

MANAGING THE GREAT LAKES BASIN AS A HOME

W. J. Christie

*Glenora Fisheries Station
R. R. #4
Picton, Ontario K0K 2T0*

M. Becker and J. W. Cowden

*Great Lakes Tomorrow
Hiram College
Hiram, Ohio 44234*

J. R. Vallentyne

*Canada Centre for Inland Waters
Burlington, Ontario L7R 4A6*



*THE ONE RESPONSIBLE
FOR POLLUTION*

This report is a product of the Ecosystem Approach Workshop held at Hiram, Ohio, in March 1983 and sponsored by: The International Joint Commission; The Great Lakes Fishery Commission; The International Association for Great Lakes Research; and Great Lakes Tomorrow

SPECIAL CONTRIBUTION

MANAGING THE GREAT LAKES BASIN AS A HOME

W. J. Christie
*Glenora Fisheries Station
R. R. #4
Picton, Ontario K0K 2T0*

M. Becker and J. W. Cowden
*Great Lakes Tomorrow
Hiram College
Hiram, Ohio 44234*

J. R. Vallentyne
*Canada Centre for Inland Waters
Burlington, Ontario L7R 4A6*

ABSTRACT. The ecosystem approach, a more holistic way to planning, research, and management of the Great Lakes basin, was articulated as a concept in the 1978 Great Lakes Water Quality Agreement. In order to stimulate movement of this concept to a series of implementable actions, an Ecosystem Approach Workshop was held in March 1983. This paper describes the process used to define common cause for a group of fifty-six participants representing a diverse spectrum of backgrounds. Three generic obstacles to attainment of an ecosystem approach, which emerged from pre-workshop efforts, were addressed by the workshop. They were: (1) lack of an holistic perspective, (2) predominance of "egosystem" thinking, and (3) lack of a preventive approach. The strategy suggested for overcoming the obstacles was identified as "enlightened self-interest." The participants proposed 33 initiatives for advancing the ecosystem approach. These initiatives related to improving the acquisition of scientific data, directing institutional change for ecosystem management, improving citizen participation, paying the costs for resources use, education, and public awareness. In order to help implement these initiatives, establishment of an ecosystem approach monitoring group and an improved public information program is recommended.

ADDITIONAL INDEX WORDS: Ecosystems, environmental management, ecological effects.

INTRODUCTION

Blueprints or *initiatives* for carrying out an ecosystem approach to managing the Great Lakes basin were developed during a 3-year process which culminated in a workshop held on the campus of Hiram College in Hiram, Ohio, on 22-24 March

1983. The process was sponsored by four organizations: the International Joint Commission (IJC), the Great Lakes Fishery Commission (GLFC), the International Association for Great Lakes Research (IAGLR), and Great Lakes Tomorrow (GLT)^a.

The development proceeded in four stages:

- 1) Preparation of an overview describing the meaning and application of an "ecosystem approach" in the context of the Great Lakes basin;
- 2) Evaluation of obstacles to implementing such an

^aSponsorship of the workshop does not necessarily imply that the findings and conclusions reached by the participants are endorsed by the sponsors.

approach among governments, industries, voluntary associations, and individuals on both sides of the border;

- 3) Preparation of a strategy for understanding and carrying out an ecosystem approach in the Great Lakes basin; and
- 4) The convening of a workshop of persons broadly representative of Great Lakes society to evaluate progress and to develop specific ideas for implementing an ecosystem approach.

This article is an interpretive summary^b of the results of each of those stages. By these means, an attempt was made to suggest some practical ways by which government and private organizations or agencies, as well as individuals, can go about managing the Great Lakes basin as a home.

OVERVIEW, OBSTACLES, AND STRATEGY

The Ecosystem Approach -An Overview

Since every person sees his or her surroundings from a unique point of view, universally acceptable definitions of the ecosystem and ecosystem approach must be broad. This does not deny the need for definition. It only means that people can agree on common characteristics of holistic approaches without waiting for universal definitions. The ideas flow directly from abstract concepts to pragmatic initiatives. An examination of these ideas follows. Useful background information in this analysis was provided by Odum (1969), Stone (1972), Jacobs (1975), Trist (1980), Axelrod and Hamilton (1981), and Olson (1983).

Ecosystems are natural or artificial subdivisions of the biosphere with boundaries arbitrarily defined to suit particular purposes. It is possible to speak of your personal ecosystem (you and the environment on which you depend for sunshine, air, water, food, and friends), the Great Lakes basin as an ecosystem (interacting communities of living and non-living things in the basin), or our planetary ecosystem, the biosphere.

The ecosystem concept recognizes that you are new, yet not new. The molecules in your body have been parts of other organisms and will travel to other destinations in the future. Right now, in your lungs, there is likely to be at least one molecule from the breath of every adult human being who

has lived in the past 3,000 years; the air around you will be used tomorrow by deer, lake trout, mosquitoes, and maple trees. The same is true of water, sunshine, and minerals. Everything in the biosphere is shared.

There is something very strange, deep, and mysterious about the way the building blocks of life are arranged as wholes that are in turn parts of larger wholes. Everything from atoms to galaxies is literally interconnected. Sharing and interconnectedness are the reasons why the boundaries of ecosystems overlap. Although most people vaguely understand the concept, they do not see how it relates to, or affects them.

There is a simple, yet profound difference between "environment" and "ecosystem." The notion of environment is like that of house-something external and detached. In contrast, ecosystem implies home-something that we feel part of and see ourselves in even when we are not there. A home has an added spiritual dimension that makes it qualitatively different from a house. It is a happier place because of the caring and sharing relationships among its inhabitants.

The emergence of an ecosystem *approach* to planning, research, and management in the Great Lakes basin is not accidental. It is the most recent phase in a historical succession of management approaches from *egocentric* to *piecemeal* to *environmental* and now to an *ecosystem approach*. This succession arose from stresses imposed by the burgeoning growth of population and technology in the Great Lakes basin. The ecosystem approach emerged in the 1970s with the realization, in part from the discovery of toxic chemicals in human food chains, that people and environments can only be managed effectively in relation to ecosystems of which they are parts.

The essence of an ecosystem approach is that it relates wholes at different levels of integration (us and ecosystems containing us) rather than interdependent parts (us and our environments). This calls for four-eyed vision—two eyes from the "egosystem" (a person, corporation, voluntary association, professional discipline, government, or nation) looking outward at its external environment; and two from an ecosystem looking at the egosystem and its operational environment as a whole. This perspective, hereafter termed an *ecosystem perspective*, is crucial to human well-being and survival.

