

# **Sustainable Uses of Urban Open Space: A Guide to the Literature**

by Mary Ann Beavis

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# **Sustainable Development, Urbanization, and Environmental Impact Assessment**

by Dianna Colnett

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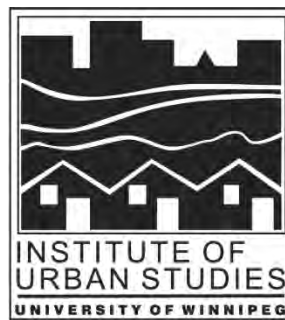
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**SUSTAINABLE USES OF URBAN OPEN SPACE: A GUIDE TO THE LITERATURE;  
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# SUSTAINABLE USES OF URBAN OPEN SPACE: A GUIDE TO THE LITERATURE\*

Mary Ann Beavis

## INTRODUCTION: OBJECTIVES AND SCOPE

The civilized part of humanity will soon be horror-stricken by a monotony, which does not only threaten this part of humankind in the future but which has already become a reality. Rye, wheat, oats, barley—or, for variety's sake, in reverse, barley, oats, wheat, rye—you see, this is likely going to be the flora in the near future. And the animal kingdom? Hens, turkeys, pigeons, geese, ducks, then cattle, horses, donkeys—the rest will be stuffed in the form of relics in museums (W. Wetekamp, 19th century).<sup>1</sup>

The term sustainable development implies *environmentally* sustainable economic development.<sup>2</sup> The logos and graphic designs adorning publications on urban sustainability often juxtapose images of the built environment with wild nature: trees, tall grasses, wild flowers, birds and animals. However, such imagery belies the content of most of the literature on sustainable urban development, where the environmental element tends to be discussed in terms of issues such as air and water quality, waste management, urban sprawl, transportation, energy use, efficient use of infrastructure, human health and social equity, and on plans and policies to ameliorate problems in these areas (e.g., WCED, 1987, 235-60; UNCHS, 1990, 1991; Brown and Jacobson, 1987; Rees and Roseland, 1991; Beavis, ed., 1990; Yesney, 1990; Crerar, 1989; Stren *et al.*, 1992). The "green" element in urban sustainability is often neglected, although the notion that a "sustainable city" will also be a (relatively) ecologically healthy urban environment is presupposed.<sup>3</sup>

The document that follows is a review of the secondary literature that has been published on various subject areas related to the field of urban green space planning. In accordance with the mandate of this series—to give an overview and commentary on the current state of research on a topic relevant to the theme of urban sustainability accessible to a wide audience—this paper is a "guide to the literature" for academics, professionals and others with an interest in the topic, but who are not necessarily experts. One aim of the review is to highlight the (somewhat neglected) "green" component of sustainable urban development, especially in view of the importance of conserving biological diversity (World Wide Fund for Nature, n.d., 1986; Ryan, 1992; Dalhousie University, 1989). The notion of sustainable development was promoted by the Brundtland Commission, and adopted by many governments, non-governmental organizations and professional groups, as a response to environmental degradation, including species loss, caused by environmentally insensitive economic development (see WCED, 1987, pp. 147-67). Urban development in the modern world has been at least as heedless as exurban natural resource exploitation (mining, forestry, fishing, agriculture, energy

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\*The author would like to thank three anonymous referees for their comments and suggestions.

mega-projects, etc.) of the effect of economic activity—including building, landscaping and recreational development—on non-human species and larger ecosystems. Indeed, as John Ryan notes, urban insensitivity to nature may contribute to the degradation of non-urban ecosystems: "One reason that the destruction of biological diversity has gone so far without major commitments to stopping it is that urban dwellers have little experience of its importance" (1992, p. 36). Urbanites make up the majority of North Americans (some 80%), and a growing proportion of the population of the world (50% by the year 2000, according to WCED, 1987, p. 235). The attitudes and activities of urban governments, developers, planners, bureaucrats, landscape designers and concerned citizens are thus of great relevance to the enhancement of environmental health, including biological diversity, both within and outside of cities. As Ryan observes, "Restoring nature where people live—reestablishing a personal link with the living world—may be necessary to have it elsewhere" (1992, p. 36). Some of the literature surveyed in this paper will indicate that ecologically informed approaches to urban open space can also lead to the preservation of remnant ecosystems and rare species, provide economic, recreational, educational and social benefits to urban dwellers, conserve energy, ameliorate urban pollution and climatic conditions, and reduce recreational pressure on exurban wilderness and agricultural areas.

A second objective of this paper is to sensitize readers to the ubiquity of urban open space, and of urban nature. This paper, it is hoped, will introduce some readers to a different way of "seeing" urban open spaces, not as "empty," "useless" or "undeveloped," but as functioning or potential habitats for a wide variety of species. For the purposes of this paper, "open space" will be defined broadly as encompassing urban parks and gardens, river corridors, schoolyards, boulevards, cemeteries, ditches, vacant lots, yards, back lanes, streets, landfills, railway lines, spaces between, upon and inside buildings, etc. As David Nicholson-Lord observes:

Almost a fifth—18 per cent—of towns and cities is open space. Much more, however—one study in Brussels suggested up to 50 per cent—is actually green and busily photosynthesizing. Houses, most with gardens, make up 54 per cent of the main built-up area [of cities], which is far less built-up than most people imagine. And even buildings can serve as home to bats, birds, owls and a small army of lesser flora and fauna. That people continue to be surprised is evidence, yet again, that many of us may *look* but we do not necessarily *see* (1987, pp. 90-91).<sup>4</sup>

The emphasis of the material reviewed below will be on the advantages of keeping urban open areas *open*, and of enhancing the ecological functions of urban open space. In view of the large amounts of space available in most cities, the preservation of urban open areas is not necessarily incompatible with increased urban densities, widely deemed to be essential to sustainable urban development.<sup>5</sup> *Quality* of urban open space, as much as or more than its quantity, is highly relevant to the environmental sustainability of cities, and to the environmental health of the surrounding countryside.

As mentioned above, the literature cited below focuses on sustainable uses of urban open spaces that keep the space open and ecologically functioning: preservation/naturalization/restoration of "nature in cities"; ecology parks; ecological landscaping; urban wildlife; urban forestry; urban agriculture. As this list of subtopics indicates, an exhaustive scan of the literature on all of them would be immense. Due to the breadth of the topic, and to the scarcity of written material on some issues, the literature covered includes a wide variety of genres and disciplines, from scientific and technical reports to popular "how-to" manuals and publicity brochures. Although specialist material will be cited, the emphasis will be on publications understandable by non-specialist readers. Readers who wish to delve more deeply into the technicalities of a given topic will be directed to more exhaustive bibliographical sources. Most of the literature cited will be in English, although some French and German sources will be included where there are "gaps" in the English sources. The survey will attempt to situate the state of Canadian work relative to that abroad, especially in the U.S. and Western Europe. Non-literary information such as conferences, organizations and examples of sustainable urban open space projects and initiatives will supplement the literature review.

## NATURE IN CITIES

The city, for all its congestion, for all its soot and smoke, is not a barrier that can stop the stream of life. It may slow the movement of the stream, may even reduce it to a trickle, but life remains, and those of us with eyes to see can seek out and find its myriad branches almost wherever we chance to look (Rublowsky, 1967, p. 5).

For most Canadians, the city and nature appear to be incompatible, even antithetical. Cities are regarded as artificial, human-dominated, inert. Urban "greenspace" is confined to parks, lawns and boulevards, whose appearance and composition are carefully regulated. Incursions of wild species are regarded as a nuisance ("weeds"), dangerous (in Canada, it is not unusual for wild carnivores like bears to stray into urban areas) or amusing (moose in the streets of St. John's, Newfoundland). "Wild nature" is something to be enjoyed on weekends, outside city limits. Inside the city, wild species are a curiosity, at best; at worst, a menace. The literature surveyed in this section covers the following topics: urban naturalist literature; urban ecology; psycho-social benefits of urban nature, and urban nature initiatives.

## URBAN NATURALIST LITERATURE

There is a large body of literature devoted to the identification, description and celebration of the remnants of wild nature found in specific cities like London (Fitter, 1945; Mabey, 1973; Burton, 1974; Goode, 1986; Weightman and Birkhead, 1986) and New York (Kieran, 1975; Johnston, 1970; Kinkead, 1974, 1978; Gardner and Greenberg, 1988); some of these are full-scale "natural histories" of the land on which these modern megalopolises now stand (Fitter, 1945; Kieran, 1959; Rublonsky, 1967). More general accounts of "nature in the city" abound (Burton, 1976; Cole, 1979; Dubkin, 1972; Garber, 1987; Goode, 1990; Kinkead, 1974; Owen, 1978; Tanner, 1975). Older books in this genre tend to dwell on plants and animals that have adapted themselves to the harsh urban environment, such as rats, mice, feral cats, pigeons, cockroaches, and tough exotic (non-native) trees and herbs (e.g., Rublonsky, 1967). The recent literature is more concerned with the identification and conservation of native species (e.g., Goode, 1986, 1990). More specialized works on specific aspects of nature in cities such as edible wild herbs that can be harvested in North American cities (Silverman, 1990), "nature in your own backyard" (Jack Schmidling Productions, n.d.), and, especially, urban wildlife (see pp. 12-13 below), are available.

Most of this literature is written from a British or American perspective. There are very few natural histories of Canadian cities; several handbooks on "backyard wildlife" have been published by Canadians (Bird, 1986; Merilees, 1989; Ontario Ministry of Natural Resources, n.d.).

