CHAPTER ONE

ECOSYSTEM

Ecosystem

"Everything Is Connected To Everything Else"

Early in the work of the Royal Commission, it became apparent that the Toronto waterfront could not be viewed as simply a narrow band along the shore: it is linked by Lake Ontario to the other Great Lakes, by rivers and creeks to the watersheds, and by watermains, storm and sanitary sewers, and roads to homes and businesses throughout the Metropolitan area.

The air along the lakeshore is influenced by emissions from local and regional sources — automobiles and industries — and distant sources in the United States and beyond.

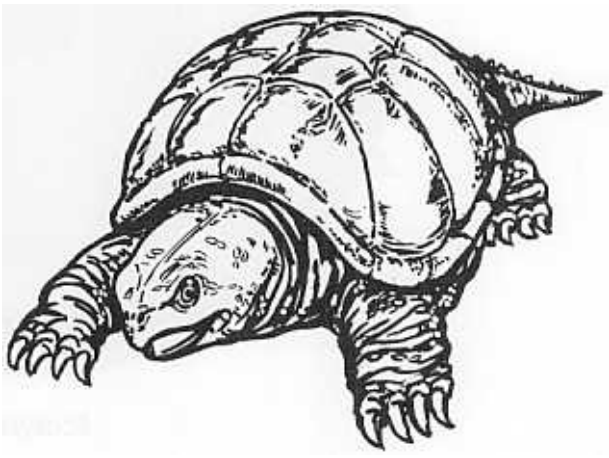
Beaches, dunes, shallow waters, wetlands, cliffs, woods, and meadows along the waterfront provide habitats for many species of resident and migrating wildlife. Some of these are linked to the hinterland through the movement of people and wildlife, via the river valleys, to Lake Ontario. Human uses of the land — transportation, housing, industry, business, and recreation — tie the waterfront economically and socially to the larger region in which it is located.

Human activities along the waterfront affect and are affected by areas outside it. Pollutants entering rivers upstream of the waterfront affect the water quality at river mouths. At the same time, organic chemicals discharged from storm sewers along the waterfront will influence water quality farther east in Lake Ontario and in the St. Lawrence River. In the same way, pollutants emitted into the air of the waterfront will have an impact downwind of the area.

These examples illustrate a fundamental point — everything is connected to everything else. They also pose challenges: how should we attempt to understand the ecosystem in which we live? How can we restore and protect it? The Commission believes that the best place to start is to adopt an ecosystem approach to all phases of activity — studying, planning, remediating, protecting, and developing.

All ethics so far evolved rest upon a single premise; that the individual is a member of a community of interdependent parts. His instincts prompt him to compete for his place in that community, but his ethics prompt him also to co-operate (perhaps in order that there may be a place to compete for). The land ethic simply enlarges the boundaries of the community to include soils, waters, plants and animals, or collectively: the land. . . In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow members, and also respect for the community as such.

Leopold, A. 1949. "The land ethic." In *A Sand County almanac, and sketches here and there*, 203. Oxford: Oxford University Press.



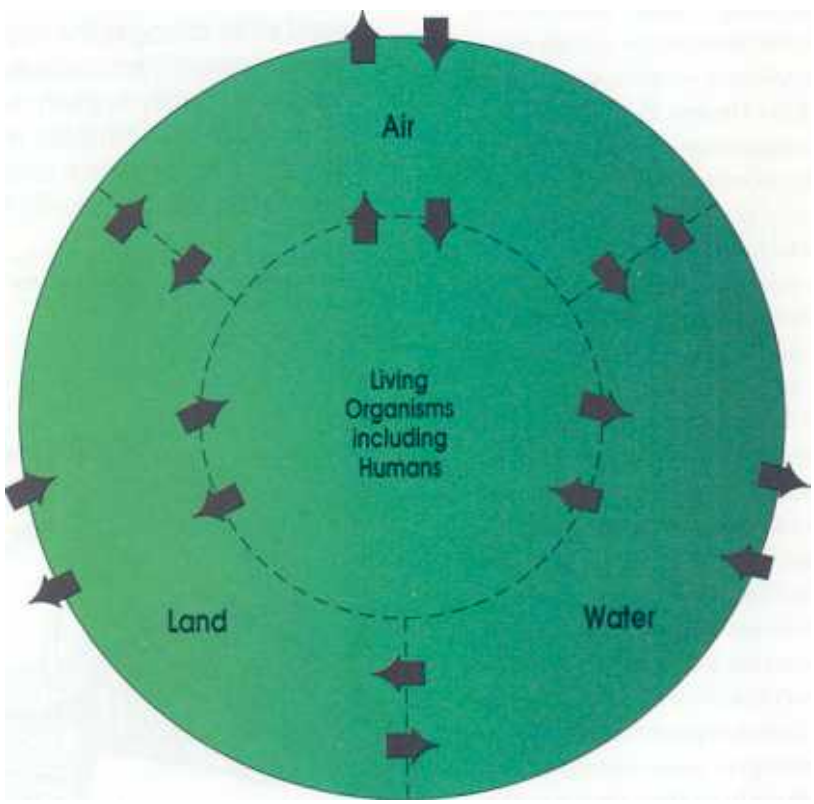
The Ecosystem Approach

Ecosystem: "eco" from the Greek "oikos", meaning household, and "system"; an interacting, interdependent complex.

The ecosystem concept is not new. The word was coined in 1935 by scientist Arthur Tansley, who defined it as a whole system that included not only the community of living organisms, but also the complex of physical factors forming the environment. Simply put, an ecosystem is composed of air, land, water, and living organisms, including humans, and the interactions among them. The concept has been applied to many types of interacting systems, including lakes, watersheds, cities, and the biosphere.

A healthy ecosystem is like a house of cards: carefully constructed and balanced, the cards support one another. If too many stresses are placed on it, the effect on the ecosystem is like that of removing too many cards from the house: the entire thing collapses.

A classic example in the Great Lakes Basin was the destruction of the Lake Erie fishery. The first sign of trouble during the 1950s was the disappearance of mayflies and their nymphs, food for many fish and birds. The cause was pollution of the water by excessive amounts of nutrients, especially phosphorus, from sewage and farm run-off. This enrichment fostered prolific growth of algae and other plants in the lake. When they died, the breakdown of the large quantities of plant matter by bacteria used up huge amounts of oxygen, and other



Ecosystem

A hardwood forest

aquatic life, including the mayfly nymphs, suffocated.

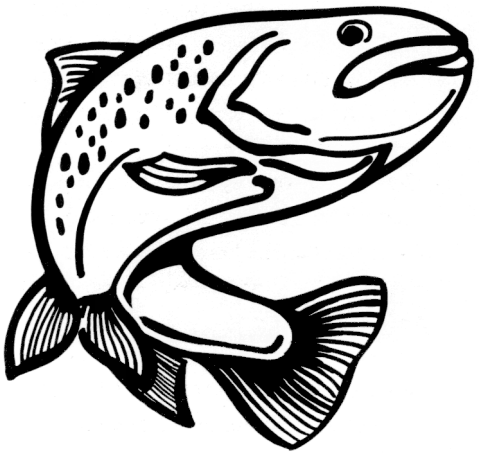
The mayfly predators, including important commercial fish species such as perch, pickerel, cisco, and bass, declined dramatically. During the 1970s, concerted basin-wide efforts to reduce the inputs of phosphorus to Lake Erie gradually improved water quality. As a consequence, the mayflies have returned, and the fisheries have made a comeback.

The Lake Erie experience illustrates the critical interdependencies within ecosystems. Although current environmental problems may not be as easy to solve, the recovery of the Lake Erie fishery gives cause for hope that degraded ecosystems can be restored, if people understand the key relationships involved and deal effectively with root causes, rather than with symptoms.

Traditionally, human activities have been managed on a piecemeal basis, treating the economy separately from social issues or the environment. But the ecosystem concept holds that these are inter-related, that decisions made in one area affect all the others. To deal effectively with the environmental problems in any ecosystem requires a holistic or "ecosystem" approach to managing human activities.

Two principles should guide conservation of intergenerational equity: the first is conservation of quality, defined as leaving the Great Lakes basin ecosystem in no worse condition than it was received from previous generations; the second is to conserve options, defined as conserving the diversity of the natural resource base of the Great Lakes.

1985. *The Great Lakes Water Quality Agreement: an evolving instrument for ecosystem management,* National Research Council and Royal Society of Canada. 109. Washington: National Academy Press.



There are some key characteristics of an ecosystem approach that help illustrate what is required. An ecosystem approach:

- ~ includes the whole system, not just parts of it;
- ~ focuses on inter-relationships among the elements;
- ~ understands that humans are part of nature, not separate from it;
- ~ recognizes the dynamic nature of the ecosystem — a moving picture rather than a still photograph;
- ~ incorporates the concepts of carrying capacity, resilience, and sustainability — suggesting that there are limits to human activity;
- ~ uses a broad definition of the environment — natural, physical, economic, social, and cultural;
- ~ encompasses both urban and rural activities;
- ~ is based on natural geographic units — such as watersheds — rather than on political boundaries;
- ~ embraces all levels of activity — local, regional, national, and international;
- ~ emphasizes the importance of living species other than humans and of generations other than our own;
- ~ is based on an ethic in which progress is measured by the quality, well-being, integrity, and dignity it accords natural, social, and economic systems.

Although widespread public recognition of the inter-related nature of environmental issues is relatively recent, scientists and institutions have been calling for the application of ecosystem thinking for some time.

For example, the Great Lakes Water Quality Agreement, signed by Canada and the United States in 1972, originally had a fairly narrow focus on the restoration of water quality. However, revisions and amendments to the Agreement in 1978 and 1987 provide a firm foundation for an ecosystem approach to the entire Great Lakes Basin. There was a recognition that "restoration and enhancement of the boundary waters cannot be achieved independently of other parts of the Great Lakes Basin Ecosystem with which these waters interact".

The Agreement promotes a view of humans as part of nature. It directs attention towards treatment of the whole patient (the ecosystem), rather than just to treatment of the symptoms of ill-health.

More recently (1989), a proposed Ecosystem Charter for the Great Lakes developed by the Rawson Academy of Aquatic Sciences recommended an approach to "management by people and their patterns of behaviour to assure greater compatibility with the natural systems of the region; a harmonizing of human activities with other parts of the ecosystem". This, it said, means "examination of the specific human activities that are behind the use and abuse of basin natural resources, and a new thinking in the design of sustainable developments in the future..."

Consistent with this thinking, the primary goal of the Metro Toronto Remedial Action Plan (RAP), as developed by the Public Advisory Committee (1989), is that:

> Toronto's waterfront and watersheds should be a diverse, healthy, integrated ecosystem. They should be managed using an ecosystem approach in order to restore beneficial uses of our aquatic resources...

On a smaller scale, the environmental audit of the East Bayfront and Port Industrial Area being undertaken by the Royal Commission is based on an ecosystem approach. During Phase I of the audit, existing information was gathered on air, surface water, groundwater, soils, natural heritage, and built heritage (see Royal Commission Publication No.10: *East Bayfront and Port Industrial Area: Environment in Transition*). The review revealed a number of existing and potential links among processes and elements of the ecosystem. For example:

> sources outside the study area contribute a great deal to the degradation of air, land, and water;
> air quality problems (e.g., odours and suspended particulates) originating in the Port Industrial Area affect nearby communities (e.g., South Riverdale);
> pollutants may be transferred from soils to buildings, affecting indoor air quality, and to ambient air in windblown dust and soil;
> ~ airborne contaminants (e.g., lead and salt from roadways) may be transferred to soils;
> ~ pollutants may migrate from groundwater to the surface waters of Lake Ontario;
> ~ food-chain contamination may result in accumulation of toxics in wildlife;
> ~ spatial links among open spaces/wildlife habitats (e.g., Cherry Beach, Leslie Street Spit, Toronto Islands, and the Don Valley) are poorly developed.

Phase II of the environmental audit will explore further these and other ecosystem relationships, in an attempt to address such questions as the following:

- ~ What are the implications of the environmental conditions in the area for human health, behaviour, activities, and access?
- ~ How are human activities affecting other elements of the ecosystem (air, land, water, and wildlife)?
- ~ What relationships exist among the environment of the study area and downtown Toronto, the Don Valley Watershed, the Greater Toronto Area, the Great Lakes Basin, etc.?
- ~ What measures are necessary to re-establish ecosystem integrity and to protect and restore beneficial uses?

Ecosystem under Stress: Greater Toronto Bioregion

The environmental audit is demonstrating the inextricable links among the East Bayfront/Port Industrial Area, other parts of Toronto, the Don River Watershed, and the Great Lakes. Similarly, the Greater Toronto Area waterfront being investigated by the Royal Commission is part of a region that includes the watersheds of the rivers leading into Lake Ontario from the GTA. Anything

that happens within this area is tied ecologically to the health of the waterfront.

Therefore, in order to truly understand the waterfront itself, we must gain an understanding of the biological region, or bioregion, in which it lies.

We have defined the Greater Toronto Bioregion as the area bounded by the Niagara Escarpment on the west, the Oak Ridges Moraine to the north and east, and Lake Ontario to the south. The lands and waters in this bioregion share climatic and many ecological similarities. The soils and landforms are based on the glacial deposits of the Lake Ontario plain as it rises from the shores of the lake to meet the gravelly hills of the Oak Ridges Moraine. The watersheds arising in the moraine drain southwards to Lake Ontario and northwards to lakes Simcoe and Scugog. Most of the bioregion now falls within the commuter and economic orbit of Toronto. In this sense it is our home — the ecosystem in which we live, work, and play.

The defines of the bioregion are similar, but slightly smaller than those of the GTA, which includes the regions of Halton, Peel, Metro Toronto, York, and Durham. This description of the condition of the bioregion includes some information from the GTA itself, simply because such information exists. Nevertheless, it must be remembered that the area described is circumscribed by natural, not political, boundaries. It is currently under considerable stress from human activities.

The authors of *Great Lakes, Great Legacy?*, published by Washington's Conservation Foundation and Ottawa's Institute for Research on Public Policy, usefully categorize the many types of stress that can affect ecosystem health.

- First, there are natural processes: weather, fire, and disease outbreaks.
- Second, there is the addition (loading) of substances to the environment; in the Greater Toronto Bioregion, it includes the erosion of soil into bodies of water, the addition of nutrients like nitrogen and phosphorus into lakes, and the emission of chemical and heavy metals into air, water or soil.
- Third, physical restructuring — e.g., damming and diking of rivers and streams, dredging of harbours, clearing of forests, drainage of wetlands, and altering shorelines with structures such

Lake Shore Boulevard and the Keating Channel

as seawalls or lakefilling — places stress on the ecosystem.

- The fourth category of ecosystem stress is the removal of renewable and non-renewable resources, including withdrawal of ground or surface waters, commercial forestry, fishing, and the extraction of minerals and aggregate.
- Finally, the introduction of non-native organisms is also stressful. Most notable in the Great Lakes was the unwitting introduction of the sea lamprey when the St. Lawrence Seaway was completed; most recently, the arrival of the zebra mussel from Europe threatens the lakes.

All these stresses are at work in the Greater Toronto Bioregion. In order to provide a thumbnail sketch of the area's condition, we examine it using an ecosystem approach. Although there are many gaps in information, the following provide some revealing information about the characteristics of land, human activity, water, air, and wildlife in the bioregion.

The Hooded Merganser

Land

Two great forces — one natural and one human — have shaped the Greater Toronto Bioregion as we know it today. The greatest natural force shaping the area was the retreat, starting about 15,000 years ago, of the Wisconsin Glaciers. As they slowly withdrew to end the last ice age, the glaciers carved out the rivers flowing north to Lake