What must be done to practice an ecosystem approach?

^bPhotocopies of the complete typewritten report with fuller descriptions of the initiatives are available on request form J. R. Vallentyne, Canada Centre for Inland Waters, P.O. Box 5050, Burlington, Ontario L7R 4A6.

1. Know your *ecosystem*. Develop a perspective that takes account of the influences on us of larger systems of which we and our external environments are parts. This requires improved knowledge of the operation and relationships of systems in nature.
2. *Act* in ways that are *ecological* (taking account of that knowledge and perspective), *anticipatory* (forestalling events that could bring later regret), and *ethical* (showing respect for other systems of nature comparable to our respect for other persons).

Because the consequences of preventing something from happening are invisible to the untrained eye, the benefits of an ecosystem approach are not readily discerned. Some examples of the evolution from indifferent to ecosystem management styles may help to clarify what is meant by ecosystem approach and to show the extent to which it is now in development:

1. *Organic waste*. First it was dumped wherever convenient—best of all in streams or lakes. Next, because of downstream problems, we developed energy-consuming sewage treatment systems. Now, an ecosystem approach focuses on recycling energy efficiently, and material recovery from sewage.
2. *Eutrophication*. First, it was ignored. When the odors became too strong, nutrient-rich effluents were diverted downstream. Then phosphorus was removed from sewage effluents. An ecosystem approach promotes low-phosphate detergents, more efficient use of fertilizers, and nutrient recycling.
3. *Oxides related to acid rain*. At first the pervasiveness of the acid rain problem was not recognized. When problems arose locally, the “solution” was to build taller smokestacks. Then came removal of acids by scrubbing. Now, an ecosystem approach advocates energy conservation and the recycling of sulfur.
4. *Water diversions and consumptive uses*. The first rule was to divert, the more the better. Then the scale of operations was increased to meet new shortages, encouraging export as a commodity. An ecosystem approach might recommend diverting water sparingly—and only in the context of overall regional planning. It might also set limits on overall use or provide incentives for non-consumptive uses.
5. *Cancer*. People were never indifferent to cancer; however, it is still commonly viewed in terms of

single causes. In an ecosystem approach, real cures (prevention techniques) must be based on the knowledge that cancer is to a large degree environmental, with many contributing causes.

6. *Toxic chemicals*. At first, toxic chemicals were used indiscriminately. Then they were dealt with one by one with regulations after the fact, as in the case of pesticides. An ecosystem approach requires designing *with* nature, particularly for long-lived compounds.
7. *Energy shortages*. Successive “solutions” were, first, to ignore the problem, then to increase the energy supply and expand the grid with pricing to encourage greater use. An ecosystem approach encourages conservation pricing with inverse rate schedules to discourage greater use.
8. *Traffic congestion*. Successive “solutions” have been to curse, build more roads and super-highways, improve public transportation, and stagger commuters’ work hours. An ecosystem approach might encourage a broader look at commuters’ work and travel needs and at overall land use planning. Solutions then might include greater use of telephones and computer terminals or the development of new combinations of work, shopping, and residential population clusters.
9. *Pests*. At first it was “run for your life.” Then came broad-spectrum pesticides. Next were selective, degradable poisons. An ecosystem approach calls for integrated pest management.

OBSTACLES TO IMPLEMENTING AN ECOSYSTEM APPROACH

Obstacles to implementing an ecosystem approach which might be experienced by individuals, industries, voluntary associations, and governments were independently examined by four participants from Canada and four from the United States. They introduced a wide array of perspectives in separate papers which each prepared as background for the Hiram Workshop.

Marlene Fluharty (1982), U.S. citizen activist and vice-chairman of the Michigan Environmental Review Board, examined problems and opportunities from a personal perspective. Robert J. K. Walmsley (1982), associate chief judge in Ontario, added to this by contrasting ecosystem concerns in his urban and rural neighborhoods. Drawing on a long career in industrial chemistry, Michigan toxicologist Eugene E. Kenaga (1982) described challenges and opportunities to industry with special reference to hazardous substances. Paul Hunt



THE SELF-DESCRIBED
PARAGON OF BEASTS

(1982) of the Petroleum Association for Conservation of the Canadian Environment presented an account of corporate initiatives and concerns in environmental protection. Wayne Schmidt (1982), from the Michigan United Conservation Clubs, discussed problems in establishing federations of environmental groups. While agreeing on the need for an ecosystem approach, he asserted that the name would not sell "in Peoria." A steering committee member, Jack Vallentyne (1982), senior scientist at Canada Centre for Inland Waters, discussed the roles, problems, and opportunities of Canadian voluntary associations in an historical and cultural context. David LaRoche, Secretary for the U.S. Section of the International Joint Commission, and John Hall, a corporate communications consultant in Canada, jointly examined the virtues and limitations of the ecosystem concept from a Canada-United States political perspective (LaRoche and Hall 1982).

These papers revealed no clear differences which could be traced to national traditions or philosophy. All agreed that implementation of an ecosystem approach was a necessary but difficult task. Progress, particularly in industry, was noted. A summary follows of central issues identified by the authors as potential or demonstrated obstacles.

Obstacles Seen From a Personal Perspective

Threats to livelihood, jeopardizing ecosystem concerns; *fear*, generating insensitivity to crises; *hopelessness*, resulting from a perceived loss of control over personal destinies; *mistrust*, of governments, "bosses," and industry- the last in respect to pollution for profit; *confusion*, from issue-by-issue reporting, making it difficult to develop a broad ecosystem perspective; and *differing perspectives*, resulting from diverse backgrounds and specializations.

Obstacles As Seen From an Industry Perspective

The desire for demoporphic growth (the growth of human and per capita technological energy consumption) and yet inability to deal with its collective consequences; *competition and secrecy* among industries and between industry and government; *conflicts in planning* between what is "good" for society versus what is "efficient" for business; the "here and now" of environmental impact assessments versus "everywhere and later" effects; *mistrust* of competitors and of big government; and

suspicion of the emotional influence that environmental organizations are thought to exert on governments.

Obstacles As Seen By Voluntary Associations

Inadequate representation, with few common forums in the Great Lakes basin for shared environmental views; *ineffectiveness* of adversarial organizations in responding to common causes; and *organization and finances* that are often weak.

