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Planning for the Environmentally Friendly City

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The growth of cities is a trend that has major impacts on both the global and local environment. In the 35 years since 1950, the number of people living in cities almost tripled, increasing by 1.25 billion. In the more developed regions, the urban population nearly doubled, from 447 million to 838 million. In the less-developed regions, it quadrupled, growing from 286 million to 1.14 billion (World Commission on Environment and Development 1987).

Girardet (1992) described these growing cities as parasites—they are energy drains whose survival depends on cheap food and energy produced elsewhere. Cities are also thirsty entities and produce large quantities of wastes. To qualify as environmentally friendly, cities must be able to break away from these trends, yet also must be able to sustain themselves.

To be sustainable, all human settlements must first meet the physical needs of its residents—needs that include air, water, food, shelter, energy, and raw and finished materials. Human settlements must also provide a healthy physical environment to support a healthy population. To meet these physical needs, a modern city provides clean water and waste disposal services; physical space and opportunities for employment and shelter; transportation and communications facilities and services; local energy distribution systems; community space for social interaction; healthy physical environments that include public and private open space for leisure and recreation; education facilities and services; and recreational facilities and services.

Urban planning is the integrating process by which these services and physical development are coordinated in cities. Some conceptual frameworks for ecosystem planning of environmentally friendly cities are highlighted in this chapter. Many challenges and problems are unique to a mining city (Fig. 25.1) in a north temperate climate, but instead of focusing only on planning needs for a city such as Sudbury, we discuss municipal planning principles that have wide application.

Ecosystem Planning

Ecosystem planning considers the natural environment more than just a medium on which urban development takes place. It sees humans living in the biosphere as a home rather than the planet being the house of humans. The word *home* evokes a much richer concept than does the word *house*—it involves a group of people who live together and jointly take care of and relate to their home; and it can be used to refer to a house, a home town, a country, or the planet all at the same time (Allen et al. 1993).

To achieve the harmony of humans at home, ecosystem planning has to begin with careful

Figure 25.1. Aerial view of downtown Sudbury with a portion of Ramsey Lake in the lower right corner.

consideration of the constraints as well as the opportunities offered by the biosphere. The built environment is then designed to fit into the home. Some useful operating principles for ecosystem planning are provided in the preface to the Royal Commission Report for the Future of the Toronto Waterfront (RCFTW 1992):

1. includes the whole system, not just parts of it
2. focuses on the inter-relationships among elements
3. understands that humans are part of nature, not separate from it
4. recognizes the dynamic nature of the ecosystem
5. incorporates the concepts of carrying capacity, resilience, and sustainability—suggesting that there are limits to human activity
6. uses a broad definition of environments—natural, physical, economic, social, and cultural
7. encompasses both urban and rural activities
8. is based on natural geographic units such as watersheds rather than on political boundaries
9. embraces all levels of activity—local, regional, national, and international
10. emphasizes the importance of species other than humans and of generations other than the present

11. is based on an ethic in which progress is measured by the quality, well-being, integrity, and dignity it accords natural, social, and economic systems

Long-Term Planning

Tonn (1986) proposed the concept and coined the term *500-year planning* to describe the goals, practice, and methodology of carrying out the design, development, and implementation of plans, programs, and laws to eliminate or substantially mitigate very long-term environmental problems—problems such as climate change, species extinction, soil erosion, salination and conversion of agricultural land, deforestation, groundwater contamination, nuclear waste, and chlorofluorocarbon pollution. These problems often take centuries either to develop or to show their full effects and take centuries to solve. The goals of 500-year planning are therefore designed to safeguard the physical/natural system for future generations and to protect present and future populations from health and safety risks caused by misuse of the environment as well as from environmental catastrophes that would restrict the future of the human species. As such, 500-year planning does not center on setting long-term goals for humankind nor to predict the future states of human society but to maximize the ways in which human socioeconomic evolution can occur (Tonn 1986).

Unlike 500-year planning, which would be more appropriate for planning at the national or international scale due to the nature and scope of the environmental problems that it addresses, 100-year planning is adaptable to local planning. In fact, the three 100-year plans existing in Canada today are all plans prepared at the local or regional scale (Moriyama and Teshima 1979, 1988, 1991). The latest is the Ramsey Lake Community Improvement Plan prepared for the City of Sudbury and the Region of Sudbury, Ontario (Moriyama and Teshima 1991; Regional Municipality of Sudbury 1992) (Box 25.1).

The philosophy behind 100-year plans is the creation of an overall vision for the long-term future, yet allowing detail planning and implementation to evolve in the future by adaptation to changes in circumstances over decades.

Techniques for Physically Planning an Environmentally Friendly City

Many planning techniques are available to plan for the environmentally friendly city. None of these techniques are new, although some have been used more often than others in the past. When used in combination, however, these techniques represent excellent starting points in achieving the desired goal.

Design with Nature

The design with nature principles and methods pioneered by McHarg (1971) still remains a powerful tool in physical design. It is both a philosophy and a technique. As a philosophy, it begins with an examination of values—both natural values and historical, cultural, and social values are considered. As a technique, it is a planning process that begins with an inventory of the individual components of the biophysical subsystem—factors such as bedrock geology, surficial geology, hydrology, physiographic features, soil drainage, vegetation, and wildlife habitats. Physical constraints to development are mapped individually and then put together as a set of map overlays. The resulting composite map helps indicate where constraints are most severe, less severe, or light. Development, whether in the form of a linear corridor such as a new road, a transmission line, or a trail or non-linear structures such as buildings, may then be located in areas where physical constraints are least severe. Alternatives can also be evaluated with the same technique, and choices can be made based on identifiable environmental factors.

Mixed Land Uses

Land use policies adopted in North America in the past few decades have been based on the

Box 25.1. Ramsey Lake Community Improvement Plan

Ramsey Lake is an 870-h urban lake located within the municipal boundaries of the City of Sudbury and within walking distance to downtown Sudbury (see Plate 18 following page 182). It is also the main source of drinking water for the city. During periods of peak demand, Ramsey Lake supplies up to 60% of the total quantity of drinking water for the city. The lake is surrounded by established residential neighborhoods and several activity centers and institutions—a university, three hospitals, a science center (see Fig. 8.12), two major city parks, and a 970-ha open space conservation area. The lake is also an important recreational area supporting swimming, sailing, rowing, power boating, and fishing. Several areas also support more passive activities such as walking and wildlife viewing, and the entire lake is valued as a scenic resource.

The Region and the City of Sudbury jointly prepared and adopted a Ramsey Lake Community Improvement Plan in 1992. The plan examines this vital resource of the city and begins with a 100-year vision of the lake and its watershed. It views Ramsey Lake and its watershed as a hydrogeological and ecological region that is shared by all people of the city. The plan identifies the highest and best use of the lake as "the green and natural heart of the City, a public domain where resources of City-wide importance can be gathered in a magnificent setting and made accessible, a place of enjoyment, discovery and recreation for all the people."

It is on the basis of this long-term vision that specific policies, programs, and projects are proposed in the Ramsey Lake Plan. Policies proposed include the preservation of the water quality of Ramsey Lake; the conservation of green space around the lake; the retention of these green spaces in public ownership over the long term and the acquisition of key open space properties by the public; and the protection of natural and environmentally sensitive areas such as wetlands, marshes, wildlife corridors, and fish spawning areas. Programs proposed include the development of the Ramsey Lake Interpretive and Recreational Trail around the lake and further development of the public park and conservation area properties for recreational uses. For the implementation of these policies and programs, the plan proposes the creation of a Ramsey Lake Trust to serve as the watchdog and guardian for the lake and to ensure long-term stewardship of the lake. Many of these programs and projects can be planned, budgeted, and carried out in 5-year time blocks, even though the completion of all the development projects for the Ramsey Lake area will probably take 20 years or longer to be accomplished.

premise of segregating incompatible land uses. Historically, segregation of land uses was needed to protect the health of residents by separating polluting industries from residences. Although this premise is still valid today for certain types of industries, it is not a necessity in most cases. This is due not only to the decline of many smokestack industries and the rise of service industries in the North American economy but also because many of the traditional industries have modernized and become much less polluting than their predecessors. Moreover, many of the emerging high-technology industries operate in industrial buildings that are physically indistinguishable from office buildings and carry out operations that have no higher environmental impacts than office work.

Furthermore, segregation of land uses has environmental costs. It requires daily transportation of workers between their homes and their workplaces. Means of transportation, whether in the form of public transit or private automobiles, are needed. It requires the construction of more roads and vehicles, the use of more energy for operating these vehicles, and the generation of more pollution from such operations. However, mixing of land uses could reduce some of these transportation needs and their associated environmental

Box 25.2. Neo-Traditional Neighborhood

Originally promoted by the husband and wife architectural team of Duany and Plater-Zyberk as neo-traditional development, this urban design concept has since evolved to become known as "New Urbanism." A primary objective of this design concept is to design urban space for people, not cars. This is in direct contradiction with the (usually unstated) urban design objective of the postwar period in North America, which is to design urban space for the convenience of the automobile.

Although the first community designed and built according to this principle was the resort community of Seaside, Florida, many other communities have been designed or built in many other locations in both the United States and Canada. In Canada, the latest examples can be found in the town of Markham, Ontario. For example, the Markham plan includes the following features on a 625-ha site that will accommodate 16,000 jobs and 10,000 housing units (Duany and Plater-Zyberk 1992; Gabor 1994; Wood-Brunet 1994):

1. seven neighborhoods positioned no more than a 5-minute walk (400 m) from the central core
2. houses are set to narrow (15.5-m right of way) streets, planned on a modified grid pattern
3. extensive street parking and rear lanes for car access
4. a range and mix of housing in close proximity
5. space above rear lane double garages for living or working
6. strong regulation of the built form to ensure a human scale (but without regulation of architectural style)
7. a central core featuring main street shopping and the highest densities for housing and employment uses
8. higher net densities and mixed uses
9. a dedicated transit line built into a 4.5-km central corridor linking the neighborhoods
10. linked open space at the edge of the neighborhoods that contain schools, parks, and remnant woodlots
11. interesting building features, civic sites, or architectural follies used to terminate the views down streets

costs. Similar benefits would also be realized by mixing residential and commercial land uses and thus reducing the number and length of shopping trips. Recently, there has been a small but growing number of new communities that are being designed and built according to what is generally known as new urbanism or neo-traditional principles that are being championed by Duany and Platter-Zyberk (1992) (Box 25.2).

Land use patterns take a long time to establish or change. Any resulting positive or negative environmental impacts will also remain for a long time. Planning therefore has to take a proactive role in influencing positive changes in the land use pattern at the earliest opportunity—the community design stage (Fowler 1991).

Green Space, Greenways, and Urban Forestry

Greenways are natural or landscaped linear open spaces for pedestrian or bicycle passage or for linking parks, nature reserves, cultural features, or historical sites with each other and with populated areas (Brown 1993). These linear corridors may include elaborate trail systems that permit walking, hiking, biking, riding, and skiing or simply a stretch of open space left in its natural state. Although recreation is a common use for greenways, they often serve the more important ecological function of protecting wildlife migration corridors and habitats. For these reasons, they are referred to by Wisconsin landscape architect Phil Lewis as "E-ways"—for environment, ecology, educa-

tion, and exercise (Grove 1990). The Junction Creek Waterway Park that traverses the city of Sudbury is one example of such a linear open space system in an urban environment (Regional Municipality of Sudbury 1991).

Whether viewed as an extension of or a component of greenways, urban forestry is an effective means to bring the natural environment into the daily urban life and the consciousness of the urban population. The educational value of urban forestry is as important as its "practical" values such as providing shade and modifying the microclimate; absorbing carbon dioxide and improving air quality; or beautifying the urban landscape. The regreening of Sudbury is an excellent example of a community effort in large-scale urban forestry (see Chapter 8).

Bioclimatic Design and Winter Cities

Bioclimatic design relates the biological requirements of human comfort with the climate of the natural environment. From an energy efficiency perspective as well as a quality of life perspective, planning, designing, building, and retrofitting cities located in colder climatic zones according to the design principles developed under the umbrella concept of "winter cities" is an application of bioclimatic design (e.g., Manty and Pressman [1988] represents one of many publications on winter cities, and Matus [1988] illustrates solar design techniques). Although this will be a slow process—as cities have to develop and redevelop over time—the benefits will also be long-lasting for any cold climate community that is developed according to energy efficiency and winter quality of life criteria.

Community Energy Efficiency

Importing fuel to meet the energy needs of a community is a constant drain on the economic wealth that could have been retained within the community. In economic development, the strategy of import substitution is one that attempts to use local resources to substitute for imported resources. Although no community can rely entirely on locally generated energy resources, strategies such as substituting imported non-renewable energy with locally produced renewable energy; improving the energy efficiency of its building stock through appropriate community design, better construction, and retrofitting of older buildings; and reducing the community's reliance on the automobile are all components of this import substitution strategy. Over time, this strategy will create a less energy-demanding urban settlement.

Transit-Friendly Communities

Employment and commuting go hand in hand in North American cities. According to a 1992 Statistics Canada survey, an estimated 9.1 million urban Canadians commuted to work each weekday, whereas only 770,000 or 8% of the employed population were non-commuters. Among commuters who used a single mode of transportation exclusively—the automobile, public transit, bicycling and walking represented 69%, 3%, 2%, and 4%, respectively. Including those who used multiple modes of transportation, the automobile carried 87% of all commuters while public transit carried only 10%. The highest percentages of public transit users were found in Toronto, Montreal, and Ottawa-Hull—at 20%, 18%, and 16%, respectively (Marshall 1994). It is worth noting that both Toronto and Montreal are served by rapid transit systems.

Mixed land uses connected by a properly designed road system in a community with sufficiently high residential densities are all preconditions that support the provision of transit services. There is a direct relationship between development density and the use of transit. Compact urban areas are more supportive of transit than low-density areas typical of suburban developments. Generally, viable bus service requires a residential density of at least 10 dwelling units per hectare. Rapid transit generally requires considerably higher densities—30–80+ dwelling units per hectare and larger catchment areas. Even at these densities, however, transit services will continue to require public subsidies (Irwin 1992).

The planning tools highlighted so far invariably focus on design—either at the community design or site/building design level. Once designed and constructed, environmental impacts of the built environment will be long-lasting, remedies will be costly, and changes will be slow. It is therefore crucial that environmentally friendly designs be adopted whenever new urban development occurs (Fowler 1991).

Evaluation Tools

Supplementing these planning tools are also analytic tools that may be used to evaluate human settlements' interaction with and human actions on the natural environment. A few examples are highlighted.

Environmental Impact Assessment

Environmental impact assessment has been used for more than two decades as a technique to evaluate the environmental impacts of a proposed project before the project is carried out. For example, in the Province of Ontario, environmental impact assessment was legislated in 1975 with the passing of the Environmental Assessment Act. In addition to the project as proposed, environmental impact assessment also assesses the alternatives to the project and the alternatives in carrying out the chosen project alternative. Finally, the process also proposes actions that will mitigate the effects of the identified environmental impacts.

Although environmental impact assessment can be an effective tool for identifying and evaluating impacts before a project is undertaken, it is still difficult to identify the cumulative impacts of multiple projects on the same natural system. This shortcoming may be somewhat overcome if environmental assessment is applied to policies or plans that precede projects. Even so, such assessments are bound to be general in nature.

To identify the cumulative impacts of multiple projects on the same natural system, new technical evaluation tools and legal/regulatory frameworks must be developed.

State of the Environment Monitoring and Reporting

Reporting on the state of the environment is not new. In fact, by the time Canada produced its first state of the environment report in 1986, 16 of the 24 member countries of the Organization for Economic Co-operation and Development had produced a state of the environment report (Bird and Rapport 1986). The second Canadian report on the environment was produced in 1991 (Environment Canada 1991).

In recent years, municipalities have also adopted this tool—for example, the Edmonton Board of Health produced a report for the City of Edmonton in 1989, and the Ottawa-Carleton Health Department produced a report for the Region of Ottawa-Carleton in 1992. In Seattle, a coalition of local organizations and citizens has prepared a report on 20 indicators of sustainable community for the Seattle area. Twenty more indicators are in the process of being researched (Sustainable Seattle 1993). The Sudbury and District Health Unit is also in the process of preparing a report to cover the Region of Sudbury.

At the local level, a state of the environment report can be used (1) as the starting point for the creation of a library of baseline data for future environmental monitoring and environmental research in the community; (2) to identify the trends; (3) to identify actions required; (4) as the background information for evaluating the accomplishments and deficiencies of existing policies and programs; (5) as the starting point for the initiation of new policies and programs to fill identified gaps; and (6) as a tool for public education.

True Cost Accounting for Resource Uses

There are two main approaches to environmental protection: (1) the legal/regulatory approach in which legally enforceable standards are enforced by the regulatory agencies through the court system; and (2) the economic approach in which economic incentives or disincentives are used to bring forth compliance. There are advantages and disadvantages

Box 25.3. Green Housing

Modeled after its successful Energy Star Program, the City of Austin, Texas, offers a Green Builder Program to assist builders to produce and market environmentally friendly homes and to educate buyers to make informed choices. As part of the program, the city publishes the Eco-Home Guide that covers four main areas in which the built environment has an impact on natural resources and environmental quality—water, energy, building materials, and solid waste. Each of these four topics is examined from a life-cycle viewpoint (i.e., the product or system listed as an Eco-Option in the guide has been evaluated from an environmental standpoint through the stages of its existence from its source to its recycling or disposal). Each Eco-Option has a rating value assigned so that each component of a home and the home itself can be rated by either a builder or a buyer. This is believed to be the first program of its kind in the United States and has been awarded by the United Nations International Council for Local Environmental Initiatives Government Honours Programme.

in both of these approaches, but often, a combination of these approaches is used to deal with an environmental problem (e.g., the case of sulfur dioxide emissions reduction by the two Sudbury mining companies over the past decade) (see Chapters 4 and 21).

Currently, many public goods are delivered to the users at below their real costs of production. Examples include the provision of municipal drinking water, the collection and disposal of sewage and solid wastes, the construction and maintenance of roads to serve primarily private automobiles, and the provision of volume discounts for high-volume users of energy such as electricity and natural gas. By not paying the true economic costs of production, the consumers of these services and resources lack the market signal for conservation. In fact, these hidden subsidies often act as disincentives for the consumers to respond to administratively or legally imposed conservation measures. To change this, service providers must account for the true economic costs of their services and charge their customers at cost. Eventually, they must also include in the basic costs the environmental costs—the so-called externalities.

Given the proper market signal, consumers, be they individual households or high-volume private or public corporate users, will adjust their consumption accordingly over time. In practice, this user pay principle based on true cost accounting can be a powerful tool to meet both the fairness objective as well as the conservation objective. For example, in a municipal setting, the use of individual meters for water use and the adoption of a pricing structure that more closely reflects the true costs of municipal sewer and water services have been successful in achieving conservation objectives (Brooks et al. 1990).

A variation of this principle is the life-cycle costing technique, which takes into account the total energy and material resources used in manufacturing, distributing, operating, maintaining, and disposing/recycling of a manufactured product. For example, this technique may be applied to evaluate the different building materials, designs, and building techniques used in constructing buildings (Box 25.3). This evaluation technique may be applied to either public goods or private goods.

Conclusions

Kenneth Boulding (1973) likened the long process of transition in the relationship between humans and their environment as the transition from the "cowboy economy" of the past to the "spaceman economy" of the future. The bulk of this book describes the legacies of earlier cowboys and tells the story of how the descendants of those cowboys attempt to restore the damaged environment of the Sudbury Basin.

This chapter highlights some broad approaches and technical tools that should be used to build and retrofit an urban environment to become a healthy component of that

future. Yet, strategies are only as effective as their users are willing to use them. Beyond these interim technical solutions and more sophisticated technical tools yet to be created, an environmental ethic must evolve to become the guiding principle for all human actions, including urban and regional planning. Leopold (1966) saw an ethic in the following way:

> An ethic, ecologically, is a limitation on freedom of action in the struggle for existence. An ethic, philosophically, is a differentiation between social and anti-social conduct. These are two definitions of one thing. The thing has its origin in the tendency of interdependent individuals or groups to evolve modes of co-operation. The ecologists call these symbioses.

Leopold further argued that a land ethic is "an evolutionary possibility and an ecological necessity."

As the Sudbury experience attests, environmental damages take a long time and great efforts to undo. Will an urban world environmental ethic evolve soon enough so that further damages will not be inflicted on our environment? In the final analysis, that is the great challenge facing all inhabitants of spaceship earth for decades to come.

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