Part 1

Connected Open Space

development costs, thereby further limiting affordable housing (in an environment where few affordable houses are being built to begin with). Since the election, developers have been scrambling to purchase land in the county for housing, retail complexes, and office parks. One executive for a national homebuilding corporation said, "Green space is like world peace: everyone is for it, but there can be bitter disputes on how to achieve it."[2]

One of this book's main themes is the tension between the widespread desire for open space and the complexity of and controversy over providing and protecting it. As often as not, the importance of urban open spaces is neglected in debates about land development, architectural design, and urban form. More theoretical and practical knowledge about creating greenspace is needed. Creating and protecting open-space networks across jurisdictional lines and with assorted land uses is a challenge. People have many different objectives for creating open-space networks—personal, community, and regionwide. However, using the criteria of landscape ecology and human ecology we can better understand both the motivations for and the benefits of greenspace. Landscape connectivity at a metropolitan scale can serve important human and natural functions; multiple objectives are often more effective and sustainable than one-dimensional solutions. A connected public realm is better than a fragmented one, and open-space connectivity can take many different shapes. Green infrastructure is explored as an approach that incorporates these multiple forms and functions.

Everyone Loves Open Space

Open-space protection is a topic of growing public dialog and concern. Where perhaps two decades ago planners, landscape architects, environmentalists, and park planners quietly pursued open-space planning and protection, today open space is on the front page, linked with issues of sprawl, health, lifestyle, and ecology. The smart-growth movement probably deserves the credit for this awareness. More and more people are fighting against sprawl and looking toward the promise that we can grow in more responsible, beautiful, and efficient ways. In fact, the protection of open space is a primary driver of efforts to curb sprawl.

Many people feel widespread remorse about the loss of open space in many land-use contexts and at many scales, which has generated significant funding for protecting open land.[3] According to the Natural Resources Inventory for the United States, 2.2 million acres are being converted to development each year. The backlash against sprawl has, among other things, created a blitz of programming, funding, and rhetoric for open space. In reviewing the environmental impacts of sprawl, Michael Johnson found twelve main factors, many of them connected to open-space destruction, such as the loss of environmentally fragile lands and the paving of farmland.[4] In particular, concern for the quality and quantity of open space

at the local level has grown. Carys Swanwick and colleagues claim that worries about the declining condition of parks, growing emphasis on urban densities, priority for developing brownfield rather than greenfield land, and increased knowledge about the benefits of urban greenspace have helped fuel this concern.[5] These worries have been converted to votes. In 2002 three-quarters of local and state open-space conservation ballot proposals were passed. According to the Land Trust Alliance, these measures generated $10 billion, including about $5.7 billion specifically for land acquisition and restoration.[6]

The provision of green, open space in urban areas may lessen the desire for residents to move farther out of cities. A study of Leuven, Belgium, showed that 50 percent of families that moved out of the city core did so because of lack of greenspace.[7] "Improving the presence and quality of greenspace might help to deter commuting, so enhancing a city's sustainability," the study found.[8] These types of studies have proliferated, generally pointing toward the importance of open space in housing preference in the United States and Europe.[9] Claims from real estate research show that nearly 78 percent of all American homebuyers rated open space as essential or very important.[10] Another national survey in 1994 found that among people who shopped for or bought a home, of thirty-nine features critical to their choice, consumers ranked "lots of natural open space" and plenty of "walking and biking paths" as the second- and third-highest-rated aspects affecting their choices.[11] One conundrum lies in the fact that increasing development of urban areas through infill (a primary smart-growth solution) sometimes drives residents toward more roomy suburban areas. Trade-offs of one open-space type for other types seem inevitable as populations grow.

On the other hand, population growth has not been the main concern among smart-growth and open-space advocates. Alarming statistics about the ratio of developed land to population increase in various metropolitan regions demonstrate the extent of sprawl and consequent loss of open land. The amount of urbanized land in the United States increased by 47 percent from 1982 to 1997, with only a 17 percent population increase.[12]

In response, nearly every spatial plan for an American municipality or urban region (and in some cases, states) includes the protection of open space as a component of land-use plans or ordinances. Open-space planning and walkable neighborhoods are increasingly a part of large-scale plans for American cities. For example, Chicago's Metropolis 2020 plan, completed by the Commercial Club of Chicago, claims, "We can build a better region. We can spend less time in traffic. We can live nearer to our jobs. We can build communities that are friendlier to walking and biking—and therefore healthier for the people who live in them. We can make economic opportunity available to more of our

region's residents."[13] Similarly, the new Envision Central Texas effort, like Metropolis 2020, developed alternative growth scenarios for the five-county Austin region, in the Texas Hill Country.[14] Through extensive public participation, a preferred scenario for future growth was developed.

The planning literature is filled with studies proposing open-space plans and planning processes for various metropolitan areas around the world—Nanjing City, Warsaw, London, Phoenix, and New York.[15] For example, D. A. Goode suggests five categories of open-space sites for Greater London that will encompass 20 percent of the total land area to produce a comprehensive nature-conservation strategy. These include sites of metropolitan importance, sites of borough importance, sites of local importance, wildlife corridors, and countryside conservation areas. For Warsaw, Poland, Barbara Szulczewska and Ewa Kaliszuk attempt to reconcile two main functions of open space—ecological and recreational. In addition, their greenspace plan tries to balance "green city" and "compact city" objectives through careful consideration of open-space types and objectives. Their work addresses an important tension between more dense human development (sacrificing certain types and quantities of open space in city centers in order to save it at the edges) and greening city centers (at the expense of density).

These plans are not only proliferating but taking on new characteristics. They incorporate new spatial territories, connect with new social and environmental initiatives, and involve new participants and constituents. Open-space planning has traditionally been linked to the design of new housing tracts. As subdivisions are laid out, so too are parks, nature reserves, and trails. Increasingly, though, open space is being thought of in new ways. For instance, natural areas can be incorporated into commercial landscapes, as brownfields are converted to new urban uses, and as farms, forests, prairies, and wetlands are embraced as amenities within the urban fabric. Rather than leaving open-space planning to the city parks department, other arms of municipal government are taking more active roles in open-space planning. In addition, the number of grassroots groups tackling these issues is impressive. Hundreds of citizens groups have organized across the continent in the last twenty-five years, dedicated to the protection and planning of open-space lands. They are concerned about the paving of open space, declining quality of remaining open space, diminished management budgets, universal access to open space, and lack of a strategic vision about open space in relation to new growth.

The Preliminary Blueprint for Renewal, a plan for Lower Manhattan following the September 11 tragedy, is a perfect example.[16] "Open spaces," it asserts, "are essential to the quality of life downtown, providing alternatives to steel and glass skyscrapers and, per-haps more importantly, a physical and psychological center around which the city can grow. Public open spaces stimulate and promote private and human development."[17] Although efforts are being made to preserve open space, agreeing on one definition of open space is often difficult.

What Is Open Space Anyway?

Just what is this open land that planners, designers, and citizens in hundreds of towns and cities are trying to designate and protect? Is it simply land without buildings? What is its spatial dimension? How does it function? At what scale is open space important for cultural and ecological values? Do connections between open-space sites matter? In order to protect open space, we need to know more about what we are trying to achieve. There is considerable ambiguity about the forms and functions of open space, as well as diverse approaches for incorporating these landscapes into larger land-use plans.

Each year I choreograph an exercise with my graduate-level, land-use-planning students to illustrate this point. We brainstorm and debate the meanings, settings, and purposes of open space, in order to prepare a land-use plan for open-space lands at the fringe of our city. The typology that develops usually swings widely between several perceived dichotomies—public/private ownership, functional/aesthetic purpose, urban/rural land use, natural/human-made elements, open field/tree cover, and visual/physical access. To the ecologically minded, open space implies a level of environmental integrity. To others, it is simply an aesthetic issue. Some think of neighborhood parks, and some think of productive farmland at the edge of town. Open space can comprise vast swaths of greenspace in urban areas, as in Figure 1.1, but it can also be small, seminal pieces in the center of the city, as shown in Figure 1.2. The constructs in people's minds around the idea of open space are wide ranging and often conflicting.

Likewise, the professional literature on open-space planning is often ambiguous and confusing. Some authors have crafted definitions that help readers understand what they mean by open space in specific locations or for specific research issues. Many focus closely on recreation. For example, Karen Payne uses the recreational focus: "Open space, or green space, can be thought of as a mix of traditional parks and reserves, hiking or biking corridors, scenic vistas and other areas that provide for informal recreation and natural resource protection."[18] Anne Beer usefully defines greenspaces based on their spatial and environmental qualities: "Greenspaces are 'places'—areas of land with mainly unsealed surfaces within and around the city—these 'places' carry human activity as well as plants, wildlife and water and their presence influences quality of life, as well as local

Fig. 1.1 Ottawa's Central Experimental Farm provides a large expanse of open land very close to the central city. (Photo by the author.)

Fig. 1.2 Civil War Memorial Fountain on Public Square in Cleveland, Ohio is a small island of green open space at the heart of the city. (Photo by the author.)

air and water quality."[19] While this definition highlights environmental processes, the nonprofit National Wildlife Federation's definition ironically omits the most ecologically important lands from its definition of open space: "Open space is undeveloped sites that don't meet the criteria for natural areas because of human disturbance, but still provide habitat, scenery and other benefits. Open spaces can include areas such as farm land, recreational areas and utility corridors."[20]

Hollis and Fulton classify open space as land conserved for

1. production (e.g., working lands)
2. human use (e.g., recreation)
3. high-value natural areas (e.g., national parks) and
4. natural systems (e.g., ecosystems).[21]

According to this definition, open space often means land with nonurban activities. However, this meaning leaves out many landscapes that people clearly value as open space—public and private urban lands, including cemeteries, empty lots, streamsides, community gardens, and schoolyards.

