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July 8, 1992

TO: EOWG Subcommittee Chairs

FROM: Joel S. O'Connor, Chair
Stewardship Subcommittee

SUBJECT: Exchange Among EOWG Subcommittees

I have postponed this exchange among our subcommittees until our Lake Ontario Stewardship Subcommittee had something tangible to send. Now I believe we have some progress which may be of wider interest, and which may justify critical comment by your subcommittees.

Enclosed please find:

1. Revised Stewardship Objective Statement (our original objective, per se, is unchanged.)
2. Minutes of the last two Stewardship Subcommittee meetings.
3. April 1992 Progress Report.
4. Guidance for Documenting Stewardship Indicators.
5. Preliminary descriptions of some stewardship indicators.
6. Great Lakes United letter regarding the Public Comment Workshop.

The Stewardship Subcommittee would be grateful if you could ask your respective subcommittee members to comment on the enclosures. The aim is to improve our strategies, and to help coordinate with other components of the EOWG.

I would also appreciate the chance to pass on to the Stewardship Subcommittee recent progress within your groups.

Enclosures

cc: Stewardship Subcommittee Members
Paul Bertram, GLNPO
Susan Bloss, E & E, Niagara Falls

Joel O'Connor

March 16, 1992

Recommended Changes

in Lake Ontario Stewardship Objective Statement of
Ecosystems Objectives Work Group

Objective [unchanged]: **Human activities and decisions shall embrace environmental ethics and a commitment to responsible stewardship.**

The ability of human society to profoundly affect the ecosystem, together with our dependence on it, requires that we **regain** an environmental ethic to guide our society's activities. Our tendency to consider ourselves separate from, **and in control of**, the ecosystem has greatly contributed to the degradation of Lake Ontario. **The Lake** has long been taken for granted and exploited rather than valued. **It is now evident that these practices can not be sustained, we must recognize and reconcile ourselves to dependence upon finite ecosystems. Other cultures respect, indeed revere, the earth which sustains all life -- we must regain a similar sense of community with the Lake and its basin. Recent dominant perceptions that society depends upon relatively unfettered environmental exploitation is not "human nature." These perceptions can change, as views have changed through history, when they conflict with new knowledge and experience. We must accept responsibility for maintaining the ecological processes and components of Lake Ontario, preserving its biological diversity and following the principles of sustainable use of resources. Responsible stewardship includes: educating society about current resource uses and practices which jeopardize ecosystem integrity; advocating environmentally sustainable behavior in individuals and institutions; and changing the economic incentives which degrade the ecosystem. Many issues, such as achieving zero discharge of persistent contaminants, and the introduction of exotic species, will be more easily resolved with such an approach.**

EOWG Stewardship Subcommittee

Guidance for Documenting Indicators of Responsible Stewardship

April 27, 1992

Joel S. O'Connor
U.S. EPA, Reg. II
New York

Purposes of Stewardship Indicators

Perhaps the most common admonition about indicators is: be clear about their purpose(s) -- Who will use the indicators and how? This is undoubtedly important. Unfounded preconceptions about specific users and uses of social indicators have been common.^{1,2} One investigator has noted that an effort to introduce a suite of U.S. social indicators taught social scientists more about the needs of politicians than it taught politicians about the needs of society.³ Important as it is to "know one's audience," I suspect that we too must anticipate surprises and learning.

Two purposes of stewardship indicators (below) seem evident. These purposes determine the expected users in broad terms, as described below. It does not seem useful to attempt much more specificity about user groups and applications of indicators until we have indicators and discuss them with intended users.

One obvious purpose of stewardship indicators was made explicit by the EOWG in its charge to the Stewardship Indicator Subcommittee: to measure progress toward the Stewardship Objective.⁴ The idea is to inform governments and the public about how good our stewardship practices and results are, thereby informing improved public policy. This implies important audiences of government offices that influence environmental uses, and the private individuals who want to keep track of Basin stewardship. The government audience embraces much more than traditional environmental agencies, of course. Environmental stewardship is influenced even more strongly by legislatures, the judiciary, and agencies responsible for economics, development, etc.

However important this passive purpose, we have also agreed that the most useful indicators will evoke action -- they should have promise for encouraging and stimulating the social and institutional change outlined in our Objective Statement. Evoking action is a distinctly different purpose from simply informing about the status and practice of stewardship. Stewardship (and other ecological) indicators can be expected to evoke action through clarifying unacceptable disparities between where we are and where we want to be, thereby prompting change in both public policy and actions of the entire Basin community.

Necessary Features of the Indicators

In order to accomplish the two purposes above, some features seem essential for each indicator. Despite the very different purposes, the same fundamental features seem to be necessary for both.

(1) Indicators must be quantitatively defined on an explicit numeric scale (dollars, tons, days/year of environmental volunteer effort, etc.). The scale need not be a measure. Many social phenomena can not be measured directly, so must be quantified on defined scales that are often dimensionless.

(2) The existing status of an indicator, e.g., 'days/year of environmental volunteer effort,' is quantified on the indicator scale. Specify the geographic scope of "existing status." Perspective on today's status will often require indicating past status of the indicator and status in different areas, all on the same scale. (Several examples are illustrated in Environment Canada's recent environmental indicator progress report.⁵)

(3) The acceptable value (or range) of an indicator must also be specified on the same scale. The acceptable indicator value (more plausibly, the acceptable range) corresponds to our Objective. We want to be within some acceptable range of indicator values. (Some, extremely oversimplified, examples are: M to N days per year of environmental volunteer effort are expected when human activities and decisions ... embrace environmental ethics and a commitment to responsible stewardship. The degree of public access to governmental decisionmaking is expected to be within the range X - Y [defined on some scale] when our Objective is met. <X mgd of water can be transferred out of the Basin per year before unacceptably compromising our Objective.) I suggest calling the indicator values (or ranges) which accord with our objective, "acceptable endpoints" on the indicator scale. "Endpoint" is a common indicator term, and "acceptable" underlines that the objective is important to reach, not just aim for. (Obviously, indicator authors are only recommending acceptable endpoints, but they are recommendations for social commitments.)

Even before an indicator is formally adopted, these three features will provide most of the information wanted by most people. They capture the essence of a specific commitment to responsible stewardship. I envision these three features portrayed as one (or a few) graphics with minimal explanatory text. I emphasize such a graphic of all indicators for two reasons. It is simple: today's unacceptable status and the objective, on one graph, can be understood by nearly everyone. Secondly it is clear, clear enough that vagueness or ambiguity can not be an issue.

Identifying numerical scales which truly indicate consequential features of the Basin ecosystem may be the most difficult part of our task. As Bertram Gross has noted of social systems generally, our system has very loose relationships among components, is not very predictable or controllable, is only partly knowable -- indeed, can be seen as an "unsystematic" system.^{6, p 33} It should not surprise us that considerable insight into this fuzzy, loosely coupled system will be necessary to identify any single numerical scale for a facet of stewardship which indicates something important -- important enough to compel change in both public policy and individual actions.

We have also emphasized seven, important criteria for judging "the most important" indicators:

1. provides information useful to environmental managers/policymakers and the public
2. is sensitive to anthropogenic change in the environment
3. is scientifically defensible
4. is cost effective
5. is quantitative and, if possible, expressed probabilistically [slight change from original wording, to acknowledge that indicator may not be measurable]
6. embraces as much as possible of overall "ecosystem health"
7. evokes action toward more responsible stewardship.

I do not elaborate on these criteria because we seem to have consensus on their meaning and importance. Authors should include evidence that the indicators meet each of these criteria.

Format of Indicator Descriptions

I do not know, a priori, whether a single format is practical for all indicators. I suggest using the following format and lengths of sections unless reasons for departure become evident. Some indicators, for instance, may seem to require more than three indicator scales and graphics. If multiple indicators are necessary to capture what is important, I only encourage as much simplicity as possible. Our generally non-technical audience has limited tolerance for details. Please get in touch with me if large departures seem important.

