Designing Small Parks




A Manual for Addressing Social and Ecological Concerns

Ann Forsyth
Laura R. Musacchio

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By Ann Forsyth and Laura Musacchio
With Frank Fitzgerald

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AN INTRODUCTION TO SMALL PARKS

Small parks are a key part of most neighborhoods, but they typically provide mostly recreational benefits. With demographic and cultural changes and an increase in ecological awareness, those involved in designing, redesigning, and maintaining parks need to understand the multiple roles that parks can play as part of the public space and ecological networks in the metropolitan landscape.

By definition small parks have limited areas, so they cannot meet all the potential demands for space for varied human activities and multiple natural processes. Helping those involved in planning, designing, and managing parks to understand where it is easy to serve multiple purposes and where it is more difficult is an important aim of this manual.

Small parks are ubiquitous in the urban landscape, but they are often the most contested spaces in neighborhoods because of limited space for social activities and natural areas.

What This Manual Does

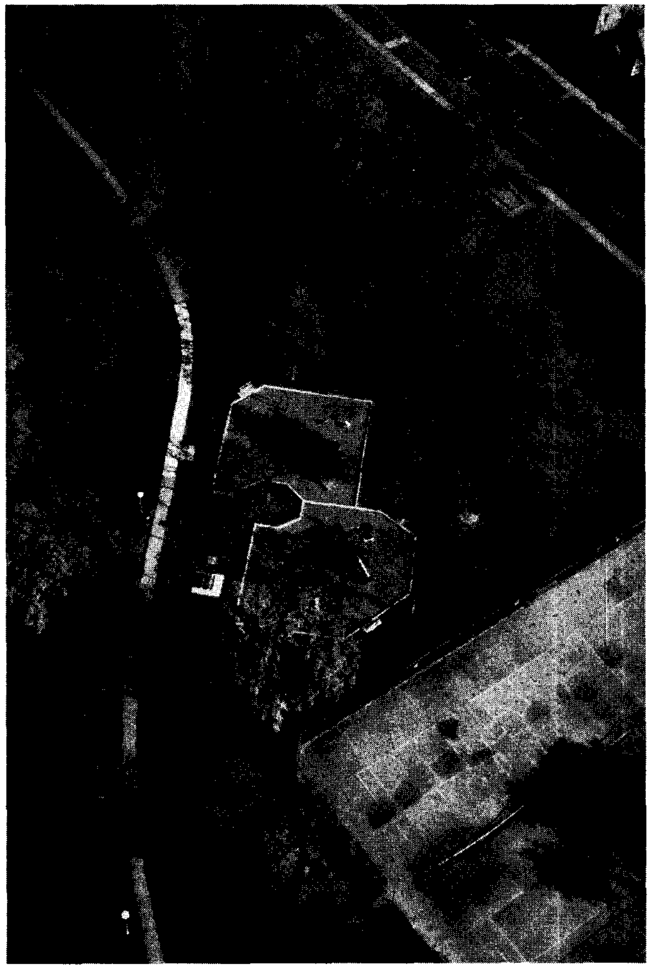
Small parks play crucially important roles in metropolitan areas, but their designs rarely reflect all that is now known about people, ecology, and landscapes. This lack of connection to current knowledge is not surprising, as this information is spread across dozens of journals, reported in technical jargon, and has sometimes contradictory prescriptions. There is also a deep division between two key areas of research—*human factors research* (on human interactions with open space) and *ecological research.* This is not merely a matter of specialty or emphasis but reflective of a larger world view.

On one hand, research on social or human factors has focused on human preferences and activities. It has examined both broadly shared attitudes and perceptions, as well as issues of human diversity. Researchers in this area are often concerned with how humans interact with nature, where nature is defined as areas where vegetation is predominant and buildings are inconspicuous (Ulrich 1986). Such areas may be highly maintained, cultivated areas such as lawns and flower beds. Most researchers in this area seek to understand people as they are, proposing design and management solutions that will be acceptable to a range of people.

On the other hand, ecological research has focused on large pristine habitats; although there has recently been more research about complex, urban environments. In this area of research, nature is defined as a habitat or ecosystem and, as is discussed later, urban means an area of human settlement, from a village to a city. For example, scientists may study the urban forest. Due to a tradition of writing many short papers on highly defined topics and a relatively high level of available funding compared with human factors research, there is a very large body of literature in this area. In addition, many papers convey a sense of urgency and moral importance due to concerns about environmental damage and problems with ecosystem health. Ecologists also use a lot of technical terms and jargon, making their work less accessible to people outside their fields. As it is largely humans who cause this environmental damage, research in this area frequently has a far more negative view of people than human factors research. Researchers in this tradition are most likely to propose educating people to appreciate "nature" as it is.

However, many park managers and designers want to tap into both these broad areas of research. They think that this will help them incorporate more ecologically sensitive features, respond to demographic changes, and also save on maintenance costs.

This manual draws on this wide range of knowledge, providing guidelines for building better parks. It provides landscape architects, park designers, parks departments, planners, scientists, and civic groups with a broader palette of design options. The manual is intended for use in the park planning and design process along with other important steps, such as recreational needs assessments and detailed facility designs. Participatory-design and public-involvement processes can draw upon the manual in the early phases of park design and redesign to demonstrate options and trade-offs.



Typical small parks tend to have play areas, scattered trees, and sports facilities, and they also have untapped potential for providing more social and ecological benefits.

Organization of the Manual

The manual starts with an overview of key issues and terms. The core of the manual is arranged around twelve topics that represent key questions, contradictions, or tensions in the design of small parks.

The treatment of each topic is similar, as each incorporates (1) a short statement of the key design questions in that area, (2) a discussion of the various issues, and (3) several specific design and maintenance proposals. Fine-Print Facts outline key research findings relevant to the topic that are too detailed to put in the body of the guidelines. These fine-print facts provide some of the research base for each guideline, and they are arranged to follow the sequence of issues in each topic. Each topic is illustrated. Lengthy captions allow the casual reader to pick up the main points by looking at the illustrations and reading their captions. The topics start with core issues that involve both human and physical dimensions from size and shape to naturalness. The manual then deals with the physical and human environments.

The manual includes a portfolio of design examples, applying the guidelines to propose alternative designs for five prototype parks, each representing fairly typical design situations in metropolitan regions. We designed these to test the guidelines under a wide range of park-design and redesign scenarios and to show how emphasizing social, ecological, or combined values results in distinctively different park designs. These design examples include a new suburban park with a stormwater management area, a central-city park in an area with relatively new immigrant populations, a redesign of an existing park in a suburban area that has key recreational and ecological roles, a new urbanist town square, and a vacant lot designed as a temporary park.

The book concludes with a number of summaries and checklists. Twelve issues sheets summarize the main findings from each topic and are formatted as independent handouts that can be used in public-involvement processes. A listing of all the guidelines in the form of a checklist can be used in evaluating existing and proposed designs. A concluding chapter reflects on the issue of small parks and sustainable communities.

The project team included people trained in landscape architecture, urban planning, architecture, landscape ecology, conservation biology, urban ecology, and social policy. The guidelines are based on an extensive review of many hundreds of articles and books—only those that we have cited are included in the extensive reference list. Materials were reviewed by professionals in the fields of park and recreation, landscape architecture, planning, landscape ecology, and urban ecology; they were tested with local residents in two of the prototype park designs; and they were presented in a variety of educational forums.

Why This Manual About Small Parks Matters

Small parks are too often relegated to the status of stepchild of municipal and metropolitan open-space systems because of assumptions that their small size and isolation limits their recreational capacity and makes them ecologically less valuable than large city and county parks. One reason for this is the long influence of the Olmstedian tradition of large urban parks, which has been the gold standard and backbone of open-space plans for the past 150 years in the United States. Park design has certainly changed over the past century and a half since public parks began to be incorporated into cities in significant numbers. As Cranz (1982) has described, park design has gone through a number of stages from parks as pleasure grounds (1850–1900), reform parks (1900–1935), and recreational facilities (1930–1965), to open space systems (1965–), and now ecological or sustainable parks (Cranz 1982; Cranz and Boland 2004). However, of these, only the reform parks were conceived of as small parks, with attention more commonly focused on large parks and park systems. Even the recent rise of new urbanism and efforts to renovate center-city neighborhoods have not displaced this preference among many park professionals for larger parks.

Yet in an era of fiscal constraint and high urban-land values, small parks have much to offer. Such parks are already appreciated for their contribution to neighborhoods and district needs for recreation, particularly in established municipalities close to the urban core. Parks and civic squares in new developments also provide signature amenities that embody the character of the developments.

While even newly constructed small parks are often conventionally planted and maintained, providing a pleasant environment but one that offers little in the way of ecological benefits or responsiveness to demographic changes, good design can do more than provide a pleasant setting with conventional plantings. Small parks are one of the most underrated but potentially valuable ecological resources in a metropolitan area because of there are so many of them in each given area. Such parks can be designed as part of an open-space system that forms an important part of a region's ecology. In addition, if designed carefully to support multiple users and uses, these parks can also provide important amenities for increasingly diverse populations.

Not only do new parks provide opportunities to

Small parks provide opportunities for people to connect with each other and with nature.

Context and connections matter in small parks. This park is cut off from its neighborhood because of the industrial area.

improve the social and ecological contribution of parks. Existing small parks of under 5–6 acres (2–2.4 hectares) tend to have fairly consistent design elements—playgrounds, turf grass, scattered trees, ball courts, and athletic fields. Deteriorating play equipment and changing recreational needs mean that every two or three decades, parks are renovated. This cycle of park renovation provides opportunities for redesign. Backed by credible research findings, it is possible to argue for demographic and ecological design changes in the face of skepticism about usefulness of such coming from the public and even parks maintenance staff.

Key Concepts

From our review of the research, we found that there are a number of key concepts, issues, and findings about the design of small parks that are concerns common to social scientists, ecologists, urban foresters, park managers, and designers. These include: *park size, shape,* and *number; park context; location;* and *trade-offs.*

Park Size, Shape, and Number Matters

The small size, potentially odd shapes, and relative isolation of neighborhood parks and other small, open spaces are conventionally considered major limitations for ecological benefits and even some social ones.

The ecology of small parks has been ignored by many ecologists, because they are interested in studying natural ecosystems in pristine condition to establish baseline studies of ecological processes. From this standpoint, small parks are less desirable, because they are human-dominated and lack ecosystems for compar-

This park is surrounded by houses. If the park was vegetated and the yards were carefully planted, they could provide an important transition zone between park and neighborhood, providing increased habitat value by allowing small animals to move around. However, such a transition zone may present social problems if it blurs the boundary of the public park, allowing neighbors to claim some of the space as their territory. Public access to this kind of design is also difficult, given its limited street frontage, even though the park has an important social benefit and provides much needed play space.

ison. Because of their small size, these parks have a high proportion of edge habitat, exotic species, and generalist species as well as altered nutrient cycles (see the key words section at the end of the manual for an explanation of these terms).

Human use constrains the capacity for ecological benefits in small parks where space is by definition at a premium. However, recent research on plants, animals, air and water quality, and the overall ecological network or system provides evidence that small parks provide important environmental benefits. As small patches of open space, they provide different benefits from large patches by improving connections between open spaces and natural areas in the metropolitan environment (Dramstad et al. 1996, 22; Forman 1995, 47). For example, generalist and edge species may find vegetation in small parks to be suitable habitat or the vegetation may serve as stepping stones to better habitat if connected by greenways and large parks. Thus theory from landscape ecology directly supports the value of small open-space patches for conservation purposes (Forman 1995).

From a social perspective, the ample quantity of small parks provides a high frequency of opportunities for people to experience nature nearby in their daily lives (Kaplan et al. 1998). They can provide an everyday connection to green areas, that is, to "nature" very broadly defined (as it is in work on the social aspects of natural areas). However, small parks are often dispersed, expensive to maintain on a per acre basis, and lack many of the facilities available in larger parks. They do not have full-time park staff. Groups may compete for facilities and it is almost impossible to avoid conflicts over space in small parks.

However, while posing a number of challenges for use and management, skillful design can allow even tiny areas to accommodate a diversity of people's needs and desires. In addition, their small size means that overall they may be cost effective, because on a per capita basis they are used very intensively even if per acre they cost more than large parks.

The lack of studies about how patch size, shape, and isolation affects small parks is a hurdle that must be overcome to improve their design in ecological terms. In addition, there is a cultural mismatch in that ecologists hesitate to give specific guidance on such issues as minimum corridor widths, but designers and managers need exactly that kind of guidance to act. We hope that this manual inspires ecologists, park managers, and designers to consider the possibilities of small parks in a quest for better knowledge about their potential as integral elements in a regional open-space system or reserve system while still maintaining their important benefits for people.

Context

From an ecological perspective, context matters because it is the landscape matrix, or wider metropolitan landscape, that influences a range of ecological factors in small parks. One of the most important issues is the edge effect, especially whether a park's edge is an abrupt one or if the park connects to vegetation in surrounding areas (termed by ecologists as hard or soft edges). In this view, vegetation provides a critical transition zone between a small park and other types of urban development, aiding dispersal of wildlife and reducing isolation for wildlife populations. For example, rather than fronting streets, park edges could abut plantings for backyard wildlife in adjacent residential areas, forming a seamless transition between the park and neighborhood*. The goal is to improve low habitat quality to at least medium.

However, this kind of "soft" edge design represents a trade-off; buffering the park with vegetation reduces street access for people, potentially increasing conflicts between park users and adjacent residents. If a park is edged by a road, the park is made more accessible for people and the public space of the park is clearly distinguished from the private space of nearby yards. A seamless transition may have benefits for wildlife but create conflicts for people. The exact balance between these important considerations, and others, will depend on the park's context within the metropolitan landscape and the regional open-space system.

* This is an example of integrating Lindenmayer's and Franklin's idea of matrix management (2002) from wildland management to the creation of a reserve system in urban and suburban contexts (also Dramstad et al. 1996).

Location

Some small parks have excellent locations that are evidence of a thoughtful design process. These parks are centrally located in neighborhoods and have physical connections into a regional, open-space system. If a stream runs through the park, it is not hidden in a buried pipe but rather provides a social and ecological amenity as an open, natural channel.

These parks are also designed in a way that reflects the local climate. In a temperate climate, there are plenty of trees to provide shade and habitat, and lawn areas are designed to support activities rather than to serve only as ground cover. In an arid climate, shade and habitat are provided by tall shrubs and small trees that are drought tolerant. In all climates, areas with vegetation are kept fairly open to address safety issues without being overly manicured to decrease habitat quality.

Other small parks are located as an afterthought of the design process on pieces of land least suitable for housing. The classic image is of a deserted park entirely made up of lawn and a sprinkling of trees, located in an isolated spot at the end of a residential street at the fringe of a housing development. There is no connection with a regional open-space system; pedestrian paths and sidewalks are absent.

Other examples may be socially or ecologically beneficial but not both. One example is the park that is situated in the center of urban development but is lacking any connection with a regional open-space system, such as parkways and greenways. This type of park often has a design that provides recreational and cultural facilities. However, the natural connections to this park are lacking, limiting the ecological benefits of the park for habitat. On the other hand, there are small slivers of remnant woodlots or grasslands, preserved to protect habitat or water quality, but without so much as a bench at a nearby sidewalk to enable enjoyment by people. Such parks may provide pleasant views for those nearby, but not much else. While small parks do not need to do everything, in both of these cases small modifications (a bench, a path, thoughtful siting or connections to other natural areas) can make the park work in multiple dimensions.

Trade-Offs

Parks are a human artifact, but as human populations have grown and diversified the demands placed on parks have increased. With the aging of the population, parks need to cater to seniors as well as children or adults playing active sports. New immigrant groups bring with them preferences for new park activities, from soccer to festivals. With the increasing obesity of the United States population, parks provide options for physical activity, although the relationship between increased physical activity and park provision has not been well researched.

Not only activities but preferences vary among groups. Many people like parks to have a naturalistic style of park design that is also highly maintained. Others want a wilder aesthetic, reflecting the regional ecology. Still others consider parks to be important recreational facilities and want a highly manicured look and the presence of play equipment, gardens, benches, picnic sheds, toilet blocks, concession stands, and similar items.

In a large park, it is possible to have numerous athletic facilities, picnic areas, flower beds, natural zones, and playgrounds, all occupying different spaces. Small parks need to be more sensitively designed for multiple activities and users who must share space more closely. Even then, only some of those desires can fully coexist with a vision of small parks as providing significant wildlife habitat. Which values are emphasized will depend on the park's context and in many cases will be highly contested, not only between social and ecological values but within them: habitat versus water quality; ball fields versus picnic areas.

Overall, this manual provides guidelines for maximizing social and ecological benefits. However, it also acknowledges that often one dimension will be dominant. In particular, small parks have specific limits for ecological benefits, especially habitat value, because of their size and isolation in the metropolitan landscape and because of the recreational needs of people. However, even in ecological terms, careful design can improve the functioning of these parks for local wildlife and for air and water quality benefits.

Exactly What Counts as a Small Park?

As was explained earlier, this book focuses on small parks of less than 5–6 acres (2–2.4 hectares), or one block or smaller. These parks are ubiquitous in metropolitan areas—from center cities to suburban areas—and in small towns. The manual is thus about urban parks, where urban is defined as areas that are not rural or wild. For the purposes of this book a park is a public green space oriented toward recreation or at least public access rather than a piece of land preserved primarily for its natural or wilderness features (as in a national park or national monument). This book also emphasizes parks rather than other public spaces or green areas such as:

- Paved downtown plazas, markets, and streets
- Public open space areas not open to broad public recreation
- Shared or common areas that are for the use of specific groups of residents or workers rather than a broader public, for example, the common areas of housing developments

Of course the lines between these types of spaces are often difficult to define, as when a farmers' market is in a park. In addition, a park does not require public ownership but, rather, a level of regulation that allows for broad public use. Some publicly owned natural areas have limited access while other private green spaces may have broad accessibility. Such access is generally part of an arrangement made with the local government at the time of development, with a requirement for public access granted in exchange for greater flexibility in development regulations. Of course, many privately owned public spaces have relatively stringent regulations, but so do many publicly owned areas, from parks to libraries (Forsyth 2000; Project for Public Spaces 2000).

Recent Trends in Park Design Do Not Yet Fulfill Their Potential

Guidelines about designing small parks are needed even though there are a number of innovative urban and community design ideas gaining broad use. We wrote this manual in part because two key approaches to small-park design—ecological design and new urbanism—do not yet fulfill their potential. While some exemplary designs deal with both social and ecological concerns, this is not the general practice.

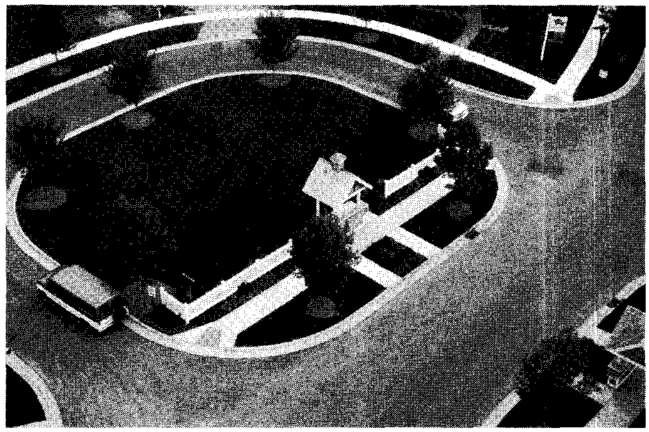
Ecological Design

Ecological design of small parks aims to increase habitat quality and restore degraded landscapes that have been overused and neglected (Crewe and Forsyth 2003; Forsyth and Crewe 2004). Some of the environmental problems that must be addressed are erosion along stream corridors, trampling of vegetation, invasion by exotic species, compaction of soils, contamination by pollutants, and extinction of wildlife and plant species. The approaches used to "restore" parks go by different names, such as brownfield rehabilitation, green infrastructure, landscape urbanism, or ecological restoration. All share the goal of rehabilitating or restoring parks' landscape structure and function through design. However, social concerns are sometimes not addressed to the fullest extent possible, especially with regard to the demographic and cultural context of parks in diverse neighborhoods. There is also a lack of writing on the theory and practice of landscape ecology, conservation biology, restoration ecology, and urban ecology in complex metropolitan contexts. In addition, landscape ecology and conservation biology tend to focus on a different scale: extremely large patches of land in rural or wilderness conditions.

New Urbanism

New Urbanism is a popular movement widely adopted by planners and developers that promotes itself as creating better public spaces, enhancing a sense of community, and promoting ecological values. Along with tree-lined streets in residential and commercial areas,

In Seaside, Florida, a classic New Urbanist development, the amphitheater area in the Central Square is a large expanse of lawn. In contrast, centrally located DiBicci Park contains extensive areas where the ground cover between trees is a local mulch that requires less overall maintenance and less water than lawn. Overall, the majority of the landscaping in Seaside uses this lower maintenance approach.



The majority of new developments with a New Urbanist philosophy have parks dominated by lawns, and they do not tap into the potential of small parks to be a major social and ecological feature in the neighborhood.

prominent elements in new urbanist designs include parks, trails, and town squares.

However, while theoretical writings and the most exemplary of the new urbanist developments have embraced ecological values and social diversity, the general practice of new urbanism is not so advanced. Overall, new urbanist developments vary significantly in their level of ecological and social sophistication in park design, and in general their open spaces could perform more ecological and social functions.