Government-Perceived Obstacles

Lack of legislation incorporating the ecosystem concept; *lack of public support* for translating environmental concerns into a wider array of ecosystem concerns; and *lack of trans-institutional networking* (strengthening cross-linkages through interagency planning). There was no suggestion that more statutes or institutions were needed, only that they could be better integrated.

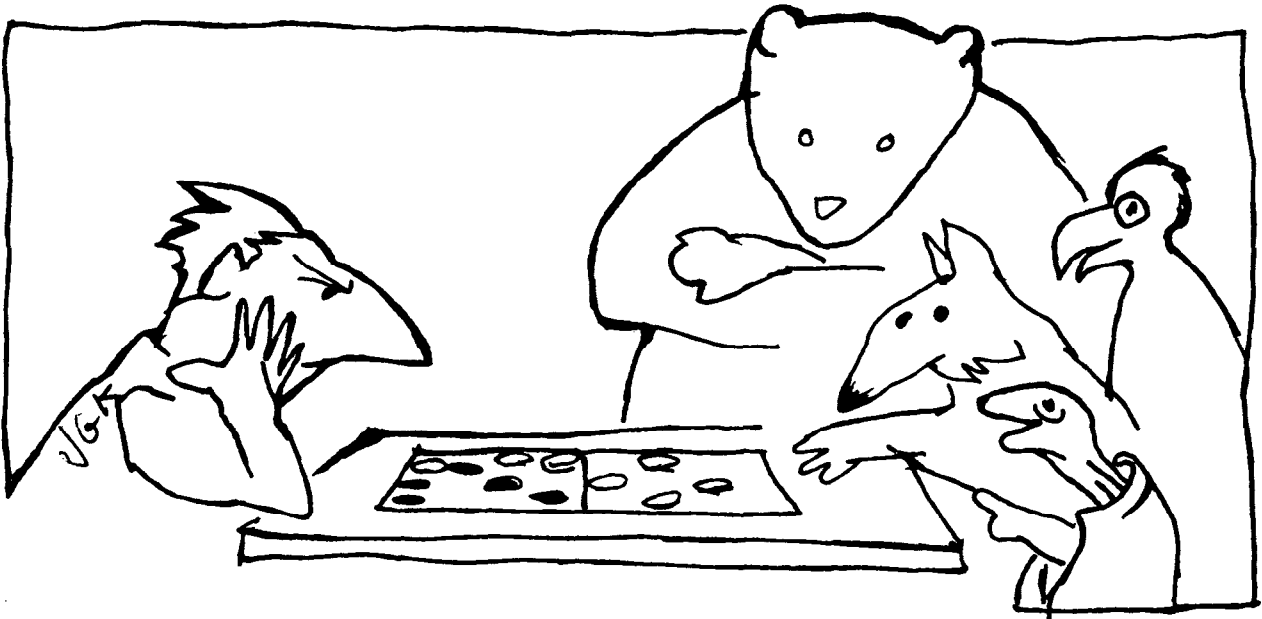
Everyone's Obstacles

A review of these issues revealed three major obstacles common to all groups:

- (a) *Lack of an holistic perspective*. Our acts in space and time have many causes and consequences, inducing effects on ecosystems that often turn back on us in revenge. We can no longer afford the shallow luxury of "out of sight, out of mind." We must look beyond the "here and now." To see the valley we must climb the mountain. To follow the flow of the river, our eyes must run with the water down to the sea and follow it back along its return to the land as rain.

Interconnectedness implies that problems have no precise boundaries in space or time. This is hard to cope with in a world where people and institutions want simplistic answers, "quick fixes," and more "things." An holistic perspective demands knowledge of inter-relationships and a focus on cycles and rhythms at various levels of integration and with varying time delays. In contrast, we and our institutions tend to be programmed in a linear, piecemeal fashion.

The public has not been well informed about ecological realities. In fact, media scares may act to draw attention away from the forces at work behind crises and the reasons why those forces are so pervasive and dangerous.



BE CAREFUL, WHENEVER HE GETS BEHIND
HE TRIES TO CHANGE THE RULES.

(b) *Predominance of "egosystem" thinking.* In a world which has become increasingly adversarial, it is difficult to convince people to be even just a little less selfish. Future shock and the decline of organized religion seem to have conspired to encourage egocentricity. There is a need to balance *egocentric* and *ecocentric* views.

The growth of human activities in relation to finite resources and space demands new rules for sharing. At the beginning of the century, limitations on sport fishing in the Great Lakes aimed at equitable distribution. Now, sportsmen are accustomed to rationing based on species-licenses and restricted creel limits. This came about because the angling population grew disproportionately relative to fish populations. It has not been a difficult adjustment for fishermen to make. It is more difficult for municipal politicians and factory managers to relate their waste effluents to the total loading of the receiving waters, and to accept more restrictive effluent standards.

The means of reconciliation for those not fully acquainted with the ecosystem concept lies in see-

ing "the big picture," rather than concentrating solely on familiar and personal views. Domino effects in ecology are not only spatial but leave permanent effects through time. An ecosystem ethic not only relates a citizen to his counterparts elsewhere, but to generations unborn, some of whose members will be his own descendents (Morse 1975, Taylor 1981). By training, law, convention, and religious upbringing, people accept the Golden Rule, at least in principle, in their interpersonal relations: "Do unto others as you would have them do unto you." An ecosystem approach requires people to consider an even wider array of "others" than the others in the Golden Rule. This is hard to teach and even harder to accept.

(c) *Lack of a preventive approach.* The ecosystem of the Great Lakes basin is not in equilibrium with the exponential increase in human activity. An apt analogy is that of a fool bent on doubling his intake of whiskey over constant intervals of time. He has a certain limited capacity that when exceeded produces undesirable consequences. The Great Lakes have similarly been overloaded with municipal and industrial wastes.

Crisis-management cycles induce heavy economic costs between the identification and resolution of problems. For eutrophication, these include water treatment, filtration, loss of recreational and aesthetic values, and reduced tourism and fishing. Finding and removing toxic chemicals from old dumpsites can be much more costly.

Announcements of newly discovered contaminants in fish and drinking water, each seemingly more persistent or deadly than the last, have become routine in the Great Lakes basin. Each becomes a crisis in its turn. Governmental reaction is often to shift dollars from prevention and research to diagnosis and treatment, mortgaging the future to pay for the past. The public, in turn, becomes progressively disenchanted with the ongoing litany of chemicals -and more concerned with ones they know must be there and haven't been told about. This trend could result in people feeling it doesn't matter what they eat and drink, that all industrial chemicals are equally dangerous and equally beyond their control.