## URBAN ECOLOGY

Despite the popular conception that the city is "non-natural," scientists have long recognized that cities function as habitats for many non-human species, plant and animal, wild and domesticated (Bornkamm *et al.*, 1982; *Urban Ecology*, 1976-1985; Dawe, 1990). Smyth (1987, p. 15) observes that scientific publications on urban ecology tend to be inapplicable to practical conservation activities. An exception is the review of the scientific literature published by the Council of Europe (Sukopp and Werner, 1982), which correlates urban land uses and their consequences for urban climate, soil, flora and fauna (see especially the table in *ibid.*, pp. 18-21). This review contains a wealth of fascinating scientific insights into some of the unique features of urban habitats. For example, scientists have observed that urban open spaces are similar to ocean islands, in that they are isolated from other vegetation-covered areas by built features; predictions can thus be made, based on the size and isolation of such "urban islands," as to which species they may contain (Sukopp and Werner, 1982, p. 17). Extreme isolation entails colonization of wind-borne species only (Tischler, 1980); whereas wildlife corridors (e.g., railway tracks, ravines, riverbanks) allow freer movement of plants and animals in urban areas (Lussenhop, 1973). Another interesting feature of urban nature is that, due to another kind of urban "island," the urban heat island effect, species from southern climates can find a home in northern cities (Sukopp and Werner, 1982, p. 25). The Council of Europe study contains a lengthy bibliography of the scientific literature on nature in cities (pp. 48-94; see also Dawe, 1990). It also contains a list of nine "principles for the protection of ecotopes and species in city development policies": (1) the principle of urban ecological zonation in the conservation of ecotopes (ecological zones) and species; (2) the principle of preventing all avoidable interference with nature and landscape; (3) the principle of paying attention to natural development in the inner city area; (4) the principle of historical continuity; (5) the principle of the maintenance of local variation; (6) the principle of zonation of intensity and frequency of use; (7) the principle of the maintenance of larger continuous open spaces; (8) the principle of joining open spaces into a network; (9) the principle of maintenance of the variety of typical elements in the city landscape; and (10) the principle of the functional incorporation of buildings into the ecosystems (pp. 42-43, paraphrase).

A less exhaustive treatment of urban ecology from a Canadian perspective is by Anne Innis Dagg (1981). Her *Reference Book on Urban Ecology* introduces the topic of the city as habitat for birds, mammals, amphibians, fish, insects, reptiles and vegetation. The book also contains interesting discussions of wildlife/human diseases and the effects of pollution on urban nature. Brief "natural histories" of birds and mammals commonly found in Canadian cities are included (see also McKeating, 1974).

## URBAN NATURE—PSYCHO-SOCIAL BENEFITS

There is also social-scientific literature on the psycho-social benefits of urban nature (reviewed in Millward and Mostyn, 1989). Research has shown that the observation of natural scenes can enhance relaxation (Ulrich, 1983; Pederson, 1978), promote altruistic behaviour (Sherrod, 1977) and lead to improved social responsibility (Lewis, 1979). Shafer and Metz (1972), in the U.S., and Mostyn (1979), in Britain, found the personal benefits of "wilderness" settings to be emotional, aesthetic, physical, intellectual and social. People tend to prefer "natural" to "designed" landscapes (Ulrich, 1983; Mudrak, 1982). According to Millward and Mostyn (1989), cross-cultural research has shown that the majority of people prefer landscapes with the following natural features: a large number of mature trees (Gold, 1977; Kaplan, 1983); a variety of vegetation (Brush and Fabos, 1975); a natural, as opposed to a planned or designed, appearance (Render, 1982); features that engage the viewer with a promise of learning or experience, as well as security (Kaplan, 1983; Isel and Maos, 1974); a variety of textures (Ulrich, 1983); built features which "fit in" with natural elements (Wohlwill and Harris, 1980); a water feature and bird life (Millward and Mostyn, 1989).

## URBAN NATURE INITIATIVES

In the U.K. and other European countries, some conservationists and landscape architects began to take urban nature conservation seriously in the 1970s (Teagle, 1978; Burton, 1974; Ruff, 1979; Cole, 1979; Laurie, ed., 1979; Nature Conservancy Council, 1979; Mabey, 1973; see also Owen, 1978, on the natural history of urban wildlife in Britain). This trend gained momentum in the 1980s (Brown, 1982; Bradshaw *et al.*; Sukopp and Werner, 1982; Millward and Mostyn, 1987; *Urban Wildlife*, 1987-, Weightman and Birkhead, 1986). Smyth (1987) gives a good account of the history and extent of urban conservation initiatives in Britain, including the role of landscape architects, local authorities, quasi-governmental national and local organizations (called "quangos" and "qualgos" in the U.K.) and the rise of urban wildlife groups. Smyth's book includes a lengthy gazetteer of urban nature sites in England and Scotland (pp. 93-224).<sup>6</sup> In the U.K., the Nature Conservancy Council, a statutory body responsible for wildlife, geological and physiographical conservation in the U.K., has been behind many urban nature conservation initiatives (see Cole, 1979; Teagle, 1979; Millward and Mostyn, 1989; Mostyn, 1979; NCC, 1979, 1980). On the European mainland, Holland has a distinguished history of landscape design based on natural principles (Ruff, 1979; Bos and Mol, 1979; Bos, 1981; Urban Wildlife Group, 1984, ch. 7; Spirn, 1989, pp. 195-98).

In Canada, urban nature activities appear to be less well established and more localized (for a sample of Canadian and U.S. initiatives, see Gordon, 1990a). A possible explanation for this is that



Canadians continue to believe that there is still plenty of wilderness left in Canada, compared with highly urbanized European countries, where intensely cultivated, managed landscapes dominate both town and countryside. The greater popularity of urban nature activities in the U.K. and Western Europe (e.g., Nicholson-Lord, 1987; Ruff, 1979) suggests that national interest in urban nature and naturalization may be inversely proportional to the variety and quality of wilderness areas in a country; thus Holland, with its "artificial" landscape, Great Britain, with its small, densely populated, long-civilized land mass, and West Berlin, until recently politically isolated from the surrounding countryside, are more amenable to urban nature conservation than North America, where the public perception—however inaccurate—remains that large tracts of unspoiled wilderness lie outside city limits.

## ECOLOGICAL LANDSCAPE DESIGN

*Wo eine Wille ist ist doch ein Gubusch* (Hermann Barges).\*

Strategies for the enhancement of urban nature can be roughly classified along a continuum from preservation/protection of natural areas to naturalization/restoration of urban open spaces to the creation of ecology parks. All of these can be subsumed under the rubric of ecological landscape design.

Modern, Western conceptions of "nature in the city" have been strongly influenced by the utopian horticultural and landscaping traditions that arose in the eighteenth and nineteenth centuries (Spirn, 1984, pp. 179-83; Hough, 1984, pp. 5-9; Nicholson-Lord, 1987, pp. 26-35; Higgins, 1986). According to Michael Hough:

. . . urban landscape design continues to operate on the premise that ecological processes are either non-existent in cities, or have little relevance to design process and form. Its underlying principles are to be found in horticulture and engineering, in aesthetic priorities that are now regarded as secondary to the new-found insights of ecological determinism (Hough, 1984, pp. 5-6).

Over the past twenty years, however, a growing number of landscape design professionals, ecologists and grassroots community organizations have sought to apply ecological principles to the planning and preservation of urban open spaces.

Planner/landscape architect Ian McHarg (1969) was one of the first modern proponents of urban design informed by ecology. McHarg advocated environmentally sensitive land-use planning, urban design grounded in natural forms and processes, and a synergistic concept of urban health. In Europe, Dutch and British landscape architects were in the forefront of ecological urban landscape design (Bos, 1979, 1981; Laurie, 1979; Ruff, 1979; Ruff and Tregay, 1982; Tregay and Moffat, 1980; see also the account of this movement in Nicholson-Lord, 1987, pp. 106-25). More recent, North American theorists (and practitioners) of urban landscape design "with nature" include Anne Whiston Spirn (1984) and Toronto's Michael Hough (1984, 1990).

As urban design professionals, landscape architects are increasingly presenting ecological landscaping as a key to cost-efficient, low-maintenance, aesthetically appealing landscape management ("nature-like" landscaping) rather than insisting on restoring, or preserving, pristine natural habitats within city limits. Some of the most impressive naturalized landscaping initiatives include large-scale urban land reclamation efforts (Tregay and Moffat, 1980; Deelstra, 1989 Bradshaw *et al.*, 1986, pp. 357-448) and naturalization of urban parklands (City of North York, 1985; Hough, Stansbury and

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\*"Where there's a will, there's a bush."

Michalski, 1982; Hough, Stansbury, Woodland, 1987, 1990). "Nature-like" landscaping can also be applied, literally, "in your own back yard" (Jack Schmidling Productions, n.d.; Tilghman, n.d.; Ontario Ministry of Natural Resources, 1990), either professionally or as a "do-it-yourself" project. In the Netherlands, naturalized landscaping provides self-sustaining residential environments (Hough, 1984, pp. 136-37; Bos, 1981; Nicholson-Lord, 1987, pp. 111-13), in accordance with Holland's ecologically informed national land-use policy. Advantages of naturalization include:

- regeneration of native species through managed succession;
- reduced maintenance costs (especially mowing);
- lower energy use;
- decreased water use;<sup>7</sup>
- reduction or elimination of chemical fertilizers and pesticides;
- increase in wildlife habitat;
- preservation of local gene pool;
- opportunities for environmental education, volunteering and enterprise.

Naturalization techniques can be used to foster native woodlands (see pp. 16-17 below), wildflower meadows (Hough, Stansbury, Woodland, 1990, p. 10; Steffens, 1990; Elmhirst and Cain, 1990), wetlands (Hough, Stansbury, Woodland, 1990, p. 10), *etc.*

As indicated above, naturalization of urban parks and other open spaces occupies a "middle ground" in urban nature conservation between efforts to *preserve* relatively untouched pockets of urban nature (e.g., Winnipeg's Living Prairie Museum; see Manitoba Naturalists Society, n.d.)<sup>8</sup> and efforts to *restore* damaged remnants of native ecosystems that persist in urban areas (Barrett, 1992; Cheskey, 1992; McMillan, 1992; Lev, 1992; Morrow and Leach, 1992; Schwartzel, 1992; Sopper, 1992; Wilson, 1992). The growing interdisciplinary field of *ecological restoration* is defined by the Society for Ecological Restoration as:

. . . the process of intentionally altering a site to establish a defined, indigenous, historic ecosystem. The goal of this process is to emulate the structure, function, diversity and dynamics of the specified ecosystem. In other words, the intent is to repair or re-establish entire functioning ecosystems. Ecological Restoration also encompasses management practices that are intended to maintain ecological integrity (Society for Ecological Restoration, 1992).<sup>9</sup>

In Canada, one of the most ambitious restoration/naturalization efforts now underway is the Royal Commission on the Future of the Toronto Waterfront's (1992) plan for improving the health and sustainability of the Toronto region by an ecosystem approach that incorporates interactions among air, land, wildlife and human needs (Barrett, 1992).<sup>10</sup>