How Research Could Help More

In spite of this interest in small parks, major gaps exist in knowledge about how social and ecological factors interact in such parks. Social and environmental researchers have noticed these gaps and are working cooperatively to create new knowledge to aid design decision making. The sciences of landscape ecology, conservation biology, restoration ecology, and urban ecology offer new insights on how to design regional park systems to protect habitat, biodiversity, and ecological processes (Burgess and Sharpe 1981; Soulé 1985; Turner 1989; Naveh and Lieberman 1994; Forman 1995; Wu and Vankat 1995; Niemelä 1999; Pickett et al. 1999; Naveh 2000; Zipperer et al. 2000; Turner et al. 2001; Wu and Hobbs 2002; Opdam et al. 2003; Jongman and Pungetti 2004). Designers and planners are highly motivated to integrate new ecological and social principles into urban design and planning (Spirn 1984; Platt et al. 1994; Hough 1995; Steiner 2002). Basic problems exist, however, such as disagreements over the definition of nature or about how to define "urban" and "urban ecosystem" (McIntyre et al. 2000; Grimm et al. 2000). In addition, scientists may be interested in phenomena that are important in increasing scientific knowledge but are not relevant to design. However, with increasing urbanization, this period is perhaps the best yet for social and environmental scientists to develop new knowledge that will help designers, managers, planners, and engineers make better decisions about small and large parks alike.

It is also important to keep in mind the information and guidelines in this manual are heuristics or rules of thumb. The guidelines are based on the best scientific understanding that we presently have, but it is essential to understand that we have incomplete knowledge about ecology. It is a situation where ecological and social scientists feel more scientific studies are needed before firm conclusions can be made and designers, planners, and managers want firm design guidelines for parks (e.g., minimum size of habitat patches to protect biodiversity and minimum widths for greenways and conservation corridors). In writing this manual, we have done our best to mediate this divide by reviewing a large number of the current research studies, contacting experts, and having the documents reviewed by those working in the field.

This book also reflects gaps in knowledge. For example, much research on ethnic differences in park use has been done in large parks in Chicago and California; therefore, only some of it is relevant to smaller park areas. There is more research on birds in temperate climates than deserts, and there is more research on birds than most other animals. Trees have been studied far more than shrubs or flowering perennials. While we have tried to fill some of these gaps with commonsense prescriptions, our desire to stay close to the research base means that the manual reflects these biases.

Overview of the Manual

The first four topics in the manual—on *size, edges, appearance,* and *naturalness*—deal with fundamental issues for small parks. They are small and can only accommodate a limited number of activities; they likely have more edges than larger parks with both problems and benefits. These issues are magnified because people differ in their preferences about park appearance and the experience of being in a park.

The next four sections—on *water, plants, wildlife,* and *climate and air*—deal with topics where natural systems are key and where small parks can play a role in a larger open-space and ecological system. However, these natural features also form part of the human environment, providing pleasure (e.g., watching wildlife) and comfort (e.g., moderating air temperature).

The final four sections focus more squarely on human aspects: for example, the kinds of activities small parks need to accommodate; management of inevitable conflicts over use; issues of personal safety; the very real problems of park maintenance and management; and the potential for public involvement in parks.

Five design examples apply these guidelines to actual cases, and a set of issues sheets and a checklist of guidelines summarizes the main implications of the manual in formats useful in participatory-design processes and in plan evaluation. The manual concludes with reflections on how small parks can contribute to sustainable communities by providing ecological resources, nearby nature for people living in higher-density communities as well as more energy-efficient dwellings, and social gathering spaces.

A Note on Conversions

Both metric and imperial conversions were supplied throughout the main text of the manual. However, if a measurement was used within a quote, the original measurement was used and was not converted.

1

Design Examples

Design Development Guidelines

Design Development Issues in Brief

Overview of Park Planning and Design Process

1

Size, Shape, and Number

Issues

Small parks, while small, are still varied in size and shape. They range from pocket parks of a tenth of an acre (0.04 hectare) or less to whole blocks of 5–6 acres (2–2.4 hectares) to linear and irregular paths and greenways hugging rivers, railways, and roads. For many ecologists, the small size and relative isolation of small parks is a problem from a habitat perspective, because small patches in cities have less interior habitat, more exotic species, more small predators (e.g., cats, raccoons, and rats), more edge habitat, and fewer connections to regional open spaces.

For everyone else, size is much less of an issue; but given their small size, such parks cannot be everything to all people, plants, and wildlife. Small areas limit options—some human activities will not fit.

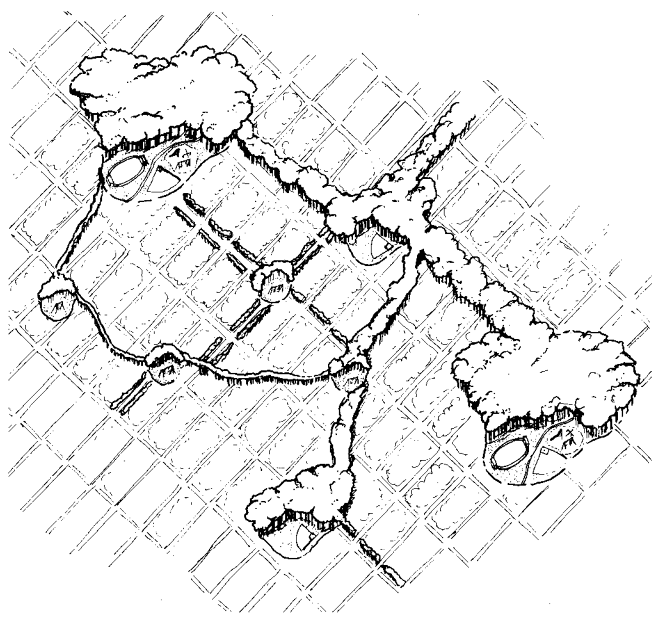
Overall, partly because of their size, small parks have many benefits, not least of which is the provision of nearby nature, green space, or habitat, often deep within an urban area. In desert areas, they can provide important cooling functions. The contexts of small parks can also increase their ecological and social values, such as a linear park located along a lake or stream edge. However, given their variations in size and shape, choices about design and management priorities are unavoidable.

Background

Social Issues

Some important social functions, such as large sports fields, may not fit in small parks. Such parks may only be able to accommodate a limited range of activities appealing to a narrow demographic, such as a play area for parents and toddlers or a single ball field. These functions are even more difficult to accommodate if the park also needs to perform ecological functions. Narrow parks pose particular dilemmas. Long, narrow parks can be useful as trails and greenways. However, they can be hard to fit activities into. Ecologically, they will be dominated by edge habitat, which may not be an optimum breeding habitat for some species, thereby limiting people's access to diverse, nearby wildlife;

This path beside a remnant forest in The Woodlands, Texas, allows for pedestrians to walk along the edge of the wooded area, while limiting fragmentation of the woodland. *Source: Ann Forsyth, used by permission.*



Parks of several different sizes create a network of green spaces. The ecological and social value of a small park increases if it is part of a well-connected open-space system.

although their linear shape aids dispersal of wildlife (with both positive and negative implications).

A small park also poses a challenge in its ability to create a restorative environment, "a place away." As Kaplan explains, such space "must be of sufficient scope to engage the mind. It must provide enough to see, experience, and think about so that it takes up a substantial portion of the available room in one's head" (Kaplan 1995, 172–173, see Fine Print Facts, page 20). While it is completely possible to create complex and diverse landscapes in small spaces—such as highly designed urban gardens, with richly textured materials and separation from distractions—this requires design attention too often lacking in small neighborhood parks (Kaplan et al. 1998, 72–74). However, small parks do have an advantage in that, if well designed, they can provide a place away from but close to home, a place that is not too isolated, and a place that avoids some of the problems that can occur in larger parks, crime, for example.

Small parks can also have a positive sense of intimacy. Work on perception has found that at 75 feet, people can "talk with raised voice, and they can see the general outlines of the expression on one another's faces" (Alexander et al. 1977, 313; Gehl 1987, 66–67). In small parks, people are rarely too far away, and this has a number of social benefits.

In addition, parks that are of the same size are not necessarily perceived as having the same dimensions. A design that includes open, grassy areas can make parks appear larger, and visible fences and buildings can make parks seem smaller (Talbot and Kaplan 1986, 89, see Fine Print Facts, page 20).

Ecological Issues

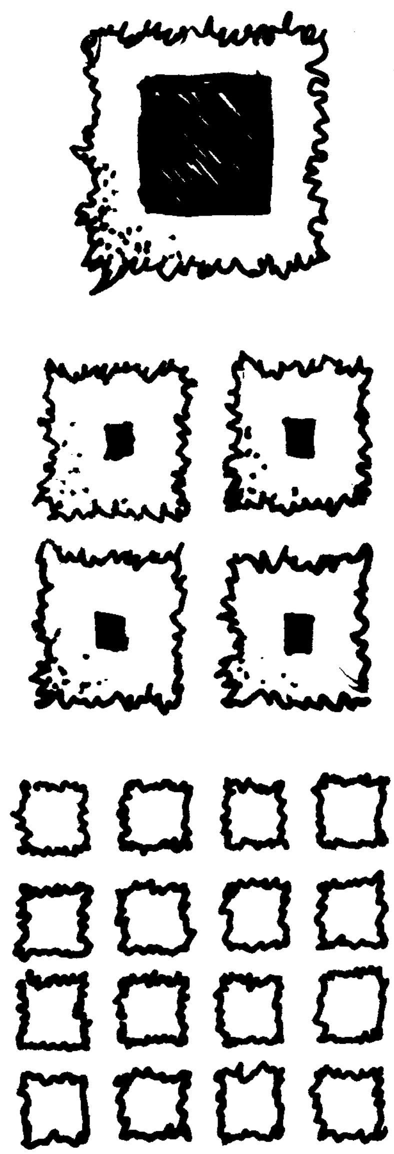
The size of small parks poses a challenge to those interested in their ecological value as nature reserves. These parks are often remnants of the urbanization process. While some parks may result from a planned process, such as a master planned community, others are leftover spaces, for example, wetland areas, rocky areas, or fragments of once-large forests. Still others are built on brownfields and fill lots.

Small parks are related to other types of remnant habitats that can be found in isolated and often abandoned locations of metropolitan regions such as old fence lines, railroad corridors, stream corridors, brownfields, and cemeteries. Cities and towns, large and small, are full of such underutilized areas that are perfect opportunities to enhance any social and ecological benefits. Since small parks are often leftover spaces, their shape may be rather unusual, such as very narrow and long or very jagged with a lot of edge along streets and backyards. This situation represents a management challenge, both ecologically and socially, although providing positive opportunities for human access and connections to naturalness (see Naturalness, pages 42–47).

For an ecologist, park size and scale mean something different than they do for most park designers, planners, and managers. For example, Cole and Landres (1996, 178) defined large reserves as greater than 100,000 hectares. Their definition is based on the scale that is needed to protect wilderness ecosystems and a full complement of species, including large carnivorous predators. In an urbanized setting, a 100,000-hectare-scale park would be an impossibility. Ecologists who study urban ecosystems are aware of this issue, and their concept of scale and park size is similar to that of park designers, planners, and managers. To summarize, large parks for ecologists are generally of a very different scale than what would ever be realistically found in urbanized environments; consequently, it is important to keep this in mind when reading and interpreting the ecological literature, when interacting with ecologists on a professional basis, or when applying ecologists' ideas to the context and circumstances of designing small parks in towns, suburbs, and central cities.

The vocabulary used to discuss parks in ecological literature also differs. The word "reserve" or "bioreserve," for example, is often used as a substitute for park. Reserves and bioreserves are any type of open space for wildlife on public and private land, such as wildlife management lands, national forest lands, and grassland reserves on farms. Ecologists use the term "reserve design" to describe the planning process for habitat areas and networks. In landscape architecture, the best equivalent term to "reserve design" is "regional design" or "conservation design," depending on the scale of the problem at hand.

From an ecological perspective, large habitat areas are preferred for reserves or parks because they comprise the widest range of biodiversity, supply opportunities to maintain evolutionary processes, offer maximum conditions for many types of species, and contain habitat for species intolerant of human intrusion, providing a "safety net" for such species (Lindenmayer and Franklin



The above diagrams illustrate that large patches have a greater amount of interior habitat (area shaded in black) than medium and small sized patches. Small patches may not have any interior habitat, but act as a supplement to larger patches. In general, the number of bird and plant species increases with the number and size of habitat patches. While small parks are, by definition small in size, they can help increase the number of species in an urban area. *Based on drawing from Peck (1998, 71) and Soulé (1991, 314).*

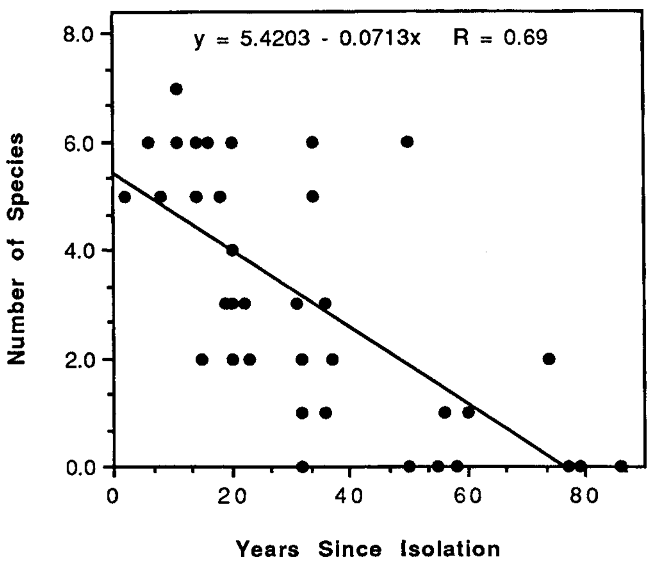
2002, 76). Large reserves are especially important for species with large home ranges (Noss et al. 1997, 94). Ecologists generally agree that small nature reserves are less preferable because their geographic areas are too small to contain a full range of natural disturbance processes, such as fires; to be representative of regional ecosystems, landscape patterns, and land-use legacies; and to maintain the populations of some species in the long-term (Lindenmayer and Franklin 2002, 76–83). Given a choice to protect large blocks of habitat over small ones, ecologists advise choosing the larger whenever possible (Collinge 1996; Noss et al. 1997, 91).

However, small habitats are the reality in most metropolitan regions and are the most accessible, nearby nature for people in their daily lives. Small habitats can be useful for conservation if managers are aware of their ecological limitations as a system of small reserves or parks and set reasonable management goals, given their large amount of edge-habitat species and high levels of disturbance and exotic species. One of the major limitations of a system of small refuges is the minimum area requirements of species, especially wildlife; according to Diamond, "different species have different minimum area requirements, while cases of maximum area limits are extremely rare" (Diamond et al. 1976, 193). Soulé (1991, 319) suggests that small, isolated habitat fragments could protect some types of plants in urbanized environments. This support of small patches of land to protect plants is not surprising considering that there is generally more controversy in the ecological literature about the value of small, isolated habitat fragments for wildlife protection than plant protection.

Forman summarily describes the conclusions of this argument as: "the bottom line: large patches, large benefits, and small patches, small supplemental benefits" (Forman 1995, 47, see Fine Print Facts, page 21). Seeing small parks as stepping stones in a nested hierarchy of a well-connected, open-space system, with a variety of other parks of different sizes, also helps; in this way small sites do not need to perform all the functions, especially when large, regional reserves are part of the open-space system (Flores et al. 1998, 300–301). For example, small parks can provide space for birds to stop over when migrating rather than actually nesting. Small parks can also play a unique role in metropolitan landscapes as a tool for increasing public awareness about effects of urbanization on nature within their neighborhoods. This is really more of a social benefit than an ecological one, but still important.

Overall, small parks are assumed to perform limited ecological functions. Island-biogeographic theory is a theory that uses the study of islands surrounded by water to predict that small islands will have lower species diversity than large islands and that the colonization by organisms to more distant islands from the mainland is less likely than closer islands because of the greater dispersal distance from the mainland (MacArthur and Wilson 1967; Wu and Vankat 1995) (see table on page 19 for an example of island-biogeographic theory). Even though this theory was proposed in the 1960s, it still is very influential in the literature about reserve design (Ranta et al. 1999). In a nutshell, park designers, planners, and managers need to keep three principles about island biogeography in mind when designing parks: "area effects" (bigger areas are better), "edge effects" (less fragmented areas are generally better), and "distance effects" (closer patches are better) (Soulé 1991, 319). Small parks are more likely to have lower species richness that consists of primarily generalist and edge-adapted species that can disperse across a neighborhood to the next park or remnant habitat.

In addition to island biogeography, metapopulation theory (Levins, 1969) predicts certain factors that will influence whether a metapopulation, which is a spatially distributed population, can disperse and repopulate patchy habitat islands, such as parks, or can be isolated and face extinction (Collinge 1996, 62). For a number of reasons, small parks may become ecological sinks or areas where species birth and recolonization rates are less than mortality rates, meaning a species will eventually die out. Some species are more vulnerable, because they are less tolerant of human disturbance, prefer mature interior habitats, or have larger home ranges



This chart demonstrates how isolation in small patches leads to extinction for many species over time. This chart specifically shows the "relationship between the number of chaparral-requiring bird species and the number of years since canyon isolation in 36 isolated canyons in western San Diego County" (Soule 1991, 36). *Reprinted with the permission of the* Journal of the American Planning Association.

(Collinge 1996, 64; Mörtberg 2001, 193; Bastin and Thomas 1999, 493; Levenson 1981, 37).

Ecologists also have found that patch isolation, species richness, and extinction in small parks and habitat remnants is an issue for organisms, such as butterflies. For example, in their study in Singapore, Koh and Sodh (2004, 1695) studied four types of open space for butterfly diversity in a tropical landscape: forest reserves, forest fragments, urban parks adjoining forests, and isolated urban parks. They found that forests within 2 km of urban parks were an important source for species richness in these parks (Koh and Sodh 2004, 1706). In addition, they suggest that the least disturbed sites are the most important to preserve for butterfly diversity; but one of the surprising findings was that urban parks near forest fragments had butterfly diversity (composition and richness) similar to that of urban parks next to forest reserves (Koh and Sodh 2004, 1706). This study offers tantalizing evidence that forest fragments may play an important role in the population dynamics of urban parks in tropical landscapes and, possibly, other climates and landscapes as well.

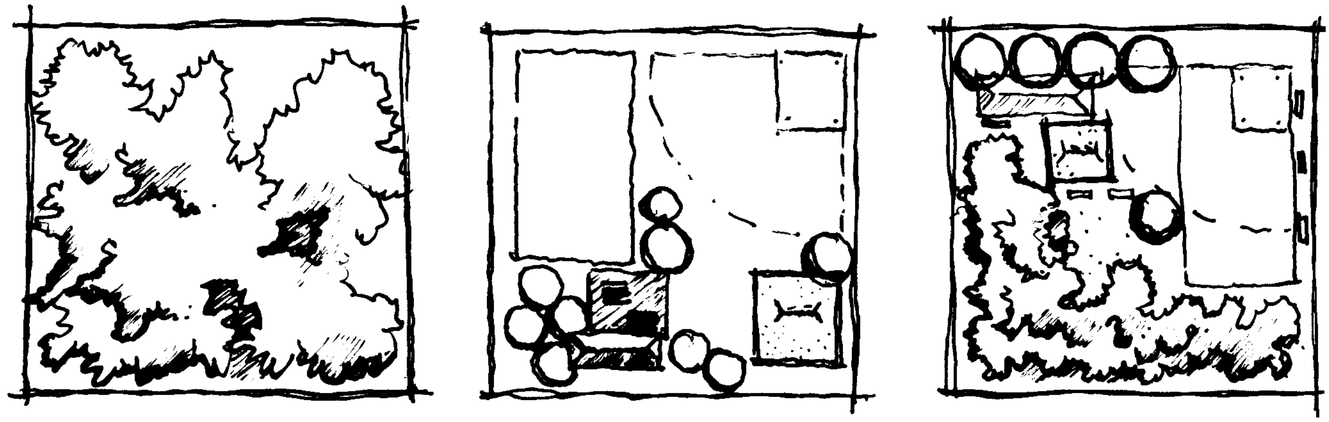
The level of connectivity, or cohesion, of the small parks to habitat corridors and networks is another critical aspect to consider and is dealt with in Connections and Edges (pages 23–32). The topic of connectivity is perhaps one of the most controversial in the ecological sciences, and no definitive scientific evidence concludes that all corridors have conservation value under all ecological and cultural circumstances, although some well-known scientists (e.g., Soulé 1991; Beier and Noss 1998) think that the corridors are valuable, especially in cities and towns, and that it is better to keep rather than to destroy corridors. For park designers, planners, and managers, the ambiguity is a major source of angst, because they need definitive facts about dimensions (e.g., minimum widths and areas) to aid designing and planning better parks and greenways. But park designers, planners, and managers have to keep in mind that exact dimensional specifications will never be available for habitat design and planning in parks in the way that exact dimensions of a baseball or soccer fields are available (Musacchio 2004).

Coming to a Compromise

Overall, context matters, and it matters more for smaller and narrower parks. Small parks cannot play every role, but they can (1) fill important gaps or (2) enhance the roles of other nearby parks and open areas. While it is tempting to say that a park that combines both social and ecological values is better than one emphasizing a single value, this is not necessarily the case, and each situation should be assessed individually.

Guidelines

1. Attempt to preserve minimum widths and areas for ecological functioning, as certain minimum dimensions increase the ecological value of small parks. However, the specific dimensions vary in terms of the specific issue under consideration:



A B C

Examples of alternative park designs. A. A remnant-forest patch before development. B. A traditional park design, with recreational facilities, seating areas, play area, and scattered trees. C. A park with the same features as B, but overlapping and compact uses allow for a larger forest patch to be maintained, providing both ecological and social benefits.

water quality, air quality, or habitat for specific species. Minimum widths will likely also depend on the physical environment of a place—for example, a desert versus temperate forest, slope steepness, and erodibility of soils. See figures 2.12 to 2.14 in the next topic for examples of corridor widths for wildlife, water quality, and air quality conservation.