Increasingly, urban design and planning critics address this open-space ambiguity head-on. Beer and others cite an "increased level of confusion concerning the role of green-space in cities: whether it was an aesthetic issue, an ecological issue, perhaps something more."[22] Similarly, Jane Holtz-Kay asks, ". . . what exactly is this thing called open space, this creed of the wild or wide-open spaces that makes the nation wax lyrical? . . . But why the phrase 'open space'? Why a concept that seems more a void for free-for-all pavers and ballpark proponents than a promise for the future. Can't we find a less vacuous phrase?"[23] Lisa Nelson and Andrew Kalmar illustrate how this confusion hinders our effectiveness on landscape-scale issues. They maintain that water quality, wildlife habitat, agricultural productivity, and recreational opportunities are all connected to the preservation of open space, but that the public is largely unaware of the many connections between these activities and their relevance to open-space planning.[24]

To make those links more apparent, and to help structure the open-space idea, several authors have expanded the definition of open space beyond parks and recreation, to embrace and prioritize alternate forms of urban open space. For instance, Catherine Thompson asks what should be expected of open space in the twenty-first century and advocates a more flexible approach, which she calls 'loose fit' landscapes.[25] Similarly, Quayle and Driessen van der Lieck describe "hybrid landscapes," spaces like beaches,

community gardens, and greenways that mix the processes and forms of both public and private landscapes.[26] And Mark Johnson describes the "open-ended environment": a landscape "that is neither an empty vessel nor one that is a deterministic composition."[27] All three authors relate public open space to ideas of democracy and social equity. "What remains true for public open space, and for the urban parks in particular, is that they are the places where democracy is worked out, quite literally, *on the ground,* and therefore, the way such spaces are designed, managed and used demonstrates the realities of political rhetoric."[28]

To build on these ideas we need to know more about how the public perceives, uses, and values open space.[29] Social values about open space vary, depending on whether we are talking about the protected land in a private cluster development, a multi-jurisdiction public greenway, a preserved farm, a brownfield site, an urban square, or a small community garden. Yet it is startling how many times these places are lumped under the broad term "open space," even though different social groups use and appreciate open space in very different ways. In fact, one line of scholarship examines the influence of ethnicity, generational status, and social class variables on recreational preferences.[30] Citing Lee's work, Carr states that "recreation sites are rarely perceived as free spaces without social definition. Rather, individuals seek outdoor areas occupied by others they perceive as similar enough to themselves to feel at home or that they belong. One of the most basic elements of a social definition of a site is the ethnic composition of the people occupying it."[31]

So it is clear that, like the term "landscape," open space has diverse dimensions, definitions, and proponents. The two words "open space" cannot, in fact, integrate the inherent complexity of the field. And open spaces, especially when viewed at the scale of metropolitan regions, are truly complex systems. Homer-Dixon identifies six factors that define complex systems, all of which pertain directly to open space embedded in an urban structure. He claims that complex systems

1. Are made up of a large number of entities, components or parts. Systems with more parts are generally more complex. For open-space networks, these components are open-space sites, social groups, transportation corridors, and a host of other entities.
2. Contain a dense web of causal connections among components. The more causal connections, the more complexity. The causal connections among open-space networks involve, among other things, political processes, citizen perceptions and preferences, ecological processes, and economic impacts.
3. Exhibit interdependence among components. An example for our purposes, elaborated

in the following chapters, is the success that comes from collaborations among organizations working toward open-space goals.
4. Are not self-contained, but rather are affected by outside variables. For instance, open-space protection in a given municipality or urban region is affected by political and economic variables at state and federal levels, by environmental processes outside the city's boundaries, and by social changes that transcend the region.
5. Have a high degree of synergy among components—the whole is more than the sum of the parts. The synergy among open-space components is the purview of ecology itself. The whole of any natural system is inherently more than the sum of its soils, vegetation, climate, and so forth.
6. Are nonlinear. A change in the system can produce effects that are not proportional to its size. A small shift in priorities within a city department can have disproportional effects on support for open-space landscapes.[32]

Open-space systems are composed of a myriad of interacting and interdependent entities, from humans and wildlife to natural features and built structures. They inherently engage complex causal connections, both ecologically and socially. Peter Calthorpe and William Fulton express the challenge of layering open-space land (which they call preserves) over the myriad of other urban priorities: "Preserves are perhaps the most complex and controversial building blocks of a regional design: complex because they include so many different elements, locations, and potential uses; controversial because the means of saving the land and the economic effects are hotly debated."[33] Categorizing types of open spaces is one heuristic device for helping us understand this complexity.

Typologies
Because the term "open space" is an ambiguous one, scholars and practitioners have long devised schemes to understand the connection of open land to the built environment.[34] Urban scholars have devised morphologies that define the structure and processes of urban places, including the unbuilt spaces. Some scholars, especially over the last couple of decades, have grappled with what Anne Spirn calls the "deep structure" of cities and related that concept to both open-space planning and new growth.[35]

Typologies based on scale, uses, or natural features can help structure open-space complexity, for the purposes of communication, use, and planning. The typologies help define the types of open-space components, as well as their connections and interdependencies. A number of approaches have been used. A hierarchy of scale is a straightforward and commonplace

strategy. For instance, Stanley Tankel, former planning director of New York City's Regional Plan Association, presented such a categorization in the 1960s.[36] His classification of urban open space, shown in Table 1.1, is based on ascending scales from the street to the region. This nested scheme is common in the parks-and-recreation literature and is often employed by park agencies as quotas for various types of parks. The classic quota system allots a minimum acreage of each type of open space per 1,000 residents, as illustrated by the average open-space standards in Canada (Table 1.2). The quantification focus of park quotas estimates the number of tennis courts for a certain population, but such

	Scale or level	Present examples of open space (Land)	(Water)
STREET	Building site	Yards, courts (i.e., sites less buildings)	
STREET	Group of Buildings	Rights-of-way, streets, piazzas, residential commons, tot lots	
COMMUNITY	Neighborhood	School grounds, playgrounds, small parks (<10 acres)	Ponds, streams
COMMUNITY	Municipality	Parks (10–100 acres), playfields	Ponds, streams
COUNTY	Group of municipalities	Parks (100–1000 acres), golf courses, minor conservation areas (flood plains, watersheds, wildlife)	Lakes, rivers
REGION	Metropolitan region	Parks (> 1000 acres), large conservation areas, major water bodies, private farms, woodland and other land on the urban fringe	Oceans, great rivers
REGION	Megalopolis	Coastline, mountain ranges, milksheds	Oceans, great rivers

Table 1.1 Stanley Tankel's categorization of open space, based on ascending scales of urban development (Adapted from Stanley Tankel, "The Importance of Open Space in the Urban Pattern," in Lowdon Wingo, ed., *Cities and Space: The Future Use of Urban Land* (Baltimore: Johns Hopkins University Press, 1960)).

Area	Acres per 1,000 population	Service Radius (miles)	Size (acres)
Tot-lot	0.25 to 0.5	1/8 to 1/4, usually 1/4	0.6 to 2.0 (usually 0.5)
Parkette (vest-pocket park)	0.5	1/8 to 1/4	.06 to 1.0 (usually 0.5)
Neighborhood park (playground, local park)	1 to 2	1/2 to 3, usually 1	1/4 to 20 (usually 6)
Community park (playfield)	1 to 2	1/2 to 3, usually 1	4 to 100 (usually 8 to 25)
City park (municipal, subregional park)	5	1/2 to 3, usually 2 (or 1/2 hour driving time)	25 to 200 (usually 100)
Regional park	4 to 10	20 (or 1 hour driving time)	25 to 1,000 (usually 100 to 250)
TOTAL	11.75 to 20		

Table 1.2 Average open-space standards across Canada. (Adapted from Canadian Ministry of Culture and Recreation.)

quotas are limited by not taking into account nontraditional forms of open space, environmental aspects of natural areas, or the landscape structure of open-space systems. It particularly fails to address ease of access from individual homes.

However, Tankel also offered a more subtle interpretation of open space for metropolitan areas. He distinguished between the kind of open space of which people are aware versus the kind of which they may be unaware but which nevertheless affects their lives. The former has three functions—it is used, viewed, or felt—and the latter does urban work or helps shape development patterns. He admits that "it is a rare bit of open space which does not perform many of these roles. And each category encompasses a wide variation in scale."[37] This approach to categorization focuses on the open-space user. Similarly, Woolley discusses a tripartite classification, based on the users' points of view and not on those of

the planner. Based on the concept of "home range," she discusses domestic, neighborhood, and civic open space, based on distances from users' homes and on social encounters, suggesting levels of familiarity, sociability, and anonymity.[38]