Although urban design professionals and government agencies have been instrumental in the planning and implementation of urban conservation, and naturalization and restoration schemes, grassroots community organizations have also played a vital role in drawing public and governmental attention to the existence and significance of urban natural areas (on the nation-wide mushrooming of the urban nature conservation movement in the U.K. in the 1980s, see Nicholson-Lord, 1987, pp. 72-161). Unfortunately, in Canada, the efforts of such groups are not well documented (for some examples, see Wilson, 1992; Schwartzel, 1992; Task Force to Bring Back the Don, 1991). A fascinating example of a grassroots organization whose efforts resulted in an official planning initiative is Toronto's Friends of the Spit (Courval, 1990). The Leslie Street Spit is a five-kilometre peninsula jutting into Lake Ontario in the middle of Toronto's industrial core.<sup>11</sup> The Spit is entirely of human origin, built up over the last thirty years with "all manners of refuse generated by a booming metropolitan area"—construction and excavation debris, lake-bottom silt, *etc.* (Courval, 1990, p. 243)—intended by the Toronto Harbour Commission as a commercial shipping facility, shortly afterward deemed unnecessary. An unexpected development in the Spit's history is that by the early 1970s, plant succession and wildlife diversity had begun to be manifest on this uninviting, "artificial" headland. The Friends of the Spit was formed in 1977 to open up the Spit to the public and to oppose proposals for "traditional" developments, e.g., boating facilities or an aquatic park. Today, the Spit (officially known as Tommy Thompson Park) is an urban wilderness blanketed with grassland and woods, and inhabited by hundreds of species of plants, birds, mammals, insects, reptiles and amphibians—all established without human intervention (Courval, 1990, p. 244; cf. Temple, 1980; Friends of the Spit, n.d.). The revised master plan for the Spit (Metropolitan Toronto and Region Conservation Authority, 1992) integrates the principles of natural succession and minimal intervention advocated by the Friends of the Spit.

## ECOLOGY PARKS

Holland's system of urban *Heemparken* ("home parks"), established in the early 1970s, involves "careful and exact reconstructions of the different landscapes to be found in the Netherlands" (e.g., sand dunes, heath bog, deciduous woodland) built into all major Dutch parks (Hough, 1984, p. 265). In London, England, the first "ecology park"—the William Curtis Ecological Park—was built in 1977 near Tower Bridge, and, although William Curtis gave way to development in 1985 (ironically, according to David Goode, former ecologist for the Greater London Council, it was replaced by a paved "pocket park"), London now boasts several ecology parks in inner-city and other densely built-up areas (Johnston, 1990). Laid out on small parcels of urban land, usually in core areas, ecology parks

recreate, in miniature, a variety of habitats (e.g., pond, meadow, woodland), sometimes retaining naturally colonized vegetation (Johnston, 1990, p. 177; cf. Nicholson-Lord, 1987, pp. 120-22). To the author's knowledge, the only urban Canadian example on the British model is Toronto's Ecology Park (10 Madison Avenue), a Pollution Probe Foundation demonstration project (Gordon, 1990b; Savage, 1986)<sup>12</sup> built on a vacant lot adjacent to Pollution Probe's Ecology House in 1986-87. The Toronto park includes a prairie element; a woodland; a Trombe Wall garden (providing shading and insulation for Ecology House); an herb garden; and a pond system (Gordon, 1990b, pp. 199-201, 218-29). Such parks provide a link with nature for people in the inner city, serve as centres for environmental education, and are havens for numerous wild and rare species.

### URBAN WILDLIFE<sup>13</sup>

Recently, the staff of the Winnipeg Tribune listed the 100 best-loved things about their city of 600,000 people. "Live deer and beaver within the city limits" was No. 48 ahead of the Jets pro hockey team, the former mayor, the new premier, and cheap wine (Shoesmith, 1978).

Advocates of ecological landscaping and urban forestry (see below) often note that one of the advantages of regenerating native plant communities is habitat creation for a variety of animal species, including mammals, birds, insects, amphibians, reptiles and fish (Hough, 1984, pp. 161-200; Spurr, 1984, pp. 207-28; Tylka, 1989; National Association of State Foresters, 1988, p. 7). In view of the paradoxical sound of the phrase "urban wildlife," there is surprisingly an abundance of literature on the topic. This can be classified under the headings of technical, scientific publications, descriptions of urban wildlife by naturalists, urban wildlife planning documents for implementation at the municipal and regional levels, and "how-to" literature for wildlife "in your own backyard."

The scientific literature is too large to be surveyed here; a good entrée is Sukopp and Werner (1982, pp. 32-39, 74-90; for more recent items, see Dawe, 1990, section 3.4; see also Bornkamm *et al.*, 1982; Kirkpatrick, 1978, pp. 7-24, 25-41, 49-56; Progulske, 1974; Dagg, 1981; back issues of *Urban Ecology*). Conference proceedings on urban wildlife include U.S. Department of the Interior (1968) and Euler (1975). The latter is the proceedings of a conference on urban wildlife in Canada held at the University of Guelph. Less technical works by urban naturalists include Cole (1979), McLoughlin (1978), Tylka (1989) and Weightman and Birkhead (1986). While the technical documents and descriptive literature may of great scientific value, and serve to heighten public awareness of nature in the city, they have limited value in suggesting ways to enhance urban wildlife.

British enthusiasm for urban nature has produced a variety of plans, guides and programs to

promote wildlife in the city, e.g., in urban parks (London Wildlife Trust, 1985); on golf courses (London Wildlife Trust, 1987); see also Nature Conservancy Council (1980); Woodward and Berger (1984); Greater London Council (1984, 1986). In the U.S., the National Association for Urban Wildlife, a private, nonprofit, educational organization, undertakes urban wildlife research, provides technical services, provides urban conservation education, establishes urban wildlife sanctuaries, and holds urban wildlife symposia (National Institute for Urban Wildlife brochure, n.d.). Publications of the Institute include a guide to the use of urban wetlands for stormwater control (Adams and Dove, n.d.), a guide to the structure of the establishment of urban wildlife reserves and corridors (Adams and Dove, 1989), bibliographies on landscaping for wildlife and urban wildlife ecology and management (Adams, n.d.), a quarterly newsletter and a quarterly urban wildlife manager's notebook series (see also Adams and Leedy, 1987). Other U.S. publications of practical interest are a guide to urban fishing and waterfront recreation published by the U.S. Department of the Interior (1981) and the U.S. Department of Agriculture booklet on managing urban woodlands for a variety of birds (Tilghman, n.d.). An M.A. thesis on strategic planning for bird life in Southeastern Ontario's Grand River forests that takes into account the impact of human settlements is available from the Heritage Resources Centre at the University of Waterloo (Cheskey, 1991). The journal *Urban Wildlife* (Packard Publishing, 1987-) is a journal of urban nature conservation.

On a more microscopic level, a variety of handbooks on identifying, dealing with and landscaping for suburban "city critters" is available (e.g., Baines, 1985; Leedy and Adams, 1984), including several Canadian titles (Bird, 1986; Merilees, 1989; Ontario Ministry of Natural Resources, 1990).<sup>14</sup>

## URBAN FORESTRY

I talked to the trees, that's why they put me away (The Goon Show, quoted in Hough, 1984, p. 111).

The term "urban forestry" was coined by Danish-Canadian forester Erik Jorgensen in 1967 (Jorgensen, 1967), and he later defined the emergent field as follows:

Urban forestry is a specialized branch of forestry and has as its objective the cultivation and management of trees and forests for their present and potential contributions to the physiological, sociological and economic well-being of urban society. These contributions include the over-all ameliorating effect of trees on their environment, as well as their recreational and amenity value (quoted in Morley, 1988, p. 360).

As an area of academic inquiry and education, urban forestry has declined somewhat in Canada in recent years (Morley, 1988, p. 364). In the U.S., urban forestry is now a well-defined subdiscipline (Miller, 1988; Moll and Ebenreck, 1989; Grey and Deneke, 1986).<sup>15</sup>

The notion of an "urban forest" seems paradoxical at first glance, but, viewed from the air, many well-treed North American cities have the appearance of forests: "Urban and community forests are comprised of street trees, open space, small forested areas, trees in municipal parks, playgrounds, yards, and trees along highways and rights-of-way" (NASF, 1988, p. 1).<sup>16</sup> Moll (1989, p. 14) points out that, in the U.S., urban forests cover approximately 70 million acres of land in municipalities, and countless additional expanses in suburbs and small towns. According to Moll, the urban forest exists in four geographical zones (ibid., pp. 14-15, paraphrase):

*the suburban fringe:* unlike rural forests, which are valued for products (timber, fuel, maple syrup, etc.) and wilderness attributes, suburban forest is valued for development potential, recreation and water quality amelioration;

*the suburbs:* here, most natural forest has been removed and, although trees exist in most open public spaces, most were planted after construction; remnants of natural forest remain, usually in association with water features (rivers, creek, wetlands, ravines, etc.);

*the city residential zone:* small-lot, single family homes and townhouses, extending from the city limits to the central business district; numbers and sizes of trees are restricted by limited space available; larger trees or groupings restricted to parks;

*the city centre:* trees grow wild in neglected spaces—vacant lots, cracks in sidewalks, even on buildings; space for street trees must be "engineered" for planted trees to survive in this zone. Life expectancy of these trees is short.<sup>17</sup>

Urban trees—especially those in the more central zones—suffer from the urban heat island effect,

drought, pollution, poor-quality, compacted and shallow soils, limited space and ecologically sterile environments (Moll, 1989, pp. 16-18; Hunt, 1989, pp. 27-27; Spirn, 1984, pp. 175-79). Even in the relatively benign setting provided by city parks, trees suffer from densely compacted soils, vandalism and damage caused by mowers (Spirn, 1984, p. 178).

Urban forests afford many hidden environmental and economic benefits: "A properly maintained urban and community forest increases property values, lowers energy costs, reduces air pollution and sediment runoff, attracts tourists and new businesses" (NASF, 1988, p. 5). The National Association of State Foresters (NASF) report cited above lists the following benefits of urban trees (pp. 5-8, paraphrase):

*Economic:* The economic value of trees in urban areas in the U.S. has been estimated at \$55 billion. An additional \$2 billion per year is spent by Americans on tree care. Trees are a part of urban infrastructure which, if properly planted and cared for, appreciates in value. Attractively treed areas have higher property values; strategically placed trees can reduce air conditioning costs by up to 55%, and, used as windbreaks in winter, can save 20-50% in energy use for heating (see Akbari and Taha, 1991; U.S. Environmental Protection Agency, 1992).