The following minimum areas and widths for habitat patches have been suggested in somewhat dated studies. Few recent studies provide such data (all cited in Raedeke and Raedeke 1995, 142). It is important to keep in mind that minimum areas and widths for habitat patches will vary from species to species, depending on their life histories:

- 1.4 acres (0.57 ha) for amphibians and reptiles (Dickman 1987)
- 1.6 acres (0.65 ha) for small mammals (Dickman 1987)
- 12.5 acres (5.05 ha) with a minimum 200 meter (656 feet) diameter of patch for land vertebrates (Vizyova 1986)
- 200 meter (656 feet) minimum diameter of patch for many birds that "prefer the interior of forests, and will not successfully nest in small forest patches that consist almost entirely of edge habitat" (Raedeke and Raedeke 1995, 142).

2. Work to create adequate dimensions for multiple programs. Socially, a number of common recreational facilities have required dimensions that while moderately flexible are not infinitely so. From ballfields to play and picnic areas, dimensions matter. This is particularly critical in small parks where there may be room for one baseball field, but there is also a need for volleyball, ice skating, community gardening, and a play area. As we show in the Tighe-Schmitz Park design example, it is possible to overlay multiple programs on the same space, but it requires careful design attention.

3. To understand the origin of small parks in specific regions, historic patterns of urbanization and landscape fragmentation can be studied through the use of historic maps, documents, and oral histories. Such research can help identify how long existing parks have been isolated from the region's natural habitats, what ecological features can be restored, such as drained wetlands or buried streams, and ways to link small parks to larger open-space systems. For example, digital orthophoto quads (digital aerial photographs) are a valuable source of information about land-use and land-cover changes in the United States. University libraries often have archives of paper aerial photographs from the middle of the

DIMENSIONS OF VARIOUS RECREATIONAL FACILITIES

Sport	Use area required/including clear zones	Playing area/Court dimensions
Basketball	None specified	25,603.2 × 15,240 mm for high school (84 × 50 feet)
Bocce	5.7–7.7 mm × 24.6–30.3 m (19–25 ft 6 in × 82–101 ft)	3,962.4–5.791.2 mm × 23,400–27,600 mm (13–19 ft 6 in × 78–92 ft)
Football	Minimum 51.6 × 111.6 m (172 × 372 ft)	48,768 × 109,728 mm (160 × 360 ft) [Including two 9 m (10 yd) end zones]
Tennis	18,000 × 36,000 mm (60 × 120 ft) for one doubles court. Multiples can be designed with 3,000–3,600 mm (10–12 ft) between courts	10,972.8 × 23,774.4 mm (36 × 78 ft)
Volleyball	15,000 × 24,000 mm (50 × 80 ft) preferred; (42 × 72 ft) acceptable	9,144 × 18,288 mm (30 × 60 ft)

Adapted from Harris and Dines (1998, 520–7, 520–11).

twentieth century and historic maps from even earlier that can help establish a baseline for a region.

4. During the planning stages of new communities, do all that is possible to maintain the integrity of large patches of habitat in the open-space plan to preserve effective patch size and to protect core habitat from edge effects. In doing this, pay attention to where the park is located in relation to other natural areas. As many ecologists emphasize, larger patches have more species. However, small parks do have value as this manual outlines, and creating compact developments, with small parks, allows large areas of open space to remain undeveloped.

5. When acquiring land for a public parks system, the shape of open space fragments is an important consideration for estimating the amount of interior habitat and types of ecological interactions with the surrounding matrix. Estimate the amount of interior habitat versus edge through calculation of the perimeter to area ratio of the park. Certain shapes naturally have more interior habitat, such as circles

DISTRIBUTION OF LAND AREA, NUMBER OF SPECIES, AND SUMS OF BIODIVERSITY SCORES AMONG SIZE CLASSES OF ISLANDS OFFSHORE FROM HELSINKI, FINLAND

Size class (ha)	Number of islands	Total area (ha)	Number of species	Sum of biodiversity scores
0.01–0.09	28	1.8	162	8.7
0.1–0.99	83	38.6	323	67.5
1.0–9.9	76	239.4	555	259.6
>10.0	20	1172.3	648	350.2
Total	**207**	**1452.2**	**686**	**686.0**

Source: Ranta et al. (1999, 1296)

and squares, as opposed to linear shapes (Collinge 1996, 66–67). Please see Forman (1995) and Turner et al. (2001) for more specific spatial statistics for the calculation of patch, edge, and corridor characteristics.

6. An inventory of rare and threatened species, area-sensitive species, and clonal (or nonseed propagating) species in a metropolitan region is a helpful reference for management of land fragments. It is helpful to know the life histories of these organisms, especially in relation to sensitivity to patch area, shape, and number as well as edge effects. This list could be compiled from local research studies, experts, and field guides. While one small park is unlikely to make a huge difference in species survival, this information is useful in park design. It also could be used as an educational tool to help the public understand the effects of urbanization on regional biodiversity and landscape fragmentation and the importance of regional open-space planning to address these issues.

7. Consider why a habitat patch has a particular shape, as its origins may be crucial for understanding flows of water and nutrients as well as wildlife movement. Some naturally linear habitat patches are indicative of environmental gradients, such as riparian habitats or wetland edges, and they will have a higher biodiversity on a per area basis (Saunders et al. 1991, 25).

FINE PRINT FACTS

Need for extent in the restorative experience

Kaplan, in a theoretical discussion on the restorative experience, points to the importance of four factors: fascination, being away, extent, and compatibility.

"Fascination is thus a central component of a restorative experience. That is not to say, however, that the presence of fascination guarantees that directed attention can rest. . . . We have, in fact, proposed three additional components that are integral to our analysis of what makes an environment restorative (Kaplan and Talbot 1983).

"1. Being away, at least in principle, frees one from mental activity that requires directed attention support to keep going. In fact, people often use 'getting away' as a shorthand for going to a restorative place. But continuing to struggle with the old thoughts in a new setting is unlikely to be restorative. Clearly being away involves a conceptual rather than a physical transformation. A new or different environment, while potentially helpful, is not essential. A change in the direction of one's gaze, or even an old environment viewed in a new way can provide the necessary conceptual shift.

"2. The environment must have extent. It must, in other words, be rich enough and coherent enough so that it constitutes a whole other world. An endless stream of stimuli both fascinating and different from the usual would not qualify as a restorative environment for two reasons. First, lacking extent, it does not qualify as an environment, but merely an unrelated collection of impressions. And second, a restorative environment must be of sufficient scope to engage the mind. It must provide enough to see, experience, and think about so that it takes up a substantial portion of the available room in one's head.

"3. There should be compatibility between the environment and one's purposes and inclinations. In other words, the setting must fit what one is trying to do and what one would like to do" (Kaplan 1995, 172–173)*.

Perception of size linked to elements in parks more than the actual size of the space

Talbot and Kaplan examined perception of open-space size in a study where 56 people ranked sizes of open spaces from photos of Ann Arbor, Michigan, and focused on relatively small open spaces, up to 18 acres. They found that: "the results of this phase of the study demonstrated that size perceptions were affected by such physical components as the visibility of buildings and other man-made elements beyond the borders of a natural area, and the appearance of fences. Areas with these characteristics were generally perceived as small, while areas with clear open spaces were generally perceived as larger. Other specific

* Reprinted from Kaplan, S. The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology* 15: 169–182, © 1995, with permission from Elsevier.

physical features were mentioned as being characteristic of either small or large places, but these were not consistently reflected in the average ratings given to the fifteen sets of photographs. These inconsistent size cues included trees, trails, and mowed grassy spaces" (Talbot and Kaplan 1986, 86, Reprinted by permission of the University of Wisconsin Press).

General size of habitat patches

Reviewing work to date on patch size and species numbers, Goldstein et al. conclude that: "As a practical rule-of-thumb, most biogeographers believe that 'to double the number of species of a given group of plants or animals' which will be present in an area, 'it is necessary to increase the size of the area by about tenfold' (Darlington 1957). This relationship holds even for very small areas (as long as they are above the 'minimum area') and is critical for vegetation planning in settled areas, because it means that per unit area the largest increase in wildlife species occurs when small and medium-sized habitats are maintained" (Goldstein et al. 1983, 203).

Potential benefits of small patches

Forman, summarizing existing research, concludes that ecological benefits from small patches include:

"1. Habitat and stepping stones for species dispersal, and for recolonization after local extinction of interior species.
2. High species densities and high population sizes of edge species.
3. Matrix heterogeneity that decreases fetch (run) and erosion, and provides escape cover from predators.
4. Habitat for small-patch-restricted species. Occasional examples are known of species that do not persist in larger patches.
5. Protect scattered small habitats and rare species.

The bottom line: large patches, large benefits, and small patches, small supplemental benefits" (Forman 1995, 47).

Forman continues: "A landscape without large patches is eviscerated, picked to the bone. A landscape with only large patches misses few values. In essence, small patches provide different benefits than large patches, and should be thought of as supplement to, but not a replacement for, large patches. We may hypothesize that an optimum landscape has large patches, supplemented with small patches scattered throughout the matrix" (Forman 1995, 48, Reprinted with the permission of Cambridge University Press).

Size as a key factor in species diversity but also habitat structure and isolation

Blake and Karr, who studied the habitat quality of small woodlots (1.8–600 ha) and breeding-bird communities, concluded that "in Illinois, area accounted for 87–98% of variation in species number among woodlots, suggesting that species-area models may have greater utility in regions where woodlots or other habitat patches are well isolated and offer sharp contrast to surrounding habitat (i.e., act as true habitat islands)" (Blake and Karr 1987, 1730, © The Ecological Society of America, Inc.).

"In this study and that of Freemark and Merriam (1986), area was less important than habitat in explaining variation in number of short-distance migrants and edge species among woodlots, whereas area explained a much greater proportion of variation in number of long-distance migrants and interior species" (Blake and Karr 1987, 1730, © The Ecological Society of America, Inc.).

"Isolation, or distance between forest patches, can influence number of species in ways other than through effects of immigration. As Howe (1984) has shown, birds breeding in small (<7 ha) woodlots may incorporate several nearby patches within their territory. Similarly, if additional, nonagricultural habitat (e.g., old fields, second growth) is nearby, birds may enlarge their territories beyond forest boundaries. Thus, a woodlot that by itself is too small to support certain species, may do so if there is additional habitat nearby" (Blake and Karr 1987, 1731, © The Ecological Society of America, Inc.).

Patch size and edge effect

Collinge reviewed the literature on patch size of habitat fragments and established that: "the size of a particular habitat fragment markedly influences the ecological processes occurring therein, partly due to the changes induced by the creation of habitat edges discussed above. Because the edge effects in a particular habitat permeate a constant distance from the border to the center of the habitat fragment, smaller fragments will contain a higher proportion of edge habitat than will larger fragments. . . . For example, if altered edge conditions extend 50 m into a deciduous forest habitat, then a deciduous forest remnant of 1 ha will be entirely edge habitat (100%) and will have no interior habitat conditions, a 10-ha fragment will have a 5.3 ha of edge (53%) and 4.7 ha of interior (47%), while a forest remnant of 100 ha will have 19 ha of edge (19 ha) and 81 ha of interior habitat (81%)" (Collinge 1996, 63–64, citations in original removed).

Studies of forest fragments as habitat islands provide evidence of the edge effect and increased nest predation near the edge

Andrén and Angelstam found empirical evidence of the edge effect on predation rates of nests in small coniferous woodlands that were embedded in a matrix of farmland in central Sweden. Small woodlots in this study were defined as tenths of hectares up to several square kilometers. Predation rates in forest nests were highest within 50 meters of the edge, but "predation rate on forest nests within the group farthest from the edge (200–500 m) was about the same as the overall predation rate in a continuous forest habitat. . . . This supports Wilcove et al.'s (1986) suggestion, namely that the edge-related increase in predation levels off at ~200–500 m from the edge" (Andrén and Angelstam 1988, 545–546, © The Ecological Society of America, Inc.).

Habitat corridor width

Collinge describes estimates of corridor width for a habitat restoration scheme for Central Park with potential benefits based on fragment size: "For example, the restoration of three major wooded areas in New York's Central Park proposed by Andropogon Associates (Rogers 1987; Cramer 1993; Sauer 1993) focused on maintaining large, intact forest patches within currently wooded areas of the park, connecting these patches to enhance movement of birds and mammals and to reducing exotic plant invasion and sedimentation caused by disturbed forest edges. To address these issues, Andropogon Associates devised a habitat corridor network for the park which included continuous, 32 m (100 ft.) wide, wooded corridor connecting three woodland areas, a 32 m (100 ft.) margin on woodland areas to ameliorate edge effects, and a 32 m (100 ft.) wide habitat corridor all along the park perimeter.

"The potential implication for Central Park's woodlands is that the proposed habitat corridor network may be very effective in enhancing species persistence of the intermediate-sized forest fragment (The Ramble), but may be less effective in enhancing habitat values of the relatively small, 4-acre Hallett Nature Sanctuary (Sauer 1993)" (Collinge 1996, 70)*.

* Reprinted from Collinge, S. K. Ecological consequences of habitat fragmentation: Implications for landscape architecture and planning. *Landscape and Urban Planning* 36:59–77, © 1996, with permission from Elsevier.

2

Connections and Edges

Issues

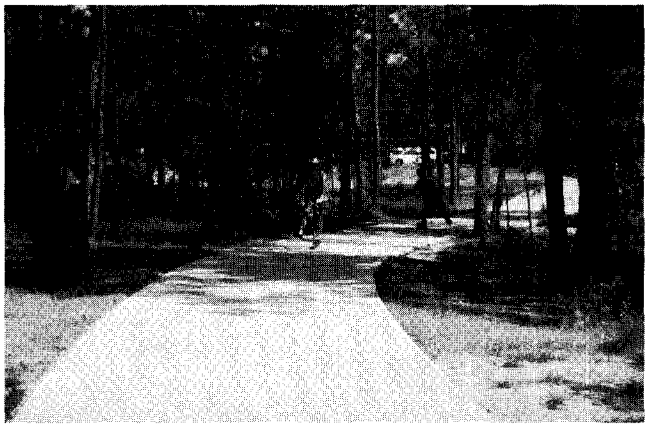
Small parks may seem like islands in a sea of houses, shops, and work places. However, they can make connections in the larger neighborhood and region in two senses: as small stepping stones or patches in a larger ecological network and as places where people can connect with others and nature. Combining social and ecological connections in a small park is not always easy, as the former can be supported by a highly manicured and cultivated green space while the latter demands that the maximum possible area be given over to native plants and wildlife habitat. Edges can be a problem for ecological processes while providing important benefits for people as places for social connections.

This fence around a park in New York City helps maintain a clear edge and manage entrances to the park. Vegetation is protected from people cutting through, but views are still allowed. This kind of edge treatment is common in very high use areas. *Source: Ann Forsyth, used by permission.*

Background

Open-space connections may have regional importance; but they need to be managed at a site scale, providing visual and physical access for people as well as dispersal routes and habitat for wildlife *and* managing how on-site systems, such as water infiltration, connect to adjacent areas. From an ecological perspective, the edge design of open space is an important consideration because of the edge effect occurring at the boundaries of vegetated areas, which have a different

Benches along a path in Boston Common allow for people to sit and watch other people in areas of high activity. People watching is a form of social connection. *Source: Ann Forsyth, used by permission.*



Recreational paths and trails, such as this one in Texas, help connect parks to other open spaces in surrounding communities. *Source: Ann Forsyth, used by permission.*

ecological structure and function than the interior habitat of a patch (Forman 1995).

Small parks can be designed as specific places and as parts of larger green systems or open-space networks. Given their small size, they can perform only a limited number of functions, and so these larger links are important. Areas in which such links are made include:

- *Transportation:* Parks can be part of a pedestrian and cycling network, providing an opportunity for active living.
- *Human connections:* Parks can have an important function in creating a sense of neighborhood and a sense of place.
- *Natural systems:* Parks can help create larger patches of habitat. However, their small size limits their ecological functioning; small parks have very specific and limited ecological roles. See Fine Print Facts (page 29) and Size, Shape, and Number (page 13) for more information.

Social Issues

Parks can connect people to plants, wildlife, history, and each other and thus support interactions (Carr et al. 1992). Some of these interactions are merely visual, such as people visiting the park to see and be seen or to look at green areas close up. Other interactions involve casual conversations and informal interactions. At the same time, it is important to discourage undesirable interactions—for example, crime. To manage these interactions, a park's interior spaces and edges need to be carefully designed.

However, a desire to provide social and ecological connections does not always result in the same design, as the response depends on the type of connections and on the surrounding environment. For example, an environment that supports positive social interactions and discourages negative ones, might well contain design elements that have a mixed environmental performance, from an ecological perspective. For example, shade trees located in arid cities might not be representative of a desert landscape, but they might be needed if the goal is to encourage people to stay in the park in some comfort and for social interactions. Another example is the fear of crime that is increased in areas with thick shrub and ground layers, but these are exactly the forest landscapes that might provide habitat for birds, insects, and other mammals. Park edges are an important place where people connect with nature, but they need careful management because of this issue of crime (see Safety, pages 83–87). The design of parks for connections will generally be a matter of compromise.

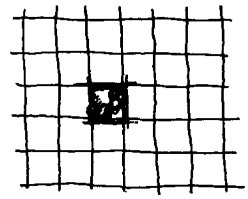
Ecological Issues

Matrix and Corridor Approaches: One of the potential problems with small parks is a lack of connections with other open spaces and a large amount of edge habitat in relation to its size. Both conditions lead to less than ideal ecological conditions, and there are two general concepts in the ecological sciences and landscape architecture that have been proposed to improve connections between the park and other green areas: (1) the matrix approach (Franklin 1993; Lindenmeyer and Franklin 2002) and (2) the corridor approach (McHarg 1969; Little 1990; Smith and Hellmund 1993; Jongman and Pungetti 2004; Fabos 2004). Both have their supporters and detractors and because of the complexity of the debate, this topic is briefly reviewed for the most important issues, concepts, approaches, and trends that influence park design, planning, and management.

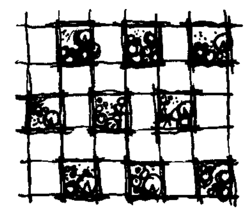
The *matrix approach* emphasizes that parks can be improved by conceptualizing each park as embedded in its surrounding "matrix" of land parcels. Franklin, a landscape and forest ecologist, has been one of the most important proponents of the matrix approach in the ecological sciences, and his classic article (1993) identified the importance of matrix conservation of human-dominated landscapes, such as farmlands and cities, that are built on the most biologically productive lands. He sees matrix conservation as an alternative to the *corridor approach* as well as the *reserve approach*, which was discussed in Size, Shape, and Number (see page 15). The matrix approach has merit because the population levels of some species are sensitive to general land use and vegetation changes across the larger context area or matrix. Willson and Dorcas (2003, 768) point out that salamanders are one of these species:

> Our data suggest that, although the size of a buffer around a stream may have some effect on the relative abundance of salamanders, the amount of undisturbed habitat present within the entire watershed has the greatest impact on salamander abundance.

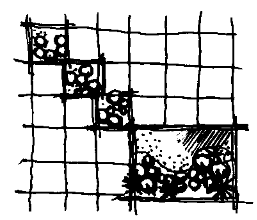
Small parks can have different levels of connection to other parks and open spaces.



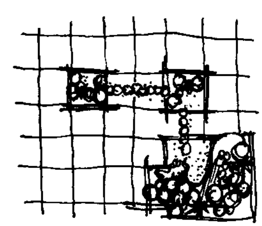
A single park may have no connections to other green spaces.



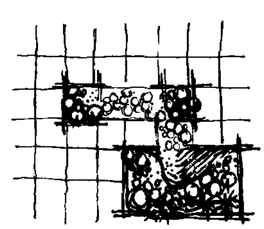
Parks may take up a large amount of area but still have a lack of connections to other parks.



Several small parks may be visually aligned with and connected to a larger park.



Parks may be connected by a thin corridor such as tree-lined streets, which enhance connectivity.



Parks may be connected by a wide corridor such as a greenway, which is the highest level of habitat connectivity of the five schemes illustrated.

Amphibians, salamanders, and other reptiles in general have minimum and maximum core habitats (117 to 368 meters, or 384 to 1207 feet, depending on the species) that cannot be satisfied with the narrower corridors associated with water quality protection (typically 30 to 60 meters, or 98 to 197 feet) (Semlitsch and Bodie 2003; Willson and Dorcas 2003). In this situation, park designers, planners, and managers should be concerned about the quality of the matrix (i.e., watershed) surrounding small parks, especially if wetlands, streams, or other water bodies are present with amphibians, salamanders, and other reptiles (see Fine Print Facts, page 29, for additional information).

In contrast, a number of *corridor approaches* have been developed by the ecological sciences, landscape architecture, and environmental planning for protecting biodiversity and ecosystem processes in relation to multiple-use landscapes. In conservation biology, the planning of species protection is called conservation planning while the design of the habitat networks is called reserve design (e.g., Noss et al. 1997). In landscape architecture, the greenways approach is one of the most popular in the United States, where linear corridors of vegetation are created, often along streams and old railroad lines, and frequently planned with trails for use by people (e.g., McHarg 1969; Little 1990; Smith and Hellmund 1993; Jongman and Pungetti 2004; Fabos 2004).

No matter what name is used—conservation corridors, habitat corridors, greenways, and ecological networks—such linear areas can provide important links to other open spaces that are used for recreation by local residents and may have benefits for improving species richness and abundance in small parks. However, some critics are less supportive of corridors because of the potential dispersal of predators, exotic species, and pests. Corridors can be differentiated into two types based on habitat quality: habitat linkages and movement corridors (Lidicker, 1999 in Bolger et al. 2001, 214). It is important to know the difference between the two since a habitat linkage provides enough resources for survival and reproduction of a species while a movement corridor only allows dispersal (Bolger et al. 2001, 214). This difference is important to keep in mind since using minimum corridor widths for a species may mean that a conservation corridor or greenway will just be used for movement from patch to patch because it has more edge habitat, which will increase the likelihood that it would be an ecological sink. Yet wider corridors will have more ecological benefits, but they may cost more up front for land purchase and maintenance. This is why a good landscape management plan is vital when ecological benefits are an important priority to communities and neighborhoods.