EXECUTIVE SUMMARY

Nature of the Indicator (1-2 para.)

(very broadly, what is being indexed to indicate what? The indicator indicates something more consequential than the indicator, per se. For instance, an indicator of environmental volunteerism, however quantified, might indicate: socially acceptable solid waste disposal practices, expected effectiveness of volunteerism under different circumstances, etc.)

Illustration of the Indicator (1-3 graphics)

Description of the graphic(s) (1-2 pages)

(indicator scale and source data, geographic scope of the indicator, today's status, temporal change and pertinent spatial variation, acceptable endpoint. All text specifically addresses the graphic(s).)

Explanation of the graphic(s) (1 para.)

(explanation limited to that necessary for understanding the interpretation [below]. It is particularly important to clarify how the scale, and points on the scale, were derived from data.)

Limitations and Uncertainties (1 para.)

(Mention the issues that probably compromise utility of the indicator more than all others, referencing full description and assessment of all limitations and uncertainties contained in the main text.)

Interpretation of the Indicator (1-2 para.)

(What does the indicator imply regarding individual action/public policy? Given this insight, what should we do? [A really consequential implication may well require more support than one indicator. One might reference another indicator(s) or additional information contained in the main text.]

[The entire Executive Summary should be 2-3 pages of text, plus the graphics. The Executive Summary should refer to issues only if they are explained in the Main Text. If it is important enough to raise in a 3-page summary, the reader deserves a conveniently available explanation of it in the Main Text.]

I also suggest creating neat, colorful slides of the indicator graphic(s), together with any other information best presented graphically in a talk. Please create slides as the synthesized information is available -- we will be giving talks soon.

CONTENTS (if helpful to the reader)

MAIN TEXT

(The main text should be as concise as clarity allows.)

Purpose of the Indicator

Nature of the indicator

(expanded, from Exec. Summary)

Value of the indicator

(Why is the indicator useful? Where? In what context?)

Illustration of the Indicator

(Expansion of corresponding Exec. Summary section, with more complete explanation and documentation.)

Description of the graphic(s)

(expanded, from Exec. Summary)

Explanation of the graphic(s)

(full explanation. It is particularly important to clarify how the scale, and points on the scale, were derived from data.)

Limitations and Uncertainties

(Describe and fully assess issues that do [or may] compromise utility of the indicator. How costly would it be to update, publish, and distribute the indicator, say, every year?)

Interpretation of the Indicator

(What does the indicator imply regarding individual action/public policy? Given this insight, what should we do? How could it be done? At what social cost, social benefit? Brief logic trail from the indicator to the interpretation, with no more embellishment than necessary. Interpretive embellishment belongs in Notes or Appendices after References Cited.)

References Cited

1. Shonfield, A. and S. Shaw. 1972. Social Indicators and Social Policy. Heinemann Educational Books, London. 151 pp.
2. Wildavsky, A. Rescuing policy analysis from PPBS. Public Admin. Rev., 29: 189-202.
3. Rose, R. 1972. The Market for Policy Indicators. pp. 119-141, In: A. Shonfield and S. Shaw [Eds]. Social Indicators and Social Policy. Heinemann Educational Books, London.
4. EOWG (Ecosystems Objectives Work Group). 1990. Ecosystem Objectives for Lake Ontario. 13 pp.
5. Environment Canada, Indicators Task Force. 1991. A Report on Canada's Progress Towards a National Set of Environmental Indicators. SOE Report No. 91-1. Environment Canada. 98 pp.
6. Gross, B.M. 1966. State of the Nation: Social Systems Accounting. Tavistock Publications, London. 166 pp.

NOTES or APPENDICES (if useful)

file: GUIDANCE

Progress Report April 1992

Lake Ontario Responsible Stewardship Subcommittee

Progress through March 1992

Membership of the Stewardship Subcommittee has been tailored to capture as much as is feasible of the diversity in cultures within the Lake Basin. The membership lists are Attachment 1. The Subcommittee has met twice, on Jan 9 and Feb 20, 1992. The EOWG Objective Statement provided to the Subcommittee has been reviewed, and some changes to the supporting statement, but not the Objective, will be recommended by the Subcommittee. The Subcommittee has agreed upon procedural issues, including criteria and a strategy to help select the most appropriate and useful indicators.

Members have submitted and discussed 16 possible stewardship indicators. These indicators are now only partially defined, and all require more compelling justifications. The Subcommittee has found it difficult to decide which indicators could be most useful, given only broad outlines of the candidate indicators and little evidence of what the intended users need most. These uncertainties seem likely to persist until we have more detailed information: more complete definitions of the indicators, evidence that supporting data are adequate or not, evidence that supporting data are available or not, perceived utility of actual indicators, etc. Consequently Subcommittee members have been asked to commit themselves to fully documenting the one or two indicators about which they are most knowledgeable and enthusiastic. Individual Subcommittee members have committed themselves to documenting the first seven of the following indicators, as indicated within parentheses, assuming that nominal supporting resources (see Budget) are available.

1. **Most important fluxes of water:** Basin input, Basin consumption, engineered transfers into and out of the Basin. (Sage, O'Connor)
2. **Degree of public access to governmental decisionmaking** (access to information, lobbying channels, etc. -- at Municipal, Provincial/State and Federal levels). (Knox, Sage)
3. **Municipal behavior** (planning, operations, land use, etc. [including some elements of indicators outlined below]). (Miller)
4. **Environmental volunteerism** (voluntary time, effort devoted to stewardship) (Lerner)
5. **"Defense expenditures,"** the costs of defending ourselves against our lifestyle (costs of pollution control, prevention and remediation; pollutant-induced health costs; limitation and remediation of habitat degradation; etc.). (O'Connor)

6. **Population density:** on margins of Lake and tributaries, and rest of Basin. (O'Connor)
7. **Public perception of public health issues.** (Rae)
8. **Water use:** per capita use by municipality, summed over the Basin; industrial use by municipality, summed over the Basin; water cost/m³.
9. **Meaningful Environmental Audits** (corporate pollution prevention activities: their openness to public, expenditures, and measures of success).
10. **Degree of public access,** to Lake shore and tributaries.
11. **Resource use:**
Annual energy use (1960 to present): per capita, by industry, residential, transportation, total.

Annual energy production: natural gas, other fossil fuels, hydro.

Food: quantities produced within Basin, imported, and exported.
12. **Land use:** on margins of Lake and tributaries (green space and developed area); rest of Basin (green space and developed area).
13. **Budget Assessment** (governmental decisions at all levels as reflected in environmental allocations, tax policy, subsidies, etc.)
14. **Environmental values** (characterize values, on recognized scales, in children (5-7 yrs) and adults, in municipalities vice rural areas).
15. **Household Environmental Audits** (water usage, energy usage, % food grown within Basin, etc.).
16. **Toxics Release Inventory** (public reporting on quantities of point-source and total pollutant releases to the Basin).

Proposed Work Plan for FY92-93

The following Work Plan has not yet been agreed to in its entirety by the full Subcommittee, but it has been developed with Subcommittee participation. The Plan assumes that Subcommittee members can devote about three work days per month* to documenting indicators, from May through October 1992. Two additional, Nov-Dec 1992, presentations and resulting indicator refinements are scheduled.

Schedule - FY 1992

- April Chair provides guidance re "fully documenting" a stewardship indicator
- Submit proposals for FY92 assistance in documenting specific indicators. (See FY92 Budget.)
- Apr-May Feedback/improvement of above "guidance."
- Define commitments and strategies to fully document particular indicators, including proposals for FY92 and 93 resources needed (see Budget below).
- June Third Subcommittee meeting, to (1) review and assist progress toward fully documenting a few stewardship indicators, (2) review and refine proposals [outlined in Budget below] for resources needed to document specific indicators, and (3) plan a workshop, to be conducted collaboratively with GLU, to gain more objective knowledge of what the public needs from stewardship indicators.
- Chair submits above proposals.
- August Fourth Subcommittee meeting, with selected invitees, to review and assist progress toward fully documenting a few stewardship indicators, and complete plans for a workshop to be conducted collaboratively with GLU.