Nature is another lens through which open-space types can be seen. An excellent example is Hough's model based on environmental value and sensitivity, which he correlates with levels of maintenance and intensity of use (Figure 1.3). Wildness is, therefore, a useful way in which to model urban open space.
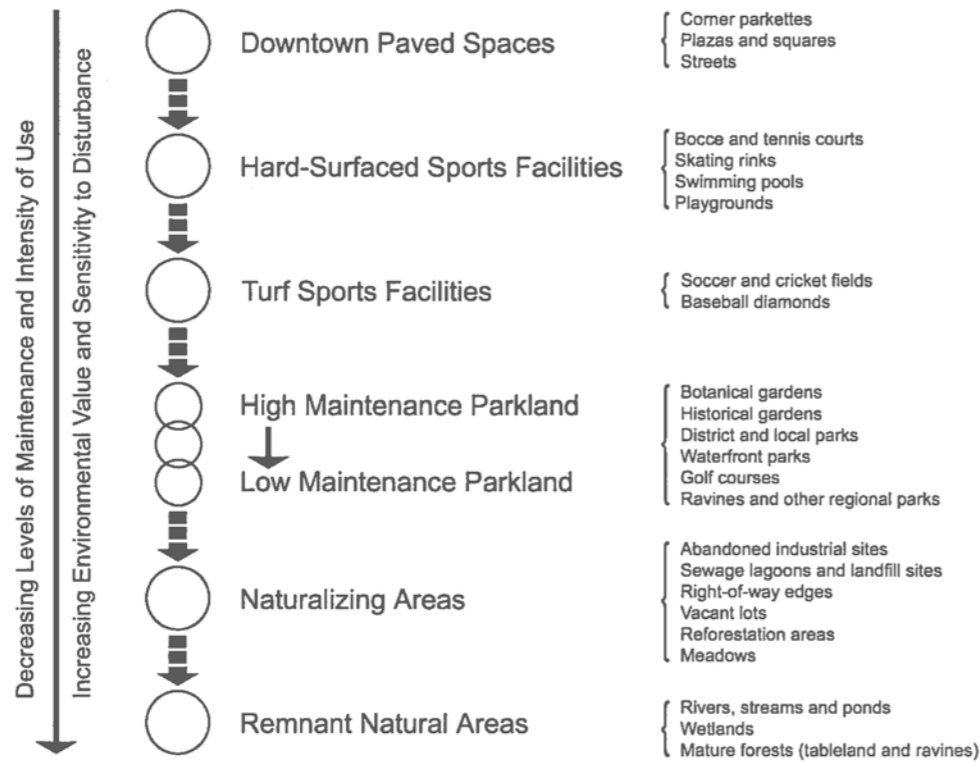

Fig. 1.3 Michael Hough's typology of open space, depicting scales of maintenance, use, and environmental value. (Adapted from Michael Hough, *Out of Place: Restoring Identity to the Regional Landscape*, New Haven: Yale University Press, 1990.)

Other systems are based on land use and ownership. Beer expressly includes both formally designated open space and other "actual" open space in her model (Figure 1.4). This view captures the imagination in a new way, recognizing that vineyards, roadsides, allotments, and other landscapes are indeed valuable open spaces.

Beer's work on open space begins to explore the structure of open space, including as
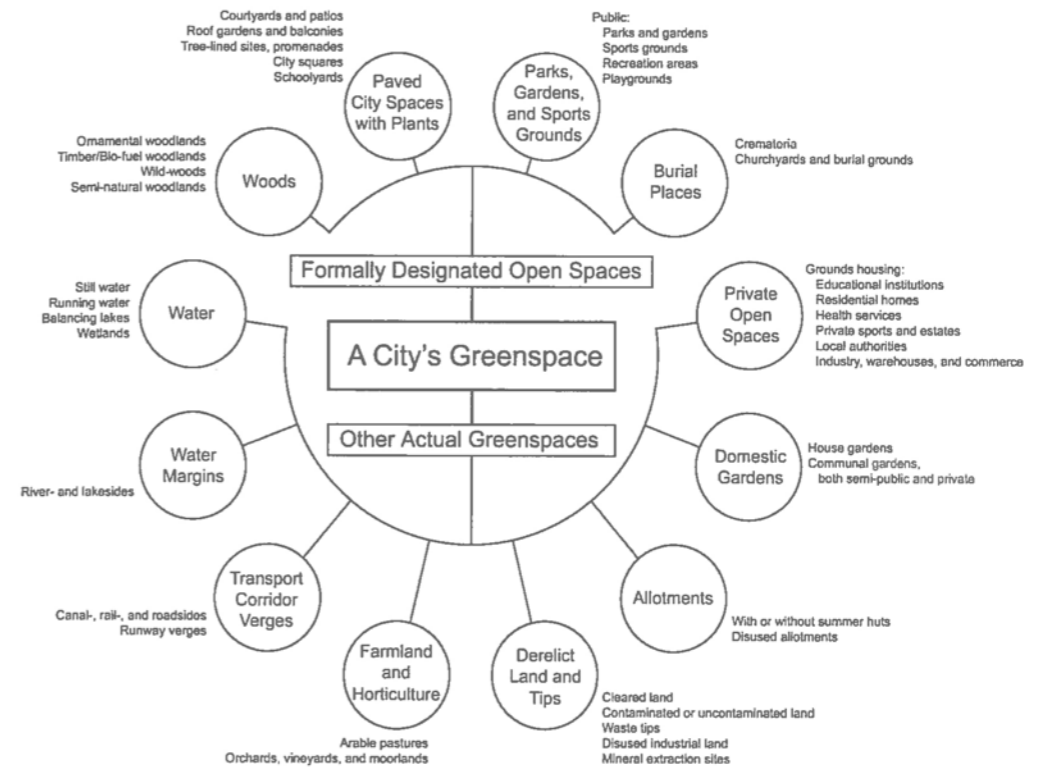
Fig. 1.4 Anne Beer's model of urban open space. (Adapted from Anne R. Beer, 2000.)

open space everything that is not impervious. A figure/ground study of a town or city would create the pattern of open space versus impervious space if parking lots and roads were included as built. Figure 1.5 shows a hypothetical example; white space represents unpaved urban land from which an open-space system might be created. This can then lead to modeling the *structure* of the greenspace—its form, scale, and connectivity. For instance, this diagram shows two adjoining, but distinctively different, patterns of urban open land. This approach transcends the public–private dichotomy by including home gardens, industrial grounds, and institutional landscapes as part of the valued open-space system.[39]

Similarly, Swanwick and colleagues developed a hierarchical typology of urban greenspace that focused on the relationship of open space to buildings and gray, impervious space.[40] They defined green versus gray space in the urban area and then created a

Fig. 1.5 Figure-ground study where buildings and paved surfaces are shown in black and unpaved urban land shown in white. There is a stark difference in amount and pattern of open land in the bottom and top portions of the diagram.

typology of greenspace based on function. They use concepts of amenity, function, and habitat as three main categories (see Table 1.3). Linear green spaces are shown as a fourth set. Similar to Beer and her colleagues, Swanwick et al. assert that "strategic approaches to green space planning clearly require a different and more comprehensive approach to classifications and definitions than the more traditional approach that has evolved in the field of park and open space management. They need to recognize the vital importance of the whole range of different green spaces within urban environments, whether or not they are publicly accessible or publicly managed."[41]

The city of Davis, California, also uses a functional approach for acquisition of rural open space around the city's edges. Working on a plan to help them categorize and rank open space, city leaders developed a scheme to create a shopping list for future land purchases. Categories include agriculture, biological and natural resources, urban fringe, community separators, and land that preserves scenic views. The first four categories include about 25,000 acres, and the agriculture category alone creates a 1-mile-wide greenbelt around the city.[42] From another perspective, many jurisdictions create ranking schemes for open-space land, often used as a funding tool by which applicants can accrue points for their open-space resource. For instance, the Pierce County, Washington, "Open space–public benefit rating system tax program," gives five points each for high-priority resources such as critical salmon habitat and wetlands, three points each for medium-priority resources such as agricultural lands and aquifer-recharge areas, and one point each for low-priority resources such as historic landmark sites, scenic view points, and archaeological sites. Bonus points are offered for public access, conservation easements, sites within designated urban growth areas, and sites that create linkage with other open-space parcels.[43]

Randall Arendt's work corroborates the need for careful open-space ranking in the context of new suburban development. He promotes codes that are specific about what consti-

ALL URBAN GREEN SPACE			
Amenity Green Space	Recreation Green Space	Parks and gardens
		Informal recreation areas
		Outdoor sports areas
		Play areas
	Incidental Green Space	Housing green space
		Other incidental space
	Private Green Space	Domestic gardens
Functional Green Space	Productive Green Space	Remnant farmland
		City farms
		Allotments
	Burial Grounds	Cemeteries
		Churchyards
	Institutional Grounds	School grounds (including school farms and growing areas)
		Other institutional grounds
Semi-natural Habitats	Wetland	Open / running water
		Marshes and fens
	Woodland	Deciduous woodland
		Coniferous woodland
		Mixed woodland
	Other Habitats	Moors and heaths
		Grasslands
		Disturbed ground
	Linear Green Space	River and canal banks
		Transport corridors (road, rail, cycleways and walking routes)
		Other linear features (e.g., cliffs)

Table 1.3 Swanwick and colleagues' typology of urban green space (adapted from Carys Swanwick, Nigel Dunnett, and Helen Wooley, "Nature, Role and Value of Green Space in Towns and Cities: An Overview," *Built Environment*, 29 (Number 2, 2003): 94–106.)

tutes open space in new neighborhoods. "Some municipalities might value woodland habitat above farmland, while others might prioritize fields, pastures and meadow above forests. Still others might rank historic and cultural resources at the top of the list. Although this kind of provision is one of the most important features of subdivision objectives, it is frequently the one that is most lacking."[44]