Even under favorable circumstances, the Great Lakes will undoubtedly continue to produce unpleasant surprises. The aim, therefore, must be to constantly work toward managing the system so that public resources and public health will be progressively better cushioned from unexpected shocks. Preventive practices are needed to reduce the frequency of costly surprises.

STRATEGY FOR IMPLEMENTATION

Strategy is a plan to overcome obstacles in reaching an assigned objective. In our case, the objective was further understanding and implementation of an ecosystem approach in the Great Lakes basin. Persons and organizations sympathetic to an ecosystem approach need little convincing of the urgency of the situation. They are the advance guard in making clear the need for managing the Great Lakes basin as a home. Others, perhaps more perplexed than disinterested, are the ones to whom ecosystem strategy needs to be aimed.

One crucial aspect of strategy is the search for a common cause. In our case, that common cause is the level of risk facing the society in the Great Lakes basin. This risk is greatest in respect to human health and economic well being; but threats to tourism, commercial fishing, recreational opportunities, aesthetics, and quality of life are also important. All members of society are at risk in this. Reducing the risk could be a unifying principle.

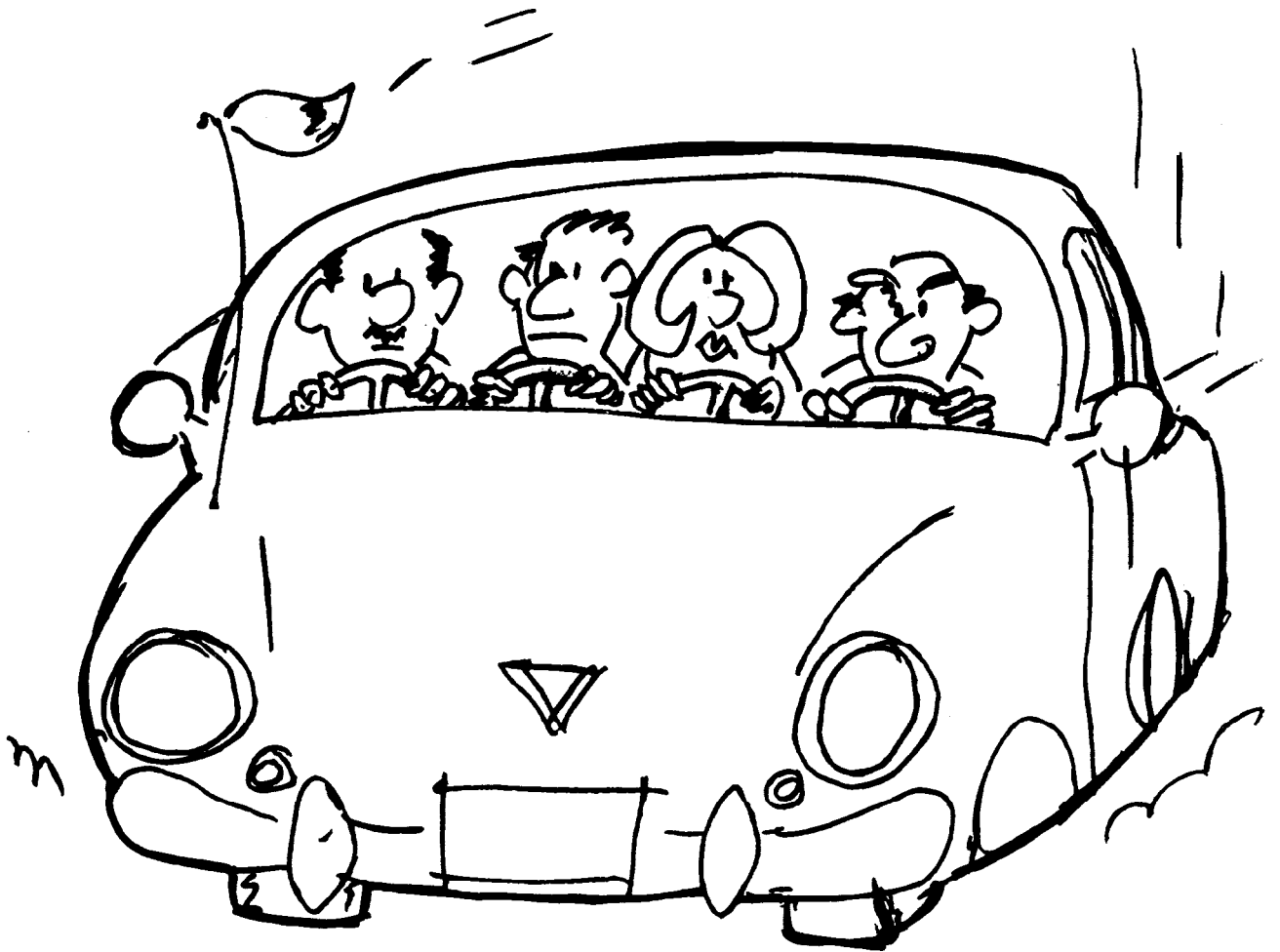
The concern about risk goes much further than direct hazards to health and economics. The greatest risks - and opportunities -in the long-term lie in the effects of people on people via the ecosystem (Odum 1969). For this reason, strategic concerns need to be broad and to take account of downstream and "down-time" effects.

The upstream-downstream situation in which people heap abuses on their neighbors below is a metaphor for the abuses we heap on each other via shared ecosystems. The fact that water circulates in lakes brings even distant shoreline communities into close relationships with each other. After the risks of poisoning one another via shared ecosystems have been removed, we will still face the problem of how to advance individually (personally, corporately, or municipally) in ways that do minimal harm to our neighbors. This has nothing to do with altruism or protection of nature in the traditional sense. It is practical long-term self-defense.

With self-defense as the primary concern, it becomes considerably easier to convince people of the need for more holistic views. Once done, they will have automatically converted some of their "egosystem" precepts to ecosystem thinking. People could be receptive to a management system that avoids nasty surprises, just as they have turned to systems of preventive dentistry and medicine.

The thrust of the foregoing is that the best strategy is *enlightened self-interest*. It says first of all that, because all citizens in the basin share a common problem, they must be committed in their own interest to its solution. It extends the Golden Rule to the ecosystem in recognition of the essential need for self-preservation, "Do unto the ecosystems you share with others as you would have others do to the ecosystems they share with you." Enlightenment not only refers to appreciation of these realities; it recognizes the need for improved understanding and anticipatory management.

