Measuring Sustainable Development Workshop

Niagara-on-the-Lake, Ontario
November 15,16,&17,1995

Prepared for:
Environment Canada, Ontario Region

By:
The Great Lakes Pollution Prevention Centre

Contents

Executive Summary

On November 15,16,and17, 1995, in Niagara-on-the-Lake, the Great Lakes Corporate Affairs Office and the Environmental Adaptition Research Group of Environment Canada hosted a workshop for a small interdisciplinary group of 28 participants to discuss the theoretical basis needed to develop a strategic framework for regional program delivery, targeting, and evaluation within the context of Sustainability in the Great Lakes Basin Ecosystem. Participants of the workshop were asked to develop a ' draft list' of indicators for the Great Lakes basin that should be observed, measured, and kept track of in order to measure success in attaining sustainable development objectives.

Workgroup Sessions:

1. Self-Organizing Systems & Sustainability
2. Environmental Stress and Encouraging Sustainable Economic Growth
3. First Principles of Sustainability: Moving Beyond Science and Policy
4. Available Data Sets and Decision Support Systems

Conclusion

The workshop was convened to address the need for a process frame work and development of a context for targets that have been set in specific basin-wide programs related to the restoration of degraded areas, the prevention and control of pollution and ecosystem health. At present, it is impossible to conclude whether or not these targets are enhancing sustainability in the Great Lakes Basin. The task proved to be very difficult to accomplish in two days, and since that time some participants have been involved in projects that would have been appropriate precursors to the workshop.

However, we have an opportunity to extend the workshop discussion through the use of the Internet. A listserver is being set up by Environment Canada for our needs. This will only be available to participants at the workshop, and you must subscribe to the service (there are no fees). If you subscribe, you will receive the comments that other participants write, and your comments will automatically be distributed to the other subscribers.

The goal of the listserver is to resolve some of the philosophical and scientific difficulties that emerged during the workshop, complete the framework, and eventually develop a set of indicators that can be used by Environment Canada to monitor progress towards sustainability in the Great Lakes Basin. We would invite all participants to subscribe to this service. Depending on the use and the level of discussion, we will have the option of setting up a web site during the summer.

Purpose

The purpose of the workshop was to bring together a small interdisciplinary group for discussions to develop the basis for a strategic framework for regional program delivery, targeting, and evaluation within the context of Sustainability in the Great Lakes Basin Ecosystem. In addition, participants of the workshop were to develop a ' draft list' of indicators for the Great Lakes basin that should be observed, measured, and kept track of in order to measure success in attaining sustainable development objectives.

Background

With the advent of the concept of sustainable development, and with environmental issues in general, there has been a lot of activity with regard to indicators of health and Sustainability. At the present time, the discussion and development of such indicators is midstream. The International Joint Commission Council of Great Lakes Research Managers have proposed biological indicators such as lake trout. The Great Lakes Information, Tracking and Reporting system(GLITR) monitors progress on 50 specific commitments in the Canada-Ontario Agreement on the Great Lakes Ecosystem (COA), and recently, the Lake Superior Binational Program have developed 20 indicators and targets for the Lake Superior Basin, and there are other projects in British Columbia and Ontario that have similar objectives.

Many of the indicator sets developed so far are environmental or biological in nature and provide no information on economic activity, and no indication of whether the program implications for the economy and the environment point in the same direction.

Environmental changes have emerge rapidly with little or no prior warning and many of the problems have been due to a failure to adequately account for the impacts and costs of land-use change, pollution, resource depletion, and ecological destruction. In the Great Lakes basin, global and the continental changes brought about by acid rain and the long-range transport of hazardous air particles, have interacted with regional stresses such as photochemical smog, and point source and non-point source water pollution. In addition, regional changes in land surface properties have resulted in soil degradation and an increase in runoff that may be equally grave threats to the basin-wide ecosystem.

Sustainable development represents a philosophy of management in which economic development takes place within the limits of the natural environment through the integration of environmental effects into economic planning. Both the federal and provincial governments acknowledge the need for sustainable development in light of the costs involved in restoring degraded ecosystems and the long-term, possibly irreversible damage due to land-use change and pollution. The goals of Environment Canada's sustainable development programs in the Great Lakes Basin Ecosystem are reflected in several intergovernmental agreements including the Canada-Ontario Agreement (COA) and the Canada-U.S. Great Lakes Water Quality Agreement (GLWQA).

COA recognized the need for collaborative agreements to protect the Great Lakes Basin Ecosystem through pollution prevention and the maintenance of ecosystem health. Under the umbrella of COA, programs are designed to achieve the following three objectives: restore degraded areas, prevent and control pollution, and conserve and protect human and ecosystem health. To restore degraded areas, the Remedial Action Plan (RAP) program has targeted 17 areas of concern for restoration over the next 20 years. Programs to prevent and control pollution are based on the zero discharge philosophy with a target of virtual elimination of persistent, biocumulative, and toxic substances from the Great Lakes Basin ecosystem.

The protection of human and ecosystem health includes the following components: the implementation of Lakewide Management Plans and the Great Lakes Wetlands Conservation Action Plan; the creation of biodiversity policies for fish and wildlife; a 30 percent reduction in human health risks by 2000; the identification and development of adaptation strategies for climatic impacts; improvements to land and water use management through ecosystem-based planning processes, environmental farm plans to reduce non-point source pollution, and water efficiency initiatives. In all, there are 50 specific commitments that fall under COA. Environmental concerns are also addressed within a wide rage of federal, provincial, regional and municipal legislation including the Canadian Environmental Assessment Act, the Energy Efficiency Act (Ontario), the new Municipal Planning Act of 1995 (Ontario), the Conservation and Development of Wildlife Act (Quebec) and regional watershed plans.

The measurement of progress towards the COA commitments is based solely on a large set of ecological indicators (GLITR), revealing little about the direction of human activity and economic growth. For example, municipal planning in Southern Ontario is based on the assumption of almost a doubling of the population and economic activity over the next thirty years. At present there are no assessments of the environmental impact s of this assumption, nor is there any visible consideration of sustainabilty. In addition, there are other policy issues of concern such as accountability of privatized water and wastewater ownership, and the ability to maintain water quality standards at reasonable prices. Similarly, economic indicators do not show whether economic growth is occurring within current environmental limits or contributing to environmental degradation.

There have been no attempts to capture the broad trends in human activity and relate them to environmental conditions in the basins, such an attempt being the minimum required to place Great Lakes management within a sustainable development framework. This disintegration often leads to a view that Sustainability must always be achieved at the expense of economic development. To move away from this view requires a strategic framework to guide the development of economic and ecological indicators, such that an indication of economic growth also indicates progress towards the sustainable development objectives for the basin. In addition, a restricted set of indicators, based on existing observations would facilitate program evaluation. Such a framework would provide managers with the information needed to assess and if necessary rectify programs accordingly.

