great Lakes region - The objective of this study will be to assess the magnitude and seasonal variation of atmospheric mercury in the Great Lakes region by monitoring sites on two sites in Michigan. The data to be collected represent the only long-term mercury data base with which to evaluate changes in emission patterns and for model evaluations.
- Meteorological Service of Canada (Environment Canada) is developing a global atmospheric circulation model to assess the world-wide mercury contribution to the Great Lakes.
- Investigation of source-receptor relationships from atmospheric deposition of mercury to the Great Lakes - The objective of this study will be to develop, test, and perform analyses to estimate source-receptor relationships for atmospheric deposition of mercury to the Great Lakes and to refine mercury emissions inventory information.
- Spatial and temporal measurements of mercury in precipitation are currently being made as part of the Mercury Deposition Network at sites in the U.S. and Canada.
- Fish-eating birds as ecological indicators of methyl mercury and PCB availability in Michigan - fish-eating birds will be selected as ecological indicators in Michigan and eventually the entire Great Lakes region. Samples will be collected from bird feathers, blood and eggs, in addition to fish and water column samples to develop a risk assessment of piscivorous birds exposure to PCB and mercury.

Data Gaps Identified

Though considerable efforts have been made, information gaps still limit researchers' ability to characterize and quantify sources, effects and patterns of atmospheric deposition of key pollutants. These data gaps include:

- Improved emissions inventories of natural and anthropogenic sources. More research is needed to improve emission factors, identify the chemical species of each pollutant emitted, and identify and quantify the emissions from those sources which may not be currently or accurately represented in the emissions inventory.

- Ambient and atmospheric deposition monitoring data for pollutants of concern often lack the appropriate spatial and temporal scales to be able to quantify loadings to all waterbodies and to calibrate and validate atmospheric transport and deposition models.

- Concurrent air and open water measurements are necessary for air-water exchange calculations and for deposition modeling.

- Improved techniques for direct air-water exchange measurements.

- Better understanding of the role of transformation processes on certain pollutants once they are released into the atmosphere – phenomena which can increase toxicity and persistence.

- Determination of theoretical attributes, pathways and fate for each of the pollutants of concern.

- Improved atmospheric transport and deposition models and improved calculations of atmospheric loads on a water body from ambient measurements.

Policy Recommendations and Needed Actions

Many of the regulatory and voluntary programs mentioned in this chapter are expected to further reduce the impact of air deposition. Additional general policy recommendations include:

- U.S. EPA and Environment Canada will encourage the states and the province of Ontario to take innovative measures to address local air sources of targeted pollutants (e.g. local burn barrel pollution prevention projects, and mercury collection projects).

- U.S. EPA and Environment Canada will continue their leadership in reducing the transboundary transport of critical pollutants, by pursuing reduction goals in the Binational Toxics Strategy, CEC Action Plans and other efforts.

- Lake Superior partners' increased involvement in national and international efforts to reduce non-U.S. source pollutants. This could include appointing representatives to become involved on the Persistent, Bioaccumulative and Toxic (PBT) Substances Initiative.

- Greater co-ordination between The U.S. EPA, EC and the state and provincial partners with the Binational Toxics Strategy toward the common goal of reducing and eliminating critical pollutants from out-of-basin sources (i.e. co-sponsorship of workshops, conferences, research projects and monitoring efforts).

- The U.S. EPA's continued support through funding, valuable pollution prevention projects such as Clean Sweeps and the Dioxin Burn Barrel Project, for direct immediate effects on reducing the amounts of pollutants available for atmospheric transport.

- Better co-ordination between the U.S. EPA and state/federal partners with other ongoing LaMP efforts.

- Efforts by the Lake Superior partners to increase public awareness and understanding of the problem of air deposition and transport (i.e. local initiatives and actions).

- Continued joint work between the U.S. EPA and EC with states and industry to fill gaps in source categories and further refine emissions methods for critical pollutants.

- U.S. EPA commits to ensuring that all Region 5 states will have enforceable regulations and the permit applications that are required to be submitted for municipal waste combustors and for hospital/medical/infectious waste incinerators by December 2000. Moreover, U.S. EPA commits to pursuing a strategy for assuring 100% compliance with these regulations.

- U.S. EPA Region 5 will support the rigorous development and refinement of the Regional Air Toxics Emissions Inventory of all hazardous air pollutants which have a tendency to bioaccumulate. USEPA will work closely with all eight Great Lakes states to identify every possible known source of all magnitudes of emissions, and develop emission estimates and updated to reflect implementation of control technologies and progress in emission reductions.

- U.S. EPA Region 5 will support and pursue activities that result in reductions of mercury emissions. In particular, by the end of 2000:
  a) Provide funding to support workshops in at least one Lake Superior basin State on how to reduce the use of mercury-containing devices at electric utilities.
  b) Develop and distribute through the Binational Toxics Strategy mercury workgroup a package of information related to mercury reduction at schools.
  c) Make a determination about whether to regulate mercury emissions from electric utilities.
  d) Complete the pilot projects to establish TMDL allocations for two waterbodies receiving mercury from atmospheric deposition.

- The U.S. EPA has committed approximately $6 million in FY2000 and FY2001 funds to support mercury research in a number of priority areas including transport, transformation and fate; and human health and wildlife effects of methyl mercury. These research activities are aimed at reducing the uncertainties currently limiting the agency's ability to assess and manage mercury and methyl mercury risks. A particular target of research will be collection and analysis of information on mercury emissions and control options for coal-fired utilities in order to support a regulatory determination on mercury controls for utilities by December 15, 2000.

- In November 1999, EPA filed civil complaints against seven electric utility companies operating coal-fired power plants in the Midwest and Southeast, charging that 32 of their plants failed to control emissions of oxides of nitrogen and sulfur as required under provisions applicable to modified sources under the Clean Air Act. Resolution of these complaints could provide an opportunity to promote solutions that reduce emissions of mercury and other pollutants, as well as nitrogen and sulfur.

Conclusion

Partner agencies have developed Lakewide Management Plans for six ecosystem themes: critical pollutants, aquatic communities, terrestrial wildlife communities, habitat, human health and developing sustainability.

The preceding chapters contain scientific and technical information, and priority actions and restoration projects that we will be initiating over the next two to three years. The chapters are summaries of the more extensive and technically-written LaMP 2000 document which is available on CD-ROM and through our website.

The critical pollutants chapter has strategies that will be used in the next two to three years to further reduce loading of nine critical pollutants with the long term goal of zero discharge of in-basin sources.

The human health chapter supports the protection of human health through the continued reduction of contaminants (zero discharge demonstration program), environmental health research and monitoring, and communicating health risks.

The habitat chapter recommends important restoration and enhancement projects. The chapter also points out areas where continued efforts are needed: consensus on the status and trends of habitat conditions; filling gaps in information, and recommendations for the protection or restoration of ecological functions including endangered species.
The terrestrial wildlife communities chapter recognizes that integrative work is necessary to inventory, monitor and manage terrestrial wildlife. Strategies for sustainable terrestrial wildlife include cooperative planning, maintaining natural variation, contaminant reduction, invasive species control, threatened and endangered species recovery, and the protection/enhancement of specific wildlife species.

The aquatic communities chapter identifies the key stresses on aquatic habitats in the basin. Recommended actions to improve and protect habitats for fish species are listed, and ongoing monitoring projects are described for each of the aquatic habitats of Lake Superior.

The sustainability chapter recognizes the complexity of sustainable management and takes a long term view. Beyond pollution prevention, society is faced with promoting a full range of environmental, social and economic initiatives that will foster a sustainable future.

Aquatic nuisance species continue to be of concern and strategies for their management are identified.

Atmospheric transport of toxic chemicals to the Lake Superior basin can come from regional, continental and global sources. Reduction strategies are being negotiated outside of the Lake Superior Binational Program. The chapter provides a summary of existing programs and recent scientific developments.

The LSBP recognizes the need for public participation and values a partnership approach to achieving specified goals. The Program encourages commitment from all partners to develop new and innovative approaches to ecosystem management. Citizens of the basin, as partners and stakeholders in the Binational Program, are strongly encouraged to become actively involved.

LaMP progress will now be reported every two years beginning in April 2000. Adaptive management will be applied allowing the process to change as needed by building upon our successes, accepting new information and drawing from public involvement and input. The LaMP therefore, can be adjusted over time to respond to the most pertinent issues facing the lake ecosystem.

The release of this document begins a Public Comment period that closes on July 31, 2000. We welcome your review and comments. Should you wish to make comments on LaMP 2000, you may use our on-line submission form at either:

www.cciw.ca/glimr/lakes/superior/involved.html or www.epa.gov/glnpo/lakesuperior/involved.html.

If you wish to send your comments in writing, please send them to :

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