The reader may wonder at this paraphrase of the traditional Gold Rule. Our view is that many people have already found a balance between egocentricity and ecocentricity which satisfies them. Others still face the transition, however, and for them the process begins with a personal orientation and evolves from that. It is far more difficult to think of other persons separated from us in either space or time (since they are physically absent) than it is to consider the physical aspect of our nearby habitat. Ultimately, the issue reduces to the need for an ethic of respect for nature that subsumes respect for other persons.



THE ECOSYSTEMS APPROACH
DRIVING SCHOOL

We need to protect ecosystems because they are the basis for sustaining life. Moreover, we need to protect ecosystems not only in their external reality, but also as symbols of all that we value in our cultural heritages and traditions. When those symbols are tarnished, we not only feel diminished, but actually are diminished in the knowledge that we have sacrificed the underlying values that the symbols express. Greater use in ecosystem management of symbols such as the American eagle, the maple leaf, and the Great Lakes could enhance the basis for enlightened self-interest.

It should be clear that implementation of an ecosystem approach, solely in the Great Lakes basin, or any other unit of the biosphere, is ultimately not adequate because of spill-over effects from functionally adjacent systems. For this reason, a major part of the strategy for implementation of an ecosystem approach must involve extension elsewhere.

Initiatives which attack symptoms are far less likely to have long-range success in preventing crises than those which strike at root causes. It is also clear that single attacks on specific issues are insufficient to deal with any one, let alone all three, of the basic obstacles. The following generic categories provide a framework for evaluating initiatives to further understanding and implementation of an ecosystem approach:

1. Improve public education and information.
2. Provide for better participation by the citizens in their environmental future.
3. Revise arrangements for payment of resource rents.
4. Improve application of existing ecosystem knowledge in management.
5. Accelerate the acquisition of new ecosystem science.
6. Revise institutional arrangements in keeping with the above.
7. Encourage more informed ecosystem outlooks.

The strategic questions to be asked of any initiative from the point of view of an ecosystem approach are:

1. Does it help people regain a sense of personal control over their own destinies?
2. Does it encourage an holistic perspective?
3. Does it enhance cooperative activities?
4. Will it contribute significantly to reduction of uncertainty?
5. Does it help managers overcome crises?
6. Is it timely?

Clearly we will never achieve a Utopia where

citizens agree on all things at all times, but rallying points are needed. Wars and great natural disasters have this unifying effect, but so far it has not been generally recognized that our environmental predicament poses an equivalent peril. Institutions, which have developed to protect the interests of particular groups or individuals from others of differing interests, may in fact perpetuate mistrust rather than rally people to a common cause. This is not to suggest that we will ever cease to debate differences in an adversarial way. It is just that it is very difficult for advocacy groups and balancing institutions to adjust to the idea of common cause. When we become convinced of the need for coalitions to combat common enemies, management strategies based on an ecosystem approach will automatically come into play.

INITIATIVES DEVELOPED AT THE HIRAM WORKSHOP

In developing the initiatives, the participants took into account the legal, bureaucratic, and information barriers to interagency cooperation, and they noted a strong need to convince political leaders of the soundness (and vote-getting capacity) of the idea of ecosystem management. Because many of the initiatives seemed to overlap in scope and purpose, the steering committee then condensed the original 53 initiatives to 33 and organized them for presentation in this report into five subject categories:

- Group A-Improving the acquisition and use of scientific data;
- Group B- Directing institutional change for ecosystem management;
- Group C-Paying the costs for resource use;
- Group D - Education and public awareness;
- Group E - Improving citizen participation - access and communication.

In the full report of which this is a condensation, the presentation of each initiative includes: a *title and description* of the action proposed, a *statement of the perceived background and need* which generated the proposal, and suggested *agencies or organizations* which might logically be expected to initiate the action. A *comment section* was added in some instances to provide additional information, explanation, or reference. *Related proposals* among initiatives were cross-references by number and title.

Participants, despite the very different backgrounds and philosophies, showed a remarkable

willingness throughout the proceedings to seek and arrive at cooperative solutions to Great Lakes basin problems. This is something which would not have been predicted a decade ago and which provides concrete evidence that people and organizations throughout the region are moving in the direction of an ecosystem perspective.

THE INITIATIVES

GROUP A: IMPROVING THE ACQUISITION AND USE OF SCIENTIFIC DATA (1-5)

There have been significant advances in this area since the Workshop. The Center for the Great Lakes (CGL) is planning a "Great Lakes Water Quality Summit '86." A Council of Great Lakes Research Managers has been formed under the aegis of the IJC Science Advisory Board. The Council of Great Lakes Governors (CGLG) prepared a novel "Charter for the Great Lakes" that calls for, among other things, the development of a common Great Lakes data base (numbers 1-3). The Great Lakes Fishery Commission has formed a Habitat Advisory Board, and conducted an International Symposium on Stock Assessment and Yield Prediction (ASPY) in 1985.

Intergovernmental and interuniversity cooperation on Great Lakes research has been becoming more frequent in recent years. Canada and the U.S. shared their information on a study of toxic substances in the Niagara River and have begun initiatives to work together in the Upper Lakes to plan for collection and use of data on the Connecting Channels. The Surveillance Work Group of the IJC Great Lakes Water Quality Board is overseeing the development of surveillance plans for each of the Great Lakes and Connecting Channels. The plans call for greater integration of biological and chemical monitoring in the assessment of Great Lakes water, sediment, and biota in relation to culturally-imposed stresses. Similarly, improvements in interagency cooperation and information sharing is occurring on Great Lakes fishery management through the Lake Committees of the Great Lakes Fishery Commission. Interuniversity cooperative research projects are becoming more frequent and the Third Interuniversity Great Lakes Regional Seminar, entitled "Sustainable Redevelopment for the Future of the Great Lakes Region," was held in Racine, Wisconsin, in July 1984. Newsletters by various Great Lakes organizations have

been improved in recent years to better convey research results to a wider audience.

All these initiatives indicate that gaining new knowledge still has high priority. IAGLR past-president J. E. Gannon has recently reminded us (Gannon 1984), however, that we have a long way to go in integrating information with an interdisciplinary perspective.

Initiative 1: Standing Board on Data Analysis and Synthesis. Creation of an IJC Standing Board responsible for integration, interpretation, and synthesis of information pertaining to the Great Lakes to counteract piecemeal planning. Related Initiatives: 2, 3, 4, 5, 10.