In summary, currently the ecological sciences give conflicting advice about whether the corridor approach or the matrix approach is better for biodiversity protection. Like everything in the ecological sciences, the advice depends on the problem at hand, scale of concern, species of concern, and so on. This is because ecology is very place-specific, and in the end, an answer to a question about ecology—such as what is the ideal corridor width—will often be "it depends." From the perspective of a park designer, planner, or manager, this can be a frustrating situation. Unfortunately, this is the situation, and it will not be changing any time soon. However, there are general ideas associated to each approach that park designers, planners, and managers should know when considering which approach is best for their situation and context.

Combined and Network Approaches: One recent regional proposal has been developed for the New York City metropolitan area that not only integrates greenways and large parks but offers also a vision for smaller open spaces—small parks, for example. In their proposal for an ecological view of the metropolitan landscape, Flores et al. capture the overall goal of planning for environmental benefits in open-space systems in the urban context:

> The key element of maintaining environmental benefits is maintaining healthy ecosystems that can persist and adjust to future changes. . . . In that regard, ecosystems need not be pristine, only flexible, connected, and diverse with a complement of species to generate the genetic,

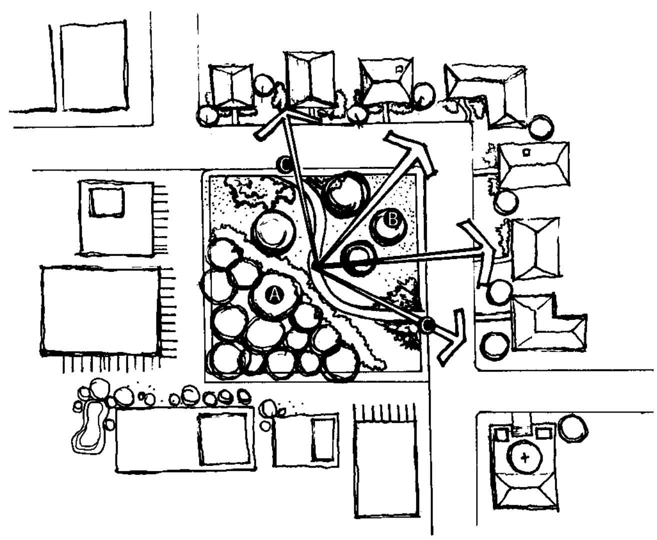
biological, and biogeochemical capacity to adapt and respond to a changing environment. This is the essence and foundation of sustainability. Heterogeneity, diversity and connectivity within and among the components of greenspaces contributes powerfully to the features and processes for which people and institutions value them. (Flores et al. 1998, 301)*

The latest approach to corridor design and planning for wildlife and people is the *ecological networks approach* that was first proposed in Europe (see Jongman and Pungetti 2004 for more information) and based on the principles of holistic landscape ecology that addresses cultural and ecological interactions in landscapes (Naveh and Lieberman 1994; Naveh 2000; Wu and Hobbs 2002; Musacchio and Wu 2004). The approach addresses a number of important habitat issues that are specific to urban and urbanizing landscapes, such as habitat loss, fragmentation, and distribution (Opdam et al. 2003), and the changing dynamic of regenerated and remnant habitat patches and potential effects on habitat quality (Zipperer 2002). Ecological networks have been accepted as a policy tool by some planners and designers in North America and Europe. In ecology, it is still a matter of much discussion, particularly in North America.

When planning for habitat issues in an ecological network scheme, planners and designers are often concerned with enhancing the following aspects of landscape structure and function: (1) enhancing connections between fragmented habitat remnants along the corridor to aid dispersal of species; (2) providing an adequate, vegetated buffer zone between a network and urban land uses; (3) reducing opportunities for the spread of invasive species and the rapid growth of small predator populations (e.g., cats, raccoons, and foxes); and (4) understanding remnant and regenerated habitats in relation to public acceptance and preferences for specific landscape arrangements. Some of the most promising landscape ecology concepts that could apply in this situation and could be integrated into a regional planning and management framework are the spatial cohesion, landscape cohesion, and habitat-network cohesion concepts proposed by Opdam et al. (2003) (Wu, personal communication). Landscape ecology concepts are an important beginning point, but they still need to integrate social factors, such as the landscape preferences of people.

Guidelines

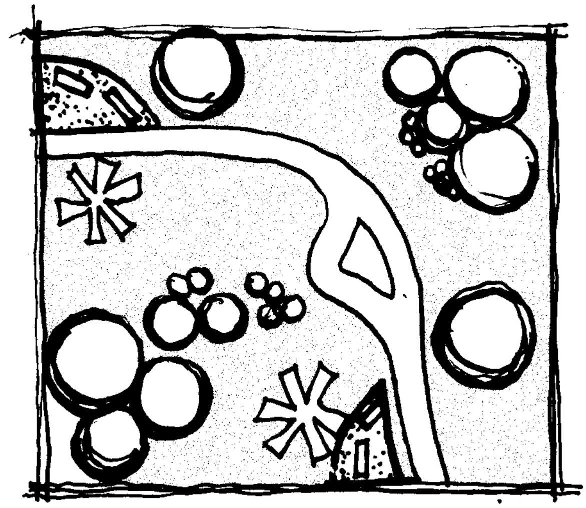
1. Manage people's access to and from the park, including visual access, so that positive connections



This illustration shows a park that provides connections to the neighborhood and preserves a patch of woods. Ecological connections could be improved, but this is often difficult in existing urban areas without retrofitting an entire neighborhood.
A. A densely-planted wooded area provides habitat and screens the park from nearby industrial land uses. A low shrub border keeps people out of this area.
B. An open area has a few canopy trees to provide shade and frame views, but they still allow views out to the surrounding neighborhoods and in from surrounding houses. These eyes-on-the-park can provide surveillance to help minimize crime problems.
C. Entrances are marked with signage and planted with low-growing shrubs and flowers. This helps to maintain clear sight lines in and out of the park, while still providing a memorable entrance to the park.

* Reprinted from Flores, A., S. T. A. Pickett, W. C. Zipperer, R. Pouyat, and R. Pirani. 1998. Adopting a modern view of the metropolitan landscape: The case a greenscape system for the New York City region. *Landscape and Urban Planning* 39:295–308, © 1998 with permission from Elsevier.

In this green space, a path leads by benches in the shade. Pedestrians can choose whether or not to talk with people on the benches, and those sitting can watch people as they pass. *Source: Ann Forsyth, used by permission.*



A design showing the plan of a park designed for social connections. A path takes visitors through the park, allowing them to choose whether or not to stop at seating areas near the park entrances, marked with an asterisk.

are enhanced. For people, visual cues and signs should indicate what is within the park if it is not immediately obvious (Kaplan et al. 1998, 85). Once within a park, views outside the park should show connections to the wider environment; although it may be useful to frame views to maximize the sense of being away by at least partially buffering such elements as parked cars.

2. Maximize the benefits for social connections, including sharing space without further interaction, by allowing nonthreatening coexistence between people who may share common interests. For example:
   - Place seating where people can watch a tot lot or pond, providing options for more intensive socializing if desired.
   - Design paths that go past seating areas, allowing people to scan the area to decide whether or not to stop (Cooper Marcus and Francis 1998, 92–93).
   - Place seating near heavily trafficked areas, such as park entrances, to allow opportunities for higher levels of interaction (Cooper Marcus and Francis 1998, 93).
   - Create landmarks or areas that can be easily described to others. Such landmarks can become meeting places (Cooper Marcus and Francis 1998, 91).

3. Conceptualize the park as a patch in a habitat network and matrix, that is, as part of a system of parks; tree-lined streets; paths and trails; rivers, gullies, and creeks; remnant or volunteer stands of trees; and connected yards. While a small park has only limited ecological value on its own, it can help connect other green areas into a larger system. To maximize this value, it is important to reinforce any surrounding green areas. If there are such nearby green areas, then plantings within the park should be placed near them to increase the impression of overall continuous areas of green. Also, consider how ecological processes could be restored, such as by daylighting a stream or revegetating vacant lots.

4. When designing and planning for corridors to small parks for wildlife, determine what the ecolog-

ical function of the corridor will be—e.g., such as a habitat link or movement corridor (see Fine Print Facts, below).

5. Become familiar with minimum and maximum core-habitat requirements of different plant and wildlife species in the particular geographic region, especially for those species that are most sensitive to land-use and land-cover changes. Corridor habitat requirements can drive the minimum widths for corridors, especially if the goal is to provide habitat conditions that meet different species' survival and reproduction needs. Carefully weigh these minimum corridor widths against goals for water and air protection, which often require narrower corridors (see Fine Print Facts, below).

FINE PRINT FACTS

Potential value of corridors as social and ecological connectors

Flores et al. summarize the debate over whether corridors are valuable:

"Within the ecological literature, there is ongoing debate about the value of corridors or greenways in the landscape. Narrow corridors can be costly to maintain because of their edge to interior ratios; they may serve as avenues for the spread of pathogens, non-native species and disturbances; and they may be detrimental to some species (Simberloff et al. 1992). However, increasing width of corridors can reduce many of the negative effects and management can compensate for other effects (Forman 1995). In the urban environment, benefits to humans may outweigh the costs of corridors and increased connectedness. In the NYCMA [New York City Metropolitan Area] greenways can connect neighboring communities and commercial centers, provide forms of recreation, connect communities poor in greenspaces to those rich in greenspaces, and provide a focus point for environmental education and citizen efforts (Yaro and Hiss 1996). Ecologically, greenways may additionally maintain genetic fitness of species populations by reducing isolation and enable species to migrate with environmental changes and to new sites created by disturbances" (Flores et al. 1998, 305)*.

Limits to corridors and small patches

In a literature review, Raedeke and Raedeke point to the limits of even large corridors and thus caution against overstating the ecological potential of small areas: "While the corridor concept has been widely accepted in the popular literature, many ecologists question their efficacy (see Simberloff et al. 1992), and suggest that limited resources would be more productive if allocated to other habitat uses. Many of the species most commonly considered to benefit from corridors may not be appropriate for urban forest landscapes (such as cougars, bears, deer and other large mammals)" (Raedeke and Raedeke 1995, 146).

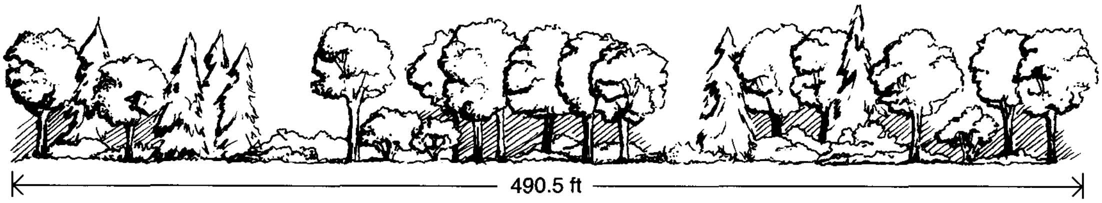
They propose that wildlife habitat design priorities should be based on "cost effectiveness and the potential for providing effective, sustainable wildlife habitat. . . . the first priority should be to retain or restore habitats that support high numbers of species or those with special conservation status. These habitats include many types of wetlands, mature forests with abandoned snags and downed logs, and riparian vegetation and stream corridors. . . . The second priority would be to maximize patch size. This could be accomplished by grouping habitat patches into a single larger habitat area. . . . Third, we recommend that a variety of patch types be retained within the urban forest landscape. . . . Finally, if resource allocation allows for corridors between habitat areas, such corridors should be incorporated" (Raedeke and Raedeke 1995, 147).

Principles of reserve design

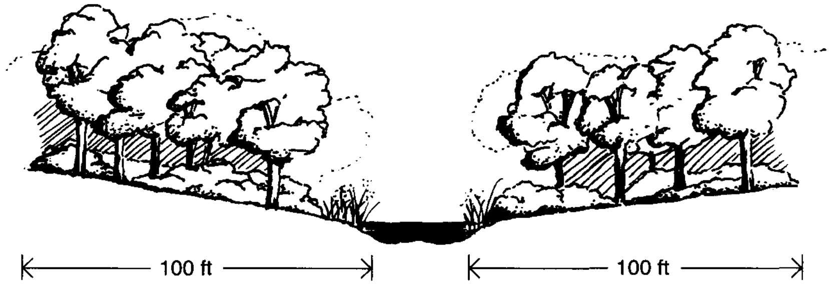
Based on extensive experience in conservation biology and practice, Noss et al. (1997) recommend these principles for habitat conservation:

- "Species well distributed across their native range are less susceptible to extinction than species confined to small portions of their ranges" (93).
- "Large blocks of habitat, containing large populations, are better than small blocks with small populations" (93).

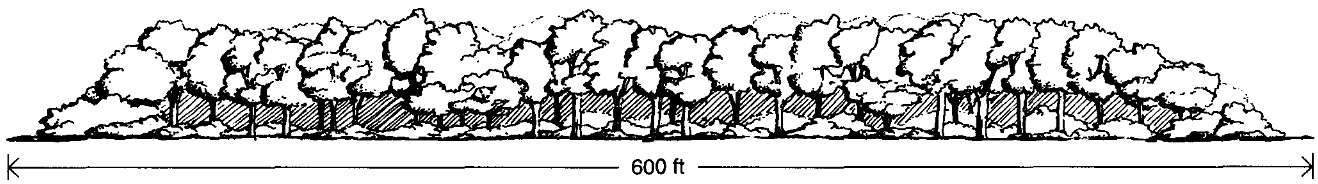
* Reprinted from Flores, A., S. T. A. Pickett, W. C. Zipperer, R. Pouyat, and R. Pirani. 1998. Adopting a modern view of the metropolitan landscape: The case a greenscape system for the New York City region. *Landscape and Urban Planning* 39:295–308, © 1998 with permission from Elsevier.



In one view, the ideal width of a corridor for improving air quality is 490.5 feet (150 meters) (Smith 1976, 297–298), although others see it as context dependent. Ideally, to improve air quality, a mix of deciduous and coniferous vegetation is present within the corridor.



For stream protection, Schuler (1995, 11) states that a minimum width of 100 feet (30.5 meters) be used as a buffer along stream edges. However, it is important that the entire floodplain occurs within the greenway, so the ideal width of the corridor will vary with the situation.



Corridor width depends on the needs of different species. In general, wider corridors have greater benefits than narrow ones (Lindenmayer and Franklin 2002, 113–114). Based on a study by Budd et al. (1987), Adams and Dove (1989, 29) recommend a minimum width of 100 feet (30.5 m). However, Schueler (1995, 97) states that "to be most effective, a wildlife corridor should be 300–600 feet [91.7–183.5 m] wide." Overall, all minimum widths depend on the context of the area in terms of vegetation and the needs of specific wildlife likely to be present in urban areas.

- "Blocks of habitat close together are better than blocks far apart" (99).
- "Habitat in contiguous blocks is better than fragmented habitat" (99).
- "Interconnected blocks of habitat are better than isolated blocks" (102).
- "Populations that fluctuate widely are more vulnerable than populations that are more stable" (103).
- "Disjunct or peripheral populations are likely to be more genetically impoverished and vulnerable to extinction, but also more genetically distinct than central populations" (104).
- "Maintaining viable ecosystems is usually more efficient, economical and effective than a species-by-species approach" (106).
- "Biodiversity is not distributed randomly or uniformly across the landscape. In establishing protection priorities, consider 'hotspots' " (107).
- "Ecosystem boundaries ideally should be determine by reference to ecology, not politics" (108).
- "Because conservation value varies across a landscape, zoning is a useful approach to land-use planning and reserve network design" (109).

Wider corridors are better but narrow corridors have some benefits

Lindenmayer and Franklin describe general guidelines for wildlife corridors in forests:

"Much wildlife corridor research has focused on identifying minimum corridor widths (e.g., Harrison 1992). This is because of the positive correlation between corridor width and the abundance and/or species richness for birds, mammals, and invertebrates (e.g., Stauffer and Best 1980; Dickson and Huntley 1987; Cale 1990; Keals and Majer 1991; Keller et al. 1993; Vemeculen and Opsteeg 1994). Corridor widths can also influence the dispersal behavior of some

MEAN MINIMUM AND MAXIMUM CORE TERRESTRIAL HABITAT FOR AMPHIBIANS AND REPTILES*

Group	Mean minimum (m)	Mean maximum (m)
Frogs	205	368
Salamanders	117	218
Amphibians	159	290
Snakes	168	304
Turtles	123	287
Reptiles	127	289
Herpetofauna	142	289

* Values represent mean linear radii outward from the edge of aquatic habitats compiled from summary data . . .
Source: Semlitch and Bodie (2003, 1221).

species (Baur and Baur 1992; Arnold et al. 1993), which can result in changes in home range size, shape and use (La Polla and Barret 1993; Lynch et al. 1995).

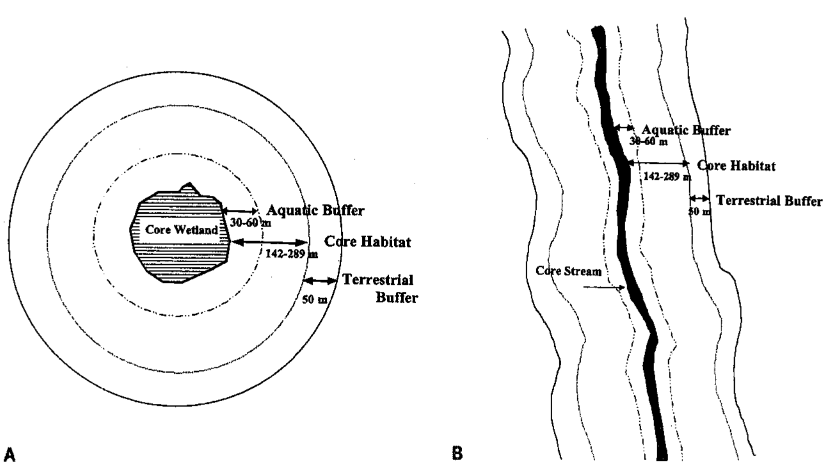
"However, corridor width is only one of several factors influencing wildlife corridor use. For a set width, wildlife effectiveness will co-vary with other attributes, such as length, habitat continuity, habitat quality, and topographic position in the landscape. It also varies for different species (Harrison 1992; Lindenmayer 1994a; Mech and Hallett 2001) and may vary among forest types, even for the same species (Lindenmayer et al. 1994b). For those reasons it is not possible to provide generic guidelines for minimum corridor widths. Nevertheless, wide corridors are generally more effective than narrow corridors (Lindenmayer 1998; Brinson and Verhoeven 1999) because:

- Wider wildlife corridors better approximate interior forest conditions and minimize edge effects (Moore 1977; Steinblums et al. 1984; Laurance 1990).

- Wider wildlife corridors may maintain plant species composition over long time periods thereby increasing long-term conservation value as compared with narrow wildlife corridors (Harris and Scheck 1991).

- Wider wildlife corridors may capture a greater array of habitat types (Lindenmayer 1994a), since these are often associated with different topographic positions in the landscape (e.g., McGarigal and McComb 1992). Consequently, they are more likely to provide for the habitat requirements of specialist species (Darveau et al. 1995; Forman 1995), although there are presently few data to support this expertise.

- Wider wildlife corridors have a higher probability of supporting populations of resident animals than narrow corridors do (Scotts 1991; Bennett et al. 1994), particularly of wide-ranging species (Shepard et al. 1992). Species with large home ranges often do not survive with narrow species corridors (e.g., Recher et al. 1987; Reiner and Griggs 1989 in Forman 1995)" (Lindenmayer and Franklin 2002, 113–114, original references to tables deleted).



This figure demonstrates "proposed zones of protection of (A) wetlands and (B) streams. Both core habitat and aquatic buffer requirements are met within the second zone, which may range from 142 to 289 meters for amphibians and reptiles." Specific values are in the table above. "An additional 50-m buffer is recommended to protect core habitat from edge effects (Murcia 1995)." *Source: Semlitch and Bodie (2003, 1222).*

Important questions to consider when developing objectives for wildlife corridors in forested landscapes

Lindenmayer and Franklin present a list of key questions for designing wildlife corridors in forested landscapes:

"Networks of wildlife corridors need to be developed around specific objectives and the array of factors influencing wildlife corridor use. . . . Key questions about their design and establishment include the following:

- Which species move between habitat patches without corridors and which species are dependent on corridors and to what degree?

- How is corridor use influenced by the suitability of the production forest landscapes in which they are embedded?
- Which species are supposed to benefit from the corridor?
- Is a corridor to function solely as a conduit for movement or is it also to provide suitable habitat?
- What types of areas are being connected by the corridor and how suitable are they for species of interest?
- What is the condition of the surrounding landscape in which the corridors are embedded?

"Unfortunately most studies of wildlife corridors have been conducted in agricultural landscapes where corridors create a stark and often permanent contrast with the surrounding fields. Extrapolation from agricultural to managed forest landscapes is problematic because conditions surrounding wildlife corridors offer lower contrasts and can be dynamic as the result of forest regeneration and development" (Lindenmayer and Franklin 2002, 115).