These schemes are useful. No one typology is sufficient alone, given the complex nature of urban open space; it is important to use multiple lenses. However, while constructive in a number of ways, few of the typologies really address the *ecological structure* of the environment. Landscape ecology, based on a taxonomy of patches, corridors, and matrices, is the basis for a more structural view of open-space systems.[45] Where previous schemes organize scale, naturalness, or land use, the simple scheme in Figure 1.6 places open spaces in relation to each other and to people, based on a system of hubs, sites, and links at a regional scale. This way of viewing open space has profound implications for how the landscape is studied, planned, and developed. This model can be applied at a range of scales, can address a gradient of naturalness, and can incorporate varied land-use contexts.
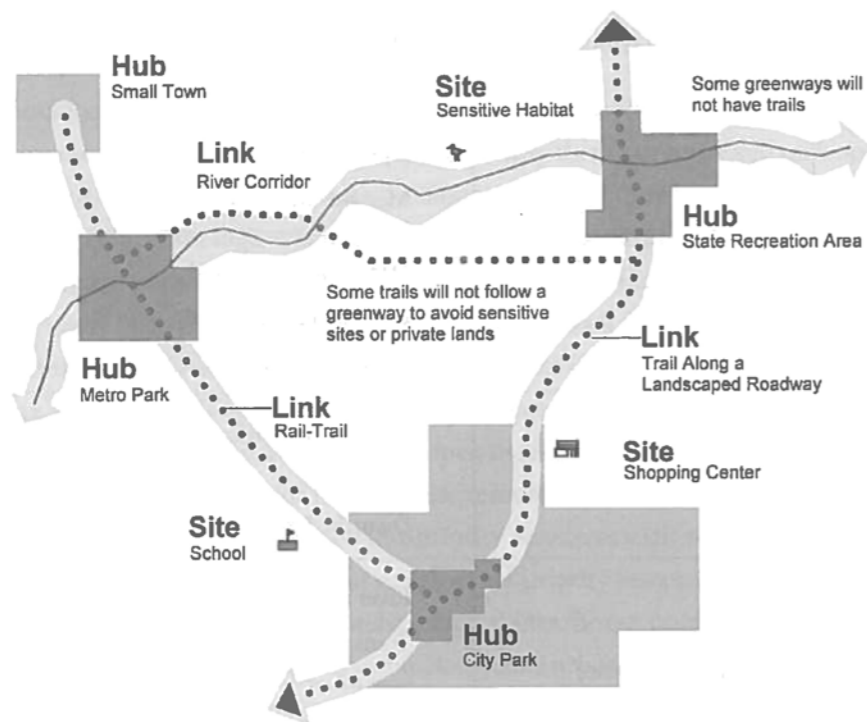

Fig. 1.6 Hubs, sites, and links as components of connected open space systems based on landscape ecology. (Adapted from Rails-to-Trails Conservancy of Michigan, "Southeast Michigan GreenWays," 1998.)

These diverse contextual settings remind us that urban open space needs specialized techniques for evaluation and categorization. D. A. Goode, writing about British open-space planning, emphasized that "established criteria for assessment of nature conservation value are not, in fact, particularly relevant for urban nature conservation. Criteria such as naturalness, diversity, rarity and size, used to assess the value of sites as potential nature reserves, are measures of intrinsic interest, but do not take account of either social factors or the local context of the site, which may be significant factors in an urban setting."[46] Landscape ecologists use four main characteristics to assess urban and suburban landscapes: large patches of undisturbed natural vegetation, natural vegetation along watercourses, heterogeneous distribution of natural patches, and connectivity between patches.[47] Connectivity is one crucial measure for assessing both ecological and social values.

Connectivity

Ecologists tell us that protecting isolated natural areas is not nearly enough. "There must also be linkages in the landscape that allow movement through the potentially hostile world of human settlement to the islands of undisturbed habitat. That makes connectivity important. An environmentally viable landscape has patches that are close or directly connected to other patches."[48] There are two main theoretical motives for connecting open spaces across metropolitan areas. The first is ecological; the second is *human*.[49]

The concern is with connections not only among ecosystems and landscapes but also between people and elements of the built environment. As discussed earlier, open space is being planned and funded in hundreds of towns and cities; likewise, connectivity among disparate open spaces is being planned and implemented with nearly the same vigor. And it is happening at all scales. Short corridors of a few hundred feet or less are being built, embedded within systems that are connecting entire river systems across hundreds of square miles. Numerous scholars and practitioners have made the case for connectivity persuasively and thoroughly.

Ecology

For ecologists, it is imperative to implement natural areas in a connected web at large scales. The concept of biodiversity summarizes many of these environmental goals. Biodiversity is "the variety of living organisms, the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning, yet ever changing and adapting."[50] Ecologists have shown that high ecosystem diversity supports high species diversity. Unfortunately, even though the habitat network concept is well established, most conservation efforts are still

1.1 Landscape Ecology

Several disciplinary areas have emerged in recent decades to help inform the natural systems and landscape-change nexus. Research in landscape ecology, conservation biology, restoration ecology, and ecosystem management is forwarding the science of landscape change and the practice of landscape planning. However, we are only in the first stages of applying the knowledge from these disciplines. Landscape ecology is especially important for understanding landscape dynamics and for informing the way we design and plan landscapes at all scales.

Landscape ecology helps explain structure, function, and change over space and time in heterogeneous landscapes.[1] It uses a taxonomy of patches, corridors, and matrices for understanding landscape patterns and processes (Figure 1.7). Landscape ecology is concerned with both the biophysical and the societal causes and consequences of landscape heterogeneity. A broadly interdisciplinary field, its roots are primarily in geography and biology. According to the International Association of Landscape Ecology, core themes for the discipline are the following: spatial pattern or structure of landscapes, ranging from wilderness to cities; relationships between patterns and processes in landscapes; relationship of human activity to landscape pattern, process, and change; and effect of scale and disturbance on the landscape.

Landscape ecology offers a way to relate environmental phenomena to a wider context, assisting in a logical zoning of space and in phasing of landscape change over time. In the landscape planning process, landscape ecology can be used in two main ways—as an evaluative tool and as a basis for deliberate landscape change. As an evaluative tool, a landscape ecological perspective can foster a more thorough consideration of change in three-dimensional space. This approach surpasses typical two-dimensional site analyses by layering landscape components into structural wholes that form the basis for species' orientation in space: patches, corridors, and matrices. This evaluative approach serves as a design net—a reminder that understanding of a site is grounded in space *and* time.

As a form-generating tool, landscape ecology offers concepts that address human well-being, as well as that of other species. It helps delineate site selection schemes in space and phasing schemes through time. In addition, it incorporates an understandable landscape vocabulary for communicating planning decisions and design solutions.

Nowhere have the principles of landscape ecology been used so thoroughly as in the study and design of natural areas. Usually these applications are made in remote natural settings where human influence is minimal. However, ideas from landscape ecology are increasingly being applied to the delineation, conservation, and management of natural areas in diverse cultural landscapes, including metropolitan open-space corridors. Semi-natural reserves, and even urbanized areas, are currently a particular focus for landscape ecological research.

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[1] Richard Forman and Michel Godron, *Landscape Ecology* (New York: John Wiley, 1986).
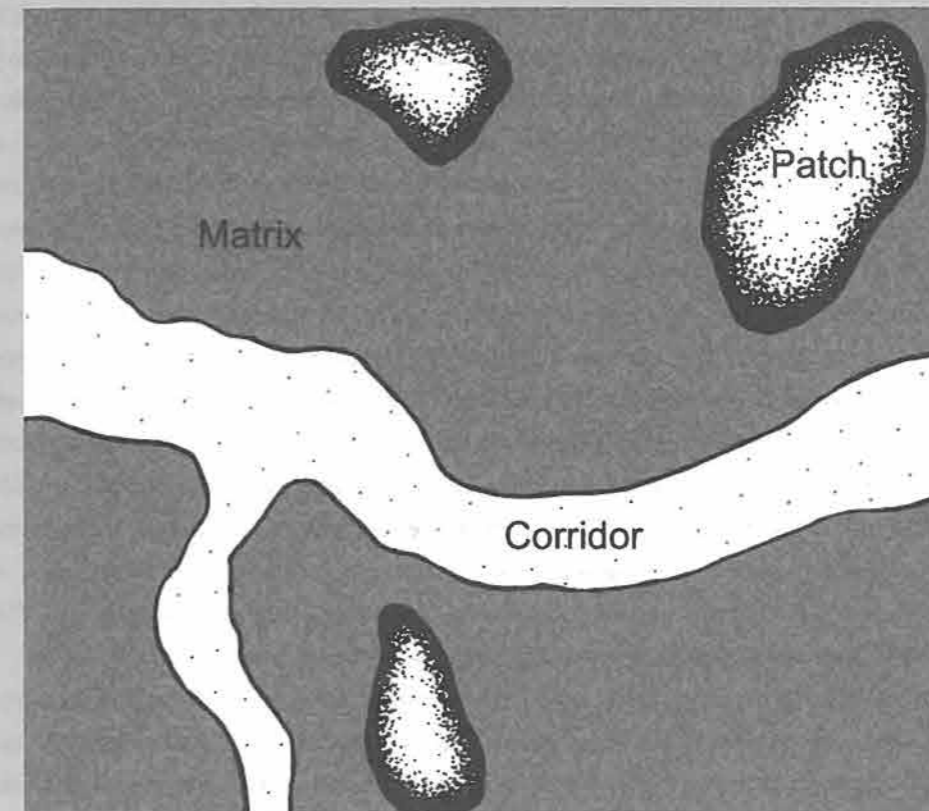

Fig. 1.7 Landscape components from landscape ecology theory: patches, corridors, and matrices.

relatively local, emphasizing isolated preserves, where protected lands are a fragmented patchwork, threatened by exotic species, edge effects, and increasing human disturbance and encroachment. The solutions generally incorporate two spatial effects—size and connectivity. However, as Soule and Terborgh have shown, implementation of large core areas and connectivity across the landscape is daunting: "On-the-ground realization of a program of large core areas and landscape connectivity will . . . require research, planning, and bold advocacy at unprecedented scales."[51]