Initiative 2: Great Lakes Basin Information Center. Establishment of a Great Lakes basin library and data base to acquire and make available to persons and agencies comprehensive information on the state of the Great Lakes basin ecosystem. Such information might include who is using it and how, how it is changing, and existing standards, regulations, and policies. Related Initiatives: 1, 3, 27, 28.

Initiative 3: Great Lakes Ecosystem Information System. Development of a binational, interagency information system to develop collaborative networks among decision-makers. This will allow exchanged information on ecosystem problems and opportunities, and provide a single system for characterizing, organizing, referencing, retrieving, and analyzing scientific information about the Great Lakes basin ecosystem. Data from this system should be available to scientists, policy makers, managers, and the public in organized, synthesized, usable form. The system should be capable of developing a data base and modeling capacity for projection of integrative scenarios of alternative Great Lakes futures. Information could be provided to all user groups through a series of illustrated atlases and, in addition, to agency decision-makers in computer simulation models. Related Initiatives: 1, 2, 26, 27.

Initiative 4: Status Report on the Great Lakes Basin Ecosystem. Development of a status report, or comprehensive *report card*, to be presented in a standard form and updated periodically, on features of the Great Lakes basin ecosystem that are of binational and interjurisdictional interest. Related Initiatives: 1, 2, 3.

Initiative 5: A Formal Decision-makers' Network. Creation of some formal means by which working group members of binational boards and commissions, along with citizen activists involved with those groups, can exchange information and ideas about ecosystem problems on a regular basis without going through traditional hierarchical channels. Related Initiatives: 1, 2, 3, 9, 12.

GROUP B: INSTITUTIONAL CHANGE FOR ECOSYSTEM MANAGEMENT (6-17)

Efforts to reduce or eliminate inter-jurisdictional obstacles to Great Lakes ecosystem management are occurring through binational communication forums under the aegis of The IJC, GLFC, and CGLG. The "Charter for the Great Lakes; and the "Joint Strategic Plan for Management of Great Lakes Fisheries" are good examples.

Some initiatives have already been acted on. Number 7, for example, is currently under consideration for action by GLU and GLT. The recommendation in Number 8 seems to be met in large part by the formation of CGL which now has offices in Chicago and Toronto. The CGLG is encouraging individual states to examine their requirements for Number 9. Number 12 was recognized as an imperative by an IJC Workshop held in October 1984 in Philadelphia. Number 14 is now law in Ontario. Number, 17 has been partially met by preparation of a Great Lakes experts directory by the Institute of Water Resources at Michigan State University. These actions reflect the generality of the problems identified by the workshop participants, and equally, the urgency of the need to systematically address the initiatives.

Initiative 6: Ecosystem Reference to IJC. Presentation of a Reference to the International Joint Commission to investigate the interjurisdictional decision-making process from a historic as well as a contemporary perspective and to address the question of whether an holistic (ecosystem) approach to environmental decisions is a preferable and feasible approach. Related Initiatives: 4, 9, 10, 11.

Initiative 7: International Citizens' Conference on the Great Lakes Basin Ecosystem. A conference jointly planned by citizens of the United States and Canada to review government action on implementing an ecosystem approach in the Great Lakes basin, to formulate a Great Lakes Environmental

Bill of Rights, to review progress on initiatives developed at the Ecosystem Workshop, and to develop additional support for the goal of restoring and preserving the basin ecosystem. Related Initiatives: 30.

Initiative 8: Great Lakes Policy Analysis Institute (GLPI). Establishment of a well funded independent policy institute similar to the Conference Board of Canada, the C. D. Howe Institute, or Resources for the Future to perform policy overviews and analyses. Related Initiatives: 9, 12.

Initiative 9: A Review of Institutional Capabilities for Implementing the Ecosystem Approach (limited to laws, agencies, and certain citizen associations). Compilation and evaluation of laws, regulations, agency procedures, policies, programs and resources, and of association charters and structures affecting resource management in the Great Lakes basin- to determine whether or to what extent each could participate in an ecosystem approach to management. Strengths and inadequacies would be identified and models for new or modified laws and institutions developed. The purpose would be to provide basic information needed by the IJC to implement Initiative 10 (Integrated Ecosystem Management). Related Initiatives: 8, 10, 12.

Initiative 10: Integrated Ecosystem Management. Expansion of the roles and technical capabilities of the IJC's standing boards and strengthened roles and staff capabilities for its Great Lakes Regional Office-the better to evaluate impacts of proposed major developments on the Great Lakes basin ecosystem and to consider ecosystem implications of existing or emerging problem areas. Related Initiatives: 1,2,3.

Initiative 11: Assimilative Capacity for Pollutants and the Ecosystem Approach. Rejection of "assimilative capacity" as a legitimate concept for any level of pollutants in bodies of water, used until now as a mechanism for determining water quality standards or effluent limits. Inclusion of a statement noting the rejection of this concept in future Great Lakes Water Quality Agreements. Related Initiatives: 4, 6, 26.

Initiative 12: Transboundary Ecosystem Impact Assessment. (1) Assessment of present policies and practices; and (2) development of a model for an

integrated assessment process for the Great Lakes basin ecosystem and proposed human activities with transboundary impacts. Related Initiatives: 3, 4, 8, 9, 14.

Initiative 13: New Mechanisms to Resolve Conflicts Over Ecosystem Management. A call for the resolution of transnational environmental disputes based on Articles IX and X of the 1909 Boundary Waters Treaty- either through use of the IJC's "fourth power" for arbitrating disputes or by expansion of the IJC's treaty powers and/or development of a mutually acceptable board, panel, or other vehicle to function as an environmental mediator. Related Initiatives: 14, 30.

Initiative 14: Enactment of the Uniform Transboundary Pollution Reciprocal Access Act. Enactment of model law drafted by the National Conference of Commissioners on uniform State Laws and the Uniform Law Conference of Canada in 1982 and recommended by states and provinces. It would permit suits when both parties reside in jurisdictions that have enacted the Uniform Act. The Act would acknowledge the fact that ecosystems do not recognize the boundary between Canada and the United States. Related Initiatives: 13.

Initiative 15: Ecology City-Municipal Pilot Project. Identification of Canadian and U.S. communities willing to act as model cities in designing and implementing an ecosystem approach at the municipal level. Related Initiatives: 16.