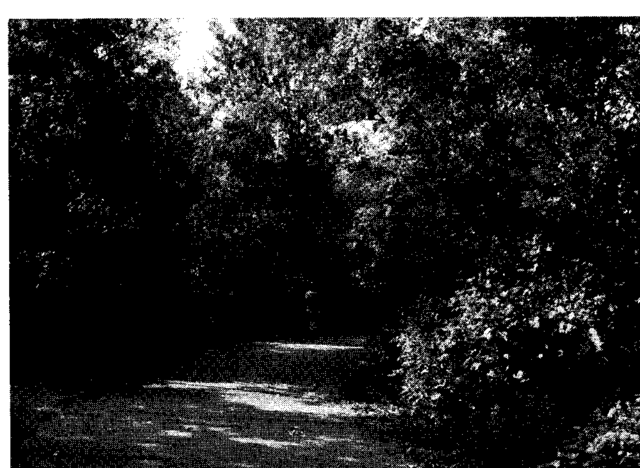
3

Appearance and Other Sensory Issues

Issues

Parks are created to accommodate both people and natural systems, but it is a challenge for park designers to deal with the diversity of people's preferences. For example, park design needs to deal with a major tension in the aesthetic realm. On the one hand, there is a widespread preference for a savannalike park setting that is "characterized by smooth ground covers, scattered trees, and depth or openness" (Ulrich 1986, 32). However, there are significant population subgroups with different preferences, both for less manicured, wilder looking places with more native plantings, and for more formal layouts with more built facilities. Some legitimate elements of parks—such as remnant natural areas—may not be appealing to at least some users. In such cases, the design of the natural area, in particular its edges, can provide important "cues to care" (Nassauer 1995) that will make such places more acceptable to the public's aesthetic sensibilities.

In addition, people see parks, but they also smell, hear, and feel them. These sights, smells, sounds, and textures change throughout the day and the year. These can be important aspects of the experience of a park.



The wild aesthetic of this park gives it a less manicured quality than many well-liked parks, but it is a popular alternative for park users who desire natural features in a design.

This well-groomed lawn with canopy trees and appropriate built features is a style of green space that is well liked by many for its conventional sense of design and high level of maintenance.

More formal, less naturalistic designs are appreciated by some.

Background
Social Issues

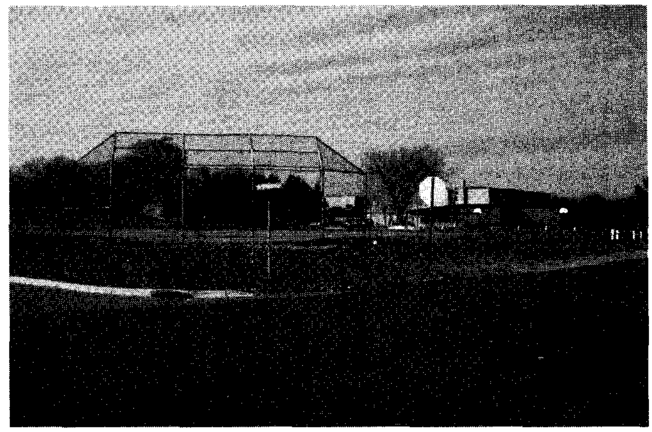
In studies of open space from a human perspective, by far the most attention has been paid to perception, specifically what kinds of open spaces people think are attractive. Following trends in research more generally, earlier studies tried to find what people have in common. Later studies often focused on how they are different. Popular definitions of "nature" have been used in both sets of research. As Ulrich explains, "In general, American groups tend to categorize views as 'natural' if the landscape content is predominantly vegetation and/or water, and if man-made features such as buildings and cars are absent or inconspicuous" (Ulrich 1986, 36).

Many articles coming from the earlier research work, have described a set of broadly shared and even cross-cultural preferences for certain aesthetic elements (see Fine Print Facts, page 39). These include:

- Water.
- Trees that are spreading, as in an acacia shape (which is a vase-shape with a relatively open, fine-textured canopy).
- A savanna appearance with "a high overstory canopy, without any significant middlestory" (Gobster 1994, 65).
- Smooth ground covers.
- High maintenance levels with a relatively manicured look.
- Either an absence of buildings or inconspicuous buildings.
- A balance between open areas and a sense of enclosure, that is, a space that is neither a vast open field nor a dense, impenetrable forest where it is hard to orient oneself and where criminals might lurk (Balling and Falk 1982; Gobster 1994; Kaplan and Kaplan 1989; Kaplan et al. 1998; Raffetto 1993; Schroeder 1989; Ulrich 1986).

The presence of this port-a-potty along a heavily used path is visually unappealing.

This expanse of lawn with a few scattered trees is a preference of many park users, and this park will be attractive as the trees mature. However, this style of park provides little habitat value. *Source: Ann Forsyth, used by permission.*



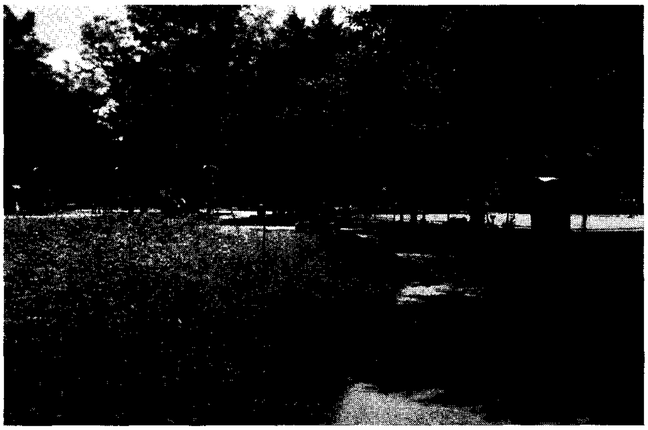
It is often difficult to incorporate a pleasing aesthetic into recreational facilities like this baseball diamond. Special design attention should be paid to these areas, making them both functional and attractive. Street trees could improve the visual appeal of this area and also provide shade and wind protection for spectators and players.

More recent research has examined a number of differences that show it is an oversimplification to assume that all people are alike:

- While spreading trees are most liked, people around the globe also prefer the trees that they grew up with (Sommer 1997, 153).
- Overall people have distinctive preferences either for or against the environments in which they grew up (Kaplan and Kaplan 1989, 87–91).
- Urban, low-income, African-American, and child populations tend to like neater appearing green spaces (Gobster 1994; Schroeder 1982, 320–321; Simmons 1994; Talbot and Kaplan 1984; Talbot and Kaplan 1993). Many appreciate buildings that provide needed facilities.
- Professionals and activists working in parks, landscape, horticulture, forestry, and other environmental fields have distinctive likes and dislikes, often different from the general public. They frequently like more vegetation and some like a wilder look (see Naturalness, pages 143–47).
- People also have entirely personal tastes that they satisfy, in part, by the landscape designs of the environments in which they choose to settle in or near. Even in new developments, such landscapes are diverse—from the very manicured to designs focused on maintaining existing vegetation in a fairly natural state (Forsyth 2005).

However, there are many areas of aesthetics about which we know little, such as preferences for colors of playground equipment. In addition, the reasons for the variation in preferences are also not clear. As Schroeder recounts: "People from urban [that is, central city] areas are less likely to mention vegetation as a desired feature of urban forests and more likely to look at urban forest sites in terms of what opportunities are present for certain activities. . . . Urban individuals were more likely to complain that there are too many trees" (Schroeder 1982, 320–321). However, as he also points out, these preferences raise questions: "Do nonurban [that is, suburban] users prefer more natural recreation sites because they have had more contact with nature, or have they chosen to live in nonurban areas because they prefer nature?" (Schroeder 1982, 320–321).

Kaplan et al. (1998) also point to an additional tension—the need for coherence or order, legibility or distinctiveness, while also including complexity and mystery. That is, well-liked environments need to be comprehensible initially, but they need also indicate



In the two photos above, the mown strip along the path provides a "cue to care" (see Nassauer 1995, 167) by helping maintain a tidy appearance while allowing spaces for more natural or unmanicured vegetation. In addition, the planting design for the more natural area in the lower photo incorporates a large number of brightly colored, flowering native plants reminiscent of a cottage garden. This helps make a more natural section of the park appealing to a variety of users.

that there is more to find out. While the appearance of natural areas has been much studied, parks can provide other important sensory experiences. The rustling of leaves, fresh air, and spring blooms, all create sensory experiences that stand out from many other parts of metropolitan areas. One particularly important and potentially overlooked use of open space is finding relative quiet—i.e., quiet relative to the urban context of the open space (Van Herzele and Wiedemann 2003, 114). Some have proposed that more natural environments are less complex than built environments yet more fascinating and thus reduce stress (Ulrich et al. 1991; Kaplan 1995).

The sound of the fountain and children splashing in this kiddie pool creates a pleasant sound environment. *Source: Ann Forsyth, used by permission.*

However, as in the visual realm, not all perceptions of parks are the same among different groups. Although little work has been done on the topic, Gobster (2002) examined park management for racial and ethnic diversity, using a survey of park users, and observed 898 black, Latino, Asian, and white users of Chicago's Lincoln Park in different parts of the park at different times of day. As he explained:

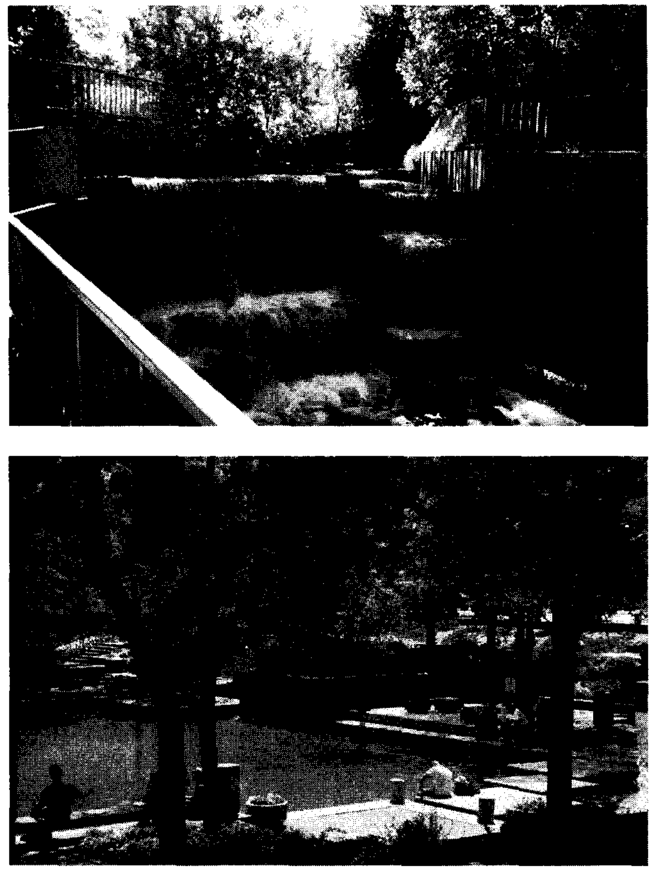
> The findings in this study . . . hint that differences in environmental and development preferences may be more complex than previously thought. As with the earlier research, Blacks were less likely than Whites to mention natural park attributes as preferred and more likely to mention facilities and social activity. However, Latinos and Asians tended to put emphasis as great or greater than Whites on the scenic view, open space, trees, water, and other natural attributes. Nonvisual attributes of the park experience were also important to certain groups; a significant number of Latinos mentioned "taking in the fresh air" as a favored activity, and "fresh air" or "lake effect" as a favored park attribute. These responses suggest sensory dimensions that may be important to some groups but that would be missed in visual perception assessments. (Gobster 2002, 154)

Overall the issue of how parks are experienced through people's senses is a very complex one that requires sensitivity to the place and to cultural interpretations of it; it is important to acknowledge that the same place may be interpreted very differently by different people.

Ecological Issues

Managing both aesthetics and ecology in the space of a small park is challenging for several reasons. As the previous paragraphs have indicated, most people judge the beauty and health of a park using "picturesque" conventions: large trees, lawn, paths, and fountains. Even those who like more natural areas, such as prairie or desert plantings, frequently assume that such areas will be highly maintained. Yet the public's assumptions about landscape health are fraught with problems when compared with evolving ecological knowledge (Nassauer 1992, 239–240). For example, from the perspective of ecologists, downed wood and a shrubby understory are signs of good habitat conditions in a park (Lindenmayer and Franklin 2002); yet the public would find such conditions to be messy and unsafe.

In these situations, park designers and managers must develop management strategies that "label ecological functions with socially-acceptable signs of human intentions for the landscape, setting expected characteristics of landscape beauty and care side by side with characteristics of ecological health" (Nassauer 1992, 248). Managers and designers need to "insert signs of our human presence as caretakers of landscapes that embody healthy ecological systems" (Nassauer 1992, 247). Such signs include mown edges, supplemental plantings of native wildflowers in fields, and selective pruning along forest edges. However, some of these strategies have management problems, for example, in Minneapolis, Minnesota, the parks board has found grass from mown strips invading the native planting areas (Ramadhyani 2004). Nassauer (1992, 2, 7) also suggests public education about ecological systems is the key to building public awareness and acceptance of what constitutes a healthy landscape.



The shade from the trees, the sound and reflection of water, and the textures of the plants in this park in a downtown area appeal to a variety of senses.

Guidelines

1. While an environment with spreading trees, little understory, smooth ground covers, curving sight lines, few incongruous buildings, and water will likely appeal to a broad public, it also is important to consider minority views. Such views may lead to more wild or more formal aesthetics in at least some parts of a park.

2. Where parks must incorporate elements that have ecological value but are unattractive, park planners should use design cues to reveal that these areas are intended (e.g., mown edges or a neatly planted border) and interpretive signage to explain it (Gobster 1994, 67–68). Compact flowering shrubs can provide

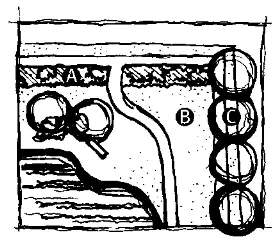
some understory, while maintaining neatness and views. The most useful design cues will set "expected characteristics of landscape beauty and care side by side with characteristics of ecological health" (Nassauer 1992, 248). For example, in a case of rehabilitating an urban park (represented by Design Example 2, pages 111–115), the "ecological" option includes a formal path with a circular focal point showing that design for habitat does not need to look naturalistic, but it can have a more formal appearance.

3. Develop educational opportunities with interpretive signage to demonstrate how beauty and ecological function can be used as a communication tool for park management and maintenance. Novel approaches for framing the "appearance of ecological function" should be considered (Nassauer 1997, 78; 1992). For example, a butterfly garden can be used to educate the public about the vital role of pollination and pollinators in the landscape. A second example is the daylighting, or uncovering, of a stream that is buried in a culvert. The stream can be used as a living laboratory for students and as a stormwater management strategy.

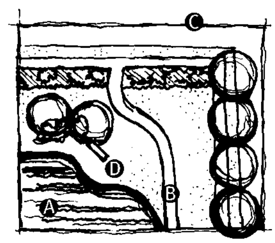
4. Provide walking paths with different sensory experiences along the edges, for example, by using flowering trees and shrubs. Along walking paths, consider how the habitats could be modified to reveal sensory experiences and ecological function season-by-season. For example, the vegetation structure of the different types of plant communities could be modified. In temperate climates, gaps could be created along a woodland trail for flowering prairie perennials. In arid climates, additional plantings of drought-tolerant flowering perennials could be added.

5. Provide a variety of sensory experiences that change with time and vary across the park. Provide opportunities for watching urban wildlife, such as birds and other pollinators. A permanent water source can attract a wide range of organisms.

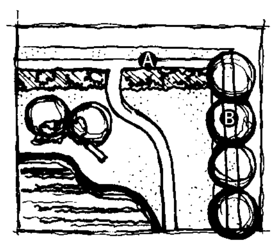
The same park can provide a variety of sensory experiences.



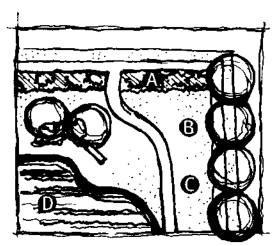
Smell: A. Flowering perennials and annuals provide a scented border along the sidewalk. B. Freshly mown grass can be smelled after the lawn has been cut. C. In the spring, flowering trees will perfume the air.



Sound: A. Sounds of ducks and splashing water can be heard near the pond. B. A gravel path crunches as it is walked on. C. The sound of passing vehicles can be heard near the street. D. A bench is located in a place of relative quiet.



Sight: A. Flower beds provide a range of colors and textures. B. Leaves change color with the change of seasons.



Touch: A. A variety of flower types provides several textures. B. The expanse of lawn provides a soft area for relaxing. C. The rough texture of the gravel path contrasts with the soft lawn surrounding it. D. Water provides a cool and refreshing texture.

6. Consider microclimate in small parks season-by-season and provide park users with choices. In temperate climates, such parks should be comfortable for people to use, with small sunny spots (Cooper Marcus and Francis 1998, 91). If necessary, consider additional shade options for activities during hot, humid summer days. In arid climates, small parks typically do not provide enough shade, especially during summer, which can last up to six months. Provide a wide range of shade options, from trees to built structures such as pavilions and shaded walkways. Consider the cooling effect of water in both climate types.

7. Do not expect everyone to agree on preferred plants or structures in a park.

FINE PRINT FACTS

Most preferred aesthetics

A comprehensive review of earlier empirical studies and other reflections on open space found the following elements in scenes judged to be the most preferred or the most attractive (Schroeder 1989, 90, 94, 96, 101; also Gobster 1994):

- Water
- Large trees with dense upper canopies but little eye-level foliage
- High levels of maintenance
- A lack of incongruous structures
- A lack of urban noises

Ulrich (1986), in a separate review, came up with similar findings that unspectacular natural areas are liked if they have:

- Many separate elements (complexity)
- A "focal point, and other order or patterning is also present"
- A "moderate to high level of depth that is clearly defined"
- Smooth ground and looks like people could move through it, which involves having "lush, grassy or herbaceous ground covers"
- "A deflected or curving sightline . . . conveying a sense that the new landscape information lies immediately beyond the observer's visual bounds"
- Few perceived threats
- Water (Ulrich 1986, 32, 34–35).

Research reviewed by both Ulrich and Schroeder found that treeless landscapes were much less preferred, particularly treeless landscapes in built areas. Ulrich's review also found that people mildly dislike small trees and downed wood and dense understory (Ulrich 1986, 34–35).

General liking for spreading trees

Sommer examined preference for tree shape in two articles on cross-national preferences (Sommer and Summit 1996; Sommer 1997). For the second article he surveyed 504 people. Combining the two articles, there were respondents from all continents. Sommer found: "Consistent with earlier results, there was a strong preference for trees with the generic acacia shape as well as a preference for trees common in the respondent's earlier experience" (Sommer 1997, 153).

Preference for trees, water, and formal gardens

Gobster had 507 adults rate slides of Lincoln Park in Chicago using factor analysis to come up with a typology of five landscape zones or scene types. Water scenes and formal designs rated the highest. The complete typology includes:

- "[D]eveloped areas—scenes of adjacent buildings, highways, and roads; parked cars and parking lots, and most in-park buildings. From a scenic standpoint, these were the lowest rated of the five landscape types.
- Treed areas—interior vegetated areas (away from roads, shore, and parking lots), ranging from densely wooded areas to areas of mixed trees and meadows. Attractiveness ratings ranged from moderate to moderately high.
- Sparsely treed open areas—large open grassy areas. . . . Attractiveness ratings ranged from moderately low to moderate.
- Shoreline and water areas—expansive senses of the lake (including skyline views), and some pond and lagoon scenes. Ratings ranged from moderately high to high.
- Formal garden and built areas—various places and features in the park, both 'natural' and 'human-made.' One common feature was that most seemed to have formal design elements associated with them. Examples

included a formal pond and café, the golf course, formal gardens, the mall, prominent statuary, and a fountain. Ratings for these scenes were among the highest" (Gobster 1993, 36).

Preference for neatness and maintenance among inner city, low-income, African-American residents

Talbot and Kaplan looked at responses to nature in the inner city by a primarily black, low-income population, using interviews and photo-sorting exercises with 97 Detroit, Michigan residents, many from older, stable, inner-city areas. They found that:

"well-maintained areas incorporating built features being preferred over natural areas that are relatively untouched. Both neatness and the presence of amenities such as benches and pathways seem to be relevant in these rankings. The built component emerged distinctly in the dimensional analysis. The concern for maintenance is evident both within the dimensions and in examining the relative ratings of individual photographs. Within each perceptual dimension, preferences were lower for the less manicured as opposed to the more trimmed areas. No matter what its specific content, the most preferred scene in each perceptual dimension had a well-manicured character, while scenes with lower ratings appear less orderly. Thus, although the element of neatness does not emerge as a coherent perceptual category in and of itself, it appears to be a critical determinant of preference ratings" (Talbot and Kaplan 1984, 224).

"Despite the participants' common appreciation for contacts with nature, these results demonstrate that urban Blacks have strongly negative feelings about some specific types of outdoor areas. Areas with large amounts of undergrowth and with dense groupings of trees received low ratings from this sample. The most highly preferred landscapes, on the other hand, were characterized by limited numbers of trees and bushes, by being well-manicured and open settings, and by including various built features such as pathways and benches. The openness and the presence of playground features appear to have special importance in alleviating the fear of danger which was implied in some of the less manicured scenes in the study" (Talbot and Kaplan 1984, 227–228).

LIKES AND DISLIKES AMONG BLACK, LOW-INCOME RESIDENTS IN THE TALBOT AND KAPLAN STUDIES.

Specific characteristic	Number of comments
Disliked features	
Disorderly (cluttered, messy, dirty, not kept up)	56
Weeds	55
Gloomy (too dark, too bushy)	43
Looks dangerous	41
Trees (too many, they look dead)	38
Liked features	
Trees (so many, so big, different kinds)	92
Built features (swings, shelter, bench, sidewalk, playground, pathway, fence, ballfield)	84
Neatness (trimmed, manicured, kept up)	84
Pretty (scenic, beautiful)	76
Park area	69
Water	69
Wildlife area (fish, birds, squirrels)	42
Looks safe	41
Natural beauty (not man-made, the woods, the country)	41
Good place to live	39
Road	37
Walking area (flat, could walk there)	33

Source: Talbot and Kaplan (1984, 226).