Open-space corridors provide one critical form for achieving connectivity. The importance of conservation corridors was proposed in the 1970s and continues to receive wide attention from ecologists, planners, and policymakers. Corridor planning is a popular strategy in conservation planning, particularly for protecting biodiversity.[52] "Corridors are a hot topic, perhaps even a fad, in conservation planning these days. Planners and environmentalists from county to federal levels are busy drawing 'greenbelts' and other habitat corridors into their designs, sometimes with only a vague awareness of the biological issues underlying the corridor strategy."[53] Daniel Smith and Paul Hellmund's seminal book *The Ecology of Greenways* skillfully documents how connected open space satisfies ecological goals, bringing more specificity and empirical evidence to corridor planning and design.[54]

Conservation biologists see corridors as "linear habitat embedded in unsuitable habitat . . . that connects two or more larger blocks of suitable habitat and which is proposed for conservation on the grounds that it will enhance or maintain the viability of wildlife populations in the habitat blocks."[55] However, the role of corridors in biodiversity planning is also controversial. Rosenberg and others make a critical distinction between corridors for movement routes and corridors as habitat. "Linear patches have often been equated with biological corridors, but in fact, linear patches serve two different functions: as movement pathways and as habitats for resident species . . . Evaluation of the corridor function of linear patches should include the three stages of successful dispersal to a target patch through a corridor—finding, selecting, and moving successfully through it."[56] In addition, they show that corridors have diverse functions, shapes, and contexts. While some definitions of corridors emphasize movement, others stress form.

Although conservation biologists agree that wildlife species evolved in well-connected landscapes and that connectivity can enhance the population viability for species, there are also downsides to corridors.[57] Reed Noss has summarized the advantages and disadvantages clearly.[58] On the positive side, connectivity can potentially increase immigration rates to a conservation reserve in a positive way. Connectivity can also provide a range of benefits for animals by providing foraging area, predator escape cover, and a mix of

habitats for species. It can also provide alternative refuges from large disturbances such as fire.

On the other hand, connectivity can also potentially lead to negative effects from immigration rates, facilitate the spread of fire and other disturbances, and increase exposure of animals to hunters, poachers, and other predators. In addition, riparian corridors can sometimes fail to enhance the dispersal or survival of upland species. They may also lead to increased costs and competition with more conventional land-preservation strategies.

Although many benefits of connectivity are documented, connection is clearly not a panacea for conservation. Despite the ambiguity, though, it is clear that corridors are often beneficial. Noss claims that "many of the potential disadvantages of corridors could be avoided or mitigated by enlarging corridor width or by applying ecologically sound zoning regulations."[59] For him, the most compelling reason to think carefully about landscape corridors is that pre-settlement landscapes were interconnected and that connectivity has declined with human settlement.

A number of scholars have documented the principles by which corridors should be protected and planned. For instance, A. C. Henry and colleagues offer the following guidelines:

1. Benefits of corridors are maximized by working at large spatial scales, for instance in watershed planning.
2. Continuous corridors are better than fragmented ones.
3. Wider corridors are better than narrow ones.
4. Structurally diverse corridors are better than those with simple structures, and diversity should be considered both horizontally across the landscape and vertically within layers and heights of vegetation.
5. Two or more corridor connections between patches are better than one.
6. Natural connectivity should be maintained or restored.[60]

The ideal width of conservation corridors is probably the most debated issue. In addition, it is a dimension that landscape planners, trying to apply landscape ecology principles, desperately need to know more about. Although many planners have searched for scientific answers about the ideal widths across different ecosystems, land uses, and corridor types, finding definitive answers is difficult. Species have different requirements for habitat; likewise, they have different requirements for corridor width. Generally, wider corridors, in the range of hundreds of feet or more across, are better for ecological soundness.[61]

Although the exact role of corridors in urban landscapes, as well as their optimum sizes, remains ambiguous, it can be claimed that the ecological importance of connectivity should be the baseline on which other open-space benefits are built. According to ecologists Rosenberg and colleagues, "because greenways are increasingly popular as means of improving urban and suburban living environments and may themselves serve as important habitat, biologists should work with urban planners and community groups to design greenways that contribute to urban wildlife conservation and education, rather than arguing whether greenways function as corridors."[62] Working with community groups is particularly important in order to incorporate humans into the realm of ecology.

Human Ecology

Landscape ecology and human ecology together provide critical information for connected open-space planning. Human ecology studies the relationships between parts and wholes, addressing how humans interact with each other and with the components of their environments. As Frederick Steiner suggests, as a discipline human ecology may be the key to the study of regions in all their complexity.[63] Connection is one part of the way regions function. It is not only good for wildlife, water quality, and other environmental features and processes—it is also good for people. This is a fundamental concept from human ecology, human geography, and the other social sciences.

Ample literature supports the idea that an urban landscape with high connectivity is more accessible, more humane, and indeed more democratic. Connected urban areas allow exchanges among various social groups, democratizing the city in a spatial way. A connected urban landscape fosters mobility, visual interest, and efficiency. Humans need to easily access services and amenities at the neighborhood and city scale, and this access should not all be dependent on cars. The walkable, connected city is one that helps foster sound human-ecological health. "

Urban and landscape planners need to pay particular attention to the connected fabric of the city. Frederick Steiner writes eloquently about the important link between human ecology and landscape planning.[64] Several of his main arguments are built around the nature of connection for humans in the built environment. Gerald Young, an eminent human ecologist, asserted that planners "*must* consider the area being planned as a system, must understand its connectedness, its interrelatedness with its own parts and those exterior to it, must understand the flow of people, energy, and materials into and out of it, must understand the design essentials based on environmental characteristics and human needs. But they do not."[65] However, planning does not always have this ecological basis. Most planning has been

done without realizing these human ecological principles. This gap is partly bridged by systematically assessing the open-space structure of metropolitan regions, including its connection to communities.

A study conducted by the Trust for Public Land (TPL) is an excellent illustration of a human ecological approach in open-space planning.[66] Fifty of the largest U.S. cities were surveyed to find what goals are used as maximum distances any resident should live from the nearest park. Findings showed that only eighteen of the cities had any goal in this regard, and that standards varied from as close as one-eighth of a mile to as far as a mile. There is no commonly accepted standard for acceptable distance. TPL contends that distance from open space is an important measure and perhaps more significant than total acreage of parkland. Los Angeles, for example, ranks fifth among large cities in acreage of parkland, but half of that land is relatively inaccessible. TPL ranks five cities highly by this criterion, three of which are used as case studies in this book: Denver, Colorado (three to six blocks); Minneapolis, Minnesota (six blocks); Long Beach, California (one-quarter mile in high-density neighborhoods); Seattle, Washington (one-eighth mile in high-density neighborhoods); and Chicago, Illinois (one-tenth mile to a pocket park).

Connectivity at the Metro Scale

Increasingly, whole urban regions are in the economic, ecological, and cultural spotlight. Just less than 50 percent of the world's population lives in cities; this percentage is expected to grow rapidly. Almost 80 percent of the U.S. population lives in metropolitan areas. And the conversion of land for urbanization is outpacing population growth. Cities are no longer compact; they sprawl in spiderlike patterns that abut wildlands.[67] And the points of abutment are critical. Burch notes, in reference to a scalar range from urban vest-pocket parks to entire wilderness areas, that "wildlands are separated from the larger social and ecological world by a thin membrane of institutional and normative patterns."[68] These membranes or edges are important zones for connecting open space with larger urban and rural landscape patterns.

Connectivity has been widely discussed in the context of city regions in recent years. New information networks change peoples' lives and the places they live. Global markets, wireless technology, cellular communication, and all manner of other digital devices connect us. Open-space connection at the scale of the region shares some of the same goals—bringing people together. It retains the old-fashioned physical dimension—creating space for an integrated spatial realm. Given the importance of connectivity in planning open-space systems, the scale of concern has widened dramatically in the last couple of decades. In fact, a dozen states have implemented state greenway programs. Pennsylvania,

1.2 Human Ecology

Human ecology is the study of the relationship between human communities and the environment, incorporating both the biological and the social sciences. It is a part of general ecology, not separate from it.[1] Landscape ecology and human ecology share the same ecological roots and a somewhat parallel conceptual evolution over many decades from several disciplines—most notably, biology, geography, and sociology. Catton defines human ecology simply as the study of ecosystems that involve humans. The ecosystem is widely used as the main concept for human ecology, and Catton uses three large categories for human ecology: (1) ecosystems in which humans are a very dependent part (the realm of ecological anthropology), (2) ecosystems dominated by humans in varying degrees, and (3) ecosystems so strongly dominated by humans (cities) that human autonomy and self-sufficiency can easily be misperceived.[2]

The academic origins of human ecology usually refer to early twentieth-century studies of urbanism and to the Odums' ecology and ecosystems work.[3] Young has claimed that it is in sociology that the concept of human ecology is most strongly established, that it is where the idea of human ecology began, and where there is the strongest and most unbroken tradition.[4] Park and Burgess are often credited with introducing the term, although the real origin of the idea is contested.[5] According to Young, "the city as a fit subject for ecological analysis is found prominently in the early works of the Chicago school of sociological human ecologists."[6] He claims that one theme runs through human ecology all along its course—"organization" as a fundamental principle. "At least one part of the organizational concern of sociological human ecologists has been with how aggregates of people have organized themselves in space: spatial analysis has played a prominent part in the development of human ecology."[7]

Human ecology is so broad that its application takes many forms. It has been used as a planning perspective, particularly in Europe.[8] Young claims that any field that manipulates the environment is applied human ecology since it affects the well-being of people, relationships of people to the environment, and behavior patterns. He claims that planning is, more than any other field, applied human ecology. Frederick Law Olmsted was one of the first students of applied human ecology, applying its tenets to open-space planning in the nineteenth century.[9] Another great landscape architect, Ian McHarg, defined human ecological planning.[10] He pointed out that if humans were accepted as part of ecology and ecology were accepted as part of planning, then one word—planning—would suffice for three.