The development of a framework to measure progress towards sustainable development in the Great Lakes Basin Ecosystem encompasses many diverse areas of research and is therefore a multidisciplinary, indeed a transdisciplinary, effort. The framework must have a firm theoretical basis, but it must also readily link up with monitoring and surveillance capabilities. It must be applicable to decision making methods, which implies the integration of different data sources and the quatification or elucidation of the associated uncertainty. The development of such a framework will be based on the new view of ecosystems that recognizes the complex interactions between various subsystems and the unexpected manner in which an ecosystem may evolve under stress.

Measuring Sustainable Development Workshop
November 15,16,&17
Agenda

Wednesday, November 15

7:00 pm **Introductory Remarks:**
Brad Bass, Environmental Adaptation Research Group, Atmospheric Environment Service; and Tom Muir, Citizenship, Assessment and Economics Division GLCA, Environment Canada, Ontario Region.

7:15 **Introduction to the Great Lakes Basin:** *Ron Shimizu, Environment Canada*

7:45 **Embracing Uncertainty:**
Silvio Funtowicz *of the European Commission Joint Research Centre, Institute for Systems Engineering and Informatics.*

Reception

Thursday, November 16

08:30 am **Introduction** - *Tom Muir and Brad Bass*

08:50 **Roundtable Participant Introductions** - *Stewart Forbes (GLPPC)*

09:30 **Perspectives on Sustainablity**
The Ecosystem Approach: *James Kay, Faculty of Environmental Studies, University of Waterloo.*

10:30 **BREAK**

10:50 **Ethics:** ***Laura Westra, Department of Philosophy, University of Windsor***

11:15 **Ecological Economics:** ***Philippe Crabbe', University of Ottawa Institute for Research on Environment and Economy.***

11:40 **Urban Sustainability:** ***Virginia Maclaren, Department of Geography, University of Toronto.***

12:30 am **LUNCH**

01:30 pm **Working Groups - Session I** -Perspectives
Self-organizing Systems & Sustainability (Stewart Forbes)
Environmental Stress and Encouraging Sustainable Economic Growth (Karrin Broadhurst)
First Principles of Sustainability: Moving Beyond Science & Policy (Bruce Nilsson)
Available Data Sets and Decision Support Systems (Marianne Lines)

03:15 **BREAK**

03:30 **Plenary Session I - Work Group Reports**

7:00 p.m. **Dinner Speaker:** ***Tim Allen, Department of Botany, University of Wisconsin***

Friday, November 17

08:30 am **Plenary Session II** - Discussion of Indicators

12:00 LUNCH

1:00 pm **Outcomes** - *Brad Bass and Tom Muir*

Introductory Presentations

Ron Shimizu of Environment Canada provided a brief synopsis of the Great Lakes Basin, and a conceptual stage for participants of the workshop.

The Great Lakes Basin contains 20 percent of the world's fresh surface water, a commodity that will have increasing economic value. Approximately 7 million people, with diverse lifestyles and perspectives live in the region. Populations are most dense in the southern half of the province, and these areas also hold the greatest commerce and political weight. General land use patterns include dense pockets of population between areas of extremely productive farmland. The basin is one of the most studied and best documented bioregions in the world, but the knowledge base on the region is still spotty (we still do not know very much).

There are a number of issues with regard to achieving Sustainability that must be understood. The first is that governments really have little control over society as compared to the forces of capital, production, and markets; and if Sustainability is to be achieved it will be necessary to have a global, collective action. Competition to solve environmental problems, for example best technology and lowest waste-efficiency to reduce expenses and increase profit, is interesting but insufficient. It does not solve the problems of dislocation and inequity. We are currently very good at adapting to technological change but we ignore the human dislocation that occurs because of it. The last innovation of the social system was unemployment insurance and some retraining programs with low success rates. Social issues arise out of efforts to help the environment; the virtual elimination of toxins should not be paid for by worker job loss.

The larger issue that must be dealt with is 'Who benefits? and Who pays?' The present methods of dealing with this issue have resulted in an increasing gap between the rich and the poor as seen in more lower paid and part-time workers, and in more violence and family breakdown. Sustainability must include all these social factors and because they are value-based, so must the indicators which monitor them. Faith Popcorn maintains that we are in a 'save our society' mode. Children and adults understand the environmental dilemma they are locked-in, and are desperate to do something environmentally sound that gives them a sense of regained control. The lesson for pursuing Sustainability is not to overlook the common place. We must not let the vision of Sustainability be subsumed by the existing paradigm of investment, production, and consumption.

Mike Goffin, of Environment Canada, spoke briefly on possible uses of Sustainability indicators developed at the workshop.

Within the Great Lakes Basin seven federal departments as well as the provincial governments are partnered to achieve 55 environmental targets by the year 2000. Three

general categories are covered: clean-up, pollution prevention, and conservation. The targets are very specific, but what is lacking is context. It is not known whether the pursuance of these targets is moving the basin toward Sustainability. Indicators could be used to provide the required context and measure the relevance and progress toward Sustainability for specific targets.

Silvio Funtowicz, of the European Commission Joint Research Centre, Institute for systems Engineering and Informatics (Italy), spoke on ' Embracing Uncertainty'.

The speaker began by saying that he has a sense of deja vu in attending a meeting for indicator development, since he has done so many times. This fact seems to show that the indicators that we have are not the ones that we need, and that what we can do is somehow not what we expect. Quantitative indicators are not a new concept. Even statistics really means "theory of state". What is assumed is that a number or a group of numbers can provide a correct picture of the state of the nation, and of people's lives. This has perpetuated the search for new and better indicators.

What is needed is a newer approach that includes different perspectives. This is still a task for scientists but it is complemented and adjusted by people who represent other views. This approach is one way to define complexity, ie. a plurality of legitimate perspectives which cannot be reduced one to the other; to only a scientific, or only a theological perspective. All the perspectives must be put together to define a shared space. This is a new idea in Western civilization.

Five hundred years ago, it was somehow collectively decided that if science found the "right" facts, expressed quantitatively, then the correct policy actions would necessarily follow. Truth = Good. What is Truth? ....that which is obtained through pure reason. They thought that values, emotions, passion, and whims create uncertainty. Therefore, we could only pursue truth by separating ourselves from the problematique. The goal of modern science has thus been the elimination of uncertainty which is necessary for correct policy ....and in this way science influences the legitimacy of policy action.

The problem with this is revealed in issues such as climate change. Here, the facts are uncertain, values are in dispute, stakes are high, and decisions urgent. Under the previous mentioned paradigm, facts are facts, scientist should be neutral, and all that would be required is enough time and research money to solve the problem and have the experts advise society on the correct policy. So clearly traditional modern science is not applicable here.