Age difference in importance of aesthetics with younger people valuing aesthetics and older people valuing maintenance

Taylor examined race, ancestry, gender, and open space in New Haven, Connecticut, using two-hour interviews of 144 people: 63 blacks (Jamaicans, African Americans) and 81 whites (Italians and others). Taylor found a significant age difference:

"While there was very little difference in the way males and females ranked the various attributes, the ranking by various age groups was significantly different. Whereas 16–19 year olds were attracted to parks because of the aesthetics or because the park was peaceful, older respondents cared more about the facilities in the park. Respondents over the age of 45 placed a high emphasis on good maintenance and upkeep (the highest level recorded by any subgroup analyzed in the study). Whereas a third of the 16–19 year olds were attracted by the aesthetics of the park, none of the respondents over 45 were concerned with that feature" (Taylor 1993, 84).

Central city children's preferences for more built scenes

In a study of children's preferences for different green spaces Simmons found definite preferences among children:

"The school site and urban nature photographic groups elicited the highest preference ratings and were by far the settings which most exemplified the built environment. Deep woods, which illustrated 'wild' nature, was given the lowest preference ratings" (Simmons 1994, 201).

Plaza spaces require special attention

A study of Puerto Rican plaza designs on the island and in ethnic enclaves in the United States proposed the following guidelines for the design of central-city parks and plazas, reflecting the social and cultural activities of many Puerto Ricans:

- "Design plazalike spaces with large, open central areas.
- When possible, central plaza-type public spaces should have a significant connection to community buildings and commercial areas.
- Plaza spaces should contain substantial amounts of open paved surfaces that are framed by planting beds.
- Paved surfaces should accommodate a variety of patterns and colors.
- Large canopy trees should be used in the planting beds, creating shade and defining the open spaces.
- Allow for activities and structures that are culturally specific, such as dominoes tables, vending carts, and marketplaces.
- Public spaces should be multiuse and allow for a variety of activities and flexible programming. . . .
- Allow for the use of bright colors and decoration both in open spaces and on structural elements such as buildings and utility poles.
- Allow for the use of cultural symbols related to ethnic identity including depictions in murals" (Forsyth et al. 2001, 75, Reprinted by permission of the University of Wisconsin Press).

Stress and views of green areas

From a review of the literature on stress, Ulrich et al. (1991) concluded that a number of theories support the contention that green areas reduce stress:

"Very briefly, *cultural* and other leaning-based perspectives suggest that contemporary Western cultures tend to condition their inhabitants to revere nature and dislike cities (e.g. Tuan 1974). Also, learned positive associations with natural environments can be acquired, for instance, during vacations and other recreational experiences. *Arousal* theories (e.g. Berlyne 1971; Mehrabian & Russell 1974) imply that recuperation from excessive arousal or stress should occur more rapidly in settings having low levels of arousal increasing properties such as complexity, intensity and movement. . . . Since natural settings may tend to have lower levels of complexity and other arousal properties than urban environments (Wohlwill 1976), arousal theory implies that nature should have comparatively restorative influences on stress. Overload perspective provides a rather different explanation of why recuperation following a stressor may be more rapid when external stimulation is comparatively low; high complexity and other stimulation place taxing processing demands (Cohen 1978) that should slow or hamper restoration from stress" (Ulrich et al. 1991, 205).

"All of the theoretical perspectives discussed earlier—cultural, arousal and evolutionary—converge in implying that everyday unthreatening natural environments, compared with most urban settings, should tend to foster greater stress recovery" (Ulrich et al. 1991, 209).

Parks providing peace and quiet

In a review paper, Schroeder outlines the common desire to see parks as places of peace and quiet:

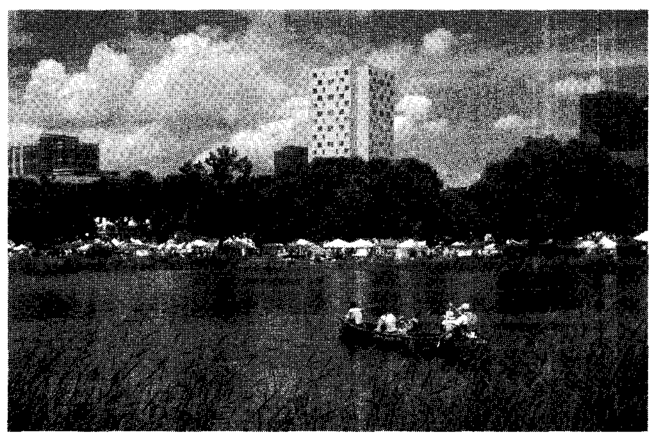
"Vegetation, especially trees, and other natural features are important items that enhance site quality. The tendency of people to mention 'nature' and 'peace and quiet' as desirable attributes suggests that urban parks and forests are seen as opportunities to temporarily withdraw from built-up urban environments and enjoy contact with more natural surroundings" (Schroeder 1982, 320).

4

Naturalness

Issues

Naturalness is perhaps one of the most controversial aspects of open space in metropolitan regions. Ideas about nature and beauty are culturally ingrained, and scenic landscapes are often considered ecologically healthy by the public (Nassauer 1997). Yet, many lingering questions remain: How natural can they be in both appearance and function? What type of naturalness is socially acceptable based on socially derived goals?



Urban lakes such as this one combine modest ecological values—for example, the unmown edge—with close connections with important social events such as the fair in the background.

Background

Ecologically, the capacity to bring nature into a town or city is limited by a park's size and shape as well as the number of parks in the vicinity (see Size, Shape, and Number, pages 13–22). However, it is also constrained by the recreational, safety, and other needs of people. This is reflected in the different ways that "nature" is portrayed in the literature. Work on social issues equates nature with green areas that may be highly designed and formally planted. Research in ecology has typically focused on pristine natural areas; but ideas are changing, and there is a greater recognition that the world is human-dominated. While linked to the aesthetic preferences outlined in the previous topic, this question is more clearly about the issue of how "natural" urban nature should be. It is important to keep in mind that when we use "urban" nature from an ecological perspective that we mean green or natural areas in any type of human settlement, from a small town to a large metropolis. This same idea applies when we refer to the "urban forest."

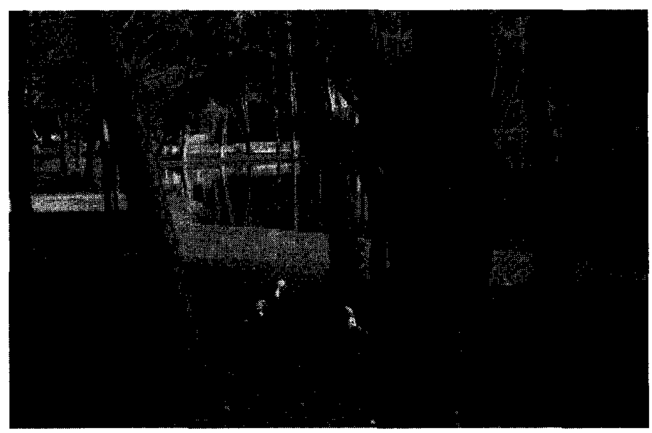
Social Issues

Different kinds of people have different positions on the level of "naturalness" appropriate in towns and cities. For example, a survey of 300 users of open spaces in Ann Arbor, Michigan, including such groups as open-space staff, volunteers, neighbors, and visitors, found that "staff and volunteer restorationists expressed a more conceptual attachment; that is, they were attached to a particular type of natural landscape such as prairie rather than to a specific place" (Ryan 2000, 213). Others were more attached to specific spaces, rather than to an idea of nature, wanting these spaces to perform socially relevant functions, such as providing recreation and views. Some wanted a quite manicured look in a natural area. In terms of ecological restoration, there are some additional dilemmas. For example, many members of the general public, and even some parks professionals, dislike restoration that involves tree removal, seeing it as unnatural even when it is required for ecologically correct restoration (see Fine Print Facts, page 146; Ramadhyani 2004).

A number of other factors are associated with differing ideas about how "natural" a place should be. The college-educated generally show more interest in a wilder version of nature. Field of study also matters. The open-space preferences of landscape architecture students and environmental professionals diverge from those of the general public (Schroeder 1989, 106; Grove et al. 1993, 26; Raffetto 1993, 63; Forsyth 2003; see Fine Print Facts, page 46). Even within groups involved with the care of open space, there is diversity of preferences. For example, studies have examined how arboretum staff preferred higher tree density compared to the staff of suburban park districts (Schroeder and Green 1985).

While a number of studies have found adult residents of center cities have lower preference for wild environments, some studies have found low preferences for such places among suburban and rural children as well (see Fine Print Facts, page 45). Overall, when people are expressing a liking for natural areas, they are not often talking about an entirely indigenous form of nature.

Parks provide educational opportunities for people of all ages. In the above photograph, people enjoy viewing and interacting with wildlife along this pond edge.



Parks can provide habitat for ducks and other urban dwelling organisms, such as insects, squirrels, birds, and rabbits. *Source: Ann Forsyth, used by permission.*

Ecological Issues

From an ecological perspective, understanding how "natural" urban nature is really a question about a place's landscape, particular how its structure and function change over space and time. For example in the United States, the ecoregion is a classification system that is used to understand how a geographic area's land use, land cover, and vegetation types vary due to shifts in climate, precipitation, elevation, soils, geology, topography, and water, and how an ecoregion is distinctive from other places (e.g., tall grass ecoregion versus forest ecoregion) (Bailey 2002). Other parts of the world have similar regional classification systems. The important thing is that these classification systems are a tool for park designers, planners, and managers, so they can understand more about the context of their particular region. Major shifts in land use and land cover, across a region, influence the types of habitats that are present in small parks, and the types of habitats present influence design, planning, and management decisions.

As the scale of human settlements, the idea of the urban-to-rural gradient is a way of thinking about the different purposes of a place's landscapes (McDonnell and Pickett 1990, 1233; Luck and Wu 2002). In their classic article about this subject, McDonnell and Pickett outline how the urban-rural gradient can be used to understand how green areas and habitats are organized in different parts of a metropolitan area:

> The gradient paradigm can be summarized as the view that environmental variation is ordered in space, and that spatial environmental patterns govern the corresponding structure and function of ecological systems, be they populations, communities, or ecosystems. (McDonnell and Pickett 1990, 1232)

For example, Bradley expands upon the concept of an urban-to-rural gradient by explaining how the urban forest relates to it:

> The notion of an urban forest gradient running from the city center to wildland setting is useful in understanding the opportunities and limitations in developing urban forest landscapes. . . . The most obvious differences across the gradient are those concerning people and plants. At the city center, people are abundant and plants are relatively scarce. At the other end of the gradient the opposite is true. (Bradley 1995, 6)

In places with different climates, other types of vegetation will vary across the urban-rural gradient, such as shrublands, chaparral, grasslands, wetlands, and savannas. The important thing to keep in mind is that vegetation composition and abundance will vary along a continuum from city center to exurban development. In addition, the idea of the urban-rural gradient has also recently influenced approaches to the theory of community design and planning in relation to open space (e.g., Duany and Talen 2002).

One of the important themes of the ideals of urban-rural gradient and naturalness is that of landscape change. This concept is a bit abstract; but it emphasizes how healthier landscapes can adjust to change; however, the kinds of adjustments are different in areas with different levels of urbanization (Flores et al. 1998, 301). For example, the persistence and resiliency of invasive, exotic plant species have become a management challenge in small parks all over the world. Designers, planners, and managers schemes could develop best management practices from case studies of where native plant communities have endured in the face of competition from invasive, exotic plant species, providing significant habitat benefits for wildlife (Musacchio 2004; Musacchio and Wu 2002).

Guidelines

1. Small parks in different parts of the metropolitan area need to deal with different preferences of nearby residents, for example:

   Preference variations between urban and nonurban [i.e. suburban] individuals suggest that forest sites in suburban areas should emphasize attractive natural areas with few man-made features, while urban parks should provide a variety of recreation activities. (Schroeder 1982, 321)

2. When restoring a park area, do not change well-loved features, or do so with great care.

3. With restorations back to an original natural state, provide education about the reasons for the change and what it will mean to the park and to the park user (Ryan 2000, 222).

4. Do not restore everything at once to its indigenous state (Ryan 2000, 222). When restoring a park, consider the natural succession of the plant communities and changes in vegetation structure over time and space. Decide whether these changes will be socially acceptable in critical areas of the park, such as picnic and play areas. Review management and maintenance plans for how best to tackle the changing needs of a plant restoration over time. Plans should be straightforward enough that trained volunteers can follow the process.

Colorful, native flowers are appealing to many people and can build support for restoring natural areas. *Source: Ann Forsyth, used by permission.*

5. Consider adding very colorful native or exotic plants, even in "native" areas of urban parks, to build support for restorations. This can provide more widely appealing vegetation and extend the flowering season (Hitchmough and Woudstra, 1999).

6. Identify the appropriate ecoregion for the area and consider it a tool for understanding more about the ecological context of the particular region and for designing more sustainable landscapes. Understanding the ecological history of the region is particularly helpful.

7. Use the concept of the urban-to-rural gradient guideline as a framework for understanding how vegetation type and naturalness of small parks varies in a region. The concept could also be used as the basis of an ecosystem-management approach to small park stewardship at the regional scale.

FINE PRINT FACTS

Suburban and rural children's dislike of wild areas

Bixler and Floyd (1997) examined children's fears and discomforts with open space using a questionnaire administered in school. The study used eighth-grade children from middle school in Texas, totalling 450 students, including 280 from two rural schools, 101 from a suburban school, and 69 from an urban school. Ethnic composition was 50% white, 28% Hispanic, and 15% black. The questionnaire was administered at the school, the response rate was 89%. In this largely rural and suburban group, researchers found a negative view of wilder landscapes. As they explain:

"Self-reports of negative perceptions of wildland environments were related to lower preference for wildland environments and activities and, to some degree, positively related to preference for indoor environments and activities. These relationships were found with this predominantly rural and suburban sample in contrast to the assumption, stated in popular writings, that it is urbanites who tend to react negatively to natural environments" (Bixler and Floyd 1997, 461).

Differences between public and park staff perceptions of prairie restoration

In a study of perceptions of ecological restoration using a survey and photo-rating exercise with users, school, community groups, and park staff in and around Lincoln Park, Raffetto found that "park employees differed significantly from the public with regard to their perceived appropriateness of prairie ecosystems in park restorations. Employees ranked prairies the highest in terms of appropriate ecosystems, while the public ranked prairies near the bottom" (Raffetto 1993, 620).

Public dislike of specific restoration techniques and any restoration involving tree removal

In research on public perceptions of different methods of ecological restoration in the Chicago area, Barro and Bright surveyed 881 people, representing a response rate of 55.8% from valid addresses. They supplemented this survey with a telephone survey that used a subset of questions with a sample of the nonrespondents. Analysis for the paper was restricted to the 563 residents of Cook County, and researchers found high support for restoration. However, Barro and Bright found a lack of support for park management techniques, as the "results indicate a large majority of the people surveyed did not favor the management techniques being used in the Chicago area. Three out of four respondents thought restoration should not be done if it meant cutting down mature trees, using herbicides, or sacrificing wildlife habitat that already existed. A smaller proportion—54.7 percent—felt that cutting or burning results in areas looking unattractive" (Barro and Bright 1998, 60).

"It appears that not only is there a lack of awareness about the characteristics of presettlement landscapes but there also seems to be some misconceptions about it. In particular, trees and forests may be strong symbols of nature and natural landscapes to the exclusion of other ecotypes. As a result, people understand—and approve of—attempts to restore or replant areas that have been denuded of trees as a result of activities such as logging or strip mining. However, they may be confused and even angered by projects that involve removal of trees" (Barro and Bright 1998, 64, Reprinted by permission of the University of Wisconsin Press).

Exotic phobia? Differing attitudes about native and exotic plants among professional horticulturists, garden designers, and landscape architects

Hitchmough and Woudstra reviewed the relationship between expertise and preferences for native and exotic plants and made the following overview of studies by others:

"Kalnoky (1997) has investigated the attitudes of professional horticulturalists, garden designers and landscape architects to exotic herbaceous perennials used in 'naturalistic' plantings in urban design landscapes in England. Within the sample selected for the study (n = 200) awareness of the risks posed by exotic species was well developed. In general, respondents overestimated the actual negative impacts of currently naturalized species on the native biota. . . . Their attitudes to exotic perennials planted in designed landscapes per se depended on the context in which these species were to be cultivated. The majority of respondents perceive a clear division between the locations in which the use of native and exotic species are appropriate. Exotic species are primarily seen as suitable for urban settings, the former in both, but primarily in rural locations. The majority of respondents were happy with the scenario of cultivating exotic herbaceous perennials in a traditional bed or border within an urban park, but were much less comfortable with cultivating the same plants in conjunction with native species in a naturalistic planting in the same park.

One factor that may be important in shaping this latter attitude is the belief that the mixing of exotic and native species demeans the natural values associated with native species" (Hitchmough and Woudstra 1999, 117)*.

Turf grass, aesthetics, and native plants

Nassauer studied suburban residents' perceptions of the residential landscape, particularly lawns, working with an opportunity sample (n = 234) that included suburban residents and members of a native plant society. They viewed colored slides of suburban residential landscapes. Nassauer found:

"In general, the conventional lawn was perceived as more aesthetically pleasing by respondents with no special knowledge of indigenous plants, while treatments replacing 75 percent of the turf tended to be perceived as more aesthetically pleasing by those with knowledge of indigenous plants. It appears that, within the context of the study, ecological knowledge does make a difference in perceptions of landscapes."

"Most instructive, however, was the finding that there was no significant difference between groups in their ratings

* Reprinted from J. Hitchmough and J. Woudstra. 1999. The ecology of exotic herbaceous perennials grown in managed, native grassy vegetation in urban landscapes, *Landscape and Urban Planning* 45:107–121. © 1999 with permission from Elsevier.

of treatment 4, where 50 percent of the turf was replaced by herbaceous prairie vegetation. Despite the fact that the less knowledgeable respondents found the conventional lawn (treatment 1) most attractive, and the more knowledgeable respondents found the treatment that replaced 75 percent of the turf with prairie (treatment 5) most attractive, this moderate treatment level appeared to have broad aesthetic appeal" (Nassauer 1993, 58).

Forest structure and function in relation to aesthetics and wildlife habitat

In a review of work in urban forestry, Bradley emphasizes that it is important to consider the purpose of the urban forest to minimize management conflicts. Bradley noted:

"The most simple structure would be a single tree planted in a sidewalk planter for the purpose of providing shade or human scale to the built environment. . . . At the other extreme, more complex structures might include a variety of tree species, exhibiting different age characteristics, surrounded by shrubs and ground covers that are spaced purposefully in the landscape. The result is a structure that has both horizontal and vertical diversity, as well as living and dead material standing and lying on the forest floor. While this landscape may not appear orderly, and consequently score low on a visual preference rating, the opportunities for wildlife may be abundant.

"Understanding the purpose of an urban forest, and the structure necessary to achieve that purpose, is essential for successful programs. Problems or conflicts may emerge when the structure for one type of landscape is at cross-purposes with another" (Bradley 1995, 5).

A summary of ecological and physical changes along the New York City urban-to-rural gradient

In a study of decomposing leaf litter and woody seedlings, Kostel-Hughes et al. found the urban-to-rural gradient a useful explanation of differences in forest growth and regeneration:

"This gradient has been the subject of numerous studies over the course of the decade (McDonnell et al. 1997). With increased distance from the urban core along this gradient, there is a decrease in human population density, traffic volume, and the percentage built-up land, and an increase in the percentage of forest land and the mean size of forest patches (Medley et al. 1995; McDonnell et al. 1997). Mean monthly temperatures are 2–3° higher and average annual precipitation is 50 mm greater at the urban end of this gradient than at the rural sites (McDonnell et al. 1993). The urban forest soils have elevated concentrations of lead, copper, and nickel (Pouyat and McDonnell 1991; Pouyat et al. 1994b) and are relatively hydrophobic (White and McDonnel, unpubl. data) compared to rural forest soils. Pouyat et al. (1994a) found that after nine months of exposure, red oak litter in the rural forests developed twice the total fungal hyphal length of red oak litter in the urban forests. Steinberg et al. (1997) found that the urban forests have 12 times the number of earthworms (nonnative species introduced by people) and over 40 times the earthworm biomass of the rural forests. Pouyat et al. (1997) found that maple leaf litter placed in litter in the urban forests decomposed at nearly twice the rate of leaf litter in the rural forests" (Kostel-Hughes et al. 1998, 264).

The exurban area of metropolitan regions has a rural gradient with specific characteristics that influence the types of bird, plant, and predator species present

Maestas et al.'s study of the exurban areas outside of Fort Collins, Colorado, indicated that three unique zones of biodiversity occur along a rural gradient from exurban developments, reserves, to ranchlands:

"Exurban developments supported greater densities of tree-nesting and human-commensal bird species . . . and elevated numbers of mammalian predators. . . . Reserves and ranches, however, had increased densities of ground and shrub-nesting bird species . . . and virtually no domestic mesopredators. . . . Ranchlands differed from both reserve and exurban areas in that their plant communities contained a smaller proportion of non-native species" (Maestas et al. 2003, 1430, Blackwell Publishing).