[1] William R. Burch, Jr., "Human Ecology and Environmental Management," in J. K. Agee and D. R. Johnson, eds., *Ecosystem Management for Parks and Wilderness* (Seattle: University of Washington Press, 1988).

[2] William R. Catton, Jr., "Foundations of Human Ecology," *Sociological Perspectives*, 37 (Number 1, 1994):75–95.

[3] See the many contributions of Eugene Odum and Howard Odum to the science of ecology in the mid- to late-twentieth century, for instance, Eugene Odum, *Ecology: A Bridge Between Science and Society* (Sunderland, MA: Sinauer, 1997).

[4] Gerald Young, "Human Ecology as an Interdisciplinary Concept: A Critical Inquiry." *Advances in Ecological Research*, 8:1–105. (1974).

[5] Robert E. Park and Ernest W. Burgess, *Introduction to the Science of Sociology* (Chicago: University of Chicago Press, 1921).

[6] Young, "Human Ecology," 1974, p. 14.

[7] Ibid., p. 16.

[8] Herbert Sukopp, "Urban Ecology--Scientific and Practical Aspects," in J. Breuste, H. Feldmann, and O. Uhlmann, eds., *Urban Ecology* (Berlin: Springer-Verlag, 1998).

[9] Burch, "Human Ecology and Environmental Management," 1988.

[10] Ian McHarg, "Human Ecological Planning at Pennsylvania," *Landscape Planning*, 8 (1981):109–120.

for instance, has decided to focus government efforts on the connectivity of its open spaces. The state's program, begun in 2001, seeks to create a network of greenways across Pennsylvania, linking open space, natural landscape features, scenic, cultural, historic, and recreational sites, and urban and rural communities. Greenways are being used as one tool to achieve sustainable growth and design livable communities. The plan's authors believe that a statewide network will result in a "green infrastructure" and provide a new connectivity within and among Pennsylvania's communities. Goals are also to promote healthier lifestyles, increase recreation and transportation opportunities, and strengthen connections to cultural and historic places.[69]

Pennsylvania, although progressive, is not alone in the pursuit of large-scale connectivity. For example, Florida's greenway concept plan, adopted in 1998, is shown in Figure 1.8. The plan networks the entire state, connecting ecological hubs with recreational and environmental linkages. Dozens of metropolitan areas, often as large as or larger than the state of Rhode Island, are actively trying to connect their open spaces into urban webs of green. For example, planners in Seattle reviewed nearly fifty plans involving the city and found that the word that comes up over and over in the plans is "connection."[70]

Where towns and cities once considered greenway connections along rivers and other linear features, now webs of connected open space are being planned for entire metropolitan regions. They include whole river systems, transportation corridors, adjoining jurisdictions, and rural fringe areas. Increasingly, cities and their regions are planning for *regional systems* of open space, motivated by more systems-oriented approaches to urban ecology.[71] These systematic efforts are driven by environmental concerns, by growth-

management efforts, by increasing interjurisdictional planning, and by larger landscape approaches to conservation and urban planning.

There is some confusion about regionalism as applied to open-space planning. While the outcomes of large-scale connected open space are ecologically desirable, the political and social scale is both less certain and more difficult. The debate over an appropriate scale for public projects is not a new one, and the efficiency of regionalism is controversial. Detractors have claimed, for instance, that regional government is not a remedy for spatial problems, and that while large metropolitan governments can best address some problems, most problems are best solved at more local levels.[72]
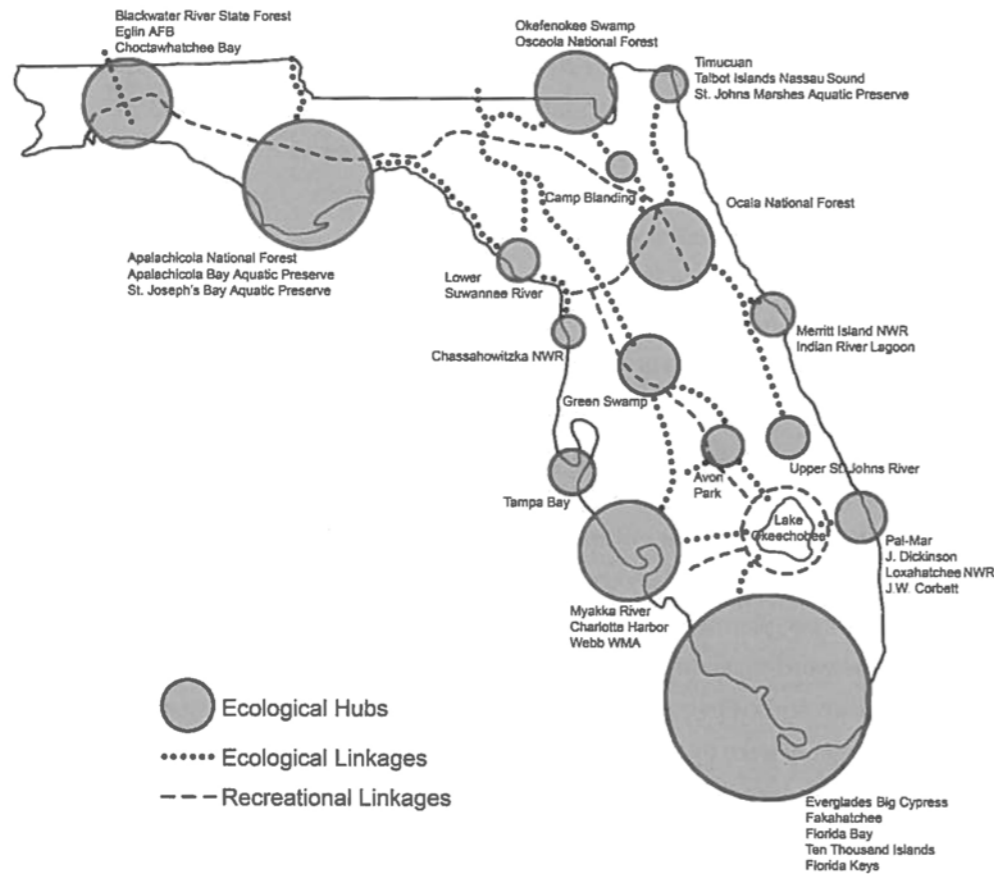

Fig. 1.8 Florida's greenspace and greenways plan. (Adapted from Florida Department of Environmental Protection and Florida Greenways Coordinating Council, "Connecting Florida's Communities with Greenways and Trails," 1999.)

However, open-space protection (as one public good) is an area where planning and implementation at the regional level are effective in both ecological and humanistic terms. In fact, success stories abound—from Denver to Chattanooga and from Austin to Toronto. Apart from the ecological benefits, people may actually perceive and use linear corridors across large metropolitan areas. Arguing for the perceptual benefits of a regional approach, Kevin Lynch states: "I mean to take the peculiar position that the experiential quality of the environment must be planned for at a regional scale . . . since people now live their lives at that scale."[73] For better or worse, people live their lives at even larger scales now than they did in 1976 when Lynch was writing. They traverse longer distances for work and shopping, and it can be hypothesized that they use a far larger array of open spaces in larger spatial realms. Where a house adjoining a golf course was once the ideal, people now value housing that adjoins walking and biking trails to access distant landscapes.

Moreover, connectivity for metro regions demands that open-space design and planning be carried out simultaneously at multiple scales. One paradigm for thinking across scales is the concept of hierarchy.[74] Open-space systems can be seen in a nested hierarchy, where small neighborhood trails are part of larger citywide systems, which in turn are part of larger regional networks. There is no single or correct scale at which to examine or plan open-space networks. They are parts of urban ecosystems, and ecosystems have no clear boundaries.[75]

Spatial Forms of Regionally Connected Open Space

Greenways, greenbelts, and parkways are all used for planning connected open spaces, but each has distinctive characteristics and benefits. While parkways and greenways are certainly not interchangeable spatial phenomena, both provide long, green corridors on the landscape. Greenbelts, on the other hand, are not necessarily linear but provide a buffering function around the edge of urban areas that can incorporate linear elements. Figure 1.9 depicts the prototypical spatial configurations for greenways, greenbelts, and parkways on a hypothetical landscape. Trails may or may not be incorporated in all three types of open land.