The case of the decommissioning of the Brent Spar oil rig is another demonstration where the mythology of modern science did not operate. The best scientific advice was to sink it

on the spot. But the principle of 'we should not dump toxic substances into the sea' was raised by Greenpeace and others, and supported by public and government opinion - the principle won!

Where uncertainty exists, as in these two cases, it breaks the relation between truth and good, and the basis of conventional decision making falls apart. Uncertainty breaks legitimacy and trust.

The concept of risk and shelter from risk is very important to modern society. Risk is exorcised by experts and science-based technology by quantifying it which provides some sense of security and control over danger. Yet trust in experts in now collapsing.

Observation of these changes, led Funtowicz and Ravets to develop the notion of Post-Normal Science and its relation to traditional modes of science. Types of science are classified as to the degree of uncertainty on one axis and decision stakes on the other. Applied Science is appropriate when uncertainty and decision stakes are low. Professional Consultancy uses applied science but adds something more - judgement and values. In Post-Normal Science it is not enough to use expert judgement, a plurality of perspectives are required due to the high stakes and high uncertainty.

We are not prepared for uncertainty-we do not even have a language with which to describe it adequately. Probability, statistics, fuzzy sets even numerical systems and logic all deal with certainty. To communicate uncertainty, however, is difficult because it is impossible to provide a simple number without a book of explanation of its history and context. It is even possible to show that physical constants are not constant but have a history and therefore bias. 'We have been trying to make the social sciences like physics, but in reality physics is more like history.'

There are also different levels and types or source of uncertainty: technical, methodological, and epistemological. The last includes the possibility that we may be totally wrong!

A language for describing uncertainty is necessary to communicate among scientists (transdisciplinary) and to the public. To this end, Funtowicz and Ravetz have developed "NUSAP".

Numerical	arithmetic
Unit multiplier	base of operations
Spread	inexactness
Assessment	unreliability
Pedigree	border to ignorance

The characteristics are listed in order of quantitative to increasingly qualitative. 'border to ignorance' implies that we should make explicit what we do know, so that it is clear what we do not know. 'Pedigree' emphasize that a quantity is as good as its production process. There is no meaning outside of this. A record of its history allows one to judge, get a feeling of its quality.

The following table provides an example of how pedigree may be measured.

THEORY	DATA	PEER ACCEPTANCE	COLLEAGUE CONSENSUS
Established	Experiment	Total	all but cranks
Theoretical model	History/field data	High	all but rebels
Computational model	Calculated data	medium	competing schools
State process	Educated guess	low	embryonic field
Definitions	Uneducated guess	none	no opinion

We must live with uncertainty. The model of decision making in present society is based on the achievement of truth - it is fast collapsing for many reasons but primarily because its success in reductionism and objectivity introduced uncertainty. Our task is to simplify complexity, but in such a way as to keep the whole and keep it reflexive with us inside the system. The traditional way of understanding quantification and indicators, quantitative and short-term, may not be the best one. A more qualitative response to complexity is needed, however this does not eliminate the need for indicators of the traditional sense. What is needed is the normal and Post-Normal sciences related and working in harmony.

Comments made during discussion and question period after talk:

* Post-modern means that anything goes and it is not a stable state;

* human civilizations have risen and fallen many times-what is different now is that this is the first time we have the ability to affect the human condition;

* it is difficult for us to see the institutions that will emerge and are now likely in their embryonic state. For example, in hindsight we know in the 13th century that it was universities and cities that emerged - maybe round tables and focus groups are part of the solution;

* we must devolve problems of the Post-Normal realm to the political and institutional levels for resolution quantitative numbers have value within limitations and there is nothing wrong with building predictive models in constrained context - we must build bridges by using intuition with results to revise conclusions;

* there is a type III error- the target is not there! - perhaps we are constructing the 'truth';

* assessment using quality involves the relation of physical levels of uncertainty to the appropriate level, i.e. the degree of qualitative/quantitative description can be decided by asking the question: How sensitive are the inputs to the options available?- in some cases the exact number may be meaningless.

***James Kay** of the Faculty of Environmental Studies, University of Waterloo spoke on the 'Ecosystem Approach, Ecosystems as Complex Systems, and State of the Environment Reporting'*

A complete transcript of James Kay's presentation is available on request, key points highlighted during the presentation are reproduced here.

The Essentials of an Ecosystem Approach at a Glance

* Living systems are self-organizing. Our challenge is to promote this capability to self-organize, while still procuring what we need from the biosphere.

* Ecosystem analysis is done in the context of nested holons, that is a hierarchically organized system description of the area of study. Careful attention must be given to scale and extent of analysis at each hierarchical level. The behavior of a system (holon) is due to the interactions of its components (also holons) in the contest of the wider system (another holon) it is part of. Focus on one level, or by one discipline, cannot adequately describe these interactions between hierarchical levels and this is crucial for understanding self-organizing entities.

* Both bio-physical and human cultural perspectives must be brought to bear as part of ecosystem analysis. Each of these perspectives will generate a different hierarchical representation of the ecosystem. The challenge is to integrate these perspectives to give an understanding of the whole.

* Ecosystem dynamics are complex, that is they are not deterministic, have a degree of unpredictability, exhibit phases of rapid change and even catastrophic

change. They are continually evolving and going through a birth, growth, death, renewal process at different temporal and spatial scales.

* Understanding ecosystem dynamics requires investigating the spatial, temporal, thermodynamic, information and cultural aspects of living systems.

* Synergistic effects and emergence (and hence surprise) are normal in self-organizing systems.

* The ecosystem approach cannot be about quantitative prediction alone but must also be about qualitative understanding. The ability to predict in many ecological situations, in principle, is quite limited. The best we can expect is a general qualitative sense, based on our knowledge of interconnections and past history. In this context management must be both anticipatory and adaptive.

* Ecosystem management is an oxymoron. It is our interactions with ecosystems which need management.

* The Ecosystem approach is both analytic and synthetic. It involves analysis of living systems by disciplinary science. But understanding comes from synthesizing together the different perspectives gained from disciplinary science.

* Discussions of ecological integrity by necessity involve making value laden judgements and hence involve ethics and politics as well as science.

Issues Related to State of the Environment Reporting Using and Ecosystem Approach

* Identification of User Groups. Who is the report for? What information do they need and in what form? What will they use it for? How often does the information need to be updated?

* Who will do the report? Who will they be responsible to? Will they have access to the necessary skills, data, and other resources?

* How will the geographical area of study be divided up into regions? Some combination of biological, geomorphological, watershed, airshed, political, and socio-economic criteria to define boundaries.

* Assign study teams to each of the ecosystems and to the whole area of study.

* Who are the stakeholders whose input is required for each of the ecosystems and how will they interact with the study team?