5

Water

Issues

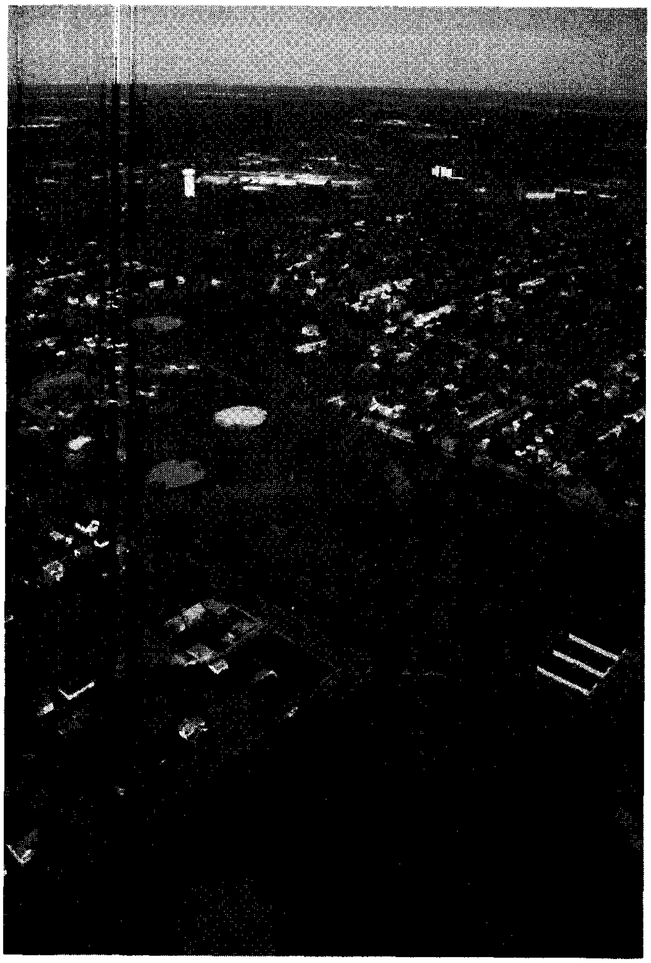
People are attracted to water for its aesthetic beauty. Wildlife and plants need water to sustain life. Urban parks offer potential areas for the natural filtration of water into the ground, including the runoff from hard surfaces in the park as well as the runoff from adjacent residential and commercial areas. They are also places where streams that have been placed underground can be exposed, or daylighted, at least for a short space. This is a potential opportunity to diversify the habitat types in a small park by creating riparian (waterway) and wetland habitats. All these factors mean that water is a big issue in small parks.

Water is valued for its aesthetic beauty, but even small parks can contribute to water quality by infiltrating stormwater runoff.

Background

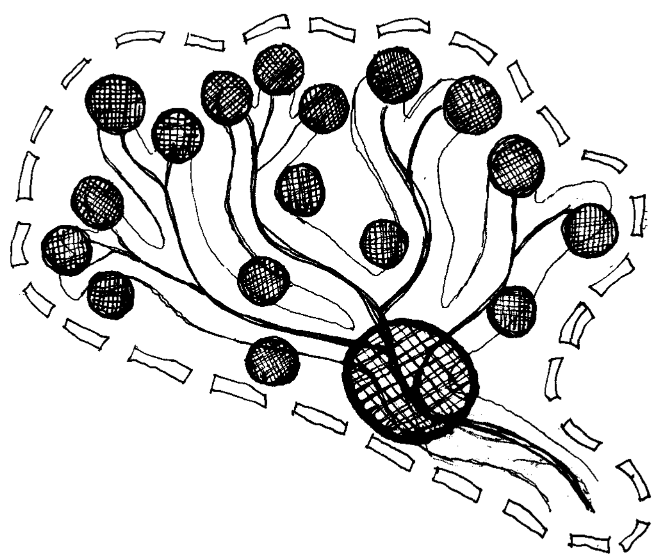
Social and Ecological Issues

Managing water in small parks requires balancing the need to shed water from areas, such as athletic fields, with the desire to hold (and to allow the infiltration of) as much rain water as possible as well as to include bodies of water, if possible. At first glance, managing for water in small parks would not seem complex because of their size. Yet the heavy use of parks magnifies potential water-related issues, such as increased soil compaction in play areas and soil erosion along paths and adjacent slopes, as well as reduced infiltration and percolation of stormwater. Some of these issues can be addressed within the park, but others are caused by off-site issues. One of the major causes of these problems is increased urbanization in areas surrounding parks.



Urban rivers and creeks can provide valuable connections between small parks.

Managing for water issues in a park requires increased understanding of the park's context. Three scales need to be considered: (1) the region's climate, geology, and topography, which influence water availability and drainage patterns; (2) the park's watershed, with its surface and ground water resources; and (3) the park's water resources that occur within its boundaries. This requires understanding water as part of the hydrologic system and understanding how changes upstream in a watershed might affect stormwater problems in a small park. Even low levels of urbanization, usually measured through extent of impervious pavement, can cause most of these problems affecting watersheds. An exact threshold is not known at this time, but estimates generally range from 10%–15% impervious cover in a watershed (Arnold and Gibbons 1996; Miltner et al. 2004). However, with mitigation measures—such as vegetation along stream edges—stream health can be maintained at much higher levels of imperviousness, so a key issue is design (see Fine Print Facts, pages 52-53).



One potential strategy for protecting headwater streams and water quality downstream in a watershed is to locate small parks along headwater streams. They can be used to filter stormwater and control erosion from housing developments located at higher elevations. The hatched circles in the diagram represent small parks that are connected by streams and greenways in a watershed (dashed line).

Understanding more about hydrological (water) processes in metropolitan areas and potential effects of urbanization on these processes is an important first step. Large quantities of impervious surfaces such as buildings, parking lots, streets, driveways, and sidewalks, contribute to many water-resource problems. Other issues can include major alterations in stream corridors by the diversion of streams into a closed system of pipes or an open system of concrete-lined channels. These interventions may address flooding in the short-term, but valuable aspects of streams are lost, such as aesthetics, long-term flood protection, and wildlife habitat.

Small parks may also be a potential strategy for protecting water quality and quantity in an urban watershed. Because small parks are replicated across the landscape, they may be used to enhance infiltration across a watershed. This approach is known by different names, such as green infrastructure, greenways, and ecological restoration. The various design examples in this volume use a variety of strategies for infiltrating water from the park directly into the ground. Most common is the rain garden, which consists of planted, shallow depressions that allow water to settle. Carefully designed stormwater ponds can do this for large volumes of water. In each case, they allow people to see how water interacts with the land.

GUIDELINES

1. Develop a site analysis for each park in order to understand its geographic location in relation to its watershed and other water resources. The location of the park has implications for understanding potential opportunities, constraints, and risks. Is the park located in the headwaters (the part of the watershed with the highest elevation)? Or is it located lower in the watershed? Locate environmentally sensitive resources in the area, such as wetlands, streams, rivers, and aquifers. Do any of these items occur in or near the park?

   If water resource expertise does not exist in the parks department, the local flood control district, watershed council, or department of natural resources will be able to provide more information and expertise.

2. If a stream runs through the park site, use stream buffers to enhance beauty and ecological functions, such as infiltration, flood protection, and habitat.

3. Daylighting of streams can be an effective community-based project for environmental education and neighborhood beautification, but it is a major project and requires long-term planning and allocation of resources (see Advantages of Daylighting a Stream, below). Small grants are often available for these projects through local and state agencies.

4. Reduce impervious surfaces and replace with alternatives within the park, if possible, to improve infiltration and percolation. While some paved paths are needed for those in wheelchairs, these should be carefully located or porous paving systems should be used, if the budget allows for it. Other paths can be of more pervious materials, such as wood chips or turf grass, although care should be taken to avoid problems of extreme soil compaction and erosion of informal paths. In these cases, paving may be a better option.

5. Use rain gardens and stormwater ponds to infiltrate water on site. See low-impact development in Fine Print Facts for potential strategies.

ADVANTAGES OF DAYLIGHTING A STREAM*

1. Daylighted, open waterways often have greater hydraulic capacity than culverts.
2. They can slow and infiltrate runoff, benefiting downstream residents by preventing flooding or erosion.
3. Or they can speed its passage in comparison to culverts that might have choked flows and flooded up stream areas.
4. Daylighting is also sometimes a way to remove water from combined sewer systems.
5. Daylighting projects often happen because they save money.
6. Creating habitat or recreational opportunities, revitalizing neighborhoods, and increasing property values can also be the motivation for daylighting projects.
7. Reconnecting people to nature is a frequent theme of daylighting proponents.
8. "Public education and outreach" and "public participation and involvement"

**Source: Pinkham 2001. © Forester Communication, Inc., www.forester.net.*

FINE PRINT FACTS

Definition of daylighting a stream

Pinkham provides a useful description of how daylighting contributes to the health of a watershed:

"Daylighting is perhaps the most radical expression of this change in attitude and approaches to surface waters. The term describes projects that deliberately expose some of all of the flow of a previously covered river, creek, or stormwater drainage. Daylighting projects liberate waterways that were buried in culverts or pipes, covered by decks, or otherwise removed from view. Daylighting reestablishes a waterway in its old channel where feasible or in a new channel threaded between buildings, streets, parking lots, and playing fields now present on land. Some daylighting projects re-create wetlands, ponds, and estuaries" (Pinkham 2001, © Forester Communication, Inc., www.forester.net).

Definition of Low-Impact Development (LID)

Hager (2003) outlines five types of management practices that are typical of low-impact design, which is a design style that tries to minimize negative ecological outcomes, particularly on water systems:

"LID takes a lot-level approach to stormwater management, treating rainwater where it falls by creating conditions that allow the water to infiltrate back into the ground. The integrated management practices applied to accomplish LID span a diverse range, including but not limited to:

- **conservation and minimization** through narrower residential streets, reductions in impervious sidewalk area, additions of porous pavement or replacement of existing pavement with pervious structures, and creation of concave medians and landscaped traffic-calming features;
- **conveyance** through grassed channels and bioretention channels, and disconnection of impervious areas to redirect runoff to vegetated areas;
- **storage** to reduce peak discharge via pedestal sidewalks, rainwater capture and use (rain barrels), green roofs, and yard, curb, or subsurface storage;
- **infiltration** through trenches and basis, and exfiltration devices; and landscape measures such as bioretention cells, rain gardens, slope reduction, planter boxes, native ground cover, and green alleys" (Hager 2003, © Forester Communication, Inc., www.forester.net).

Costs of LID practices versus conventional development practices

While low-impact design practices can cost more initially, this is not always the case, and they also save money in the long term:

"Stormwater managers and engineers wary of high installation and maintenance costs question the affordability of LID practices. But results of completed LID projects indicate that the higher initial landscaping costs of LID might be offset by reductions in the infrastructure and site preparation work associated with conventional approaches. Estimates from pilot projects and case studies suggest that LID projects can be completed at a cost reduction of 25–30% over conventional projects in decreased site development, stormwater fees, and residential site maintenance" (Hager 2003, © Forester Communication, Inc., www.forester.net).

Hazards and LID practices

The public is often concerned about hazards from low-impact design, such as mosquito breeding; however, Hager reports that there are best management practices (BMPs) that avoid many of these problems:

"Weinstein explains that the threat of mosquitoes in LID practices is minor because LID uses BMPs to temporarily store, filter, and infiltrate, so there is less potential for large volumes of stagnant water to form than in conventional BMPs. Although Weinstein is unaware of any study of the hazards of LID projects, he believes that the smaller scale of these approaches reduces hazards. Coffman agrees, asserting that there are more 'financial, public health, and safety liabilities' associated with conventional stormwater management than with LID" (Hager 2003, © Forester Communication, Inc., www.forester.net).

Commercial and industrial areas are the largest sources of contaminants because of connected impervious areas and stormwater runoff

Bannerman et al. (1993, 242) looked at contaminant loads and runoff volumes from different land uses in 46 sites in Madison, Wisconsin, over 9–10 rainfall events, focused on feeder streets, collector streets, lawns, driveways, residential roofs, parking lots, and flat roofs. They outline some of the issues in their article as follows:

"Source areas with the largest amount of connected impervious area produced most of the runoff. Residential streets and roofs had about the same amount of area, but the streets produced most of the runoff from these residential land uses. Streets were 100% connected, and the roofs were only 2% connected. Because the impervious source areas in the commercial and industrial land uses were largely connected, the volume of runoff coming from each impervious source area was more closely related to the size of its area. For example, industrial parking lots had the greatest amount of area and also produced the largest volume of runoff" (Bannerman et al. 1993, 255; Reprinted from *Water Science and Technology* 28(3–5):255, with permission from the copyright holders, IWA Publishing).

"Runoff from parking lots had the largest loads of solids, dissolved copper, and total recoverable copper. Phosphorus and fecal-coliform loads were largest in runoff from lawns. The small runoff volumes from lawns were not as important as the large phosphorus concentrations and bacteria counts" (Bannerman et al. 1993, 257; Reprinted from *Water Science and Technology* 28(3–5):257, with permission from the copyright holders, IWA Publishing).

Tensions between water quality and compact development

Girling and Kellett (2002, 105) used "CITY green . . . to estimate stormwater peak flows for both two-year and ten-year storm events," then they examined three urban types: "A conventional low density 'Status Quo' plan . . . represents the pattern of many subdivision developments. A more dense 'Neighborhood Village' plan . . . represents a more compact and mixed use new urbanist-influenced pattern. A third, less common but lower environmental common impact 'Open Space' plan . . . represents similar density and land use mixes to the Neighborhood Village plan with greater open space, urban forest, and stormwater features" (Girling and Kellett 2002, 101–102) Girling and Kellett concluded that "comparing neighborhood development patterns from a stormwater perspective, these findings suggest that the higher densities, mixed uses, and greater vehicular and pedestrian connectivity now encouraged in Oregon and elsewhere in the nation can either compete with or complement goals of water resource protection and stormwater runoff reduction. To become complementary, strategic tradeoffs must be made between land dedicated to roads and parking and land dedicated to open space, urban forest, and stormwater" (Girling and Kellett 2002, 108, Reprinted by permission of the University of Wisconsin Press).

Stream health and percentage of imperviousness in watersheds

Reviewing the relationship between stream health and impervious surface, Arnold and Gibbons make the following summary:

"These thresholds serve to create three broad categories of stream health, which can be roughly characterized as 'protected' (less than 10%), 'impacted' (10–30%), and 'degraded' (over 30%). Recent studies also suggest that this threshold applies to wetland health. Hicks (1995) found a well-defined inverse relationship between freshwater wetland habitat quality and impervious surface areas, with wetlands suffering impairment once the imperviousness of their local drainage basin exceeded 10%. Impervious coverage, then, is both a reliable and integrative indicator of the impact of development on water resources" (Arnold and Gibbons 1996, 244).

Threshold of percentage of imperviousness in a watershed and not meeting Clean Water Act goals

Miltner et al., in a study in Columbus, Ohio, outline thresholds of imperviousness that affect ecological health:

"The health of streams as measured by the Index of Biotic Integrity, declined significantly when the amount of urban land use measured as impervious cover exceeded 13.8%, and fell below expectations consistent with the Clean Water Act goals when impervious cover exceeded 27.1%" (Miltner et al. 2004, 87)*.

The location of watershed imperviousness matters rather than just percentage

However, the situation in terms of specific thresholds may not be so clear. Brabec et al. conclude from a literature review that a specific impervious-surface threshold does not exist:

"(1) the determination of a single threshold of watershed imperviousness may not be the only or even the most important watershed variable; (2) mitigation efforts such as detention ponds and riparian buffers have limits to their effectiveness; (3) woodland cover and other pervious land uses are critical to the pervious/impervious equation, and, finally, perhaps the most comprehensive issue, (4) the location of impervious surfaces in a watershed can have significant impacts on water quality" (Brabec et al. 2002, 500).

Watershed mitigation strategies can counter increased imperviousness in a watershed

Miltner et al. outline further mitigation measures in developed watersheds:

"The few sites in our data set where biological integrity was maintained despite high levels of urban land use occurred in streams where the floodplain and riparian buffer was relatively undeveloped. An aggressive stream protection policy that prescribes mandatory riparian buffer widths, preserves sensitive

* Reprinted from R. J. Miltner, D. W. White, and C. Yoder. 2004. The biotic integrity of streams in urban and suburbanizing landscapes, *Landscape and Urban Planning* 69:87. © 2004 with permission from Elsevier.

areas and minimizes hydrologic alteration needs to be part of the larger planning and regulatory framework" (Miltner et al. 2004, 87)*.

In addition, Miltner noted that:

"Steedman (1988) found that an intact riparian zone of 20 m width was important in mitigating effects of urban land use on aquatic life in Toronto area streams. Our own data show habitat quality as an important explanatory variable across the urban gradient. . . . together these results suggest that aggressive regulations that protect riparian buffers and preserve much of the predisturbance hydrology may be effective at maintaining aquatic life uses consistent with basic Clean Water Act goals in suburbanizing watersheds, at least up to a point. That point currently appears in the range of 10–30%, but may go as high as 50–60% under the regimen of aggressive watershed protection (Steedman 1988)" (Miltner et al. 2004, 97)*.

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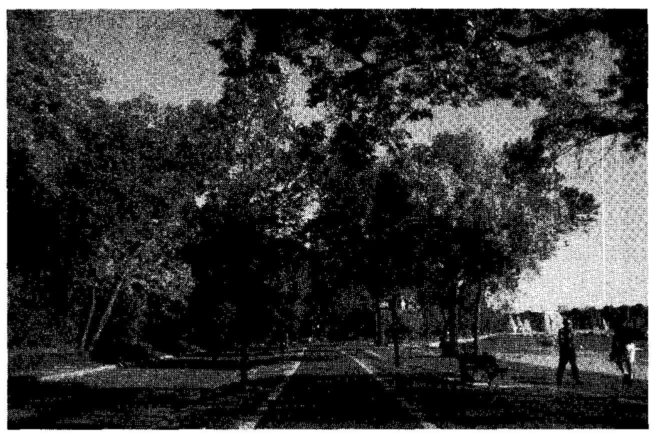
6

Plants

Issues

Plants are valuable for their aesthetic and ecological qualities. Trees are often the most conspicuous form of vegetation in a park and help form the spaces for enjoyment, recreation, and habitat. Shrubs or bushes, ground covers, and flowers are also significant for organizing and structuring open spaces. As a whole, and across different regions, vegetation provides many benefits such as modifying microclimate, improving air quality improvement, controlling stormwater, and providing habitat. The challenge is that urban vegetation lives in a stressful environment because of urban conditions, such as contaminated soils, higher air pollution, a modified hydrological cycle, and other effects of urbanization. Urban trees are often shorter in stature and have shorter lives than their counterparts outside metropolitan areas; although in desert areas, increased watering in urban sites can counteract these stresses and allow plants to grow where they might not flourish naturally.



The urban forest includes trees along streets and in parks, such as these, but also plants in other parts of the cities such as yards, business parks, schools, and utility easements.

Background

A Holistic View of Plants in Parks

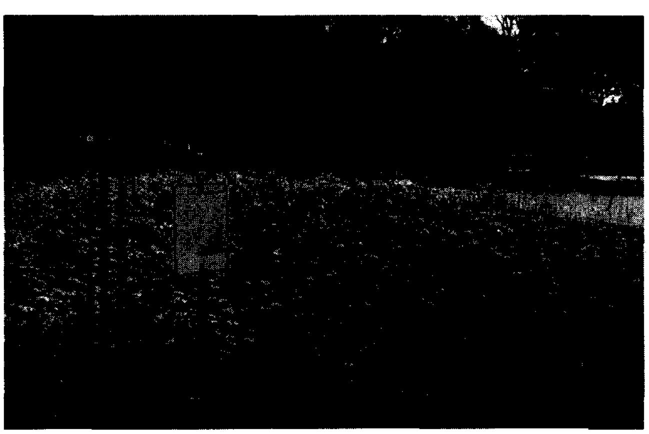
For many years, when people discussed the urban forest, they meant trees along streets and in urban parks.

In the past decades, the definition of the urban forest has expanded to include the metropolitan area's entire vegetation (Dorney et al. 1984, 83). However, today most research continues to be conducted on trees rather than shrubs, ground covers, or flowering annuals and perennials. Many ecologists have also emphasized studies of plants native to a region, although the urban forest also reflects the settlement history of a place, including plants from elsewhere that demonstrate important cultural values in gardens, parks, and streetscapes.

New research has proposed an urban-to-rural gradient model for understanding change in the coverage of the urban forest and its species composition and abundance (McDonnell and Pickett 1990; also see Fine Print Facts, page 57, and Naturalness, page 42). Ecological properties that vary over the gradient include decomposition rates, soil composition, exotic species, and microclimate. One of the most critical issues is the fragmentation of the natural vegetation as cities grow. The fragmentation leads to habitat remnants that may include endangered plants and animals that become hot spots for conservation but that more often than not provide homes for only limited native plants and animals.

Whether this lack of native species is a severe problem or not depends on the local context. There is value in planting strategies that reflect historical patterns of urbanization, honor a region's ethnic heritage, or use a mixture of local and exotic plants to highlight seasonal change and the sensory experience of a park. This can increase plant species diversity. However, a park filled with invasive species with little habitat value provides a maintenance problem for park designers, planners, and staff.

These perennials add to the aesthetic value of a park, while also providing ecological benefits for pollinators like bees, butterflies, and hummingbirds. *Source: Ann Forsyth, used by permission.*



A native prairie planting provides habitat, color, and an educational opportunity within this park.

Forest Management

The management of a healthy urban forest is also a major concern for foresters, scientists, and the public. Quigley (2004, 38) reports that based on his earlier research, species selection and site preparation are key to forest health. The benefits of the urban forest are numerous if it is healthy, long-lived, and well-maintained. As Dwyer et al. recount in a literature review:

> Urban and community forests can strongly influence the physical/biological environment and mitigate many impacts of urban development by moderating climate, conserving energy,

> carbon dioxide, and water, improving air quality, controlling rainfall runoff and flooding, lowering noise levels, harboring wildlife, and enhancing the attractiveness of cities. These benefits may be partially offset by problems that vegetation can pose such as pollen production, hydrocarbon emissions, green waste disposal, water consumption, and displacement of native species by aggressive exotics. Urban forests can be viewed as a "living technology," a key component of the urban infrastructure that helps maintain a healthy environment for urban dwellers. (Dwyer et al. 1992, 228)

Yet these benefits can be difficult to produce without good management practices for selecting trees, amending soils, and maintaining health. For example, when development occurs, it is tempting to keep mainly mature trees; however, younger trees will likely adapt better to changed conditions (Dunster 1998, 163).