Parkways

Many of the historic parkways in North America provide important open-space amenities. However, scholarly analyses of the parkway as a distinct urban form are sparse. In searching for concise treatments of parkways in the classic texts and contemporary planning books, one is often directed to *see streets, see roads,* or *see national parks.* However,
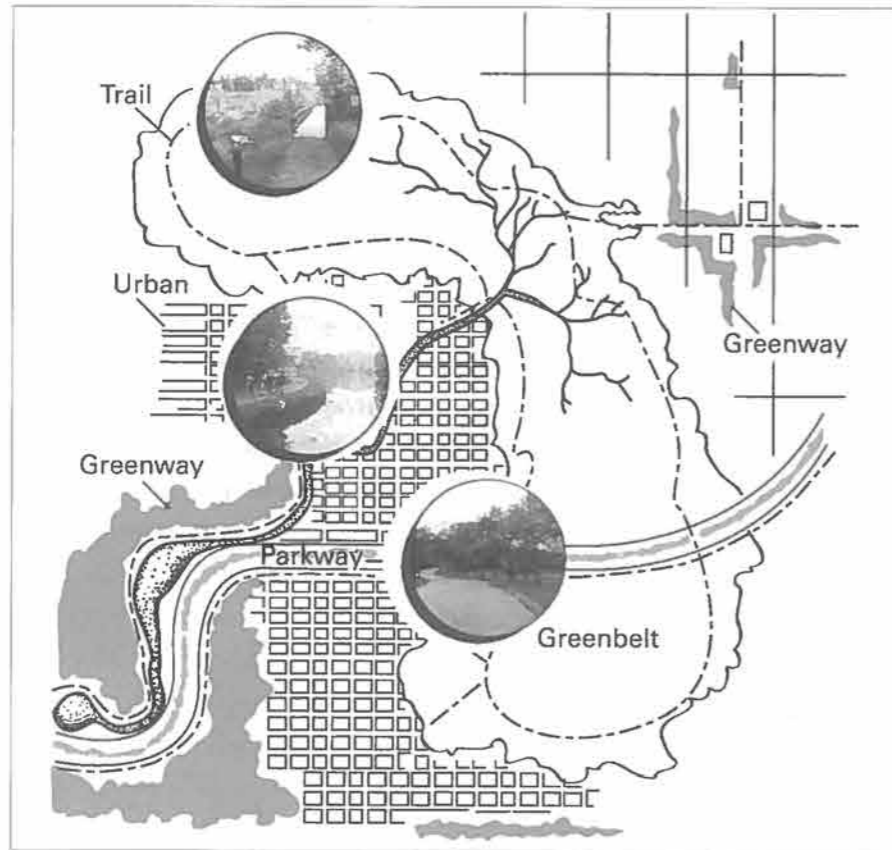
Fig. 1.9 A hypothetical image of greenways, greenbelts, and parkways in a city and adjacent countryside. Trails may or may not be incorporated in all three types of open land.

parkways have a distinct and fascinating history as an American urban open-space form. In addition, since the 1930s parkways have been created and managed within the National Park Service system, providing attractive connections between parks and as destinations in their own right.[76]

As Newton writes, "It is doubtful that any single type of park area has been more widely misunderstood and misinterpreted than the parkway. The confusion is hardly to be wondered at when one considers with what free and easy imprecision the term 'parkway' has been used. Unfortunately, it has even been employed by real-estate developers in recent years as a sort of status label."[78] Newton describes early parkways more accurately as boulevards with limited access. Parkways designed in the growing twentieth-century cities were meant for comfortable driving in pleasant surroundings, with alignments of gentle curves and low speeds; visually they were meant to be a natural part of the countryside. The park-

way's broad swath was often roomy enough for pathways and other recreational features (see figure 1.10). They were meant not only to beautify the city but to reduce environmental hazards and enhance transportation options within the city.

A 15-mile stretch of the original Bronx River Parkway in New York City, completed in 1923, is generally regarded as the first true parkway in the United States.[78] "It was only with the completion of New York's Bronx River Parkway after World War I that the modern parkway came into being with its clear set of distinguishing characteristics. The term now denoted a strip of land dedicated to recreation and the movement of pleasure vehicles (passenger, not commercial, automobiles)."[79] Parkways were primarily conceived for transportation; whatever benefits they may have had as connected greenways had more to do with scenic views from cars than other purposes and integrative potentials were often unrealized. According to Cynthia Girling and Kenneth Helphand, "parkways have great potential to integrate recreational and open space functions; unfortunately, however, most are image without substance, offering no more than 'entry statements' and a ceremonial greening of the street."[80]

Fig. 1.10 A parkway scene in Ottawa, Ontario, with wide, green right-of-way, scenic curves, and separate non motorized path. (Photo by the author.)

Greenbelts

Greenbelts, in contrast to both greenways and parkways, are swaths of natural or open land surrounding cities or towns, protected in part to control or guide growth. They often contain a mix of public land and privately held land on which development restrictions are placed. Originating in the Garden City Movement of the early twentieth century in Great Britain, greenbelts were meant to control urban growth by protecting a ring of undeveloped land, often forested or agricultural, around the city. Where greenways follow linear features in the landscape, often radiating through cities, greenbelts are less structured by rivers or other natural features and take a belted form encircling the urban region. In some cases their forms are quite arbitrary. Greenbelts remain a planning strategy and land-use policy in Great Britain, where they are used to check unrestricted sprawl, prevent neighboring towns from merging, assist in protecting the countryside, preserve historic values, and promote urban regeneration.[81] Historically, greenbelts are perhaps the most prevalent approach to shape urban growth with open land. In contemporary use, greenbelts are one mechanism for providing open space near residents, as used in Ann Arbor, Michigan, or Boulder, Colorado. For Boulder, the greenbelt helps buffer the Rocky Mountain Front from the encroaching urbanized region (Figure 1.11).

Many analyses have concluded that greenbelts have failed to control growth or to protect natural features, although they have sometimes resulted in other benefits; in fact many early greenbelts have now been converted to urban development.[82] According to Whyte's greenbelt analysis, "the arbitrary boundaries that look so tidy on a map are extremely difficult to hold on the ground. The kinds that work follow the idiosyncrasies of the land; the ridges and valleys, and especially the streams and rivers."[83] Even with these limitations, the greenbelt idea is still being promoted.[84] It provides the public with a simple land-preservation concept to relate to. Greenways may overcome some of the disadvantages of greenbelts.

Greenways

The greenway idea, a renewed landscape concept from the nineteenth and early twentieth centuries, has swept across North America as one solution to landscape connectivity. According to William Whyte, "Linkage is the key. Most of the big tracts in our metropolitan areas have already been saved, or they have already been lost. The most pressing need now is to weave together a host of seemingly disparate elements—an experimental farm, a private golf course, a local park, the spaces of a cluster subdivision, the edge of a new freeway right-of-way."[85] Leaders in Toronto see greenways as a simple way to link existing greenspaces, thereby increasing open-space usefulness for both people and wildlife.[86]

Fig. 1.11 Aerial image of Boulder, Colorado from the 1930s. Much of the land surrounding the city has since been developed. However, the area between the city and mountains is now Boulder's greenbelt. (Photo by the Denver Photo Company, courtesy of the Denver Public Library Western History Collection.)

Charles Little credits the term "greenways" to Whyte, from Whyte's monograph *Securing Open Space for Urban America*.[87] Robert Searns, in his paper defining eras of greenway planning, claims that the roots of greenways go back several centuries. He sees greenways as an adaptation of humans to their environment—"a response to the physical and psychological pressures of urbanization."[88] A nationwide push for greenways was spurred by the 1987 President's Commission on Americans Outdoors, which linked greenways with American pride, patriotism, and spirit: "Greenways . . . have the potential to be this country's most important land-based effort for conservation and recreation in the next several decades . . . And, if greenways truly capture the imagination and boldness of the American spirit, they could eventually form the corridors that connect open spaces, parks, forests, and deserts—and Americans—from sea to shining sea."[89] While greenways may not always seem so patriotic, they offer a range of amenities.

Greenways are linear open spaces along natural or human-made features such as rivers, ridgelines, railroads, canals, or roads. They are planned, designed, and managed to connect and protect ecological, scenic, recreational, and cultural resources. A greenway may include trails, or it may be a conservation corridor without recreational access. Greenways receive wide attention as landscape connectors for conservation, recreation, and transportation in the built environment. They are sometimes referred to by other names, such as extensive open-space systems, ecological infrastructures, wildlife corridors, or habitat networks.

Some cities have implemented impressive greenway networks. Others continue to develop comprehensive greenway plans, attempting to weave together those diverse urban elements that Whyte valued over thirty years ago. Meanwhile, urban planners are increasingly hoping that connected landscape corridors provide more than recreational opportunities. They are promoting metropolitan greenway networks that help shape urban growth, contribute critical environmental values, and, indeed, *place* economic development and neighborhood revitalization.[90]

Greenways are unique landscapes. As long linear features, they are often developed on a complex mosaic of public and private lands. They traverse property lines, natural features, and other public infrastructure (see Figure 1.12). They transcend jurisdictional boundaries and sometimes even state lines. Greenway development usually includes aspects of both creating new spatial forms and protecting existing resources. For these reasons, implementation is difficult. Cross-jurisdictional cooperation is imperative.[91] When multiple, isolated segments are implemented by various local agencies and organizations, the result is often competing, conflicting land-use policies and narrow plans that fail to take into consideration the greenway in its entirety. Lack of coordination can result in the degradation or even loss of the greenway and its component resources.[92]

Since many citizens' groups, municipalities, and organizations have decided to create and protect greenways in their communities, practical information about design, planning, and implementation has been needed. Given their unique scope, complexity, and audience, understanding how greenways and greenway networks are realized is crucial. Charles Little's book *Greenways for America* has been particularly influential in depicting historic and contemporary greenways, their planning processes and constituents.[93] Flink and Searns subsequently published a helpful volume with applied advice on greenway planning processes.[94]

Empirical evidence of greenway impacts is also critical if the phenomenon is to secure the needed support, funding, and attention. Social scientists have therefore analyzed the human dimension of greenway planning, asking important questions about use, percep-

Fig. 1.12 Seattle's Burke-Gilman Trail is an example of a greenway converted from a former rail line, one of the most popular in the United States. An 11-mile section of Burlington Northern track was converted in the early 1970s. Now the greenway is 27 miles long, extending out into King County. (© 2005, Rails-to-Trails Conservancy.)

tion, and economics. An influential study by the National Park Service documented economic impacts, showing that greenways have positive effects on property values and other economic indicators.[95] Other scholars have described greenway users' characteristics and perceptions, particularly documenting intensity and pattern of use and its variation across greenway types.[96] Paul Gobster showed that trail location, especially relative to users' homes, influenced frequency and type of use.[97] He concluded that local rather than regional trails should be the basic framework for metropolitan greenway systems.