Initiative 16: Value Impact Analysis- Pilot Study. Incorporation of a decision-making process including value impact analysis in a pilot program to test ecosystem management at a municipal or other local government level. Ecology City, proposed in Initiative 15, or a proposed management plan for Allegheny State Park in Pennsylvania might be suitable vehicles for testing this approach. Related Initiatives: 15.

Initiative 17: Advice for State and Provincial Legislatures. A talent inventory provided by State and Provincial Academies of Science to provide or find (outside) qualified persons to supply scientific advice to legislative committees dealing with environmental affairs or other programs that would directly affect an ecosystem approach in the Great Lakes basin. Related Initiatives: none.

GROUP C: PAYING THE COSTS FOR RESOURCES USE (18-22)

Differences in political systems and institutions make this problem area the least amenable to generalized solutions. Consequently it has received little attention before or since Hiram.

Initiative 18: Establish a continuing bi-national task force to encourage the design and adoption of policies likely to motivate behavior in a direction consistent with an ecosystem approach. Establish (via governments or IJC) an interdisciplinary task group to evaluate policies, programs, and actions related to the Great Lakes that are or have been compatible with an ecosystem approach and to recommend alternatives to those that need improving. The Task Force would also provide suggestions on implementation of alternatives. Related initiatives: 3, 4, 9, 12, 22, 28, 32.

Initiative 19: Create a Great Lakes Rehabilitation Fund. A tax on consumptive resource uses (i.e., water for irrigation, cooling towers, fishing, etc.) to finance the measures needed to reach and maintain the intent of the Great Lakes Water Quality Agreement. Related Initiatives: 20, 21, 22, 32.

Initiative 20: Full Cost Pricing: Internalizing Pollution Costs. Designate a binational study group to:

- 1) conduct a technical, legal, and economic feasibility study to address the internalization of environmental fees, surcharges, and penalties and to explore other measures for internalizing pollution costs.
- 2) develop means for doing feasibility assessments for proposed development schemes and review processes (including hearings) for approving or "licensing" developments that adopt the principle of "full cost pricing" to assess the societal worth of the proposed undertaking. This process would have to be designed to go beyond the conventional economic interpretation of "opportunity costs" that are often ignored in development decisions.
- 3) make recommendations to federal, state, and provincial governments.

Related Initiatives: 19, 21, 22, 32.

Initiative 21: Paying the Bills for Environmental Protection. Development of options, such as per-

mit charges and tax incentives, that shift more environmental protection costs from the taxpayer to the consumer. The aim is to provide a more secure financial base for environmental protection. Related Initiatives: 9, 19, 20, 22.

Initiative 22: Incentives for Implementing an Ecosystem Approach. An interdisciplinary task force representing the perspectives of government, industry, and citizens to develop incentives for implementing an ecosystem approach in the Great Lakes. Related Initiatives: 14, 18, 19, 20, 21, 32.

GROUP D: EDUCATION AND PUBLIC AWARENESS (23-25)

There is considerable forward movement in this area, but much remains to be done to systematize and integrate the work. The recent emergence of GLU was important because it has an explicit charge for education and public awareness. The "Decisions for the Great Lakes" programs conducted by GLT have been successfully underway for some time in both the U.S. and Canada. There are individuals on both sides of the border working on middle and high school science curriculum materials pertinent to the Great Lakes basin. The Sea Grant Colleges in the U.S. have an informal network of communications, and the Minnesota, Wisconsin, Ohio, and Michigan Sea Grant Programs have developed teaching units and manuals on Great Lakes topics. There is a Great Lakes Basin Educators' Network associated with the IJC Science Advisory Board's Social and Economic Considerations Committee. Extension programs in the U.S. and outdoor educators and programs of nature centers and aquaria in the Great Lakes basin contribute to non-traditional education on Great Lakes subjects.

Initiative 23: Education and the Ecosystem Approach: Getting the Context Right. Curriculum revision to strengthen primary and secondary educational systems to improve basic understanding of principles of ecology and to learn about how they apply to the Great Lakes basin ecosystem. Problem solving exercises that focus on the difference between managing a house (environment) and a home (ecosystem). Related Initiatives: 24, 25.

Initiative 24: Cross-Disciplinary Courses in Ecosystem Management. Development of transdisciplinary courses in ecosystem management (such as Decisions for the Great Lakes) within universities

and other institutions of higher education with credits available in each participating department (economics, sociology, engineering, political science, biology, law, etc.), so students and professors will have increased opportunities to contribute and participate. Related Initiatives: 23, 25, 26.

Initiative 25: Public Education and the Ecosystem Approach: Innovative Ideas. Innovative non-traditional techniques tailored for specific audiences to communicate ecosystem ideas and practices in ways that capture and maintain attention. Marketing techniques. Related Initiatives: 2, 23, 24, 26, 27.

GROUP E: IMPROVING CITIZEN PARTICIPATION -ACCESS AND COMMUNICATION (26-33)

This group and the previous one produced the greatest overlap in initiatives, so much of the preamble to Group D applies here, as well. There has been progress, however. A number of universities are doing work related to Number 26. The "Charter for the Great Lakes" addresses efforts toward Number 29, as do regional and national environmental action and citizen participation organizations such as GLT, GLU, the National Wildlife Federation, the League of Women Voters, and Pollution Probe.

Initiative 26: University-based Centers for Great Lakes Information. Establishment or expansion of centers at key universities in the Great Lakes basin to facilitate: 1) development of Great Lakes basin information; 2) public access and use of information; and 3) university-based expertise related to improving/developing an ecosystem approach to important resource/environmental issues. Related Initiatives: 3, 11, 24, 25, 27, 28, 31, 33.

Initiative 27: Dialogue Network: Enhanced Communication. Tie in with a computer network such as I. P. Sharp, GIESO, or ARPANET via time-shared terminals to continue the dialogue begun at the Hiram Workshop in a network communications context to clarify operational criteria for "ecosystem thinking." Related Initiatives: 2, 3, 4, 10, 12, 24, 25, 26, 32, 33.

Initiative 28: Improved Decision-making Toward Ecosystem Management. Establishment of an improved system for making environmental/resource development decisions to allow input

from all parties involved in or affected by a proposal and for more extensive consideration of social and environmental implications. Related Initiatives: 2, 16, 18, 26.