In Zurich, Switzerland, a major portion of urban parkland is dedicated to forestry, which produces commercial timber for sawlogs and pulp, the sale of which, in 1984, offset more than half of the total costs of the city's park system (Hough, 1984, p. 149).

City forests can also be used as filters for urban sewage (Sopper, 1990).

*Air quality:* Trees trap dust and dirt particles, thus reducing air pollution (NASF, 1988, p. 6). Leaves can absorb significant amounts of gases like ozone and sulphur dioxide (Hough, 1984, p. 43), but, of course, plant damage occurs with high levels of pollutants (ibid., p. 44). Water transpiration by trees and other plants helps to regulate temperature and humidity (ibid., p. 42).

*Soil erosion:* According to soil scientists, soil erosion on developed land is 2000 times greater than on forested land (NASF, 1988, p. 6). Sediment from soil erosion is a major cause of water pollution that can be significantly reduced by trees.

*Recreation:* The NASF report on community forestry (1988, p. 7) predicts that both the quantity and quality of urban parks will have to increase to meet the future demands of urban dwellers. However, the condition of urban park trees in the U.S. is deteriorating, partially due to stresses imposed by increased park use.



**Wildlife:** Urban forests provide habitat for a wide variety of wild plant and animal species, and function as wildlife corridors linking rural and urban places (NASF, 1988, p. 7; Tylka, 1989, pp. 112-18). Bird-watching opportunities for urbanites are greatly enhanced by urban woodlands (Tilghman, n.d.).

**Social values:** The NASF report (1988, p. 8) observes that the "intangible" philosophical and emotional values of urban trees—in stress reduction, enhanced sense of well-being and relaxation, in providing a link with the natural world, *etc.*—is of equal or greater value than the economic and environmental advantages of community forests (cf. Ebenreck, 1989, pp. 49-557; Willeke, 1989, pp. 58-63; Allison, 1989, pp. 64-69; TreePeople, 1990, p. 28).

### RE-ESTABLISHING NATIVE FORESTS

For many North Americans, the ideal city park or other urban open space consists of "a manicured lawn with mature shade trees" (Spirn, 1984, p. 180)—an aesthetic which owes more to English country estates, royal hunting parks and Romantic art than to the native landscapes of Canada and the U.S. (Spirn, 1984, p. 182; Hough, 1984, p. 231). The trees planted in urban open spaces are mostly exotics (non-native): "tough trees that can tolerate drought, poor soils, and periodic beatings" (Moll, 1989, p. 20). A few, carefully selected, non-native species tend to dominate urban tree plantings, thereby leaving the urban forest susceptible to catastrophic losses due to plagues such as Dutch Elm Disease (Spirn, 1984, p. 180).

Some urban foresters, landscape designers and ecologists advocate naturalizing urban tree plantings as much as possible (see Moll, 1989; Hough, 1984, pp. 132-50; Spirn, 1984, pp. 171-83). In most North American cities, however, the growth of native tree species is inhibited by heat, pollution, poor, shallow and compacted soils, and competition with aggressive non-native species. Moreover, the dominant landscape aesthetic of "green concrete with lollipop trees" militates against public acceptance of more natural, stratified woodlands and unmowed savannas. The naturalization of urban treed areas thus requires, as Moll observes (1989, p. 21), not only changing the varieties and numbers of trees planted, but "changing the ecology of the city"—an undertaking that will require extensive experimentation and research. Toronto landscape designer Michael Hough (1984, p. 132) advocates naturalization through ecological processes such as plant succession: "the introduction of landscape elements into the city that include the re-establishment of woodlands through the reforestation of some lands, the creation of wetlands where hydrological conditions are appropriate, the development of meadow communities through modified turf management and the establishment

of varied wildlife habitats" (p. 133). Since such ecological woodland communities are self-regulating, they are much less labour-, water- and energy-intensive than manicured landscapes (Hough, 1984, p. 133; Spirn, 1984, pp. 179-83). Ecologically, native tree communities provide habitats for many more plant and animal species than do exotics, because native flora and fauna have co-evolved over the ages; in the U.K., for example, "The British oak and native willows each support insect communities of over 400 kinds, and these in turn are a food source for a great many birds and mammals. Sycamores, on the other hand, an introduced species, support only 30 different species!" (London Wildlife Trust, 1987, p. 7; cf. Woodward and Berger, 1984).

An urban area in Canada where extensive reforestation is underway is the City of North York, Ontario (Morley, 1988; Granger, 1989; City of North York, 1985), where twenty parks have been selected for naturalization. Compared with traditional, formal landscaping, the underplanting of seedlings and mulching done by volunteers has been found to be extremely cost-effective: "Total costs for an acre of manicured, formalized parkland, complete with shrub beds and weekly seasonal maintenance for the three years was \$44 028 (1982 dollars). In contrast, an acre of reforested parkland, including three years of follow-up maintenance, totalled only \$4 875" (Morley, 1988, p. 362). Morley describes the ecological results of reforestation on a test site, the Driftwood Community Centre (*ibid.*, p. 362):

Since mowing has stopped the results have been spectacular. A good mixed understorey appeared while the closing of the canopy, as the trees returned to vigour, meant that the tall grasses, originally present after mowing was discontinued, became shaded out. Dogwood and sumac have returned, while birds and small wild animals now occupy the woodlot. The community volunteers responsible for the initial planting gained a sense of stewardship for the park woodlot while the appearance of the Centre has greatly improved. It is now a very pleasant setting, framed by the natural grove of trees, shrubs and grass.

Other urban areas experimenting with reforestation as a cost-effective and ecologically beneficial landscaping strategy are Ottawa (National Capital Commission) (Holubowich, 1989; Hough, Stansbury and Michalski, 1982; Hough, 1984, pp. 137-39) and the City of Kitchener (Hough, Stansbury, Woodland, 1990). An interesting initiative in Toronto is the restoration of the black oak savannah in High Park (Rothenberg and Varga, 1992). Problems experienced with restoration of ecological woodlands include public disapproval of the "unkempt" appearance of such sites—a concern usually countered by public awareness campaigns (Hough, Stansbury, Woodland, 1990, pp. 17-18; City of North York, 1985, pp. 13-14)—and concerns about the safety of wooded areas (see Orsini, 1992). A guidebook for citizens and community groups interested in initiating tree planting projects is available from TreePeople, a program of Friends of the Earth (1990).

## URBAN AGRICULTURE

I often pick my best camomile flowers in Paris, growing on waste ground, insignificant little flowers you would hardly notice. But they have a flavor that is *unesteemable*.—Colette

The term "urban agriculture" can have more than one meaning. It can refer to farming within city limits—a "non-traditional" land use in contemporary Western cities (Wals, 1982; Hough, 1984, pp. 201-38; Nicholson-Lord, 1987, pp. 144-61; Dorney, 1990; Pelissero, 1990). The term can also refer to "agriculture in the city's countryside" (Bryant and Johnston, 1992)—"traditional" agriculture threatened by the encroachment of urban fringe areas.

According to Jane Jacobs, agriculture may have begun within city limits, and, until very recently, farming was commonly carried on in cities (Wals, 1982, p. 6; Hough, 1984, pp. 207-8, 209-13); urban agriculture remains an important land use in some Third World cities (Furedy, 1988).<sup>18</sup> During World War II, city dwellers in Canada, the U.S. and Britain were officially encouraged to cultivate backyard crops and raise livestock (Hough, 1984, pp. 210-12). An estimated 10% of Britain's food supply came from urban allotments and garden plots in wartime (*ibid.*, p. 212). In post-war times, urbanites have been discouraged from carrying on intensive agriculture; livestock, especially has been restricted through by-laws (*ibid.*, p. 207). For most urban Canadians, "city farming" has shrunken from a significant source of food and even income to the scale of a pleasant hobby (gardening).

Recent decades have seen a resurgence of public interest in urban farming. In the British cities of Bristol, London, Liverpool and Birmingham, small-scale urban land reclamation, horticulture and animal husbandry have transformed derelict urban core sites into productive, (more) ecologically healthy city farms (Nicholson-Lord, 1987, pp. 144-52; Hough, 1984, pp. 232-35). Community gardens have also become a feature of inner-city areas in large North America, including New York, Chicago, Philadelphia and Toronto (Lewis, 1979; Britz, 1981; Ontario Public Interest Research Group, 1986; Sommers, 1984; Fox *et al.*, 1985; Francis *et al.*, 1984).

As a means to urban environmental and economic sustainability, urban agriculture has many advantages: more efficient use of energy and land resources through urban land reclamation and recycling of urban wastes for fertilizer; shortening of supply lines and greater urban self-reliance; improved diet for low-income urbanites; and enhanced social, economic, recreational and educational opportunities (Lewis, 1979; Hough, 1984, pp. 213-25; Nicholson-Lord, 1988, pp. 150-51; Wals, 1982). According to Alexander, "Intensive food gardening is over a hundred times as efficient as industrial agriculture" (1991, p. 109). Urban greenhouses are potential consumers of waste heat (Hough, 1984, pp. 223-24); rooftop gardens are a possible use of "the hundreds of acres of rooftops that for the most part lie desolate and forgotten in every city" (*ibid.*, p. 221).<sup>19</sup> Grazing by livestock

such as sheep, cows and deer is a low-energy, low-cost method of maintaining urban grasslands widely practised in Britain, and found in scattered urban locations in Canada (*ibid.*, pp. 154-57).

Probably the most thoroughgoing effort to integrate agriculture into the urban environment is Australian Bill Mollison's Permaculture ("permanent agriculture") (1988). Permaculture is both an ethic and an approach to design and land use in human settlements that attempts to integrate climate, vegetation, animals, soil and water management and human needs into sustainable communities (see also Mollison and Slay, 1991; Mollison *et al.*, 1990, Lindegger and Tap, 1986). Permaculture Services International, Inc. provides information, educational materials, training programs and research on design informed by permaculture principles.<sup>20</sup>

The study of "agriculture in the city's countryside"—farming in rural/urban fringe areas—is a relatively new field of inquiry (Bryant and Johnston, 1992, p. 190). Much of this literature has been concerned with the loss of agricultural land to urban development (*ibid.*, p. 197). As in many other countries, Canadian cities tend to be situated on land that is highly suitable for farming (*ibid.*, pp. 39-40). Bryant and Johnston observe that in Western Europe, more than in North America, concern about loss of agricultural land focuses on its non-agricultural benefits: "farming as a landscape support (both 'natural' and the cultural and historic values embedded in the farming landscapes) and as a backdrop for outdoor recreational and leisure-time activities for the nearby urban population" (*ibid.*, pp. 197-98). Bryant and Johnston's (1992) study is a recent analysis of the role of agriculture in the urban fringe, from the perspective of the resource base, the market, the farmer and the role of government (with and extensive bibliography, pp. 206-26).

## CONCLUSIONS: OPPORTUNITIES FOR SUSTAINABLE USES OF URBAN OPEN SPACE IN CANADA

[The ancient Mexican city of] Monte Alban was a place electric with the presence of the gods. . . . the very forces of nature with which peasants were respectfully intimate . . .\*\*

As indicated in the body of this review, urban natural areas offer many ecological, economic, psycho-social, educational and recreational benefits. However, in Canada, the city/nature dichotomy remains to be overcome; this requires new ways of "seeing" urban open spaces and a new landscape aesthetic, as well as institutional changes and innovations.

Although Canadian scientists and naturalists may be as active as any in the study of urban ecological processes, this body of knowledge is not available to the majority of Canadians in accessible form, as it is, e.g., in the U.K., mediated through organizations like the Nature Conservancy Council, or, in the U.S., the National Institute for Urban Wildlife. Natural histories of Canadian cities and guides to urban nature sites in Canada are scarce and little-known. Many small, grassroots groups dedicated to the preservation or restoration of remnants of nature in Canadian cities exist, but their efforts have not been documented in a systematic way; nor has the extent of urban agriculture/community garden projects. The task remains for the established Canadian nature conservation organizations to research and publicize the range and benefits of nature in cities, and, perhaps, for new local, regional and national urban wildlife organizations to emerge, to undertake research, education, urban nature conservation projects and advocacy, and public awareness campaigns.

Canada is fortunate to be the home base for one of the foremost proponents of ecological landscape design, Toronto's Michael Hough, whose consulting work has been instrumental in naturalization schemes for, e.g., the National Capital Commission and the City of Kitchener. However, few Canadian universities currently offer courses in ecological landscape design, and, at present, no full-scale programs of post-secondary study in this vital subdiscipline exist in Canada.<sup>21</sup> Similarly, although the term "urban forestry" is of Canadian coinage, and though many Canadian cities employ city foresters, educational opportunities are very limited in Canada's universities.<sup>22</sup>

Ecological landscaping, environmental restoration and conservation, and urban agriculture all require not just commitment, knowledge and expertise, but also the co-operation and endorsement of governments. As noted above, although many Canadian cities have staff foresters—and even urban naturalists<sup>23</sup>—their activities are little publicized. Sometimes, city by-laws and provincial legislation

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\*\*John Paddock, quoted in Thomas Merton, "The Sacred City," in Richard Grossinger, ed., *Ecology and Consciousness* (Richmond, CA: North Atlantic Books, 1978), p. 87.

are actually antithetical to naturalization.<sup>24</sup> While some cities have well-promoted naturalization programs (e.g., City of North York,<sup>25</sup> National Capital Commission), often, officially sanctioned urban nature initiatives remain "best-kept secrets"—for example, how many Winnipeggers know that there are tallgrass prairie restoration sites at The Forks, Elmwood High School, the Main Street Bridge, the Health Sciences Centre, Kil-Cona Regional Park and Beaudry Provincial Park?<sup>28</sup> More public awareness of naturalization principles, projects and aesthetics might encourage developers—and individual homeowners—to adopt less ecologically sterile landscaping practices; even more effective would be the kind of environmentally sensitive land-use policy adopted by the Netherlands (or, more recently, by the Toronto region (Royal Commission on the Future of the Toronto Waterfront, 1992), incorporating the kinds of principles recommended by the Council of Europe (see p. 6 above). Examples of initiatives to enhance urban nature that can be undertaken by government at the municipal, provincial and/or federal levels are:

- inventories of existing urban natural areas (municipal, provincial, federal);
- policy on preservation/restoration of urban natural areas (municipal);
- policy on naturalization of urban parks and open spaces (e.g., City of North York) (municipal);
- city-wide programs to naturalize parks and open spaces (municipal), e.g., participation of in federal government's Tree Plan Canada (Forestry Canada);
- city-wide programs to educate the public on the value of naturalized landscaping (municipal);
- revision of legislation to reflect the ecological value of native plants stigmatized as "noxious weeds" (provincial);
- revision of by-laws to allow urban grazing (municipal);
- recognition and encouragement of community gardening/urban agriculture (municipal, provincial);
- recognition of urban nature in federal and provincial environmental strategies;
- establishment of quasi-governmental urban nature organizations (municipal, provincial, federal);
- integration of urban ecology into public school science curricula (provincial);
- establishment of programs in urban forestry and ecological landscape design at Canadian universities (provincial, federal).

This study has indicated, in Canadian cities, some important examples of the sustainable use of urban open space already exist. However, for this aspect of sustainable urban development to become the norm rather than the exception, major transformations in public awareness, education, research, policy and planning must take place.

## NOTES

1. Quoted in A. Barthelmeß, *Landschaft, Lebensraum des Menschen* (Freiburg/München: Alber, 1987).
2. The terms "sustainable development" and "sustainability" are used interchangeably throughout this paper. Many definitions of sustainable development have been proposed, the best-known of which is that of the Brundtland Commission: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:
  - the concept of "needs," in particular the essential needs of the world's poor, to which overriding priority should be given; and
  - the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs" (WCED, 1987, p. 43).
 According to the WCED report, the concept of sustainable development is a framework for a multifaceted international economic, environmental and social policy framework which takes into account population and human resources, food security, species and ecosystems, energy, industry, urban development, the management of the commons, peace and security. Daly and Cobb (1989, pp. 71-72) add that sustainable development (as opposed to "sustainable *growth*") "should refer to the qualitative change of a physically nongrowing economic system in dynamic equilibrium with the environment." Daly and Cobb underline the ethical aspect of sustainable development implied in the Brundtland report with the observation that "sustainability is really justice extended to the future" (p. 146).
3. The literature on "green cities" focuses more on the city as a living ecosystem, often within the framework of bioregionalism, and the environmental quality of urban open space in relation to larger ecosystems is an issue that often figures prominently (e.g., Gordon, ed., 1990; *City Magazine*, 1989; Nicholson-Lord, 1987; School of Urban and Regional Planning, 1991).
4. Spirn (1984, p. 224), gives the following list of locations in which urban wildlife can be encouraged: "virtually all unpaved, unbuilt-upon land in the city, including the private grounds of colleges and universities, schools, hospitals, prisons, corporations, zoos, cemeteries, church-yards, sand and gravel quarries, canals and reservoirs, golf courses, sewage treatment facilities, industrial parks, gardens, parks, and urban wilds."
5. See, e.g., Jeffrey Patterson, "A Quarter Century of Canada's Metropolitan Fringe Development," *Sustainable Cities* 4 (Autumn 1992).
6. Even more detailed is Smyth's "green guide" to urban wildlife in the U.K. [Smyth, 1990]; for localized surveys of urban wildlife in Britain, see Teagle, 1979 (Birmingham and environs); Greater London Council, 1976; Mabey, 1973; Talbot, 1984; Goode, 1986; Weightman and Birkhead, 1986 (London). Goode (1990, p. 10) notes that the city of West Berlin has made a complete inventory of ecological features in the city.
7. Xeriscaping—"dry landscaping"—uses native desert plants that can survive on a minimum of water; this technique has been successfully used in Tucson, Arizona and other areas of the U.S. with arid climates (Moll, 1989, pp. 18-20; cf. Russell, 1992).

8. For a literature review of tallgrass prairie restoration and preservation, see Hoechst Canada Inc., 1990.
9. For introductory essays on ecological restoration, see Nilsen, 1991; for technical papers, see Berger, 1990; see also Dawe, 1991.
10. A long-standing conservation effort in an urbanized area of Southeastern Ontario is the Grand River Conservation Authority (MacMillan, 1992; Nelson and O'Neill, 1990; Cheskey, 1991); a more recent conservation initiative that encompasses a number urban areas is the Niagara Escarpment Plan (Nelson and Shulz, 1991).
11. For an annotated bibliography of the literature on Great Lakes shoreline resource management, see Knight *et al.*, 1987.
12. There is a small ecological garden, designed by Canadian ecologist and planner Robert Dorney, on the campus of the University of Waterloo. For an example of a backyard ecology park, see "Home on the prairie," *Winnipeg Free Press*, 3 August 1993, p. B5.
13. In the U.K., "urban wildlife" often refers to *all* urban wild species (fauna and flora); in North America, the term usually refers to the animal kingdom only.
14. For an account of an interesting program to provide habitats and urban corridors for Canada's declining amphibian population, see Johnson (1992).
15. Canadian cities with staff foresters include: Winnipeg, Fredericton, Toronto, Ottawa, North York, Oakville, Hamilton, London, Windsor, Sioux Ste. Marie, Montreal, Quebec City, Halifax, Calgary and Vancouver. At present, no degree program in Urban Forestry exists at a Canadian university, although individual courses are taught at institutions like the University of Manitoba, the University of Guelph, and l'Université de Montréal (conversation with Mike Allen, City of Winnipeg Forester). The City of Winnipeg has Canada's largest urban forestry program, probably due to the danger to the city's American Elm population from Dutch Elm Disease. The first Canadian urban forestry conference was held in Winnipeg in May 1993.

For a Canadian community forest initiative, see Dunster and Associates, 1989.

16. Most urban treed areas, of course, are not forests in the sense of self-regulating ecological communities.
17. According to one of this paper's expert reviewers, five to seven years.
18. According to Hough (1984, p. 213), some 85% of vegetables consumed in Chinese cities, in 1984, were city-grown; Shanghai and Peking were self-sufficient in vegetables. These cities use human and animal wastes as fertilizer and as media for fish farming. In 1978, Hong Kong produced 16% of its freshwater fish in local fish ponds. On the outskirts of Calcutta, urban sewage and other organic wastes are used in agriculture and aquaculture (Furedy, 1988).
19. The German city of Mannheim has a by-law which requires citizens and developers to plant roof gardens (Overtveld, 1990). Failure to comply can incur a hefty fine (about \$13,000 Cdn.). Roof gardens can facilitate better stormwater runoff, amelioration of noise, heat, air



pollution and wind, and enhanced energy efficiency (cf. Schiele, 1988; Backhouse, 1988). A community rooftop garden project initiated by McGill University researchers (Alward *et al.*, 1976) showed that "the use of rooftops for productive purposes is realistic and practical in situations where little space at ground level is available" (Hough, 1984, p. 223).

20. More information on Permaculture, including publications, is available from Marvin Melnyk Associates, Ltd., Box 220, Queenston, Ontario L0S 1L0. A similar, U.S.-based design perspective is espoused by the New Alchemy Institute, which applies biological/ecological principles to the design of buildings, human settlements and societies (Todd and Todd, 1984).
21. Conversation with Charlie Thomsen, Department of Landscape Architecture, Faculty of Architecture, University of Manitoba.
22. Conversation with Mike Allen, City Forester, Winnipeg, Parks and Recreation Department.
23. Conversation with Cheryl Nielsen, Assistant Naturalist, Winnipeg, Parks and Recreation Department.
24. See, e.g., "Councillor's plant is bureaucrat's weed," *Winnipeg Free Press*, 24 January 1992, p. 321. As noted earlier, many municipalities have by-laws that would prevent urban grazing; an exception is Fort Saskatchewan, Alberta, where a flock of sheep maintains city parks and boulevards (see "A far from woolly-headed idea," *Winnipeg Sun*, 20 June 1992, p. 14).
25. See the City of North York's brochure entitled "Nature in the City."
26. Prairie Habitats 1993 catalogue. Several prairie restorations are also underway at private residences, according to *ibid.* See also "Lawn back to its roots," *Winnipeg Free Press*, 3 August 1993, p. B5.

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*Backyard Safari.* Jack Schmidling Productions, 4501 Moody, Chicago, IL 60630, U.S.A.

*City of Seattle: Green City.* Contact Jerry Clark, City Arborist, Seattle Municipal Building, Room 704, Seattle, WA 98104, U.S.A.

*Manitoba's Tall Grass Prairie.* Winnipeg: Manitoba Naturalists Society.

*This is Urban Forestry.* American Forestry Association, 1516 P Street, NW, Washington, DC 20036, U.S.A.

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National Community Tree Foundation (Tree Plan Canada)  
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National Institute for Urban Wildlife  
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Natural Areas Association  
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Society for Ecological Restoration  
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# SUSTAINABLE DEVELOPMENT, URBANIZATION, AND ENVIRONMENTAL IMPACT ASSESSMENT

Dianna Colnett

## INTRODUCTION

This paper reviews the literature concerning urban sustainability and environmental impact assessment (EIA). It begins with a brief overview of what sustainable development means and then examines the environmental impacts of urbanization. Given that modern urban settlements are energy and resource-intensive, and depend on resources from non-urban regions, can cities really become sustainable? After considering this question, this paper looks at the role of EIA in sustainable development. Following a discussion of the positive and negative features of EIA, the paper draws together suggestions for improving the practice of EIA in urbanized areas.

## SUSTAINABLE DEVELOPMENT

The concept of sustainable development was popularized by the World Commission on Environment and Development in their report, *Our Common Future* (WCED, 1987). Charged with the task of formulating "a global agenda for change," the Commission returned with the challenge of moving towards sustainable development, a form of development "that would meet the needs of the present without compromising the ability of future generations to meet their own needs." Now there is a plethora of sustainable development definitions as various interests in society adjust this concept to satisfy their own values.

The degree to which the various definitions of sustainable development require social change to be realized is strongly linked to the values embodied by the group making the definition (Rees, 1989). Some groups call for sustainable economic development, or business as usual, while at the other end of the spectrum are people who see the need for significant changes in society, as reflected in the following definition:

Sustainable development is an integrated approach—including social, environmental, cultural and spiritual well-being, as well as economic progress in its field of endeavour. It places particular emphasis on ecological balance and social equity in development planning, promoting, for example, decentralization and democracy in the workplace and the broader community (Wismer as quoted in Rees, 1989, p. 8).

Wismer goes on to describe what she sees as the principles of sustainable development, including ecological balance, local self-reliance, regional locus of control, and use of appropriate technologies.

A definition of sustainable development that will be used as a reference point for this review is one by Rees (1989). This definition recognizes the social aspects of sustainability and acknowledges the existence of ecological limits to development. It also emphasizes co-operative planning processes as a means of promoting sustainability.

Sustainable development is positive socio-economic change that does not undermine the ecological and social systems upon which communities and society are dependent. Its successful implementation requires integrated policy, planning, and social learning processes: its political viability depends on the full support of the people it affects through their governments, their social institutions, and their private activities.

Agreeing with this perspective requires major shifts in most of Western society's beliefs and actions. Currently, most discussions about sustainable development focus on the utilization of natural resources and not on reforms to social or political systems. Development proceeds as if there are no physical limits to growth. In addition, integrated and co-operative planning is more rhetoric than reality. What sustainable development means is a different kind of development than what we currently have. In particular, sustainable development has significant implications for urban development.

## URBANIZATION AND THE ENVIRONMENT

According to Lewis Mumford (1938, p. 5), cities (besides language), are humanity's greatest works of art. Cities provide for people's physical needs as well as their social, cultural, spiritual and artistic needs. While dense clusters of human settlement have come and gone over the centuries, the rise of modern cities, with their dependence on fossil fuels for energy, has paralleled the growth of the Industrial Age.

The term urbanization, as it is used in this review, refers to the conversion of rural or natural lands to uses associated with human settlements. Urbanized areas are the villages, towns, and cities where people live as opposed to just where they work—a mining operation—or just where they sleep—a collection of summer cabins around a lake. In urban areas, natural, "free" processes tend to be replaced by mechanical processes: storm and sanitary sewers and water pipelines in place of streams and rivers.

The number of people living in cities has grown rapidly over the past sixty years, as documented in *Our Common Future* (World Commission on Environment and Development, 1987, pp. 235-38), and will continue to grow in the foreseeable future. By 2000, nearly half of the world's expected population of six billion people will live in urban areas (WCED, 1987).

That cities have a significant impact on environmental quality is without argument. Urban dwellers in developed countries account for a large proportion of the world's resource use, energy consumption, and environmental pollution because of a higher *per capita* rate of consumption.



## CANADIANS HAVE A BIG IMPACT

Canadians, nearly 80 percent of whom live in urban areas, are among the highest consumers of resources, as noted in *The State of Canada's Environment* (Environment Canada, 1991). Canadians are the world's heaviest energy consumers, largest producers of solid waste, and second highest consumers of fresh water. Of the over 300,000 ha of agricultural land lost to urbanization between 1966 and 1986, 58 percent was of high quality.

With similar forms and patterns of urbanization, European cities are generating virtually the same environmental impacts as North American cities. One impact that is more obvious in Europe, as mentioned in a report by the Organization for Economic Co-operation and Development (OECD, 1990), is the loss of irreplaceable cultural resources, such as the old city of Venice. In Canada, especially in the Western provinces, awareness of heritage and cultural values is somewhat lacking, although growing slowly.

## CUMULATIVE EFFECTS: THE TYRANNY OF SMALL DECISIONS

Most significant environmental impacts associated with urban development—air and water pollution, loss of agricultural lands, and deterioration of the quality of life—are the result of "the tyranny of small decisions" according to Odum (1982). For example, lakes become more eutrophic ". . . through the cumulative effects of small decisions: the addition of increasing numbers of domestic sewage and industrial outfalls along with increasing run-off from more and more housing developments, highways, and agricultural fields" (Odum, 1982, p. 728).

This process of cumulative effects also occurs with hundreds of people travelling in single-occupancy cars, creating smog, or buying a new single-family house on the urban fringe, thereby squandering valuable natural habitat. A thorough analysis of the loss of wetlands and agricultural lands to urban uses in the Greater Vancouver area in British Columbia is presented in Moore (1990).

Cumulative effects are the predominant form of environmental impacts in urban areas. A simple definition of cumulative environmental effects is presented by Davis (1991, p. 5): "The combined effects of all activities in an area over time; and the incremental effects associated with individual projects in an area over time."

A more complex definition of cumulative effects, with a description of the pathways by which they occur is given in Peterson *et al.* (1987). Sonntag *et al.* (1987) present a typology of effects. Both reports, prepared for the Canadian Environmental Assessment and Research Council (CEARC), focus on natural resource development because that is where most assessments of cumulative effects have been done.

Cumulative effects are difficult to categorize and assess, and even more difficult to manage than project-specific environmental impacts. Because the cumulative effects associated with urban development are becoming more commonplace, as more and more cities repeat the same pattern of development, these effects are being manifested at the global level: the enhanced greenhouse effect from fossil fuel burning, habitat loss, and freshwater pollution.

## SUSTAINABLE CITIES

Given the environmental impacts of urban development, is the term "sustainable cities" an oxymoron? Some people would say so. The current design of cities creates a high dependence on energy for transportation, heat and light, energy that is largely derived from fossil fuels, a non-renewable resource. In addition, urban areas rely on non-urbanized areas to provide the natural resources to keep the city or town functional.

Rees (1992) refers to this transfer of resources to urban areas as "appropriated" carrying capacity. Carrying capacity is "the maximum rate of resource consumption and waste discharge that can be sustained indefinitely in a defined region without progressively impairing bioproductivity and ecological integrity" (Rees, n.d.). Therefore, the sustainability of an urban area depends on regions outside its immediate surroundings—regions that are often out of the political influence of a local or regional government.

Recognizing that urban areas are energy-intensive, inefficient and drain resources from other areas, several people have attempted to redefine how cities should be structured and how they should function (Van der Ryn and Calthorpe, 1986; Bookchin, 1981; Lowe, 1992; and Register, 1987). The definitions tend to be visionary, providing images and qualities of an alternate way of living. Some key qualities the definitions share are:

- more compact urban forms with a higher diversity of uses;
- walking, bicycling, and transit (buses, trains) as predominant forms of transportation;
- a greater integration of natural areas with built areas in the form of greenways and protected areas;
- urban agriculture;
- reduced energy and resource consumption;
- higher degree of citizen involvement in decision making and community development; and
- low levels of waste due to recycling and lower levels of resource use.

A definition that expands upon the social and economic aspects of a sustainable community is given below (Rees *et al.*, 1989; pp. 57-58):

A sustainable community is a settlement which:

1. has a stable, healthy population;
2. understands that humans are only one of many life forms which share a sustainable region;
3. is a population with a strong sense of place, history and global responsibility;
4. is empowered to guide an ecologically regulated economy based on the sustainable harvest and conservation of local natural resources;
5. shares both its surplus production and culture with other communities and regions;
6. has a collective ethic of conserving its culture and natural resources for future generations;
7. does not export pollution to other regions;
8. does not base its affluence on the draining of other regions of their resources;
9. reduces to a minimum income leakages which leave the community;
10. gains fullest possible value from harvest and manufacturing of natural resources through use of locally controlled and adapted appropriate technologies;
11. is committed to the goal of providing equal opportunity for a high quality of life for all residents of the community; and
12. is a population which strives to continuously learn of its changing needs though the passage of time.

Although these concepts are visionary and alternative, especially those concepts concerning urban form, many of these ideas are being put forward as goals of major metropolitan planning initiatives in Canada and the United States. For example:

- Vancouver: The Livable Region Strategic Plan (to be released in the fall of 1993) (Greater Vancouver Regional District, 1993).
- Toronto: Regeneration (The Royal Commission on the Future of the Toronto Waterfront, 1992).
- Seattle: Vision 2020 (Puget Sound Council of Governments, 1990).

Some smaller centres, such as Bamberton, British Columbia (a proposed new town on Vancouver Island) (Gurstein and Curry, 1993) and Waterloo, Ontario (Maclaren, 1992) are also promoting sustainability.

Can urban areas become sustainable? What vision should we be aiming for? Measures such as better mass transit and urban agriculture will not make cities sustainable. Because of the sheer mass of people in one place, the environmental impacts of cities are beyond the absorptive and healing capacities of the surrounding natural systems (Orr, 1992, p. 39). Orr suggests that urban areas be justified on their contribution to intellectual, cultural, and economic life and be made to function more efficiently and planned with more greenbelts, urban parks, urban agriculture, and nature preserves.

Orr's suggestions mean that merely reducing the environmental impacts of cities through better assessment and mitigation procedures will not make cities sustainable. Redesigning cities and making them more efficient and "green" will go a long way to making them more livable and "environmentally friendly," however. This observation does not invalidate the visions of sustainable cities described above; it puts the concept of sustainable cities into a more realistic perspective.

## **ROLE OF ENVIRONMENTAL IMPACT ASSESSMENT IN SUSTAINABLE DEVELOPMENT**

Given that the urban form and function of "green" cities is radically different than the urban areas we are now building and live in, how are we going to get from here to there?

One way, identified by Sadler and Jacobs (n.d.), is through greater use of environmental assessment as a tool for translating the principles of sustainable development into action. They note "Environmental assessment, in microcosm, illustrates the rethinking and restructuring of the environment and development decision-making process that must take place in order to achieve the delivery of sustainable development" (Sadler and Jacobs, n.d.; p.17). Meredith (1992) also suggests that EIA could be in "the vanguard of strategies" for sustainable development.

## **DEFINING ENVIRONMENTAL IMPACT ASSESSMENT**

Environmental assessment is a term used interchangeably with environmental impact assessment (EIA) and impact assessment. EIA refers to a decision-making process that predicts and assesses the environmental effects of specific human actions and identifies the means of addressing those effects (Beanlands and Duinker, 1983). In this definition, "environment" includes social and economic effects.

Assessing the environmental impacts of development was first required in the United States in 1969, under the National Environmental Policy Act. In Canada, a federal cabinet directive to conduct EIA for major projects was issued in 1974. Most provinces followed with legislation in the late 1970s. For those interested in the genesis of legislative arrangements for EIA in Canada, see Couch (1982). An overview of the use of EIA around the world is given by Wathern (1988).

The procedure or methods for conducting EIA have evolved as people gained experience with the technique. In the early 1970s, checklists of impacts, weighted decision matrices, and network diagrams were often used (Wathern, 1988). As people's understanding of ecology and environmental impacts grew, the complexity of methods increased. In the mid-1980s, conceptual and computer models were often used to predict impacts. At the same time, the breadth of analysis grew: social

impact assessment, fiscal assessment, risk assessment and technology assessments, and most recently cumulative effects assessment, are all variations on EIA.

Research in environmental assessment has focused primarily on improving methods and practice (e.g., Holling, 1978; Beanlands and Duinker, 1983; MacLaren and Whitney, 1985; and Westman, 1985). A limited amount of research has been directed at evaluating institutional arrangements (Rees, 1980; Wallace, 1981). Only recently have researchers taken a detailed look at the ethical basis of the scientific methodology (Shrader-Frechette, 1985) and the policy implications (Bartlett, 1989; Rees and Boothroyd, 1987a, b) of environmental assessment.

Like any decision-making tool, environmental assessment has positive and negative features. It is worthwhile reviewing these features to determine if this tool can be used in an urban context.

### **POSITIVE FEATURES OF EIA**

Environmental impact assessment provides one of the few opportunities in a policy-making framework for the integration of environmental concerns with economic development (Rees, n.d.) and an opportunity to look into the future to determine and evaluate the effects of change.

Environmental assessment also provides a visible forum for public debate about development issues (Creighton, Chalmers and Branch, 1980). It is really one of the few decision-making processes concerning development that is open to public scrutiny and input.

Environmental impact assessment improves government effectiveness by enhancing the ability of bureaucrats to handle complex and interdependent policy issues (Bartlett, 1989). Environmental impact assessment also increases opportunities for government co-ordination through shared decision making with other agencies and outside interests (Bartlett, 1989). These benefits must be tempered with the observations that improved bureaucratic expertise can lead to elitism, and enhanced government co-ordination can work against the move to the devolution of power.

Although environmental impact assessment is usually seen as a decision-making tool, its major, yet often overlooked, benefit may be as an important policy-making process (Bartlett, 1989). The success of impact assessment in a policy context, says Bartlett, is not its methodological or substantive focus, but the relevance and effectiveness of its implicit policy strategy in particular circumstances. In many cases, the conditions applied to particular projects have become regulations for similar projects.

## **NEGATIVE FEATURES OF EIA**

In practice, the methods for EIA are reductionist, leading to specialization within disciplines, with little attention paid to the synthesis of information. A reductionist approach, which simplifies information in order to increase understanding, is inappropriate for understanding complex and dynamic ecological and social systems.

When applied to ecological (and social) issues, this approach eventually leads to "surprises" (i.e., unintended ecological or social problems) because the complexity of interactions is not understood (Holling, 1986). Valid predictions through impact assessment are nearly impossible to make because the way science is used (analytic instead of synthetic) gives an incomplete and simplified picture of reality.

### **Scientific Approach is Limiting**

Structural biases, or basic assumptions, in the practice of environmental impact assessment limit the effectiveness of this approach in addressing the serious ecological issues facing society. The overriding structural bias from which other biases follow concerns the "scientific" approach on which environmental assessment is based.

The "scientific method," the acquisition of knowledge through observing reality, experimenting, and using inductive reasoning, stems from the "Western" world view.<sup>1</sup> The origins and development of the Western world view is the subject of many books and papers (e.g., Berman, 1981, 1989; Griffin, 1988; Roszak, 1978).

Although this analytic and reductionist approach to understanding the world has led to the creation of many beneficial technologies and advances in public health and education, the Western world view has also led to many problems. Because science is now considered to be the only valid form of knowledge, our perception of problems and solutions is limited to a narrow range of possibilities (Roszak, 1978).

### **Science is Not Value Free**

The dominance of scientific knowledge over other forms of knowledge is a relatively recent phenomenon. Knowledge is also conveyed through history (i.e., legends), religion, the visual arts, drama, and so on. The Western world view, taken to the extreme, regards information from these sources as interesting but not representative of the truth because the information is value-laden. Yet, values are a critical component of any decision that is not simply technical (Vickers, 1987).

The assertion that science is value-free is increasingly coming under question (Griffin, 1988; Shrader-Frechette, 1985). As a result, the application of an objective, scientific approach to environmental assessment is seen as inappropriate. According to Shrader-Frechette (1985, p. 74), "It is simply not possible to have an activity which is *both* wholly objective ('positive') *and* about the real world." The reality is that decisions about people and ecological systems are based on choices involving values, they are not made on the basis of being true or false.

Evidence of the separation of values from material knowledge in environmental assessment is seen in the emphasis on producing facts. Public opinion, community values, indigenous beliefs, and personal stories do not carry nearly the same weight as observable scientific facts.

### Asking the Wrong Questions

A related problem, stemming from the separation of values from material knowledge, concerns the type of questions that are asked in assessments:

For the last several decades, at least, we have intently formulated our science—and environment-related problems in terms of technological questions about purely technological solutions. . . . Not surprisingly, we have been getting technological answers, ones which respond to the questions asked, but which fail to resolve the more difficult problems which generated the original inquiry (Shrader-Frechette, 1985, p. 106).

The assumption is that technological and environmental problems have only technical, but not ethical, social, or political, solutions (Keniston, 1974, cited in Shrader-Frechette, 1985).

This bias towards technical problems and solutions is also evident in the choice of problems for EIA. When researchers and practitioners focus on predicting the outcomes of development, there is little room for asking different questions, such as what are the environmental constraints on this project if we wish to maintain the region's assimilative capacity? This and related questions can only be answered through processes that explicitly address a wider range of issues associated with development, for example, urban transportation policies.

### Increased Specialization Limits Participation

The analytical, reductionist approach of the scientific method leads to greater specialization, and, as a result, the generation of increasingly technical information. Problems are left to experts to define and resolve because few other people feel they understand what is important in the face of the technical information explosion (Meredith, 1992). As Pierce and Lovrich (1981, p. 8) observe:

. . . the scientific and technical content of modern political questions has significant implications for political communication, public control of leadership behaviour, public

participation in policy formation and the public's fundamental feelings about the country's politics and government.

There are two major outcomes from this bias of specialization: (1) information becomes a commodity, limiting public involvement in assessments; and (2) specialization leads to problematic jurisdictional splits in institutional arrangements.

The first outcome is that scientific information is becoming a commodity traded among the political elite. As a consequence, the public is less able to monitor the outcome of policies (Pierce and Lovrich, 1981). For the same reason, the public is also less able to participate in assessments. As currently practised, environmental assessment involves a high degree of technical knowledge. As a result, members of the public are at a disadvantage because they often lack the resources and skills to acquire the scientific information necessary to counter the expertise of government and project proponents. Special interest groups that are able to enter the arena of scientific debate do not necessarily represent the range of public interests. The question of how the public can participate in these assessments, given the gap in technical knowledge, has not been adequately addressed (Healey, 1988; Pierce and Lovrich, 1981).

Second, the bias of specialization is also seen in the organization of institutional arrangements. The responsibility for the environment is shared among agencies with specific responsibilities for fish, lands, parks, forests, and so on, leaving the Ministry of Environment with few responsibilities. With the large number of agencies involved in environmental management in certain areas, it is no wonder that management programs are difficult to organize.

For example, in the Fraser River estuary surrounding Greater Vancouver, a 1982 B.C. Ministry of Environment survey revealed 67 units of government and 120 interest groups were involved in its management (Dorcey, 1986). According to Sonntag *et al.* (1987), jurisdictional splits have been a major impediment to conducting environmental assessments.

## **IMPROVING THE PRACTICE OF EIA**

The structural biases in the current approach to environmental assessment constrain its effectiveness in improving or maintaining environmental quality. In the mid-1980s, researchers and practitioners in EIA recognized, through mounting evidence of multiple social and environmental impacts, that the technique of project-specific impact assessment could not effectively address the broader issues behind cumulative effects (CEARC and U.S. NRC, 1986). Consequently, the approach of cumulative effects assessment (CEA) arose.



CEA differs from EIA in the types of issues that are addressed: CEA tends to focus on multiple impacts, have a larger geographic focus, and consider impacts over a longer time frame. The scientific approach to predicting and assessing environmental impacts is similar, however. The types of methods used to identify and assess cumulative effects are simulation modelling, group problem solving, area assessment, cross-impact analysis and threshold analysis (Sonntag *et al.*, 1987).

A decade before this approach was officially recognized, researchers were already looking at the broader issues concerning development. The first examples of assessing cumulative effects were urban-based. They included an urbanization assessment method, prepared for the Environmental Protection Agency (Jameson, 1976); carrying capacity as a planning tool (Schneider, Godschalk and Axler, 1978); and an area-wide environmental assessment procedure, developed for the U.S. Department of Housing and Development (Skidmore, Owings and Merrill, 1981). Although the area-wide assessment procedure purported to be "fundamentally" concerned with cumulative impacts, the methodology for identifying and addressing such issues was poorly defined.

While there are probably a multitude of reasons why these procedures did not evolve into regular practice, three factors stand out as being major constraints. First, because urban planning has a history of facilitating urban growth, assessing the environmental impacts of urban growth often runs counter to the attitudes and inherent biases in most planning processes (Forester, 1989).

A second related problem is locating the responsibility for such assessments in the appropriate institutional structure. No one municipal government can take responsibility for an area-wide assessment; a level of government with greater authority is necessary. Yet, in both Canada and the United States, municipal governments often resist attempts by senior governments to get involved in local jurisdictional issues (De Grove, 1989).

The third factor concerns how environmental impacts are characterized. Most research has focused on the physical impacts of development, an assessment problem, not on the development which causes the physical impacts, a management problem (Roots, 1986). Thus the physical changes resulting from development continue to be analyzed instead of finding ways of managing the activities that cause environmental impacts in the first place.

In Canada, there is less experience with assessing and identifying cumulative effects and more examples of strategies to manage the effects of development. The Fraser River Estuary Management Program (described in Sonntag *et al.*, 1987 and Richardson, 1988) and the Great Lakes Water Quality Agreement (Peterson *et al.*, 1987) are two of the best known examples of such management strategies.

The overall approach currently being developed for CEA still closely follows that of environmental assessment. Much effort is directed at developing techniques for evaluating multiple impacts and complex cause/effect relationships after the major parameters of projects have been defined. CEA is seen as an adjunct to project planning, not the context for project planning.

To become a more effective assessment process for creating more sustainable forms of urban development, EIA and CEA will have to overcome their negative features. This means expanding the definition of usable information so that community, cultural and personal values can be incorporated into the assessment of alternatives (Meredith, 1992).

The questions that are asked about development will need to change as well. Instead of assessing the impacts of pre-determined projects, we need to step back and ask what kinds of urban development are desirable given the goals of reducing resource consumption, limiting pollution, fostering local economic development, *etc.* Beatley and Brower (1993, p. 16) suggest that "sustainability is a fundamental organizing principle against which to evaluate all of a community's proposed actions and policies."

Because these broader questions are not as technical as questions about specific environmental impacts, the assessment process then becomes more accessible to a wider range of people.

With these suggested changes, the environmental assessment process begins to look more like a planning process. As described in the next section, planning has not, however, been very successful in addressing the environmental impacts of urban development either.

## PLANNING AND URBAN SUSTAINABILITY

Planning practices in metropolitan areas have only been marginally concerned with the negative effects of urbanization in relation to overall environmental quality. For example, the mitigation of air pollution has relied on the strategies of vehicle exhaust technologies or the introduction of cleaner burning fuels. According to Banta (1989), the experience of dealing with air pollution in Southern California has shown these measures are insufficient to reduce pollution. Strategies such as placing jobs and housing closer together and limiting parking opportunities, concerns of metropolitan planning, will also be needed.

In some cases, metropolitan planning appears to be contributing to the problem of urban environmental impacts. For example, metropolitan planning has only marginal success in encouraging green spaces in cities or in preventing urban development from sprawling into the countryside. The Strategic Planning Group of the Town & Country Planning Association (1990) observed that urban sprawl continues to be a problem that metropolitan planning has been unable to contain. How best to

control urban sprawl also continues to be a major concern of growth management strategies in the United States (Brower, Godschalk and Porter, 1989).

Urbanized regions require large government expenditures to maintain the mechanical systems which have replaced the "free" systems found in nature. As more biophysical processes are replaced by mechanical systems, diseconomies of scale will result. Instead of being centres of economic growth, urbanized regions will become sinks for public expenditures (Overby, 1985).

In the development of urbanized regions, people have not fully considered the effects of incremental decision-making. The loss of wetlands in the Greater Vancouver region was given earlier as an example of cumulative effects. Individual decisions to eliminate wetlands, made on the basis of self-interest, were responsible for what is now recognized as a 70 percent loss of riparian habitat. The loss of that portion of a productive ecosystem is even more significant when viewed in the context of the need to limit development within the Pacific Flyway, the major migratory path for birds along the west coast of North and South America.

## **INTEGRATING PLANNING AND ENVIRONMENTAL ASSESSMENT**

If current approaches to environmental assessment, CEA, and metropolitan planning are ineffective in the management of environmental quality, is there another way to begin addressing the cumulative effects of urbanization? Research concerning planning for sustainability (see, for example, *Town and Country Planning*, vol. 1, 1990) and CEA (Sonntag *et al.*, 1987 and Peterson *et al.*, 1987) point to regional planning as one of the primary tools to achieve environmental objectives.

In Britain, people are experiencing ". . . a revived recognition of the crucial role that planning can play in protecting and improving our environment" (Gould, 1990, p. 245). Take the issue of global warming, for example. To avoid the risk that this condition would entail for life as we know it on the planet, energy use must be curtailed. "There are many routes to curtailing energy use, but the appropriate development of urban form is one of the surest and most effective" (Gould, 1990, p. 245). Gould also feels that planning will be most effective at the regional scale.

This is the point where the intent of cumulative effects assessment and the processes associated with land-use planning overlap. Concern about environmental quality is the integrative force and provides a new set of boundaries within which political manoeuvring can take place (Healey, 1988). Richardson (1989) also suggests that linking EIA to land-use planning can give EIA the context and continuity it now lacks, as well as helping to simplify the process.

The integration of planning and EIA is already occurring and leading to some interesting approaches. Two of these approaches are outlined below.

- Ecosystem planning is being proposed by the Royal Commission on the Future of the Toronto Waterfront as a way of directing urban development to environmentally appropriate places and protecting ecosystem values. As detailed in *Regeneration*, the final report of the Royal Commission, ecosystem planning attempts to balance ecosystem health, quality of life and economic vitality rather than distributing land according to economic, social and political imperatives. Ecosystem planning focusses on interactions in ecosystems and takes a long-term view of development. The rationale for this approach is discussed in Davis (1991).
- Integrated land-use planning is the approach used in the state of Oregon and described in Rohse (1987). Oregon's planning system is based on 19 state goals that were formulated through a broad public involvement process. This system facilitates the integration of social, economic, and ecological goals in urban and rural areas as well as on federally administered lands.

Land-use planning systems such as these can provide the context for more specific policies and actions in support of urban sustainability. Roseland (1992) provides a very detailed and useful compendium of such policies and actions.<sup>2</sup> Maclaren (1992) also provides a compendium of urban sustainable development initiatives in Canada, although in a less accessible form.

It is within the larger context of a planning framework for more sustainable urban development that EIA can take place. Rydin (1992) provides a detailed analysis of the environmental impacts of residential development and suggests how such an analysis can contribute to the generation of relevant policy and guidelines for development. Much more work along similar lines could be done, for example, on retail development such as shopping malls, office and light industrial parks, and so on.

## SUMMARY

Urban EIA is rarely carried out, as this review has shown. The reasons for this are varied. Early attempts in the 1970s to undertake area-wide assessments or carrying capacity analysis for urban development suffered from lack of well-defined methodologies and absence of a comprehensive planning framework to provide the context. As discussed in the literature on EIA, its scientific, reductionist, and project-specific approach is not appropriate for assessing the cumulative and dispersed environmental impacts from current forms of urban development. Because methods for CEA are also largely based on a scientific approach, CEA appears to be poorly suited to shifting urban development in more sustainable directions.

The literature, and practical experience, suggest that the integration of land-use planning with EIA will be most helpful in creating more sustainable cities. Ecosystem planning and integrated land-use planning are two approaches, based on this perspective, that look promising.

## NOTES

1. Civilizations in Western Europe gave rise to this viewpoint, hence the term Western.
2. Roseland's book is available at no charge from the National Round Table on the Environment and economy in Ottawa.

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