* Assume 18 full work days (excluding time of assistants) are required to fully document an indicator, present it at two meetings, and incorporate refinements from peer reviews. Given indicator "completion" in Oct 1992 (see Schedule), the May-Oct (6 mo) effort requires $18d/6mo = 3$ work days per month.

Schedule - FY 1993

Oct	Complete indicator documentation and formal presentations.
Nov	Subcommittee/GLU workshop. The workshop would solicit reaction of presumed indicator users to presentations of fully worked out indicators. Benefiting from workshop, refine indicators and their presentations.
Dec	Submit text/graphic versions and make formal presentations to EOWG of (1) the "final" indicators and (2) strategies and costs for monitoring and disseminating indicators. Incorporate EOWG improvements to indicators and monitoring strategies; submit final report for publication and implementation.

Budget - FY 1992

Existing Travel Budget

February travel allocation (EPA, NFPO)	\$ 3.0 K
Feb Subcommittee Meeting	<u>1.2</u>
April Balance	\$ 1.8 K

Requested Budget

Additional travel request (one Subcomm. mtg and consultation with experts on Indicators 1, 2 and 5).	\$ 8 K
Proposal for two Atlantic States Legal Foundation interns (summer 1992) to assist authors of Indicators # 1, 2 and 3.	4 K
Proposal for summer 1992 student to seek and summarize Environmental Volunteerism data (Indicator # 4)	2 K
Proposal for consulting with two (U.S. and Canadian) government economists to seek and summarize "Defense Expenditures" (Indicator # 5)	6 K
Proposal to assist in drafting and evaluating questionnaire (Indicator # 8)	<u>4</u> K
FY92 Total (Request only)	\$24 K

Budget - FY 1993

Subcommittee meetings and travel	\$ 5	K
Proposal for Subcommittee/GLU workshop (Nov 1992)	<u>10</u>	K
FY93 Total	\$15	K

file: PROGREPT

MEETING SUMMARY

EOWG Stewardship Indicators Technical Subcommittee

Environment Canada
Toronto, Ontario
February 20, 1992

Participants: Joel O'Connor, Sally Lerner, Sam Sage, Sarah Miller, Louise Knox, Robert Boice

Clarifications to Minutes of January 9, 1992 Meeting:

Definition of Stewardship clarification (on p. 1): The last line of the section on definition of stewardship was changed starting with the word "duty." The new wording shall read, "desire to create conditions which enable people to exercise their judgement."

Clarification #1 (on p. 2): The group agreed that a "vision" for the lake is necessary, and that many groups have determined their individual visions for the lake. It is the group's recommendation that EOWG assist in a process that would allow stakeholders to come together and develop a common vision for the lake.

Clarification #2 (on p. 2): All group members feel comfortable that they understand the limitations of analysis of the indicators.

Clarification #3 (on p. 2): The group decided that the "existence" of an advisory group would be the indicator.

Discussion/Comments on Potential Indicator Materials:

James W. Ransom Letter on Stewardship Objective Wording -

While it is true that "management" of the environment may not be the most desirable wording, management and mismanagement of resources has occurred. The goal of stewardship is to correct those mismanagements.

The wording of the objective must be understood by the public and the word "stewardship" is well understood. The subcommittee should not be too academic in its wording.

The subcommittee may have to clarify that "stewardship" implies stewardship over other peoples' actions, as well as stewardship over the environment.

Recommendation:

The wording of the objective will remain as written; however, there will be accompanying text that reflects the sentiments expressed in Mr. Ransom's letter. Joel O'Connor will draft the accompanying text.

Sally Lerner Framework for Conceptualizing Indicators -

This framework uses "backcasting," determining the desired outcomes and working backwards. In our situation, the desired outcomes are changes in behavior by all actors, and a measurable improvement in environmental quality, e.g. drinking water. Once the outcomes have been determined, the group has to look at what activities will achieve the outcomes. Finally, the group must examine what decisions have to take place on public, private, and governmental levels to make the desired activities occur.

This framework can help us recommend priorities among the suggested indicators. For manageability, the group might keep the number of indicators to between six and eight.

EOWG's March, 1990 goals are fairly specific and should function as the group's vision for this work.

There may be some overlap between this group's work and the work of the human health indicators group since a "healthy system" implies healthy humans making good stewardship decisions.

John Maher and Sarah Miller Document on Indicators for Lake Ontario Municipalities -

Ideally, several of the indicators can be agglomerated, e.g. #5 on access in the introduction also speaks to participation.

The indicators should not be too "easy." Indicators that would allow a municipality to point to an existing plan on paper should be eliminated. The indicators should measure action.

The cost of water might serve as an aggregate for the indicators listed in the water conservation section. If the price of water is high, there is more likely to be efficient transport, restricted use, etc.

Increases in water cost will more heavily penalize the agricultural sector, a sector that is least able to pay.

An alternative might be to look at sustainable use of water as an indicator, however each municipality has its own definition of "sustainable."

Dividing the indicators by municipality may be an artificial distinction. The group may want to look at percentage of shoreline accessible as an indicator.

It may be useful to have a few indicators that embrace the whole lake and a few that address smaller spatial scales. Each municipality would receive a manual of indicators to guide them and an annual report card on its progress.

The indicators should be useful to all groups: politicians, so they know the appropriate place to allocate money; bureaucrats, so they can make appropriate action decisions; the public, so they can hold the other two groups responsible, and the scientists.

Sam Sage Document on Access Indicator -

The indicator would quantify community access to the Lake Ontario shoreline. Unfortunately, access does not speak to the character of the shoreline. Natural shoreline is preferable to cement or rubble.

In Toronto, connecting corridors to the lake are also considered. The concept is to protect headwaters, make linkages, and view the area as a basin and not just a lake. However, it is much more difficult to characterize access to the entire basin.

In some situations, land use dictates no access. An ideal "percentage accessible" is needed for our indicator since 100% access is not achievable or desirable.

An alternative goal statement might be that "when people want to use the lake, they can." This may be difficult to measure and the "steward" is not clearly identified.

General Indicator of Lake Level and Water Export as Proposed by Joel O'Connor -

An indicator involving a desired range of lake levels and a maximal acceptable rate of engineered water export from the Basin would provide legislators guidance when other regions seek to divert water from Lake Ontario.

Lake level and water export could serve as a federal stewardship indicator since the federal government makes water level decisions.

An overall water level indicator would not allow for identification of individual, non-steward municipalities.

Natural Lake water-level fluctuations may interfere with the usefulness of the indicator.

An alternate approach might be to monitor manmade imports and exports. The indicator goal would be a set lake level. The indicator would consider the trends over time and known information on natural lake fluctuations.

Sewage might be an import that would unrealistically offset water exportation and show a false indicator of positive stewardship.

Precipitation related to global warming is an input that cannot be altered by man within a basin framework and would become noise in

a Lake water-level indicator.

It might be appropriate to recommend that the Aquatic Communities Subcommittee develop an indicator which addresses consumptive use of water and water levels.

Potential Per Capita Water/Sewer Use Indicator -

An alternative to lake water levels might be per capita water/sewer use. A reduction of per capita use would be an indicator of good stewardship.

Rural, non-municipal users would not be included in the data. However, this should only be a very small percentage of the population.

This type of indicator might encourage municipalities to install meter systems if they do not now have them.

Industrial facilities should also be monitored by this indicator.

Potential Point Source Toxics Indicator -

As stated by the Toxics Management Plans, zero discharge would be the goal for this indicator.

The Toxics Release Inventory program could provide the indicator data in the U.S. However, Canada has no equivalent program. The indicator should be used to encourage Canada to develop a similar program.