Initiative 29: Coalitions to Pressure the U.S. and Canada to Establish Long- and Short-term Research and Monitoring Standards and Goals. Establishment of coalitions to provide Congress and Parliament with information about the consequences of cuts in funding and programs for research and monitoring on the Great Lakes. Develop short-term strategy to fund U.S. programs threatened or disrupted by USEPA budget reductions and program priorities. Establish a long-term strategy of need. Couple with major public information and media information programs in key centers around the Great Lakes. Related Initiatives: 3, 4, 9.

Initiative 30: Environmental Bill of Rights for the Great Lakes. An environmental bill of rights for the Great Lakes would be developed as a "charter" and incorporated into the Great Lakes Water Quality Agreement. Efforts to incorporate changes, reflecting that bill of rights, would also be made in various other policy documents at provincial, state, and federal levels. Related Initiatives: 7, 13, 14.

Initiative 31: Improve Public and Industrial Input to the IJC. The IJC should receive and respond to formal inquiries or delegations from public or industrial interest groups concerned with problems within the Great Lakes basin ecosystem. Related Initiatives: 26.

Initiative 32: User Participation in Regulation. Provide for user group participation in regulatory decision-making with a view to sharing responsibility for management of a Great Lakes basin resource such as the fishery. A management system whereby user groups could reap benefits from their own restraint. Related Initiatives: 18, 19, 20, 22, 27.

Initiative 33: Political Action and the Ecosystem Approach. Encourage the adoption of "ecosystem

approach" platforms by politicians and political parties and the election of parties and politicians willing to make some commitment to the "ecosystem approach." Related Initiatives: 2, 9, 26, 27.

RECOMMENDATIONS

To ensure the expeditious implementation of the foregoing initiatives, and to provide for evaluation and action for other such proposals as they emerge, the Steering Committee⁷ and workshop participants offer two recommendations:

1. establish a continuing group to monitor and evaluate progress in implementing an ecosystem approach in the Great Lakes basin, with annual reporting and a five-year review in full; and
2. establish a public information program with examples and illustrations describing how to practice an ecosystem approach in government, industry, citizen groups, and in personal behavior.

ACKNOWLEDGMENTS

The Steering Committee⁷ expresses its appreciation to the following sources for financial and *in-kind* contributions which permitted the workshop to take place:

The International Joint Commission, directly and through its Great Lakes Science Advisory Board.
 The Great Lakes Fishery Commission, directly and through its Board of Technical Experts.
 Great Lakes Tomorrow through its contribution of staff for workshop planning and coordination.
 The Petroleum Association for Conservation of the Canadian Environment.
 The President of Hiram College and the Canadian Consul General, Cleveland, Ohio.

Appreciation is also extended to the staff of Hiram College for the efficient and friendly manner in which services were extended to the workshop and to teaching faculty from Hiram College and Michigan State University who provided technical assistance in facilitating and recording workshop sessions.

The authors are indebted to H. H. Prince of Michigan State University for valuable comments during the preparation of this manuscript and to Glenda Daniel for assistance in condensing and sharpening the issues.

⁷The Steering Committee consisted of: J. R. Vallentyne, W. E. Cooper, G. R. Francis, M. Becker, H. H. Prince, W. J. Christie, J. E. Gannon, H. A. Regier, and D. R. Talhelm. C. J. Edwards acted as IJC liaison.

Conventional graphs and charts were prohibited at the Workshop. Laughter was felt to be more appropriate *lingua franca*, and this was ably stimulated by cartoonist Jim Kempkes. Jim contributed thematic sketches of the sort included here, and satirized the participants and their activities with great wit and charm, during the Workshop. We are deeply indebted to him.

REFERENCES

- Axelrod, R., and Hamilton, W. D. 1981. The evolution of cooperation. *Science* 211:1390-1396.
- Fluharty, M. 1982. Ecosystem management for the Great Lakes Basin: a personal perspective. Manuscript available on request from the Great Lakes Regional Office, International Joint Commission, 100 Ouellette Avenue, 8th floor, Windsor, Ontario N9A 6T3.
- Gannon, J. E. 1984. Great Lakes-One person's dream, hope for tomorrow. *J. Great Lakes Res.* 10:97.
- Hunt, P. 1982. The ecosystem approach and Canadian industry. Manuscript available on request from the Great Lakes Regional Office, International Joint Commission, 100 Ouellette Avenue, 8th floor, Windsor, Ontario N9A 6T3.
- Jacobs, J. 1975. Diversity, stability and maturity in ecosystems influenced by human activities. In *Unifying Concepts in Ecology*, ed. W. H. van Dobben and R. H. Lowe-McConnell, pp. 187-207. The Hague: Junk.
- Kenaga, E. 1982. Business considerations pertaining to the interactions of man's activities in ecosystems. Manuscript available on request from the Great Lakes Regional Office, International Joint Commission, 100 Ouellette Avenue, 8th floor, Windsor, Ontario N9A 6T3.
- LaRoche, D. A., and Hall, J. 1982. Implementing an ecosystem approach at the government-political level in the United States and Canada. Manuscript available on request from the Great Lakes Regional Office, International Joint Commission, 100 Ouellette Avenue, 8th floor, Windsor, Ontario N9A 6T3.
- Morse, N. H. 1975. *An environmental ethic-its formulation and implications*. Can. Env. Advisory Council Report No. 2: 1-20.
- Odum, E. P. 1969. The strategy of ecosystem development. *Science* 164:262-270.
- Olson, E. R. 1983. Community, relevance and change. *Focus* 9(1): 1-4.
- Schmidt, W. 1982. Implementing the ecosystem approach via associations - United States. Manuscript available on request from the Great Lakes Regional Office, International Joint Commission, 100 Ouellette Avenue, 8th floor, Windsor, Ontario N9A 6T3.
- Stone, C. P. 1972. *Should Trees Have Standing?* Los Altos, CA: W. Kaufmann Inc.
- Taylor, P. W. 1981. The ethics of respect of nature. *Env. Ethics* 3:197-218.
- Trist, E. 1980. The environment and system-response capability. *Futures* (April issue): 113-127.
- Vallentyne, J. R. 1982. Team-work: voluntary membership associations -Canada. Manuscript available on request from the Great Lakes Regional Office, International Joint Commission, 100 Ouellette Avenue, 8th floor, Windsor, Ontario N9A 6T3.
- Walmsley, R. K. 1982. The web of life-a personal view. Manuscript available on request from the Great Lakes Regional Office, International Joint Commission, 100 Ouellette Avenue, 8th floor, Windsor, Ontario N9A 6T3.