* Identify, with the stakeholders, the nested holon structures to be used to define the ecosystems for every region. (Checkland's Soft Systems Methodology can be quite useful in this context.)

* Describe the ecosystems as self-organizing entities and the issues related to maintaining the integrity of the self-organizing processes. (This requires substantial scientific and socio-economic data input and analysis.)

* Synthesize the information together to generate an evaluation of Sustainability in the region.

* Generate the report - which might not be a paper document.

* Follow up with users to determine if the report is useful, what changes could be made and when an update is necessary.

***Laura Westra** of the Department of Philosophy, University of Windsor spoke on: ' An Apology for Ethics; In Defense of Sustainability.'*

In understanding the meaning and function of moral discourse in public policy one may look at Socrates'*Apologia* - his defense. In post-normal science, and ecosystem approaches values are allowed to be introduced, but questions can still be raised. In the business managerial mindset there is a problem with the observer view of morality. Socrates was declared a criminal for encouraging debate, we still see this today, however he did not compromise his moral integrity.

Morality - right and - wrong define endpoint. In rational argument, not a simple counting of heads should determine policy. We need to avoid the amorality of cultural relativism, otherwise we can justify Nazism and slavery. In short, we must reject the post-modernist idea of everything goes.

Manasinghe identifies patterns and causes of unsustainability, and then develops a system of human management. But can we do this? Efforts to inform and co-opt are necessary but not sufficient in today's extreme individualist society. We need a change of direction as we can only go so far with individual rights. We must recognize social good, as well as limits to individual action when it impacts upon others. Environmental racism is an example of 'Tyranny of the Majority.'

Social science offers defensible principles that have respect for all and are universal. It also offers clear and rational arguments for prioritization of principles, however first order principles are not sufficient. Practical application of moral discourse provides two things to risk assessment: cultural relativists (Relativists) and naive positivists (Reductionists). In the Sagoff vs. Daly debate, in Bioscience October 1995, on ecological economics. Sagoff argues for the need of religious and moral issues; and against the need for economics. Sagoff argues against this exclusionary approach and speaks about consumers' vs. citizens' values.
When looking at global ecological integrity we must understand the relationship between the wild, health, and conceptual models of environmental interaction. Sustainable development must maintain the integrity of the wild, manage ecosystems, and ensure equality, biodiversity, and justice by protecting natural function and by preserving core areas. Disturbing and destabilizing life support systems, impacts on human health. Epidemiologists report that we are losing control over disease vectors. Indicators include the number of people not feeling well, car accidents, etc..

Pilippe Crabbe' of the University of Ottawa Institute for Research on Environment and Economy spoke on ' Is Ecological Economics a New Transdisciplinary Field?: A Very Personal View from an Economist.'

A complete transcript of Philippe Crabbe's presentation is available on request, key points noted during his presentation are reproduced here.

The Canadian Society for Ecological Economics has yet to come to agreement on a definition of Ecological Economics, however the Manifesto of Ecological Economics (EE) is contained in a chapter called ' Goals, Agenda, and Policy Recommendation for Ecological Economics' of the book Ecological Economics authored by R. Costanza, H. Daly, and J. Bartholomew (1991). It states that 'Ecological Economics is a new transdiciplinary field of study that addresses the relationships between ecosystems and economic systems in the broadest sense' Ecosystem Approaches currently include humans, but not necessarily economic systems. From a personal view Ecological Economics is eclectic and opportunistic, it is not a systematized science. It caters to methodological developments such as complex systems theory, thermodynamics of dissipative structures, the ecosystem approach, sustainable development, integrity, ecosystem health, community participation and conflict resolution.

Environmental Science, as described by Walter DeGroot's book on environmental science, has lots of overlap with what ecological economics is trying to do. Sustainable Development as a discipline can make a taxonomy of principles, if not a definition. So, how does ecological economics situate itself? This depends on the specific research agenda. Crabbe' sees ecological economics as a passing catalyst in an evolution of neoclassical economics.

What are the specific concepts of Ecological Economics?

1. Physical limits to growth.
2. Dynamic holarchic constraints in time and space and discontinuous system behavior.
3. Natural Capital
4. Life-Support Systems and concern for the long run.
5. Social Capital
6. Common Property
7. Societal Framework for policy instruments and institutional concern for the long-run.
8. Second order science
9. Polluter pays including for uncertainty (reversal of burden of proof)

Ecological Economics will be able to make a lasting contribution if it can change the societal ethic from self-interest to an ethic of stewardship or partnership in nature and is able to implement the change through institutional reforms. Transdiscipliarity is simply a means non-specific to E.E. towards that end. This approach was tried once before with general systems theory but never quite succeeded. It has now a new lease on life with complex system theory. It may have a more lasting influence if it can tackle the ethical roots of our environmental crisis.

***Virginia MacLaren** of the Department of Geography, University of Toronto spoke on 'Urban Sustainability'*

Urban Sustainability indicators are 'bellwether tests of Sustainability and reflect something basic and fundamental to the long term economic, social or environmental health of a community over generations.' (Sustainable Seattle 1993)

Key aspects of indicators must be that they are integrative and forward looking. To be forward looking a combination of trend, predictive, and conditional indicators must be used that address social and geographical distributional effects. Indicators should be stakeholder driven. An example of conditional indicators is found in British Columbia's housing indicators that present conditions stemming from development.

Important Steps in Development of Urban Sustainability Reports

1. Define Urban Sustainability Goals
2. Identify Number of Indicators
3. Choose Indicator Selection Criteria
4. Identify Potential Indicators
5. Evaluate Indicators
6. Report Preparation and Presentation

Indicator Selection Criteria

1. Scientifically Valid
2. Representative
3. Responsive
4. Relevant
5. Accurate and Accessible Data
6. Historical Record
7. Understandable
8. Attractive to the Media
9. Unambiguous

Framework Typologies	
Domain-Based	Environment Economy Society
Goal-Based	Carrying Capacity Basic Human Needs Social Well-Being Economic Prosperity
Sectoral	Housing Welfare Recreation Transportation
Issue-Based	Urban Sprawl Solid Waste Management Crime and Safety Job Creation Industrial Pollution
Causal	Conditions: Air Quality Stresses: Automobile Use Responses: Traffic Demand Management

Discussion following Virginia MacLearns presentation:

* The use of indicators are only in the first generation, so far there have been only a few examples.

* We need more research in creating buy-in and how to influence the decision-making process.

* In relation to the idea of Industrial metabolism, several people commented that there are not very good records at present, and there are questions regarding the important aspects of waste that need to be kept track of.

* Current research is drawn from looking at existing development; we have not yet begun to look at new development.

* The issue of accountability in the use of indicators was raised, and it was noted that experience with institutionalizing the indicator process - as with the Sustainability Seattle Report- was not found to be really valid for city planners.

* It is necessary to have a framework for analysis within to place indicators.

Work Group Sessions

Participants of the workshop were divided into four separate working groups to discuss perspectives on one of the following issues:

1. Self-organizing Systems & Sustainability
2. Environmental Stress and Encouraging Sustainable Economic Growth
3. First Principles of Sustainability: Moving beyond Science & Policy
4. Available Data Sets and Decision Support Systems

Assignment of participants to the working groups was based on area of expertise and the issue to be discussed.

Work Group 1.

Self-Organizing Systems & Sustainability

Participants

George Francis
Roger Hansell
James Kay
Tim Allen
Orie Loucks
Jan Barica
Sally Lerner
Stewart Forbes - *Facilitator*
Anastasia Svirejeva-Hopkins - *Reporter*

Objective
To identify the theoretical concepts that define Sustainability, and to identify potential indicators to measure progress towards Sustainability in the Great Lakes Basin.

Focus Questions:

1. What are the theoretical concepts that define and measure Sustainability?
2. What are the processes in the Great Lakes basin that are crucial to 'Sustainability.'
3. Derive Indicators or measures of progress towards Sustainability.

1. What are the theoretical concepts that define and measure Sustainability?

* Potential for adaption and resilience
* Transients lead to new self organizing systems
* Rapid temporal gradients lead to property changes
* Must look beyond physical organization
* Self organization require feedback
* Need to know when the system will break down
* Hierarchy must exist
* Boundary conditions influence the system must be monitored
* NAFTA changes context
* Complexity - technical, natural, societal, economic. No control on societal processes
* Evolution and adaption to disturbance

Some of the complex systems to consider:

1. Nested living systems
2. Macro mass balance
3. Cup and Ball
4. Holling's four-box model or figure 8

2. What are the Processes in the Great Lakes basin that are crucial to "Sustainability"

* Pathways need to be defined
* Sustainability of life in a defined way (apply at all levels).
* Rate dependent interdependence
* Sustainability curves

Also:

* Indicators should change societal processes
* Beliefs and values, rule systems, societal economics
* Natural Capital to drive decisions
* Degree of variability / Homeostacious in trouble.
* Indicators have to monitor the differential which stimulate change.
* Theory of governance that act on economy and environment

3. Derived Indicators or measures of progress towards "Sustainability":

Concepts used in developing indicators:

* Do not have to be quantitative
* Should influence societal processes
* Influence beliefs and values / rules / socio-economics
* Measure natural capital
* Beyond basin forces
* Past history
* Nested systems
* Management of human use in flexible manner

Indicators:

1. Social Justice

2. Consumption related to assimilative capacity - closed loop systems, integrate social and resources, population.

   Need :Information, material - self contained and exergy - rate of use in balance i.e. Consumer product reuse, integration of society and resource values., relate efficiency and adaptability

3. Rate of decoupling work and welfare i.e. hours working to maintain welfare

4. Institutional measures - degree of alienation

5. Societal Denial (Degree of paranoia)

6. Ecological Footprint - urban sprawl, radiation measurements, transport

7. Environmental Measures - climate change, water levels, local issues

8. Corporate Environmental Performance

Features of Early Warning
Monitor amplitude and periodicity and variance of key measures

Aggregation
Derive a method to aggregate indicators into a "Sustainability Index" Use Green GDP as a start, find its limitations then refine from experience. Population role is critical.

Systems for Sustainability Indicators:

* Modular systems not matrix
* Must be hierarchial
* Loose coupling
* Counter balance efficiency vs. adaptability

Work Group 2

Environmental Stress and Encouraging Sustainable Economic Growth

Participants

Murray Brooksbank
Linda Mortsch
Virginia MacLaren
Philippe Crabbe'
Ted Cowan
Robert Gale
Dale Rothman (Reporter)
Karrin Broadhurst (Facilitator)

Objective

To identify major economic trends and variables that have an environmental impact in the Great Lakes and to define indicators that could be used to link the key trends and the environment.

Focus Questions:

1. What are the major economic trends and variables that have environmental impact in the Great Lakes basin?

2. Define indicators that link the key trends and the environment.

Major Economic Trends:

* ***Institutional Failures***
  - decentralization/devolution
  - authority and money is moving to the local level

* ***Economic Restructuring (Ethical Positives)***
  - telecommunications
  - increasing share of service industries
  - clean production
  - development
  - production efficiency in agriculture and industry
  - environment a source of latent demand looking for a market

* ***Major Ecosystem Restructuring and Stress***
  - more irrigation
  - investment differential - public Vs. private transit
  - current impact of non-neutral economic subsidies
  - no rests on water, aggregates, waste and inefficient cities
  - open access resources
  - flow input/output - types of matter and energy
  - historical impact of forestland clearing

* ***Urbanization***
  - telecommuting
  - industrial land redevelopment
  - new housing developments - infill developments
  - intensification of land use
  - infrastructure
  - transportation

* ***Culture of Material Growth***
  - number of hours worked a week
  - demand for consumer products - cars
  - GDP, GNP
  - belief that economic growth should not be held up because of scientific uncertainty
  - belief in undifferentiated growth

* ***Spatial Scale***
  - globalization

* **Technological Change**

Indicators Linking Economic Trends and the Environment

* ***Population and Land Use***
  - urban land growth
  - conversion of non-developed land to other uses
  - population
  - urban density

* ***De-Materialization***
  - per capita expenditures on non-food/shelter
  - ecological foot print
  - volume of matter and energy; through-put/population
  - books, music, theater as percent of GDP

* ***Maintenance of Natural Capital***
  - air , water, and land quality
  - institutional stability
  - park and reserve growth
  - inventories/ inputs
  - use of renewable resources-sustainable yield
  - maintenance spending as a percentage of GNP
  - indicators of ecological tax and fiscal reform
  - internalization of costs - full costs accounting
  - resource rents paid
  - adaptation rate of environmental technology
  - material & energy efficiencies
  - environmental prosecutions
  - number of environmental conflicts in courts

* ***Cars***
  - fuel tax collected
  - net volume
  - ticket sales for GO, VIA, and Greyhound
  - modial split
  - number of trips/miles by car
  - car sales, new and used
  - cumulative distances traveled
  - gasoline use

* ***Waste Per Capita***
  - Waste residual reduction
  - landfills/population
  - production efficiencies

* ***Hazardous Products***
  - chlorine use
  - demand for environmentally harmful/problematic products
  - pesticide and fertilizer sales

* ***Index of Ecosystem Health***
  - number of species lost
  - mortality and morbidity indicators
  - health indicators for plants, wildlife, and communities

* ***Social Economy***
  - income of environmental charities
  - number of self sustaining community environmental groups

Work Group 3

First Principles of Sustainability: Moving Beyond Science & Policy

Participants

Laura Westra
Miriam Wyman
Dennis O'Hara
Rick Peters
Bruce Nilsson- Facilitator
Richard Martell- Reporter

Objective: To identify ethical or philosophical concepts and principles that are key to achieving Sustainability and could be used in developing a framework or list of indicators for Sustainability.

Focus Questions:

1. Think about different religious, philosophical, and cultural definitions of the first principles of sustainable development. List what you think are the first principles that are common to all of these approaches.

2. Because we cannot measure principles, what concrete actions must be taken to give effect to these principles?

3. What measures, concepts or principles must be linked to indicators of Sustainability?

Principals:

1. Spiritual

* Partners in ongoing creation
* Humility
* Silence
* Listening
* Mystery
* Experiencing the vision
* The Earth is our primary teacher - not science

Indicators: The Presence or Absence of These Principals

2. Reverse Onus

* Absence of shift in eurocentric view

3. Time

* Irreversible, development & evolutionary time
* Distant elsewheres and elsewhens
* Future generations

Indicators

1. Corporate criteria for inter-generational equity.
2. Corporate annual reports.

4. Life and Relatedness

* Human and nature relations
* Respect for life
* Care and respect for all humanity
* Mutual nourishment and sustaining
* Cultivating a connection to the land

Indicators:

1. Criteria for biocentric regulations
2. Who digs?
3. Wildness
4. Females in decision-making positions

5. *Land*

* Necessity for zoning land use regulations (strictures)
* We do not own the land - use it but not exploit It
* Learn from native peoples (traditional knowledge)
* First the land & the first Inhabitants of the land (a disrupted relationship)

Indicators

1. Inclusion of Native Knowledge
2. Zoning and Land Use Regulations

6. *Action*

* Need to break paradigm addiction
* Equity between developed and less developed nations/populations
* Avoidance of oppression of the land/humans/animals
* Cultivating a connection to and with the land (ecosystems)

Indicators

1. Inclusion of equity considerations
2. Consumption patterns in developed and less developed countries
3. Changes in environmental racism
4. Water

Work Group 4

Available Data Sets and Decision Support Systems

***Participants*:**

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Anne Kerr
Joe Russo
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Bruce Pond
Michelle Ulbrich (Reporter)
Marianne Lines (Facilitator)

Objective:
Discuss data sources and variables to be used in the development of a set of indicators to monitor progress toward sustainability in the Great Lakes basin.

Focus Questions:

1. What data sets are available or could be developed, economically, to measure sustainability?

2. What data sets or models can be combined to provide additional information for the measurement of sustainability?

3. What roll-up indicators are available or could be easily developed to measure sustainability?

I. Prior to Identifying Data Sets

Without the delineation of a conceptual basis or framework for the indicators, the identification of data sets would not be useful. The development of indicators can only proceed after the following issues are addressed:

* goals and objectives (purpose of the indicators)
* who is making the decision and how (indicator selection)
* audience / users of the indicators
* scale of focus (spatial scale and resolution)

II. Key Considerations

In the development of useful indicators, policy making should recognize:

* spatial scale
* complex interactions between subsystems
* relationship to decision-making
* thresholds
* self-adjustment
* monitoring
* quantity of associated uncertainty.

Questions of Scale

'Isolated' municipalities could be sustainable without the basin being so, as population increases, scale of measurement must change due to variability. At different scales the variable chosen to measure certain aspects of sustainability changes, the choice of indicators must be concerned with the scale at which variability is a concern.

III. Possible Measurements

Measuring 'distance to target' and tracking trends could be a viable way to make use of monitoring data. Variables of early warning should be investigated - before irreversible critical thresholds are crossed. An alternative to keeping a system below thresholds is to increase the size of the ecological footprint (implications!!). The assignment of thresholds needs to be iterative since the system is always changing.

IV. A Workable Approach

Data could be presented in GIS by ecological unit (eg. Ecodistricts), for the Great Lakes basin as a domain, with the variables layered. Sustainability thresholds could be assigned (through scientific expertise) locally and for the basin as a whole. As the critical overall threshold is approached, decisions could then be made about how to contain the variable in the big picture, usually involving tradeoffs at the local level. For indicators, GIS representation would allow any cross-section or indices of variables to be constructed from the individual layered variables. This approach raises issues of value judgements, policy implications, and equity.

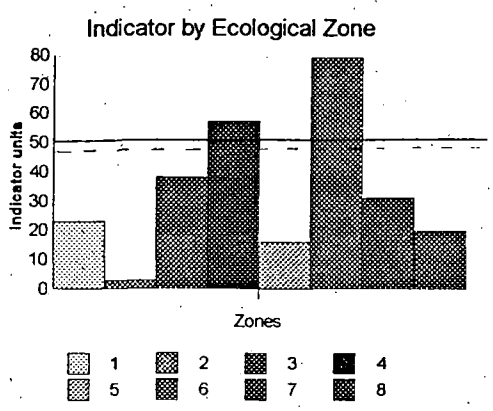
Suggested Method for Presenting Data

Several indicators can be chosen to monitor sustainable development in the Great Lakes Basin. However; the importance of a particular indicator to the basin as a whole depends on its scale. For example, per capita water consumption as an indicator of available fresh water would be very important to a rural community with a small, constant number of people. Therefore, the measurement of an indicator and its ultimate assessment for sustainability must account for small areas as well as the entire Great Lakes Basin.

An analysis method is proposed which can account for an indicator's local variation as well as its regional behaviour. The method begins with the division of the Great Lakes Basin into geographical 'zones.' These zones can be defined ecologically, socially, economically, politically, or from whatever perspective is appropriate for a sustainable policy. Next, the

indicators for sustainable development are measured periodically in each of the zones. At each sampling time, the zone measurements for an indicator are graphically compared among each other, and as an all-zone average to some limiting threshold.

An example of the analysis method is shown in Figure 1. For an un-named indicator having arbitrary units. The indicator was measured in each of eight 'ecological' zones. It had units ranging from 5 to 75 among the zones and an average value of 48 units for all zones. Units for individual zones are shown as vertical bars and the average value is shown as a background dashed line in Figure 1. Parallel to the average value line and shown as a background solid line in the graph is the limiting threshold. In the example, the value for the threshold line is 50 units. This value was predetermined as a matter of sustainable policy before any of the individual measurements were made in the zones.



The graph, complete with individual zone values, an all-zone average, and a value indicating a limiting threshold, provides quite a bit of information for sustainable decisions. First, it reveals how the indicator varies among the eight zones at the scale of a zone. Second, it shows, via the all-zone average, how the indicator behaves in the entire basin. By comparing the average value to the individual zone values, it is immediately obvious which zone contributed relatively large indicator values. A comparison between the average value and the threshold reveals if the indicator exceeded the basin limit as set by sustainable policy. In other words, if the average value is greater than the threshold, than the indicator has exceeded an acceptable limit for sustainable development at the scale of the entire basin. An inspection of indicator units in each zone would reveal which area of the basin was responsible for pushing the average above the threshold.

The Proposed analysis method would be conducted on an indicator after each set of zone measurements. Over time, the monitoring of indicators would reveal which geographic areas in the Great Lake Basin were adhering to sustainable policies and whether the basin as a whole was maintaining sustainability.

Work Group Plenary Discussion - Thursday pm

During the plenary session that followed the initial workgroup presentations, discussions focused on the sequence that needed to be followed in order to identify useful indicators of sustainable development. Many participants felt that they needed a better understanding by who and how the indicators were to be used to make the proper choices. The was also concerned voiced that we needed to have concensus on the guiding principles that were to be used in developing a framework as it was felt that the appropriate indicators would fall out of this process. Linking trends that we can measure now to outcomes that we do not want, was seen as important, as well as determining the consistency of policies of the involved municipalities.

Key questions asked by the group were:

> If we were 100 percent successful, what would it look like?
> What elements would we like to see if the basin were 100 percent sustainable?

One of the participants commented: "We are closer than we think; people are resisting being pushed across the bridge. Sustainable basically means the lack of a need for a persistent subsides. This idea can be applied to a variety of areas."

A suggested framework for sustainable development was to look at " our consumption oriented society and what share of our production that we do not use. This would include a look at production and reassimilation- something we have not seen previously - and aggregated by taking composite measurements across sectors."

At the closing of Thursdays' plenary session a small task force took on the responsibility of developing a framework for further discussion the following day.

Necessary Conditions for Sustainability

Values and Equity

Intergenerational & Intragenerational distribution of equity
(Time and Spatial Equity)

Spirituality

Connectedness to earth

De-emphasis on materialism

Inclusion of equity considerations

Systems

Need for Closed Loops & Cycles

Economic systems

Social systems

Natural systems

Communication

Information & Dialogue Toward Shared Expectations, Beliefs, & Paradigms

Connectedness to institutions

Inclusion of traditional & local knowledge

Education to assist adaptiveness

Resource accounts reports

State of Sustainability assessment

Systems

Economic Systems

Decoupling of work & welfare

Decoupling of growth from development

Consideration of externalities of urban sprawl

Cradle to grave life-cycle management

Technology of reuse and recovery

Measure of economic activity relative to natural capital drawdown

Natural Systems

Maintain natural capital

Protecting basic ecological processes

Regional patterns of landscapes reflecting diverse and connected eco-systems

Social Systems

Human health and well-being are assured

Extent of participation in democratic process

Reductions in alienation from government

Inequitable downstream effects

Population and consumption patterns

Plenary Session - Friday

Schedule:

1. Round table- consensus and contradictions, what have we learned?
2. Current Policies
3. Discussions of Measures (Interpretation with new principles)
4. Indicators

1. Round Table Comments

Themes:

Interconnections
There was consensus within the group that interconnections needed to be emphasized in the development of indicators and that there had to be a tie between the synthesis of indicators and policies. It was noted that we are in a time of devolution within the Great Lakes Basin, and therefore there will be a time lag before the emergence of many new structures. The question of whether we are masters in our own house was posed with regard to trends in globalization; we needed to understand what we actually had control of. We can only manage human systems, therefore we should focus on these. Emphasis was placed on obtaining good models and understanding what had already been done.

Hierarchies
It was proposed that socio-political concerns should be placed subordinate to ecological ones, and that the group should then work back and forth between the two to evaluate social, economic and political actions. There was disagreement, by several participants, in placing ecological issues above socio-economic in hierarchy: " If you do not address the economic issues equally the poor will wreck the environment, human well-being is just as important as environmental well-being. To resolve the problem we must take the point of view that we do not have direct access to reality, therefore our actions are socio-economic." This became an unresolved issue for the purposes of the workshop.

Social Issues
Values and equity were a recurring theme in the discussions, as well as prioritization of social goals that accommodates a pluralism of views. It was acknowledged that economics and emotions are the main drivers of decision making in our society but

that inclusion of the environment is essential for continued function. A sustainable society was characterized by one participant as: closed cycles, inter-generational equity, with full information and dialogue on expectations. The question of quality of life - "do we want to just survive or *live*?"- was raised. Population growth was identified as one of the strongest drivers of environmental and social change - its influence will only continue to grow.

Local Communities

There are 63 First Nations in the Great Lakes Basin that have their own ideas of science and Sustainability indicators. The example used was the population of moose in a given area. From this data it is possible to derive a large amount of information about the social and economic conditions of the people. It was felt that local communities should be able to define their own indicators.

Systems

There was discussion with regard to the need to minimize or maximize energy and matter flows through systems and related back to establishing closed-loop systems and maximizing efficiencies. It was suggested that measures for socio-economic systems could be analogous to those for ecological systems. This raised the question of how to define a closed-loop in a social system.

With regard to complex systems, nested systems need to be understood more, 'we have a history of past instabilities from which new structures emerged out of surprise and catastrophe- we need to keep this in mind.' Hypercycles (cycles-upon-cycles) maximize throughput (of exergy, materials and information) in order to structure the next level. Systemic and scale hierarchies need to be resolved along with details on required amounts of throughputs in systems.

Indicators

We can use synthetic indicators like outgoing long wave radiation to tell us much about the whole system - e.g. urban sprawl, organization of ecological systems, and even possibly social problems and inequities.

There are a number of indicators, both quantitative and qualitative, already available and it may be as simple as picking out those that fit the objectives. The question of synthesis of the indicators available was posed. Many felt that it was not possible to have only a few "roll-up" indicators with which to measure progress because of the complexity of the issues.

The spiritual dimension of Sustainability was acknowledged as important issue, but unfortunately remained outside the scope of the workshops discussions. It was felt that a different format for the discussions was needed in order to fulling explore the spiritual.

Areas of Consensus

During the final plenary discussions, consensus was sought from the group in identifying guiding principals along with a process framework for sustainable development. A list of 8 possible groupings of indicators was developed that could be used monitored progress, with regard to sustainable development, in the Great Lakes Basin.

Guiding Principals

1. Maintain ecological life support system
2. Sustainable management of human-use resources
3. The focus should be on management of human systems
4. Closing loops in human activities
6. History is crucial
7. Beyond basin forces are important
8. Nested Systems
9. Management of human use in a flexible manner

Process Framework

The following process emerged towards the end of the workshop which ties together many of the ideas that were discussed. In addition, it provides a means for continuing and refining the issues that have been brought up at the workshop. The questions are only examples of topics that can be discussed.

1. **Preamble** - a statement of purpose or vision. A possible preamble has been drawn from the introduction and some of the talks at the workshop.