The environmental effects of greenways have also received close attention, particularly connecting to the landscape ecology literature. In addition to Smith and Hellmund's *The Ecology of Greenways*, research by other scholars has focused on ecological impacts of connected corridors.[98] These contributions have shown that greenways can positively affect water quality, habitat, and other environmental assets.

A few researchers have focused on implementation and the larger planning framework within which greenways dwell.[99] Jack Ahern's contributions have integrated greenways with wider planning issues, arguing for open-space design as a strategic method for comprehensive landscape planning.[100] However, little research has focused closely on the institutional setting for greenway development, especially at regional scales. And the linkage of greenway corridors into larger metropolitan networks has received only spotty attention. Many of the regional greenway systems have been planned only over the last decade or two, and systematic implementation (let alone evaluation) has only begun in most cities.

So we know a good bit about how to achieve greenways and other corridors on the landscape, including the planning methods, participants, funding, and logistics. And the physical form of connectivity has been analyzed and classified. The various forms that connected open space takes are, of course, only part of the story; function is another critical variable. The "form and function" discourse is not a new one. However, regardless of whether form or function leads, the functionality of greenways and other open-space networks is at the heart of the matter.

The Functions of Connected Open-Space Networks

Greenways, and open space more generally, must serve specific functions. For contemporary open-space projects, success will of course depend on the objectives the projects are setting out to serve. As background, Searns defines three generations of greenways and their objectives: Generation One greenways, up to 1960, consisted of boulevards and parkways, whereas Generation Two greenways, from 1960 to 1985, were trail-oriented recreational greenways and linear parks providing access to rivers and abandoned rail lines. Generation Three greenways, since 1985, are multiobjective greenways that include wildlife protection, water-quality concerns, education, recreation, and other goals.[101] Searns describes how the greenways movement has become more sophisticated and comprehensive in serving multiple needs and connecting to diverse urban contexts. Still, the most common objectives of most greenway systems are recreation, conservation, and/or non-motorized transportation. In most places, the protection of ecological quality is a particularly strong motivator. Economic development and growth-management issues are less likely to spur greenway planning at the outset; however, these are sometimes secondary effects that are later connected to implementation. Similarly, scenic quality and historic preservation are mentioned less often, but are sometimes important long-term benefits of greenways.

The new frontier for urban open-space planning lies in having multiple objectives. Natural-features protection and restoration will, like the restoration of neighborhoods, be central to successful implementation strategies for urban greenways. In reference to this new generation of greenways, Searns writes that the latest thinking "addresses more complex issues and reflects more sophisticated thinking about environmental issues."[102]

The natural and social functions of connected open space are additive. The more functions that a landscape provides, the greater its worth to the system. However, this complexity is also one of the challenges of these new projects. For instance, a small urban park that provides a children's playground, basketball courts, and large, older trees may be more valuable than a pocket park with a fountain. Another greenway concept claims that the functions are nested, that connected open space is multifunctional but should be based on an ecological framework that takes precedence in open-space planning. An ecological system that protects regional diversity could form the framework of a regional greenway system. In this approach, the determining factors are ecological, forming the basis on which other functions are added (such as recreation or transportation). This approach is a 180-degree departure from traditional open-space planning.[103] The concepts of greenstructure (as it is called in Europe) and green infrastructure (the North American term) provide the framework for ecology as a basis for connected open-space development.

European Greenstructure

For some time, European scholars and planners have been investigating, planning, and implementing landscape plans based on connected open-space networks. This work has advocated a more serious approach to open space as the city's critical infrastructure, specifically promoting an approach called greenstructure—a multiobjective approach that uses ecology as a base.

Beer and colleagues explain that greenstructure planning "emphasizes the multifunctional nature of greenspace within the land-use planning system and demonstrates that there are many reasons to take its planning and enhancement more seriously."[104] They argue that greenstructure should have equal weight with other city infrastructure in the planning process and be adequately financed. "What is still lacking in most cities is a 'vision' for the role of greenspaces; an understanding that greenspaces form a greenstructure, which can be used as a resource for the benefit of inhabitants and to enhance sustainability."[105] They see a functional urban greenstructure as important to quality

of life for residents as is the city's "gray" infrastructure (roads, sewer lines), and that this significance needs to be recognized in the planning and financing systems. They recommend urban greenstructure plans that are citywide but have enough detail to be included into local plans.

Similarly, greenstructure plans have been created and implemented in the Netherlands for a couple of decades. These types of plans are defined as "a coherent package of objectives, principles and priorities for the desired quality of green areas in the public domain throughout the whole municipal territory, leading to proposals for sustainable development, with agreements about shared responsibility and finances." [106] Greenstructure plans depict physical interventions in the urban landscape using open space as a framework. Tjallingii describes the defensive and offensive stances of those working in open-space planning and advocates a more integrative working relationship between the open-space and development sectors.[107] He also notes a shift from thinking only about quantity and distribution of greenspace (hectares per 1,000 residents) toward considering a green strategy with emphasis on the quality of open space and its structural role relative to other land uses. Indeed, the amount of open space in a neighborhood or city doesn't indicate much about its environmental soundness.

Green Infrastructure

The progress being made in Europe provides an interesting background to green infrastructure planning in North America. Green infrastructure is synonymous with greenstructure but is being used specifically in the context of exploding urban growth in American cities where the economic, social, and political conditions are quite different from those of Europe. The term "green infrastructure" has been used recently with almost the same frequency and enthusiasm as the term "smart growth." Indeed, the two are often used in the same breath. Like greenstructure, green infrastructure is perhaps the most promising direction for a more holistic definition of open space. In fact, Ed McMahon of the Urban Land Institute makes a compelling case for new terminology, replacing the term "open space" with "green infrastructure", claiming that this shift in nomenclature gives more specificity and value to the meaning of open land.[108]

Mark Benedict and Edward McMahon endorse the use of green infrastructure for proactively shaping new growth, defining green infrastructure as "an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations . . . Planning utilizing green infrastructure dif-fers from conventional open space planning because it looks at conservation values in concert with land development, growth management and built infrastructure planning."[109] Their principles create a compelling argument for change, where green infrastructure is designed and planned as a critical public investment before development occurs. It would provide the framework for conservation and development, engaging key partners and diverse stakeholders. Their model stipulates, furthermore, that green infrastructure creates key linkages, functions across jurisdictions at multiple scales, and is grounded in sound science and planning theory.

While green infrastructure presents a persuasive case for taking open-space planning more seriously, so far the literature *promoting* green infrastructure as a planning approach outweighs the literature that critically *assesses* its potential and impact. Ample evidence exists for the ecological soundness, centered on the need to curtail fragmentation, protect biodiversity, and improve water quality. Unfortunately, many local communities protect open space with little regard for the needs of wildlife and ecosystems.[110] In addition, there is little examination of how the green infrastructure approach fits within real political and social contexts, the concept as a community planning strategy, or the fiscal effects of greening the gray urban infrastructure. According to Kostyack, "understanding which policy tools are working is extremely difficult because there are no universally accepted measures to protect green infrastructure. Biologists, urban planners, policymakers, and others must agree on these measures of success and gather the data needed for meaningful comparisons. Otherwise, we face a future where open space and other protection programs spend vast sums yet fail to deliver on their promise of conserving our natural heritage."[111] Green infrastructure offers the most systematic approach to protecting open space and evaluating land-use decisions.

Conclusion

Urban residents, suburban commuters, farmers, politicians, and environmentalists are all increasingly distressed about open spaces being paved over. However, literature on open-space planning shows that open space must be more than open and must offer more than space.

Protecting and designing meaningful open space that enhances landscape ecology and human ecology is a tall order. The results must be ecologically sound, and they must be beneficial to people. That combination is difficult, partly because we have scant evidence on the effect of managed recreational use on habitat quality in urban contexts.[112] And one

patch of open space cannot do it all for any given community, unless it is not only large but also uniquely situated. So we need creativity in putting together open-space systems that, like intricate puzzles, create a whole that is greater than its parts. In her critique of standard approaches, Holtz-Kay writes, "Forgotten is the fact that defined space, visionary space—not 'open space'—makes the pulse race and the place pulse."[113] To create these visionary spaces, designers and planners need to be very specific about what open space means, how local residents value it, and how it is connected into functional networks for city regions.

2

Learning from City Stories: Ten Case Study Comparisons

The city is a fact in nature, like a cave, a run of mackerel or an ant-heap. But it is also a conscious work of art, and it holds within its communal framework many simpler and more personal forms of art. Mind takes form in the city; and in turn, urban forms condition mind.

—*Lewis Mumford*[1]

We learn from the stories of places. They reveal patterns and processes that are useful not only for understanding one place but for anticipating what might be experienced and accomplished elsewhere. Chapter 1 explained that open-space connectivity is worth pursuing at metropolitan scales and that, indeed, many places are attempting to fit open spaces into larger patterns that achieve environmental and social goals. Ten cities in North America have grappled with open-space connectivity in assorted ways and for diverse purposes. While each story is unique, there are themes that cut across the cities and inform efforts in other places.

Ten City Open-Space Stories
The ten case studies of Canadian and U.S. cities in the Part II portfolio, mapped in Figure 2.1, are central to this volume: