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# Nature as Infrastructure: Strategies for Sustainable Regional Landscapes

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The concept of the metropolitan landscape can be said to have originated in the late nineteenth century with Patrick Geddes, the Scottish biologist, sociologist and planner, who introduced the idea that cities and their regions were interdependent.<sup>1</sup> A hundred years later, the American regional designer Philip Lewis began analyzing patterns of urbanization across the U.S. from satellite photography taken at night.<sup>2</sup> He argued that urbanization was becoming so widespread that, if key natural and cultural landscapes were to be protected, all planning actions needed to be seen within a regional context. However, he also concluded that urbanization could be guided to protect these natural resources that sustain the cities. In effect, where the city in Geddes's day was at the center, surrounded by its regional landscape, Lewis concluded that the natural landscapes of the region should form the center.

Despite these perspectives, urban growth in North

**Above:** The Countryside Agency agenda in Britain is encouraging farmers to manage their lands for public benefit as well as for what they produce in food. Photo courtesy of the author.

America has commonly been associated with an assumption of limitless space. Evidence of this myth is clear when we understand the relationship between the land areas covered by development and increases in population. Thus, between 1982 and 1997 the Brookings Institution found that the total amount of developed land in the U.S. increased by 45 percent, while the population grew by only 17 percent. Meanwhile, in Portland, Oregon, a city with a self-imposed urban growth boundary, the population grew by 31 percent, while land consumption increased by only 3 percent.<sup>3</sup>

The use of urban growth boundaries, greenbelts, and green infrastructure to control growth evolved from Ian McHarg's concept of ecological determinism.<sup>4</sup> McHarg proposed using the same biophysical processes that shape the natural landscape to determine the form and location of towns and cities. In other words, he proposed putting nature first, not last, on the planning agenda.

This article examines three ways to employ such a vision to control urban growth and protect ecologically and culturally significant places.<sup>5</sup>



### Greenbelts: Nature as an Organizing Framework

In 2005 Ontario's Provincial government adopted planning legislation to control the sprawl that was overtaking Toronto and other regional municipalities. Among the goals of the legislation was to protect one of the most remarkable landscapes in Canada, the Oak Ridges Moraine, a highly significant aquifer recharge area that includes hardwood forests, agricultural areas, wetlands, and kettle lakes rich in wildlife. The moraine also provides pure water for rural communities and the source of more than 25 river systems that flow south to Lake Ontario. As part of the Provincial plan, a greenbelt natural system will now shape the future growth of the Toronto metropolitan area to accommodate its projected population expansion to 4 million people by 2031.<sup>6</sup>

Within this emerging regional context, the Town of Markham had already implemented an earlier plan to protect three river valleys that cross it from future development. Following a natural features study in 1993, a comprehensive strategy was enacted to protect and integrate these valleys into a town-wide system of parks, protected rights-of-way, and trail corridors.<sup>7</sup>

The plan's purposes were to prevent further losses of river habitat, reestablish riparian connections, restore wooded valleys and upland forests, protect groundwater supplies and upland cold-water fisheries, and create forest nodes large enough to support viable populations of birds such as hawks which require large home ranges. In addition to protecting the valleys, the plan established cross-connections on the tablelands, linking isolated woodlands and marshes, creating major nodes for groundwater recharge, and allowing establishment of a network of recreation trails.

As a feature of the town's Official Plan, this natural infrastructure has since provided a firm guide for growth, linking the town to other municipalities, and creating a framework for cooperative planning. By the year 2000 all remaining vacant lands in the town (an area of 2,400 hectares) had been built on according to the framework, including two New Urbanist developments.

It is rare to see results from such long-term ecological planning in such a short space of time, and to be able to assess their success or failure. The Markham plan is also significant because it raises several issues related to sustainability at the scale of the metropolitan landscape.

*First*, given the right level of political commitment, the plan shows that a "nature-first" concept can succeed in structuring growth. Yet, even as protection of the valleys and remaining open tablelands became a central mandate, the terms of reference in Markham continued to assume that the form of housing development and the ecological structure of the regional landscape were separate issues. For the development plan to be truly sustainable, there should have been a greater attempt to integrate these concerns.

*Second*, "sustainable building" requires design objectives that both support and contribute to the functioning of natural systems. Architectural design can and should manage rainwater runoff at its source, contribute to air quality and waste recycling, encourage natural ventilation and energy conservation, and promote alternative energy systems and a general economy of means.

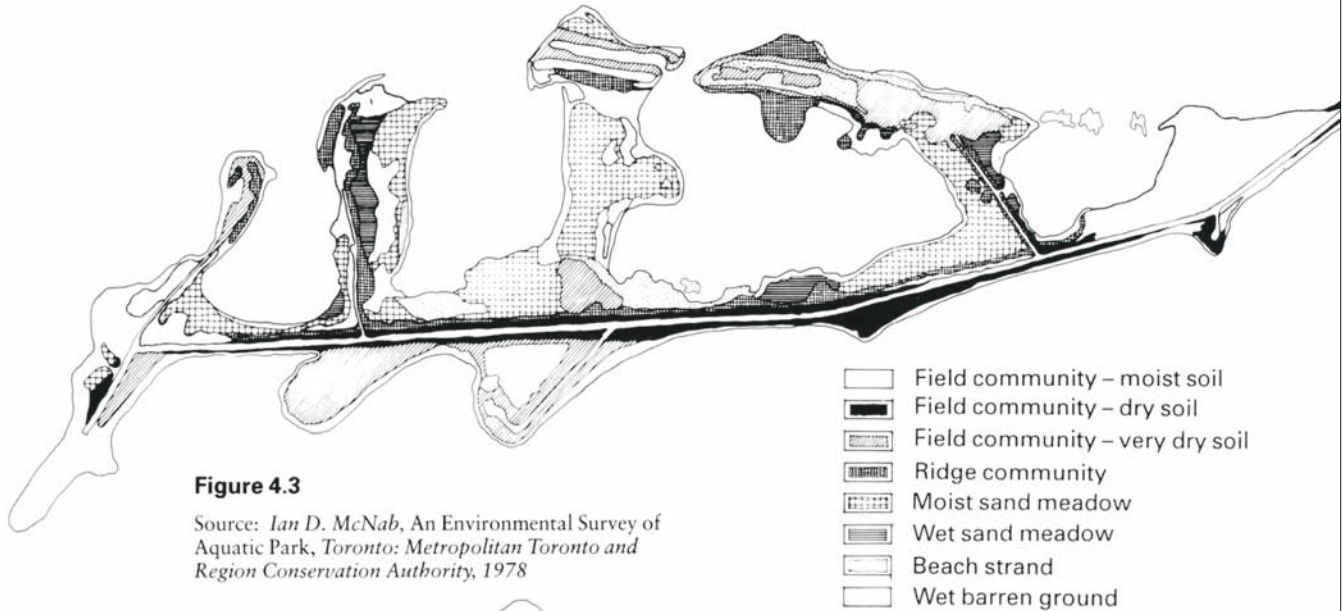
However, there is little evidence that such commitments have been met in the two New Urbanist communities in Markham. While New Urbanist principles pay general lip service to principles of ecological sustainability, they largely fail to promote environmentally driven urban form, relying instead on a past architectural vernacular with little continuing relevance.

*Third*, the people who reside in the communities near the valleys should be encouraged to learn more about these landscapes. This includes learning how to protect them;

**a** Plan of Outer Harbour Headland, Toronto Waterfront

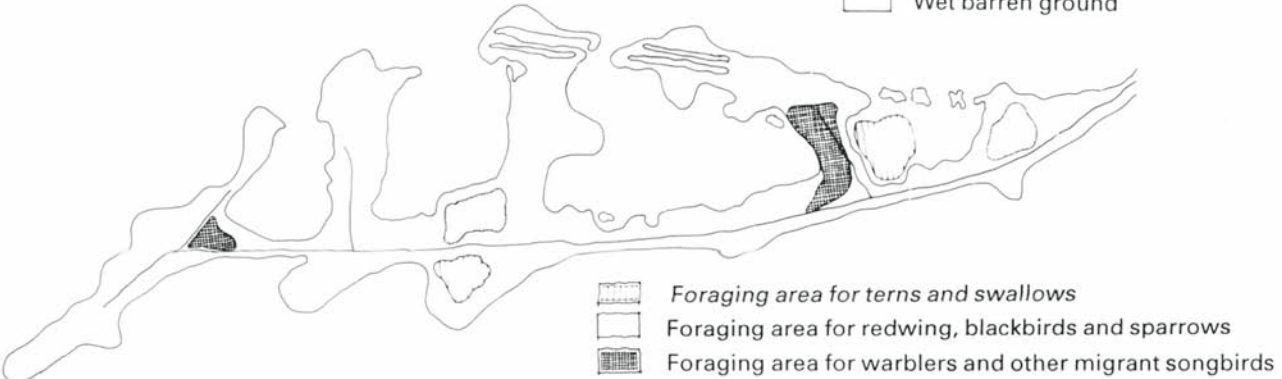


**b** Outer Harbour Headland vegetation communities



**Figure 4.3**

Source: Ian D. McNab, *An Environmental Survey of Aquatic Park, Toronto: Metropolitan Toronto and Region Conservation Authority, 1978*



**Figure 4.4** Foraging areas for birds, Outer Harbour Headland, 1978

Source: Ian D. McNab, *An Environmental Survey of Aquatic Park, Toronto: Metropolitan Toronto and Region Conservation Authority, 1978*

how to garden with plants associated with the valley flora; how to keep pets from invading protected wildlife habitats and harassing or killing the species that live there; and, in general, how to become better stewards of the land.

**Restoring Devastated Landscapes**

There are more than 400,000 brownfield sites in North America, and about 750,000 across Europe.<sup>8</sup> In North America, the rebuilding of urban communities on these abandoned industrial lands has become an increasingly accepted way to avoid expanding development to greenfields at the city's edge.

One of the most powerful examples of this policy, however, comes from Germany's Ruhr Valley. The need for regional restructuring became obvious there in the early 1990s, when once-prosperous industries based on coal and steel became obsolete. In addition to high unemployment and a depressed economy, the decline of these industries left behind a ravaged landscape, massive land subsidence from mining operations, and a hydrology of channelized rivers carrying a mix of waste and rainwater.

In 1988 a commitment was made to renew the ecology of the Emscher Valley, a part of the larger Ruhr industrial region, through a series of development projects. Guided

by a regional coordinating agency, the International Building Exhibition, a continuous 320-sq.km. greenway forest system has now been established connecting seventeen towns and a number of decommissioned industrial sites. As part of this work, portions of these sites have been protected as significant monuments, resources for economic and social renewal, and future venues for celebrating the arts, architecture, and landscape design.

The overall goal of this effort has been to improve the living and working environments of two million people by connecting isolated open spaces and restoring the ecological health and beauty of the countryside. Politically, the towns now form a federation along the main artery of the Emscher River, acting as a spatial and conceptual entity, unifying cultural and recreational areas, housing, and places of work.

This ongoing effort has raised important issues related to ecological restoration. For example, how does one reconstruct a forest environment on thousands of hectares of industrial wasteland? One fortuitous solution has been to leave what was already occurring naturally. Young birch, willow and poplar trees are now emerging on open lands and amidst concrete foundations, steel pipes, railway sidings, and other disused industrial structures. The visitor is left with a sense of natural renewal: of animals, birds, and insects establishing themselves in a reinvented habitat.

The Emscher Valley restoration has also shown the importance of preserving local memory and regional identity by working within an existing structure of local places. Here this has had less to do with aesthetics than with informing people about their history—both bad and good. Thus, sections of channelized stream and remnants of the industrial architecture of coal-processing and steel-making have been preserved. Much of this has been left untouched, but new uses have also been worked into their interior and exterior structures. But the most dramatic aspect of this brownfield restoration has been the integration of ecology, economy, and the arts.

### Islands to Networks

The two examples above concern using the natural landscape as an organizing framework for controlling city growth and maintaining nature within urban areas. It is also important to consider how this regional theme can be expanded to include a larger, macro-scale relationship of protected wild areas. It is here that the misguided perception arises that cities and nature have to be two separate entities.

In the late 1990s, a national panel of eleven people was created whose mandate was to report on the ecological integrity of Canada's National Parks. Over eighteen

months as we crossed the country visiting many of them, I began to realize that nature-city disconnections are a problem for Canada's parks as well as its urban areas. For example, in protected, "unspoiled" park areas we watched bear and elk line up along the roadside waiting for hand-outs. Visitors incongruously seemed to believe that wild animals could be treated as pets, while the park itself represented the epitome of pristine wilderness. Most of these parks are also threatened by overpopulated campgrounds, water pollution from worn-out infrastructure, tourist developments, and arrival areas complete with green lawns and golf courses. In effect, perceptions of wild, untouched nature are rarely supported by reality.

The study team found that the very viability of many national parks is under threat from a variety of sources. In ecological terms, they are also becoming isolated islands, surrounded by forestry, mining, and industrial agriculture, and divided by highways that fragment habitat, kill wildlife, and isolate gene pools. Nevertheless, there remains great political and educational value to these parks as places to protect ecological integrity and teach about ecological diversity and natural beauty. Educational efforts linking these protected areas to urban open spaces should be central to the evolution of the environmental ethic.

In the late twentieth century, ecosystem-based management introduced new ways of thinking about the protection of such natural areas. Most importantly, the establishment of networks of protected areas is today recognized as essential to maintaining the ecological and genetic diversity of wildlife sanctuaries, heritage rivers, and other significant places. One dramatic example is the ongoing effort to establish a continuous Rocky Mountain wildlife corridor from Yellowstone National Park to the Yukon.

A smaller-scale effort to rethink the planning of natural areas has been initiated at Ontario's Georgian Bay Islands National Park. The closest national park to Toronto, it consists of 59 islands in an area of 16 square miles. Due to the park's small size, its ecological integrity can only be maintained through a collaborative effort between federal and provincial agencies, private nature conservancies, cottage associations, and the District of Muskoka.

**Opposite:** The Leslie Street Spit (Tommy Thompson Park) in the City of Toronto. A remarkable evolving and productive habitat for fish, animals and birds, its evolution began in 1959 when landfill was placed to establish a new harbor. When this project proved economically unrealistic, natural processes took over. By 1992, 290 species of birds had been counted on the spit, including the Caspian tern, and black-crowned night herons were nesting there.

### Environmental Awareness Begins at Home

Linking urban parks to national and regional protected areas also allows urban residents to gain levels of ecological awareness and knowledge that ultimately help preserve distant resources. Since the occasional trip to a national park likely leaves only fleeting memories, environmental literacy and the values that go with it must start at home. But the impacts of human activity and ways of overcoming them can be learned on a daily basis in ecologically diverse and heavily used city parks.

Around Toronto, several examples can be cited to illustrate this point. In High Park, the largest woodland park in the city, a program of prescribed burns has been ongoing since 1993 to remove exotic and invasive turf and restore a black oak savannah. In the spring following a major burn in 2000, native lupins appeared for the first time, following many years of traditional mowing.

Ever since, the surrounding community and local fire department have fully support this approach, with each burn serving as a community event. The use of fire management in the park also parallels its larger use in Canada's Grasslands National Park, offering a compelling lesson in transboundary environmental education.

Another example of local ecological learning happens daily in Tommy Thompson Park, a five-kilometer-long spit on Toronto's waterfront. Made from urban construction debris and sand dredged from Lake Ontario, its purpose was originally to create a new harbor. When the harbor project was abandoned, however, natural processes took over, and the park has been gradually transformed over fifty years into one of the most ecologically diverse urban habitats on the Great Lakes. Some 400 species of plants have now appeared; coyotes have made it their home; 290 species of birds visit or nest there; and 60,000 people visit every summer.

The spit can also be seen as an experiment in minimizing human impacts on plants and wildlife through a cooperative program of public education to control circulation and prohibit access to sensitive areas. For instance, signs requesting that people stay out of the spring nesting areas of the ring bill gull from April to July are generally respected.

As it extends into Lake Ontario, the spit functions in very similar ways to Point Pelee National Park on Lake Erie. "Artificial" and "natural" habitats, respectively, both are important to spring and fall bird migrations, and both function ecologically in the same way. The erosional processes at work on the two peninsulas are also similar, even if their origins could hardly be more different.

### Some Final Observations

The above examples tell us much about the important place of natural processes and networks in the twenty-first-century metropolitan landscape. They show the absolute necessity of an integrative, ecological view of cities and city regions and how this can teach us to tread lightly on valued and beautiful places. They show how a "nature-first" view can structure planning priorities and enrich the urban environment. They show how conscious design can restore life and health to devastated urban landscapes. And they show how home-grown environmental understanding can create linkages between urban regions and distant parks and protected areas.

These strategies provide the environmental framework for linking cities to a sense of larger protected ecological systems. Evident at the scale of the metropolitan landscape, these systems will be fundamentally linked to the ecological health of twenty-first-century urban areas.

#### Notes

1. Philip Boardman, *The Worlds of Patrick Geddes: Biologist, Town Planner, Re-educator, Peace-Warrior* (London: Routledge and Kegan Paul, 1978).
2. Philip H. Lewis, Jr., *Tomorrow by Design: A Regional Design Process for Sustainability* (New York: John Wiley, 1996).
3. William Fulson et al., *Who Sprawls Moss? How Growth Patterns Differ Across the U.S.* (Washington, D.C.: Brookings Institution, Survey Series, July 2001).
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5. For a more in depth analysis of these issues, see Michael Hough, *Cities and Natural Process: A Basis for Sustainability* (London: Routledge, 2004, second ed.).
6. Province of Ontario, "Places to Grow: A Growth Plan for the Greater Golden Horseshoe," discussion paper, Summer 2004.
7. Gore & Storrie, Ltd., in Association with Hough Stansbury Woodland Ltd. et al., "Town of Markham Natural Features Study, Phase 2," report, March 1993.
8. See Michael Hough, *Cities and Natural Process*, Chapter 7.