2. **Guiding Principles**

    * Maintain ecological life support systems
    * Sustainable management of human-use resources
    * The focus should be on management of human systems
    * Closing loops in human activities
    * History is crucial
    * Beyond basin forces are important
    * Nested systems
    * Management of human use in a flexible manner

3. **Scale and Indicator Types** (eg. systems, values, communication, etc.) *Do we want to have indicators that are representative of the basin as a whole? What is the appropriate scale of analysis*?

4. **System Description**: organization (internal characteristics) influence from above (flows of exergy, information, nutrients) *Do we have an adequate description? What is missing?*

5. **Indicators** : scale, purpose (influence/response, current status and history, early warning signs, and adaptability) *Are the indicators related to the system description? What is an appropriate number of indicators? Are there unnecessary redundancies in the list that was generated at the workshop? Can we sell the types such as "social justice" in government?*

6. **Monitoring**- *How should data be stored and the indicators presented? Working Group 4 presented on possible prototype based on critical thresholds at two different scales.*

7. **Evaluation**: *Are we moving towards sustainability? Obviously, this cannot be answered until a monitoring system has been operationalized. How do we use a set of indicators to answer this question?*

1. Preamble - *a first draft*

Sustainable development represents a philosophy of management in which economic development takes place within the limits of the natural environment through the integration of environmental effects into economic planning. Both the federal and provincial governments acknowledge the need for sustainable development in light of the costs involved in restoring degraded ecosystems and the long-term, possibility of irreversible damage due to land-use change and pollution. The goals of Environment Canada's sustainable development programs in the Great Lakes Basin Ecosystem are reflected in several intergovernmental agreements including the Canada-Ontario Agreement and the Canada-US Great Lakes Water Quality Agreement (GLWQA).

COA recognizes the need for collaborative agreements to protect the Great Lakes Basin Ecosystem through pollution prevention and the maintenance of ecosystem health. Under the umbrella of COA, programs are designed to achieve the following three objectives: restore degraded areas, prevent and control pollution, and conserve and protect human and ecosystem health. The targets are very specific, but what is lacking is context. It is not known whether the pursuance of these targets is moving the basin toward sustainability.

The framework will be designed to help make strategy and to assess results towards meeting Environment Canada's sustainable development objectives in programs such as the Canada-Ontario Agreement on the Great Lakes Environment, Great Lakes 2000, and the Canada-US Great Lakes Water Quality Agreement. In the present context, a "framework" is intended to mean an organized and rationalized set of ideas - ' a shopping list' - about what indicators we should observe, measure, and keep track of in order to see whether we are succeeding in enhancing sustainability.

Indicators

1. Social Justice

Distribution of income, minorities, voting patterns
By-in by population
Employment
Great Lakes Charter
Internet
Meeting basic needs
Access to education
Health
Access and volumes of fresh water

2. Closed Loops

Historical context
Listing of closed or closing loops and facilities
Fecal matter
Mercury
Nitrogen
Processes beyond end-of-pipe
zero discharge compliance
Total wastes - multimedia
Consumption- vehicles, water use, etc..
Subsidies- unfair to Sustainability

3. Capability to Adapt

Social wealth, level free to change non-sustainable activities
Job share opportunities
Flexible work systems
Emerging cottage industries
External forces
Elimination of subsidies that hinder adaptation
Ratio of external to internal trade
Problem rate issues

4. Alienation

Voting patterns
Cultural identity
Community participation
Social capital/activities
Crime

5. *Institutions/Business*

Denial of issues
Monitor media- i.e. Sustainability, ozone
Gap between public and government institutions -movement to bridge gaps
Decentralization/devolution of governments
References to future generations in environmental reports
Numbers of post secondary environmental programs
Corporate governance and third party verification
Environmental performance
Investment funding

6. *Ecological Foot Print*

How much space is required to support a person (on average)
Image analysis- outgoing longwave radiation
Land based equivalence
Changes in built-up areas -urban envelope boundaries
Number of miles driven
Volumes of hazardous products/wastes

7. *Environmental Context*

Climate change/variability
Pressure patterns
Crop changes and varieties
Green house gases
Insurance claims
Water quality and quantity
Health issues-respiratory
Health community based - admissions, over the counter drugs, global
Natural capital

8. *Natural Capital*

Inventories
Inputs of renewable resources
Resource recovery
Reserved land
Land quality - carbon
State of fisheries
Sustainable yields
Rural land use- land abandonment
Habitat and biodiversity
Reproductive failures
Essential rates governing microfauna
Collapse of traditional community -subsistence

Conclusion

The workshop was convened to address the need for a process frame work and development of a context for targets that have been set in specific basin-wide programs related to the restoration of degraded areas, the prevention and control of pollution and ecosystem health. At present, it is impossible to conclude whether or not these targets are enhancing sustainability in the Great Lakes Basin. The task proved to be very difficult to accomplish in two days, and since that time some participants have been involved in projects that would have been appropriate precursors to the workshop.

However, we have an opportunity to extend the workshop discussion through the use of the Internet. A listserver is being set up by Environment Canada for our needs. This will only be available to participants at the workshop, and you must subscribe to the service (there are no fees). If you subscribe, you will receive the comments that other participants write, and your comments will automatically be distributed to the other subscribers.

The goal of the listserver is to resolve some of the philosophical and scientific difficulties that emerged during the workshop, complete the framework, and eventually develop a set of indicators that can be used by Environment Canada to monitor progress towards sustainability in the Great Lakes Basin. We would invite all participants to subscribe to this service. Depending on the use and the level of discussion, we will have the option of setting up a web site during the summer.

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Appendix B

Workshop Evaluations

Of the 27 participants attending the workshop, 10 completed evaluations of the workshop. The response are summarized in the chart below.

Question	Low 1	2	3	4	High 5
Did the workshop meet your expectations?	-	1	5	2	-
Were the presentations effective in providing you with a good overview of the topics of discussion?	-	3	1	5	-
Did you find the written information provided useful?	1	3	2	3	-
Did you have a clear understanding of the workgroup objectives?	1	5	3	-	-
Did you have opportunity to participate in discussions?	-	-	-	5	5
Were the facilitators effective?	1	-	5	2	1
Were the discussions effective?	-	1	3	6	-
Did you feel the objectives were met?	-	3	5	2	-
Did you find the meeting facilities suitable?	-	-	-	3	7
Did you feel the workshop was worthwhile?	Yes	NO			
	6	0			

Comments:

General comments from those responding to our questionnaire indicated that the objectives of the workshop were not clearly defined at the beginning of the workshop and that this lead to some confusion. However once this was sorted out through the groups discussions, it was generally felt that a lot was accomplished and that there was some very important exchanges on how to measure sustainability in the Great Lakes basin. All the respondents indicated that the workshop was worthwhile, however this report and continuing communication was seen as very important to the overall success of the workshop objectives.