George Werezak's Industry Indicators of Responsible Stewardship -

(#s refer to Dr. Werezak's white paper.) Trends in emission reduction (#10) could be a useful overall industry indicator.

The existence of education/outreach programs (#7) and community advisory panel (#8) could be grouped as one indicator.

Environmental audits (#3) could include a provision for opening the audit and the action implementation plans to public scrutiny.

For the indicator to be effective, guidelines must be developed to define a "meaningful" audit.

Joel O'Connor/Dennis King's Lake Ontario Regional Accounts Indicators -

A defense expenditures indicator would give people an idea of the economic cost of their actions, as part of the gross regional product.

Unfortunately, watershed economic data is not available. For the indicator to be effective, it is necessary to have data according to natural boundaries, not artificial political boundaries such as municipality and or state. Seeing the regional accounting "bankbook" will enable the region's citizens to be good stewards.

A decrease in "defensive" expenditures might not necessarily imply good stewardship since it could also mean that less is being spent to study and clean up problems. Defensive expenditures might be a good indicator in the future when existing problems have been addressed.

Expenditures in preventative programs might be an better indicator.

In terms of regional accounting, it might be useful to show where proceeds are going, e.g. is the money from a sewage treatment plant going back into treatment/cleanup and source control, or is it going toward other budget items, possibly promoting urban sprawl?

An expenditures indicator could be misleading in that companies that are spending money could be spending greater amounts not because they are good stewards but because they are having to remedy existing problems.

Sally Lerner's Environmental Volunteerism Indicator -

The numbers of volunteers and the number of hours they contribute may not be a clear-cut indicator of individual stewardship. Volunteers and hours could decrease because people feel they are ineffective and are not able to accomplish their goals, and not necessarily because problems have been solved.

Volunteerism may be an area for greater research.

Sally Lerner's Environmental Education Indicator -

England and France have developed extensive environmental education programs. Efforts on the part of school systems within the Great Lakes Basin to duplicate these kinds of efforts should be viewed as good stewardship.

It is difficult to predict how many education programs are the result of good stewardship and how many are the result of shock and fear on the part of the school system.

Again, this may be an area for research.

Summary of Potential Indicators (roughly in order of acceptance by Subcommittee):

1. Annual change in per capita water/sewer use (by municipality

and over the Basin).

2. Annual change in industrial water/sewer use (by municipality and over the Basin).
3. An increase in the percentage of accessible lake shore, working toward a set percentage access goal.
4. A reduction in toxics released as measured through the Toxics Release Inventory, working toward zero discharge.
5. An increase in the number of corporations conducting meaningful environmental audits, that, along with action implementation plans, are open to public scrutiny.
6. A reduction in human-engineered water export from the Basin to a level no greater than "X."
7. Human-engineered inputs to the basin that are at least "X", but no greater than "Y."
8. Trends in emission reduction such as the National Emission Reduction Master Plan of the CCPA that are shared with the public.
9. An increase in the number of corporations with employee education programs/public outreach programs on topics such as pollution prevention, recycling, etc., and the existence of a community advisory panel.

Other Recommendations:

1. The Aquatic Communities Subcommittee should develop an indicator that addresses consumptive use of water and lake water levels.
2. The areas of gross regional product, environmental volunteerism, and environmental education require additional research before they can become indicators.
3. Work group meeting summaries should be exchanged between work groups so that overlap can be avoided and better coordination of effort can be achieved.

The next meeting of the EOWG Stewardship Indicators Technical Subcommittee will be April 16, 1992, at the Airways Hotel in Buffalo, New York.

MEETING SUMMARY

EOWG Stewardship Indicators Technical Subcommittee

**Airways Hotel
Buffalo, New York
June 18, 1992**

Participants: Joel O'Connor, Jennifer Rae, Sally Lerner, Robert Boice, George Werezak, Lester Milbrath, Adam Eagle, Sam Sage, Michael Washburn

Status of Indicators in Progress:

Joel O'Connor - Indicator of Ecosystem Effects from Manufacturing

Jennifer Rae - Perception of Health Risk and Social Attitudes

Sally Lerner - Environmental Volunteerism Indicator

The indicator will measure the number of volunteer days/years as a measure of stewardship. The limitation to the indicator is if volunteerism declines, it will be necessary to determine if volunteers are merely suffering burnout or if situations have truly improved.

Robert Boice - Public Access/Land Use Indicator & Population Density Indicator

The public access indicator will measure the availability of areas for recreation and the quantity of land classified as public access/greenspace.

The population density indicator will measure the density of urban areas. The density of people is related to the amount of toxins, sewage, etc. generated in a given area. Stewardship will be measured as a increase or decrease of carrying capacity for the area around the lake. Information necessary to generate this indicator is readily available and is easily understood by the public.

George Werezak - Corporate Volunteerism Indicator

The corporate volunteerism indicator will measure several aspects of an industry's behavior. Internal indicators, policy statements, capital dollars spent per year in environmental areas, and a decrease in emissions per year. The indicator will apply to not only the chemical industry but to manufacturers such as steel, auto, etc.

Lester Milbrath - Public Opinion Indicator

The current data on public opinion is approximately six to seven years old and is no longer appropriate. For \$100,000, a new mail survey can be performed to assess the opinions of business leaders, public officials, environmental leaders, and the general public. With mail

surveys there is always the risk of inference. Talking with people directly can help reduce the possibility of inference.

Adam Eagle - Water Flux Indicator

This indicator is being developed in cooperation with Joel O'Connor. Since water quantity usage data is minimal for Lake Ontario, the indicator will measure fluxes in water level and flow over a given time period. Comparison of fluxes over time, including proposals for future diversions, will indicate stewardship. A decrease in fluctuations over time will indicate good stewardship. Contributions from rainfall must be accounted for in order for the indicator to be useful.

Michael Washburn - Three Sector Interaction Indicator

This measurement of the degree of access to government by industry, public interest groups, and agencies will not directly show stewardship, but rather the potential for stewardship. If more opportunities for access exist, there is a greater chance for stewardship. A survey might be a means of measuring access.

Stewardship Subcommittee/Great Lakes United (GLU) Workshop on Indicators:

Since the indicators are intended to be useful to the public, this workshop will be important for educating the public, and for determining:

- o Which of the indicators does the public perceive as the most important?
- o What purpose should the indicators serve?
- o Which component of the public should the indicators be geared toward?
- o In the public's opinion, what level of detail is necessary?

GLU has gathered some materials on two purposes for the indicators, guiding the public and guiding agencies.

Members of the subcommittee will need to develop clear, concise presentations on their individual indicators to present at the workshop.

The workshop will consist of approximately 25 active individuals from various sectors of the environmental area. November has been proposed as possible workshop date since the subcommittee needs to present its indicators at the December meeting of EOWG.

Several problems could result from this proposed schedule. The public may view a workshop in November as too close to the December EOWG meeting for them to have any real input into the report. They may perceive that all the real decisions have already been made. The schedule may also not leave sufficient time for the subcommittee to make alterations to its recommendations before the December meeting. Another problem may be that the public does not understand the relationship of the subcommittee's work to other Lake Ontario work

since it has been such a long time since any other Lake Ontario group has met. Another way to speed up the recommendation preparation process would be to have subcommittee members send draft recommendations to their peers for feedback prior to the workshop. The subcommittee could also hire an indicator expert like Dan Tunstel to review the indicators prior to submission to EOWG.

It may be more efficient to ask the other subcommittees to participate in the workshop and present their proposed indicators as well so the public can see that all the issues have been covered.

A suggested workshop format is to have a two-day workshop where on the first day the subcommittees could coordinate their proposed indicators to ensure that all issues have been covered. The invited public would be invited to be observers at this session. The second day would be a working session on the stewardship indicators with the invited public. The other subcommittee members would be invited to stay as observers for this session. The media should also be invited to the workshop since they are potential users of the indicators.

Recommendations:

Descriptions of the proposed indicators should be sent to peer groups and the EOWG subcommittees for their input.

In late August or early September, the invitations for the workshop should go out to announce the workshop in late September.

Louise Knox will serve as workshop coordinator with assistance from GLU and Sam Sage. GLU will provide workshop facilitators.

Joel O'Connor, Louise Knox, Phil Weller, and Sam Sage will serve as the steering committee, and the committee will select the meeting date. September 25-26, 1992 is a tentative workshop date. Buffalo or Toronto will be the site for the workshop.

Phil Weller will develop a generalized budget to present to Louise Knox.

Joel O'Connor will contact the other subcommittees to organize their involvement and suggest that they develop a proposed indicator package.

Draft, proposed stewardship indicator materials will be circulated to the subcommittee prior to peer review distribution.

Proposed Peer Review/Public Questions:

1. Have we covered those things you consider most important?
2. Are there any indicators not listed that your group would find especially useful?
3. Do you disagree with any of the indicators that we've listed? Why or why not?
4. How would you use these indicators?

5. Do you agree or disagree with our proposal for their use?
6. Which indicators do you consider most useful?
7. Do you agree with our definition of stewardship?
8. Are there inputs concerning the other areas of indicators that you could provide to us?

Review of Indicators, Suggested Improvements:

Joel O'Connor - Indicator of Ecosystem Effects from Manufacturing

The indicator identifies 12 sub-basins around the lake and considers the value added by Standard Industrial Category (SIC) industry code for raw materials purchased. This figure is weighted by the toxics used in the manufacturing process. The index is expressed in 1986 dollars of value added by contaminating industries in the basin. The index is useful because information on toxicant leakages from manufacturing are very imprecise relative to economic statistics for the industries.

Limitations to the indicator are that pollution by an industry might not take place in the same sub-basin where manufacturing occurs, and some toxics may be bound up in a manufactured product, e.g. benzene in polystyrene, and would not be part of the pollution potential. Improved stewardship could be indicated by a decrease in toxics use over time, however, a recession could result in a false indication of stewardship. The goal would be to maintain or increase value added and at the same time reduce the levels of toxics used in manufacturing.

Other limitations are that the indicator as proposed:

- o Does not include non-manufacturing industries, nor all toxics used in manufacturing
- o Does not address non-toxic impacts, such as habitat destruction
- o Only addresses toxics in a broad manner
- o Does not address airborne loadings from outside the basin.

SIC information for this indicator is available back to 1970. Before that date, the SIC classifications are different. Older information is available back to the 1920s.

The toxics included in the indicator come from "Human Activity and the Environment", a Canadian list.

Forthcoming MISA data and Toxics Release Inventory data might be helpful in making this indicator more complete.

Lester Milbrath - Public Opinion Indicator

A survey to gauge public opinion should involve interviewing leaders, the public, agencies, etc. to get their sense of stewardship for Lake Ontario. Questions should cover topics such as:

- o Their use of the lake
- o Actions of stewardship that they are involved in
- o The types of laws they desire to see in place regarding Lake Ontario
- o Their knowledge of about interactions and fates of behavior, e.g. do they know where their water comes from and where their sewage goes?

An increase in awareness and concern over time would be an indicator of stewardship. The survey could also include questions regarding other stewardship indicators such as volunteerism.

Jennifer Rae - Perception of Health Risk and Social Attitudes

Public opinion polls on environmental issues show that from 1988 to 1991 concern over environmental pollution increased. Concern over human health issues also increased. Surveys have also showed that Canadians are now much more concerned over air pollution issues.

Questions can be added to the survey for approximately \$5,000 apiece. Hopefully there will be other parties who are interested in adding questions, and or the results, and will help pay for the survey.

The survey should be directed toward all groups, the public, interest groups, industry, and public officials. The survey will allow us to show trends over time.

Mike Washburn - Three Sector Interaction Indicator

This indicator will measure the frequency and quality of interaction among three sectors; government, industry, and public interest groups. This interaction includes cooperation and information sharing in terms of their projects which affect the Lake Ontario ecosystem health.

Interaction is the same as access for the purposes of this indicator. Questions regarding interaction could be included in the survey.

The limitations to this indicator are:

1. There is no measure of interaction within a sector.
2. It will take several years of data before trend assessment can take place.
3. If the trend shows an increase in frequency and quality of interaction overall, it may mask a decrease in interaction between two individual sectors.

The cost of the survey will depend on the firm hired to conduct it.

Survey participants will be selected from directories, etc., but the rationale for selecting individual groups, industries, and agencies has not yet been determined.

Sally Lerner - Environmental Volunteerism Indicator

Canadian environmental groups are working on putting together information for this indicator. They will be providing information on:

1. The group's activities.
2. The extent of their interaction with government agencies.
3. An estimate of the group's longevity.
4. An estimate of the person hours per year for various activities.

Adam Eagle - Water Flux Indicator

There is very little information available on outflow or fluxes of the lake levels. There is however, IJC data on diversions and consumptive uses.

If the fluctuations decrease over time, that will be an indicator of increased stability in the lake system.

More information is needed on how specific diversions affect water levels.

Information on precipitation is available to factor into the indicator, but no information is available on degree days.

Evaporation rates will also affect the indicator.

Adam also agreed to investigate information for developing an environmental education indicator.

Next Meeting:

The next meeting of the Stewardship Indicators Subcommittee will be August 13, 1992, at the Airways Hotel in Buffalo.

Post-Meeting Addendum

The Chair requests draft versions of all indicators which can be provided by July 10, for distribution to our Subcommittee members and to other EOWG Subcommittees. Please mail copies to Joel O'Connor and Susan Bloss, for receipt by July 10. Indicator authors satisfied with the drafts they provided at the last meeting need not respond.

THINKING ABOUT STEWARDSHIP FOR THE LAKE ONTARIO ECOSYSTEM

by

Lester Milbrath

Research Program in Environment and Society
SUNY at Buffalo

Stewardship (or the lack of it) is a moral activity that only humans undertake. Even though humans are responsible for much of the degradation of the Lake Ontario ecosystem, only they can remember the past and foresee the future and thus are equipped to imagine, plan and carry out stewardship activities. Other creatures devastate ecosystems from time to time (usually be reproducing at epidemic rates) but we never blame them, nor do we expect them to have the foresight or stewardship that would allow them to correct the damage they caused.

It is now obvious that humans have greatly degraded the Lake Ontario ecosystem and, if it is to be restored to higher integrity, humans must take responsibility for carrying out remedial action programs and for insuring that its ecosystem is maintained with high integrity far into the future.

What is stewardship? It is the moral obligation to care for something and undertaking the behavior necessary to provide the care. Behavior that accidentally supports something would not be thought of as stewardship unless the person undertaking the behavior felt obliged (responsible) to do the caring thing. On the other hand, feeling the obligation to care but not doing anything to provide the care would not be thought of as responsible stewardship.

Given that definition, how might we measure stewardship? The moral obligation part of the phenomenon is "in the head" and can only be inferred from verbal or nonverbal behavior observed by the researcher. Even though researchers can observe nonverbal behavior that might be stewardship, it is still necessary to infer whether it is accidental or the result of purposeful care; if it is not purposeful care, it is not stewardship.

The question then becomes: what is the best (most valid) basis for making inferences of stewardship? Researchers typically infer what is going on "in the head" from seeing how persons respond to questions put to them by the researcher, or they observe nonverbal behavior believed to be relevant (expenditures, votes, programs, political action, etc.) and make inferences about the meaning of the behavior. Which evidence is best?

Evaluating Validity of Inferences

Inferences about the way people think, value, and behave are unavoidable. It is impossible to interact with other people or think about public policy without utilizing such inferences. Regrettably, many people carry such inferences as background assumptions and do not raise them to consciousness for careful examination. I sometimes say that everyone has an implicit theory of social change. Every decision about a contemplated political action - even the decision not to be active - is based in a person's operative theory of social change. A first step in our discourse, then, is to raise our implicit assumptions, our theories of social change, to full consciousness so they can be scrutinized for validity.

As we evaluate the validity of inferences, here are two general rules to hold in mind. First, keep the inferences as short as possible; each additional step in the inference adds error. Second, beware of unspoken (and unanalyzed) assumptions that play a role in the inference; such assumptions must be analyzed for validity.

For example, it is often said that what people do is a better guide to what they think (believe, value) than what they say. Is it? This assumption may have some validity when applied to a candidate for public office who you believe is telling people what he thinks they wish him to say in order to win their votes. It may also be relevant for concepts or views that society highly proscribes or honors. For example, very few people today will readily declare, in private or public, that they are racist or anti-environmental. Even Ronald Reagan and George Bush declare themselves to be environmentalists. Yet, these barriers to being candid are special circumstances that do not apply to many contexts in which people express their values and beliefs.

We can tease out a better understanding of validity of inferences by examining a case that is central for our concern. Most survey studies of environmental thinking report that a high percentage of people express deep and sustained concern about environmental problems; yet, these same studies also report that most of these people take no overt action to improve the environment. How do we resolve this seeming contradiction? One possible interpretation is that people do not really mean what they say. Another is that people do mean what they say but an additional set of factors shape what they do. What could those additional factors be?

Action carries time, effort, and money costs that are far greater than expressing an opinion. These costs bring other values into consideration such as needing to rest to relieve fatigue, spending time with one's family, giving time to other causes, having other purposes for one's money, and so forth. A belief that one does not have the proper skills (typically verbal skills and appropriate information) is also a considerable barrier to action. Being at ease socially is nearly a prerequisite for political action. A person with concern may also believe that his government does not respond to his action; therefore, why waste energy, money and time on something that will not result in change. Finally, occasions for action (a meeting, a public hearing, etc.) are episodic and often not very visible to the average person; people cannot take action if they do not cognize the possibility.

Given all these confounding influences on behavior, it is obvious that feeling concern is only one of the possible antecedent factors determining if, when, and how people act. It is much more straightforward to recognize that concern is one thing and behavior is another and that they are loosely linked. The antecedents of behavior constitute a very complex set that it is seldom possible to thoroughly explore in a study.

Tracing back from observed non-verbal behavior (especially the lack of it) to infer concern (or lack of it) involves a complex chain of reasoning and indefensible assumptions. Asking people if they are concerned leads to a much more parsimonious and defensible inference of concern.

A similar critique can be made of inferences about value when only economic behavior is observed (e.g. inferring the value of a park from people's expenditures to get there). Many people have recently sent money to a campaign to preserve the North Slope Wildlife Refuge in Alaska where the U.S. DOE would like to drill for oil; surely most of them have no intention of ever going there. Should we infer that those who gave money highly valued the refuge and that it was their main motive?

Should we infer that those who did not give money to fight DOE have no value for the refuge?

As another example, fighting for the preservation of the ozone layer is a struggle for a public good; should we infer that those who do not join the struggle have no value for having an ozone layer? A much more defensible way to measure value is to simply ask people if they value something and to indicate the strength of their value. When values are clearly in conflict, it is possible to ask people to trade them off and thereby obtain an indication as to how values compare in strength.

If survey studies provide insightful information for inferring what is going on in people heads, why is there so much resistance to them? For example, one frequently hears politicians or reporters saying that they really do not trust polls. Yet, persons who disparage polls cannot avoid making some assumptions about how people think, value, and behave if they are trying to understand or to influence political activity and public policy; therefore they are leaving unsaid, and probably are not examining, the assumptions they do use for making their inferences. They are using even shakier evidence for inferences than the evidence they could draw from polling data. I suspect people disparage polls because they have not examined their own hidden assumptions that guide their personal interpretation of the way the world works.

SKETCH OF A DESIGN FOR A SURVEY STUDY OF STEWARDSHIP OF LAKE ONTARIO

Subjects to be inquired into

1. Beliefs about the Current Condition of the Lake Ontario Ecosystem (LOE)
Do people see a problem with the LOE? If people believe the LOE is splendidly healthy, they may feel no responsibility for stewardship of it.
 - 1.1 Where do they get their information about Lake Ontario?
2. Are they concerned that something should be done to restore the integrity of the LOE? (assuming they see a problem)
 - 2.1 Do they hold the government responsible?
 - 2.2 Do they hold themselves responsible?
 - 2.3 Are they aware of opportunities to do something, be a steward?
3. (If they feel a responsibility) What are they doing to fulfill their responsibility? How often?
4. Do they see ordinary behaviors, such as consumption levels, waste disposal, energy consumption, land use activities, etc., as part of their responsible stewardship? Do they see the connections to ecosystem integrity?
5. The general importance (value) people assign to the Great Lakes (specifically Lake Ontario). What is the strength of this value compared to other things people value?
6. The various ways people actually use the Lake; & their frequency of use.
7. What value do they place on their various uses?
8. Do they feel that they are at risk (& how great a risk?) from: drinking the water, swimming in it, eating fish from it?

9. Are they aware of such global biospheric problems as global warming, loss of the ozone layer, acid rain, deforestation, etc.? Do they see any connections between these problems and the quality of the LOE?
10. How extensive is their knowledge of lakes ecosystemic processes?
11. Willingness of people to devote money, time, and political support (including taxes and higher prices) to improving the condition of the Great Lakes and the global Biosphere.
12. Willingness of people to sacrifice sovereignty and local autonomy so as to develop better structures for coordination and governance to restore and protect large ecosystems.
13. Leadership respondents should be asked how they believe the public would answer key questions. (Misapprehension by officials of the public's knowledge, concern, willingness to sacrifice and support is a significant barrier to effective policy making.)

Sample Design

We should target to get completed replies from 1,000 public respondents on each side of the border (i.e. 1,000 in Ontario and 1,000 in New York) who live in the basin. In addition we should sample leaders, on each side of the border, in three categories: business leaders, environmental leaders, and public officials (elected and appointed, and at various levels of government). Completed replies from 200 business and 200 environmental leaders in each country should be sufficient. The public official category should be elaborated to: 100 appointed local, 100 elected local, 100 appointed county, 100 elected county, 100 appointed state/provincial, 100 elected state/provincial (600 total) in each country. The total projected sample size would be 4,000.

Costs (very rough estimate)

1. Designing and drawing the sample	\$4,000
2. Designing and pretesting the questionnaire	8,000
3. Mailing the questionnaire (labor & postage) to 7,000 potential respondents (30% to 50% will not reply); using at least two reminder mailings.	50,000
4. Labor for receiving and coding responses	10,000
5. Computer time	3,000
6 Salary of chief researcher/data analyst	50,000
Grand total	125,000

Overhead (Institutional costs) ?

**An Indicator of Responsible Stewardship:
Ecosystem Effects from Manufacturing
in the Lake Ontario Basin**

- Preliminary Draft -

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*Prepared for the Lake Ontario Stewardship Indicator Subcommittee
of the Bi-National Ecosystems Objectives Work Group.*

EXECUTIVE SUMMARY

Nature of the Indicator

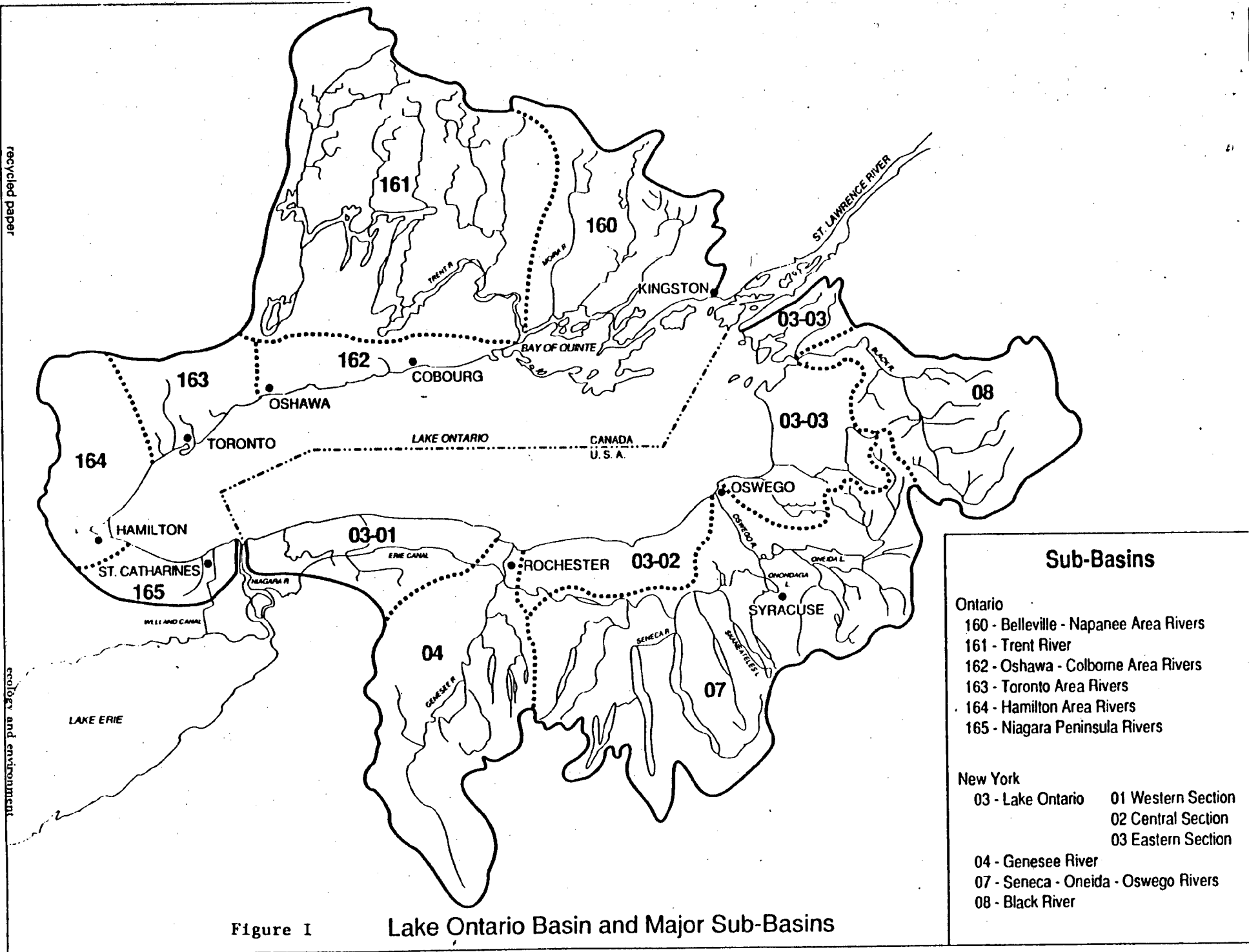
Students of the environment have long noted that the combination of too many people and intense economic activity degrades ecosystems. This indicator was developed in order to quantify this effect with regard to manufacturing activity, and to illustrate the need for less destructive, "greener" manufacturing.

Most, though certainly not all, toxicants get into Lake Ontario and its drainage Basin (Figure 1) via their use in manufacturing. This manufacturing is located primarily within the Basin. Toxicants leak into the environment, not only from manufacturing processes but from use, disposal and breakdown of some of the products manufactured. Most effects from toxic leakage become evident decades or longer after manufacturing takes place. These past leakages continue to cause serious ecosystem impacts in and around the Lake.

Currently, curbs on toxicant leakages are not sufficient to stop ecosystem degradation. One major reason is the typical inability to legally justify limitations on particular toxicant sources. A common argument against limiting these sources is that environmental measurements of both the leakages and their linkages to effects are not reliable enough. The uncertain evidence, it is said, fails to justify the costs of pollution control and environmental remediation. It is true that extensive chemical analyses are so costly that measurements are seldom made with useful precision over an entire lake basin the size of Ontario. Experience indicates that simply refining these measurement strategies can make them only incrementally more effective in legal frameworks. Yet, more convincing, cost-effective linkages between chemical sources and ecosystem effects are clearly necessary. Only such compelling linkages will spur and guide remediation efforts, as well as efforts to improve industrial and personal stewardship.

This indicator benefits from relatively reliable economic statistics gathered regularly and consistently over the entire Basin but specific to individual counties. The indicator indexes the intensity of toxicant usage in manufacturing within each of the 12 watersheds comprising the Lake Ontario Basin. These toxicants represent "potential" pollution which may leak into the environment in many places in many ways. However or wherever the leakage, issues of stewardship arise: How are we valuing the earth which sustains all life, including all future life?

The indicator's geographic scope is the Lake Ontario Basin (Figure 1). This is an appropriate region to consider, recognizing that some manufactures containing toxicants are marketed outside the Basin, and some toxicants enter the Basin via products manufactured elsewhere and via other sources. Industries such as transportation and



Sub-Basins

Ontario

- 160 - Belleville - Napanee Area Rivers
- 161 - Trent River
- 162 - Oshawa - Colborne Area Rivers
- 163 - Toronto Area Rivers
- 164 - Hamilton Area Rivers
- 165 - Niagara Peninsula Rivers

New York

- 03 - Lake Ontario
- 01 - Western Section
- 02 - Central Section
- 03 - Eastern Section
- 04 - Genesee River
- 07 - Seneca - Oneida - Oswego Rivers
- 08 - Black River

service also contribute large quantities of toxicants. These will be incorporated later into an improved indicator of industrial effects.

Illustration of the Indicator

The indicator quantifies a general relation that is well understood:

$$\text{Ecosystem Toxic Effects} = \text{function of (Population Density, Manufacturing Activity, and Intensity of Toxicant Usage in Manufacturing).}$$

Manufacturing activity is measured as dollar "value added" during the manufacturing process. "Value added" is a conventional economic statistic. It documents the value of goods manufactured, discounting the costs of materials and supplies, fuel and electricity, and net changes in inventory. This indicator considers only the value added to toxic chemicals entering manufacturing processes. Manufacturing value added is adjusted here to account for its toxic polluting potential.

Manufacturing activities vary greatly in their use of toxicants. The intensity of toxicant usage by different industries has been quantified by Statistics Canada. The indicator incorporates this information. Within each county this adjusted value added is totalled, then summed over the counties within each watershed. (See indicator equation in text.) The resulting values are indicators of toxic potential from manufacturing, expressed in units of U.S. 1986 \$ (000,000).

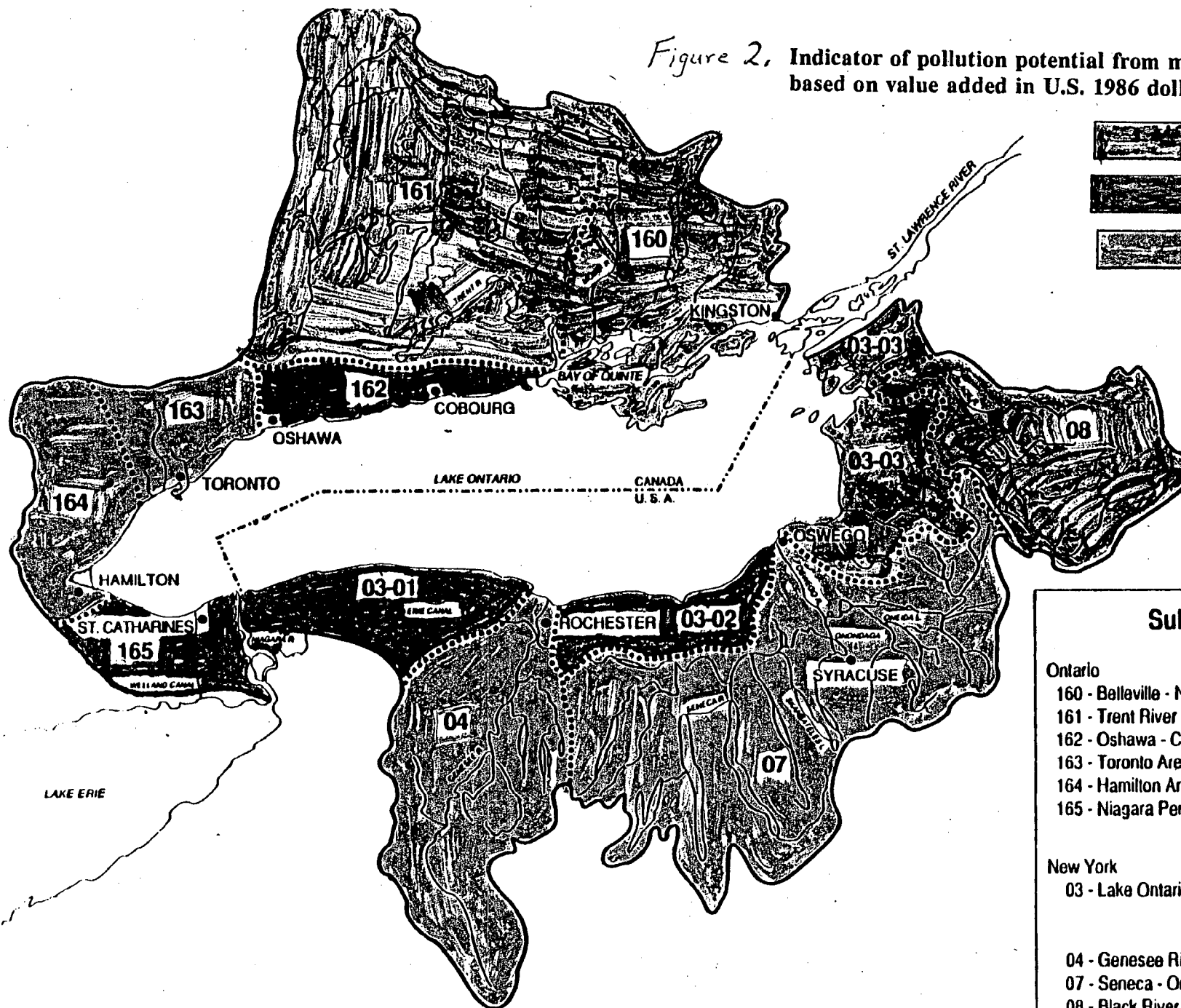
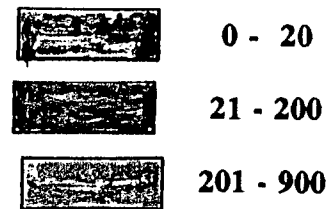
Human population, per se, is not used to calculate the indicator. However, the distribution of population within counties that are only partially within the Basin helps determine the county's value added within the Basin. Population density is, of course, an important cause of toxic pollution. However, population is so closely correlated with manufacturing activity (see text) that population would be a redundant variable for the indicator.

Limitations of the Indicator

The preliminary indicator does not include economic activities other than manufacturing that release toxicants to the environment. This will be amended in future versions.

The preliminary indicator characterizes industrial activity only for 1986. Temporal perspectives are necessary, and future versions will cover at least 1970 through 1986.

Figure 2. Indicator of pollution potential from manufacturing, based on value added in U.S. 1986 dollars:



Sub-Basins

Ontario

- 160 - Belleville - Napanee Area Rivers
- 161 - Trent River
- 162 - Oshawa - Colborne Area Rivers
- 163 - Toronto Area Rivers
- 164 - Hamilton Area Rivers
- 165 - Niagara Peninsula Rivers

New York

- 03 - Lake Ontario
 - 01 Western Section
 - 02 Central Section
 - 03 Eastern Section
- 04 - Genesee River
- 07 - Seneca - Oneida - Oswego Rivers
- 08 - Black River

Lake Ontario Basin and Major Sub-Basins

The indicator, by its definition, addresses only toxicant loadings and impacts. Habitat degradation and other atoxic impacts must be addressed by other indicators.

The indicator addresses impacts in broad terms -- toxic impacts in all media, and some impacts primarily outside the Basin (e.g., chlorofluorocarbon impacts on the atmosphere). Airborne toxicant loads on the Basin from outside the Basin are not embraced (NO_x, etc. and acid rain).

Interpretation

The intensity of manufacturing which has potential toxic effects is illustrated in Figure 2. As expected, toxicants are most used in and around the largest cities. The relatively rural watersheds such as the Trent and Black Rivers use the least toxic material in manufacturing. In contrast, highly industrialized watersheds like the Toronto area and Genesee Rivers use about 200 times as much toxic material as the green watersheds (Figure 2). The Figure also indicates that the largest toxic loads carried by surface waters from manufacturing to the Lake, per se, might be expected to reach poorly flushed areas like Hamilton and Totonto Harbors, and the mouths of the Genesee and Oswego Rivers. These plausible expectations are considered more carefully in the text.

Socially acceptable limits on the amount of toxicants used in manufacturing are determined primarily by perceived consequences, generally long after the manufacturing has taken place. In many cases the presence of toxicants has raised concerns about the health of manufacturing workers. Other concerns that need to be addressed include air pollution, congestion, and toxic effects on aquatic organisms. Past debates over acceptability of these consequences have been crippled by the lack of a common language that protagonists accept. The Lake community needs a common language to reach consensus on limits for these kinds of activities. Indicators of stewardship are one promising contribution to such a common language, a language that helps the community agree on what we want the ecosystem to be, including upper limits on toxic impacts. The aim is to sustain economic activities that are consistent with responsible stewardship, to sustain value added without further degrading the ecosystem.

However, there are no socially agreed limits on how much toxic chemicals are used in manufacturing. Based upon the evident effects (see text), many would say that the toxic indicator of \$ 200,000,000 value added per year in a watershed is excessive. This might be considered an indicator endpoint, only below which is stewardship responsible. This sort of endpoint deserves wide and full discussion. Before seriously considering such limits, one must include the value added by non-manufacturing industries -- especially transportation, services and agriculture.

The indicator is also an inexpensive means of estimating toxicant loadings from any particular array of industrial activities. Limited direct, chemical measurements, guided

by the indicator, may be the most cost-effective way to rigorously document toxicant loadings and fates -- now, in the past, and in the future.

TEXT

[Full text and supporting documentation are in preparation - only bits of text are below.]

The indicator of manufacturing-induced toxicant effects is:

$$\sum p_i \sum V_{ij} \times R_j$$

where: V_{ij} = total manufacturing value added in the i 'th county and j 'th manufacturing category

R_j = coefficient proportional to toxic inputs to the j 'th manufacturing category

p = proportion of population in the i 'th county which resides within the Lake Ontario Basin.

The indicator uses routinely compiled value added statistics for manufacturing, adjusted for amounts of toxicants used in various manufacturing processes, to indicate the pollution potential of industries within each watershed of the L. Ontario Basin.

The coefficients R_j are determined for each (j 'th) industrial category (2-digit SIC category). Magnitudes of the coefficients are dictated by the quantity of toxicant inputs used by the manufacturing categories. Since most kinds of manufacturing uses very little toxic material, R_j is generally very small. These coefficients are derived from the useful Table, Industry Impact Classification, 1984 (Table 3.1.1.2) in Statistics Canada's "Human Activity and the Environment 1991." R values are directly proportional to "Potential Contaminant Inputs" in this Statistics Canada table, and are scaled for our purposes to range from .00017 to 1.0 (see Appendix).