McPherson (1995) found that appropriate selection of long-lived trees makes a major difference in carbon sequestration levels, important for controlling the greenhouse effect. When trees are stressed, they require more maintenance, work that often produces greenhouse gases (see Climate and Air, pages 67–72). For example, some street trees show stress as compared to those in rural areas; increased soil compaction and mechanical (physical) stresses as well as the lack of competition from other plants are some of the factors that make managing street trees different than managing a natural forest (Quigley 2004, 37). Trees that are planted in proximity to pavement frequently show the most stress, although it is important to keep in mind that pavement is not a problem for all tree species (Quigley 2004, 37).

As Bradshaw recounts from a review of the literature, tree planting in areas of derelict urban land is particularly challenging as:

> the performance of trees planted on urban sites has often been extremely disappointing. In a recent survey of newly planted trees in a variety of urban sites Capel (1980) showed the average survival after planting was approximately 60% and that average growth was only 50% of that shown by the best sites. Part of this can be attributed to vandalism, but it must be remembered that trees are as sensitive to the lack of nutrients and water as other plants. Trees are often planted in poor soils but these are rarely as nitrogen deficient as derelict land materials" (Bradshaw 1980, 298, Blackwell Publishing). However, it is precisely these areas, among others, that most need forest cover for both ecological and social reasons. As Iverson and Cook (2001) found in Chicago, low-income areas are likely to have the least tree cover with implications for overall livability (see Fine Print Facts, page 58).

Human activities can cause problems by both decreasing and increasing plant growth. For example, a number of recent studies have found trampling on forest paths reduces plant growth, particularly in the understory. In a study in Chiba City, Japan, Bhuju and Ohsawa found human trampling along paths damaged plant growth and, in particular, understory succession over time (Bhuju and Ohsawa 1998, 134). However, in a study of urban bushland remnants in Australia, Lake and Leishman found that nutrients from urban stormwater increased the invasiveness of exotic plant species, noting that: "[T]he addition

> of nutrients to low fertility soil is a critical prerequisite for successful invasion by exotic plants. Low fertility soils subject to physical disturbance only did not support exotic plant invasion and native species richness and abundance of more fertile vegetation communities, such as riparian areas, were not as vulnerable to nutrient enrichment. (Lake and Leishman 204, 225)

Guidelines

1. When placing plants in urban parks it is crucial to create a good growing environment (McPherson 1995, 191). For example, extensive soil testing is needed to understand the condition of urban soils

in a park. This step is often overlooked, but it can provide invaluable information for management and cost-effective decisions.

2. Select trees and other plants that are tolerant of urban conditions, especially pollution, and long lived in the particular location on the urban-to-rural gradient. In addition, carefully evaluate the benefits of trees that drop fruit and seeds if located where these need to be cleaned up. This will help increase benefits in relation to maintenance costs.

3. Compare locations of rare and endangered habitats to small parks. Few will be located in such parks; but when they are, they will be an important consideration in design. In this case a vegetation survey of remnant habitat is invaluable. Information about the extent of invasive exotic species is crucial if habitat rehabilitation or restoration is a goal.

4. Tree-well specifications should be large enough to ensure room for ample growth space for the root system. Care should be taken to protect trees from mechanical stresses, such as wind and soil compaction.

5. Trees need adequate water in the summer because of increased maximum temperatures caused by the urban heat island in many metropolitan areas. Establish a watering regime especially for newly planted trees.

6. Consider planting a range of tree species rather than large plantings of a single species, to promote aesthetic appeal, improve habitat quality, and reduce disease susceptibility (Quigley 2004, 38).

FINE PRINT FACTS

Areas of greatest benefits for tree location

McPherson used benefit-cost ratio (BCR) information to evaluate the economics of urban forestry in Chicago, from earlier studies (McPherson et al. 1993, 1994):

"Benefit-cost ratios were projected to be positive for plantings at park, yard, street, highway, and public housing locations at discount rates ranging from 4 to 10 percent. Assuming a 7 percent discount rate, BCRs were largest for trees in residential yard and public housing . . . sites. The following traits were associated with trees in these locations: relatively inexpensive to establish, low mortality rates, vigorous growth, and large energy savings" (McPherson 1995, 190).

Characteristics of center-city and suburban vegetation differ significantly

DeGraaf compared Massachusetts tree populations in residential areas of urban Springfield and suburban Amherst:

"Woody vegetation was sampled in 1975 on forty, ½-ha plots on two urban residential tracts in urban Springfield, Massachusetts (population 250,000) and on twenty 1-ha plots in two residential tracts in suburban Amherst, Massachusetts (population 20,000)" (DeGraaf 1985, 236).

DeGraaf found significant differences in the urban forest between study areas:

"Sampling of all trees and shrubs on 20 ha in each community revealed a total density of 49.35 trees/ha in the urban residential area and a significantly greater density of 138.30/ha in the suburb ($P = 0.05$). Shrub densities were more similar: 144.0/ha in the urban areas and 161.2/ha in the suburb. In Springfield, 74.7 percent of shrubs were coniferous compared with 38.0 percent in Amherst. . . .

"Thirty-six tree species were recorded in the urban area compared with 82 in the suburb. . . . The suburban environment also is characterized by a preponderance of relatively few tree species: only nine tree species account for 61.4 percent of the trees. . . .

"Introduced exotics accounted for similar proportions of both tree species and of all trees. The urban area contained six exotic species of trees (17.1 percent), which accounted for 24.1 percent of all trees. The suburb contained 24 exotic species (14.6 percent of all tree species, 31.2 percent of all trees)" (DeGraaf 1985, 237–238).

Urban development increases species diversity of plants

Dorney et al. in a study of the vegetation of Shorewood, Wisconsin, found that it was a savannalike area, with great species diversity, especially in residential back yards:

"The Shorewood savanna, with 38 different tree taxa, is mostly deciduous; however, coniferous trees make up a moderate proportion (9%) of total stems. The conifer component makes this ecosystem unique in southern Wisconsin, where coniferous species are usually isolated in swamps, bogs and ravine (Curtis 1959). Species richness also reflects the introduction of exotics such as Russian olive, privet and Norway maple. In addition, several species (Alianthus and mulberry) reach their northern limits in southern Wisconsin. Thus, urban development has increased species richness for southern Wisconsin" (Dorney et al. 1984, 83).

Diversity of ground and shrub layer and the role of human disturbance along an urban gradient: Milwaukee versus other American cities

Guntenspergen and Levenson studied 24 small remnant forest stands in the Milwaukee area in southern Wisconsin:

"Studies in several New York City parks documented the lack of a ground layer because of pedestrian traffic, arson, and other anthropogenic activities (Stalter 1981; Loeb 1982; Profous and Loeb 1984). McDonnell et al. (1997) studied forest stands along an urban-to-rural transect in the New York City metropolitan area. Forests at the urban end of their gradient had depauperate understories and an increasing proportion of non-native species compared with similar forests in rural areas.

"We did not find significant differences in species diversity in either shrub or herb species richness along our urbanization gradient. . . . Forest stands in the urban portion of the Milwaukee metropolitan area may not be used as heavily as those in the New York City metropolitan area. However, urban development in the Milwaukee metropolitan area has led to changes in the understory composition of forest remnants" (Guntenspergen and Levenson 1997, 165–166).

Plant diversity of cities changes as they grow and may increase because of seminatural remnants

Based on a study of plant species distribution in Plymouth, England, with data on species collected for 100-meter-grid cells but for analysis combined into 103, one-kilometer-square grid cells, Kent et al. conclude:

"Given this pattern of urban biogeography and the linking of floristic composition to the historical sequence of urban development, it is interesting to speculate on the possible underlying ecological processes. The model here suggests that as sectors of cities age, their floras will change. In the case of the central older areas of Plymouth, this means a reduction in the diversity of the spontaneous flora over time, as urbanism and development intensify. In contrast, however, as a city expands and former rural areas are progressively urbanized, these areas may still have high species richness. . . . The concept of time-lags or relaxation time in species response to intensification of urbanization is a vital concept here (Kowarik 1995b). Further research is thus required to monitor changes in species assemblages in response to this gradual intensification of the urbanization process in the various sectors of a city.

"Space and time are thus linked in city floras. In Central Europe, Pyšek (1989, 1993, 1998) and Wittig (1991) have demonstrated highly significant correlations between town and city size and species and plant community richness. The greater the spatial extent of the town/city, the more diverse its flora" (Kent et a. 1999, 1293–1294, Blackwell Publishing).

Tree cover and correlation with income levels

Iverson and Cook used GIS data to examine tree cover in Chicago, beginning with the following delimiter: "total tree cover is calculated here as the sum of the forest and residential with trees classes. Because the residential areas also include houses, lawns, and driveways, the total tree cover will be slightly overestimated" (Iverson and Cook 2001, 111).

"Forest areas with scattered trees, residential areas with trees, and manicured grass are strongly and positively correlated with household income in the six-county area. Conversely, increases in urban land are linked with lower household incomes.

"Tree cover is greatest in quarter sections with three or four times the average income for the region. . . . However, some of the wealthiest quarter sections, where household income exceeds four times the regional average, have proportionately more manicured grassland compared to tree cover. The poorest quarter sections (<0.4 times the regional average) are strongly correlated with urban land and are probably housing projects in the city center. Many individuals living in these areas may be suffering economic hardships; the lack of trees may also contribute to increased environmental hardships for these individuals (Iverson et al. 1989; Iverson 1991)" (Iverson and Cook 2001, 118).

A strong relationship exists between vegetation richness and socioeconomic status in Phoenix, Arizona, and this can influence approaches to the design of small urban parks

Martin et al. studied the association between socioeconomic status and urban vegetation in 16 Phoenix parks and adjacent residential neighborhoods with a range of socioeconomic levels classed as low, medium, or high.

"Our results showed clearly that there does exist a strong relationship between residential vegetation richness and SES in Phoenix, AZ, and that people who live in low SES neighborhoods are less likely to enjoy rich assemblages of vegetation in their neighborhoods than people who live in neighborhoods with high SES. Landscape and urban planners should be concerned with this for two reasons. First, these differential accesses to 'nature' by urban residents have environmental justice implications. And since environmental quality affects human quality of life, and likely more so in congested urban areas, judicious management of park vegetation composition may ameliorate inequitable access to environmental amenities in surrounding yardscapes of lower SES neighborhoods. Second, urban ecosystems, though intensively managed and mediated by cultural and economic status for human aesthetics, are also locations of substantial ecological interactions. Many species such as birds (Warren et al. 2003) inhabit urban systems in response to patterns of urban vegetation diversity" (Martin et al. 2004, 366)*.

* Reprinted from C. A. Martin, P. S. Warren, and A. P. Kinzig. 2004. Neighborhood socioeconomic status is a useful predictor of perennial landscape vegetation in residential neighborhoods and embedded small parks of Phoenix, AZ, *Landscape and Urban Planning* 69: 355–368. © 2004 with permission of Elsevier.

Preventive management is needed to reduce compaction of soils

Jim, in a study of soils in Hong Kong, emphasized the need for care of urban soils, noting that: "for the future, it is necessary to adopt rigorous preventive measures during the construction phase to forestall the all too common problem of compaction (Lichter and Lindsey 1994). The need to incorporate a detailed soil study in site surveys cannot be too strongly emphasized (Marsh 1991). Similar to the preservation of trees of high amenity value, enclaves with good soil should be kept for vegetation rather than building or hard-surfaced uses. . . . For locations designated for heavy foot traffic, it may be necessary to adopt an innovative soil mix with a coarse matrix that can support trampling pressure and with sufficient fine materials and porosity to take care of root requirements (Grabosky and Bassuk 1995). In the storage, stockpiling, and handling of such materials, care should be taken not to introduce unwanted changes. The soil management measures can be suitably combined with a choice of more trampling-resistant grasses and other groundcover species, and a strategy to influence visitor movement and access to spread out and reduce overall impacts on green areas" (Jim 1998a, 692–693).

Site preparation and planting practices are key to the survival of trees

A park designer from Minneapolis, Minnesota, Ramadhyani has provided the following guidelines for tree planting:

"Use structural soils as the medium for planting street trees; when planting trees in a park, surround the tree with 4" depth of bark mulch to a diameter at least a great as the dripline; if possible, group several trees together in a large island of shredded mulch; unless using a tree space, plant trees of not more than 1.5" caliper (larger trees do not transplant well and grow slowly); be sure to plant trees at the appropriate time of year for the species; use good tree protection practices to protect existing trees during nearby construction; be sure that trees are planted with the root flare at or slightly above grade, not buried, and that ropes, cages, and burlap are removed from the trunk; planting trees in groups will minimize storm damage and wind throw to which isolated trees are vulnerable; avoid planting monocultures. Rigorously following practices such as these will maximize the survival of newly-planted and existing trees" (Ramadhyani 2004).

7

Wildlife

Issues

Animals need food, water, and shelter to complete their life cycles. In reality, small parks will never have much wildlife. However, they can be designed and managed to bring generalist species—that is, wildlife that can survive in a wide range of environments—into the city. Small parks certainly can be designed for birds, butterflies, amphibians such as frogs and toads, and small mammals such as rabbits and squirrels. In addition, the habitat quality of surrounding landscape can play an important supplementary role. Occasionally other kinds of species (called specialist species and area-sensitive species) have been surprising adaptable to urban conditions, especially if large patches of habitat are available in the metropolitan region. Even a few wildlife, seen close up, can provide a great deal of enjoyment and information to people.

Background

Ecological Issues

Urban wildlife may sound like a contradiction of terms; but cities are a place where certain types of wildlife can thrive given the right resources. Small parks can provide some of that habitat. It is well known that small predators, such as cats, raccoons, and skunks, can place strong pressure on wildlife, including songbirds and ground-nesting birds (Sorace 2002). This decreases reproductive rates and increases mortality rates and can be unsustainable (Crooks and Soulé 1999, 565; Lepczyk et al. 2003). In a study of free-ranging cats on a rural-to-urban gradient in Michigan, Lepczyk et al. found that each cat killed over 23 species of birds, averaging between 0.7 and 1.4 birds each week (Lepczyk et al. 2003, 191).

The tolerance of wildlife species to urban conditions depends on their life history. Generalist species are more typically able to cope with urban conditions, because they can use a wide range of habitats for food and cover. Specialist species, which include many endangered and threatened species, usually have some particular habitat requirement, such as patch size, core habitats, vegetation structure, vegetation composition, food resource, or other environmental conditions that limit their home range. Some species flourish in urban conditions, such as large populations of Canada geese and deer that can cause management problems, especially when people choose to feed these animals. In some parts of the United States, these species are considered to be pests.

The process of urbanization also brings certain changes that can potentially transform the ecology of urban landscapes. Many exotic plants and animals can be found in cities, and most are benign when they become naturalized in a metropolitan region. Yet, a small number of plants and animals, which lack natural predators or environmental limitations, become invasive species that radically outcompete other species. Examples include buckthorn, purple loosestrife, kudzu, zebra mussels, phragmites, and tamarisk. A major controversy in ecology about invasive exotic plants is how their establishment affects habitat quality for wildlife by reducing nesting success and increasing predation. No definitive scientific answer exists for this controversy because more research is needed for each individual species. But a recent study, in Ohio, by Borgmann and Rodewald (2004, 1757) found "nests in exotic shrubs in urbanizing landscapes were twice as likely to be depredated than nests in native shrubs," which was "likely due to reduced nest height and larger shrub volume." In their survey of literature, Collinge et al. (2003, 184) found several studies that showed that there is relationship between the presence of exotic shrubs, disturbed habitat, and the lack of more uncommon or native butterflies.

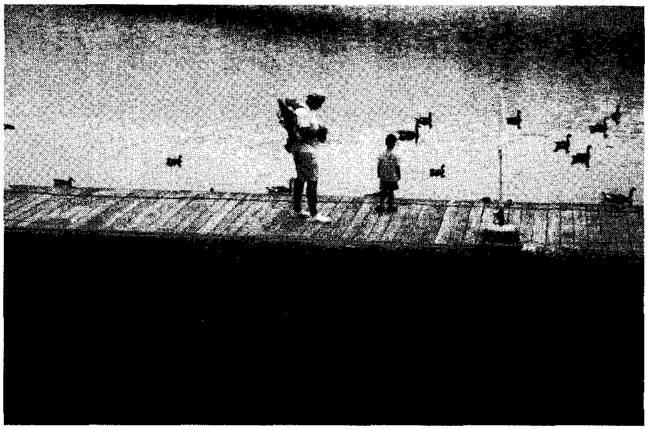
As with plants, a number of studies have shown dramatic changes in plant and animal composition along the urban-to-rural gradient. Most research on wildlife in urbanized areas has been done on birds and earthworms. Studies have shown rates of leaf decomposition are much higher in urban areas because of the higher numbers of earthworms, resulting in a thinner leaf layer that is less able to protect soil moisture and to prevent soil compaction (Kostel-Hughes et al. 1998). Plant-species diversity is also substantially different in urban centers versus rural areas. Because vegetation patches are more fragmented in metropolitan areas and often managed to minimize undergrowth, they have less interior habitat for wildlife because of the edge effect and less diversity of plant heights (DeGraaf 1987, 110; Tzilkowski et al. 1986, 393). As Raedeke and Raedeke (1995) concluded from a review of the literature:

> Birds, for instance, often partition a given habitat by using different layers or strata, such as forest floor, low shrubs, tree trunks, lower canopy, and upper canopy. More bird species will find adequate habitat in a patch that includes these various structural features. (Raedeke and Raedeke 1995, 142)

A. Canopy trees with little or no understory | B. Vertical layering of vegetation types | C. Low growing shrubs and flowers

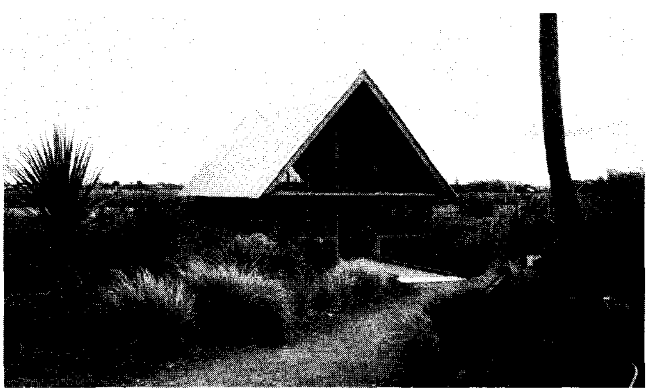
This diagram represents the gradient of vegetation types that can be found in an park. A. Canopy trees can provide shade and frame views in a park, but the absence of an understory decreases their habitat value. B. Having layers of vegetation types provides habitat value, but they may raise safety concerns in small parks. C. Low-growing shrubs and flowers are ideal in small parks, as they help maintain sight lines while still adding color and texture, but the limited vertical structure is inadequate for many urban wildlife species.

The amount of mature vegetation for particular habitat types, especially trees, in small remnants is also a concern. For example, a study of small urban vegetation remnants (<2.5 hectares, 6.2 acres) in Melbourne, Australia, found that urban remnants had fewer hollow-bearing trees, an important source of habitat for cavity-nesting birds and mammals, than unlogged, nonurban areas (Harper et al. 2005, 181). A study from Europe emphasized preserving mature decaying trees and patches in urban areas as a key management strategy for habitat protection (Mörtberg and Wallentinus 2000, 215).



In an urban setting, there are few places for humans to experience wildlife. Parks can provide an opportunity for humans and wildlife to interact on an intimate level. *Source: Ann Forsyth, used by permission.*

Sometimes wildlife can be a pest, such as these Canada Geese. Design strategies have often been employed so that humans and wildlife can peacefully coexist.



This structure in a larger park in Christchurch, New Zealand, houses educational materials on wildlife, and it is also a site for viewing wildlife in a coastal wetland. *Source: Laura Musacchio, used by permission.*

Park size (or area) is one of the most important determinants in species diversity. Given their limited size, the habitat in small parks is in general most suitable for primarily generalist species that are not area sensitive. The width and structure of vegetation at the surrounding edges of the park often plays a role in determining which species will inhabit the park. If a park is surrounded by a soft matrix (that is, heavily vegetated), then a wider range of species may occur in the site than if it is abruptly finished at a paved sidewalk. For example, a soft matrix in a desert environment like Tucson, Arizona, would include water courses, low-density housing, and natural open space; because they have the highest percentage of desirable habitats, such as native shrubs, grasses, and cacti (Livingston et al. 2003, 131). For additional discussion, see Connections and Edges, page 23–32, and Naturalness, pages 42–47).

Social Concerns

How people interact with wildlife is a key issue for small park designers and managers if they propose that the park function as a habitat. While some wildlife certainly become pests, watching wildlife—particularly birds and small mammals—is a source of fascination for many people. Either in parks or in nearby homes, people often try to increase birdlife by feeding it or other measures. For example, studies of central Montreal, Quebec, and an exurban development outside Fort Collins, Colorado, found increased bird numbers in these areas due to bird feeding, artificial nests, and in the case of Colorado, landscaping that provides "vertical habitat structure, otherwise missing from this shrub-grassland plant community" (Maestas et al. 2003, 1431; Morneau et al. 1999, 119). Examples like these show why ecosystems in human-dominated landscapes have different dynamics than those in more pristine places. For example, Singer and Gilbert (1978) associated bird feeding in Britain with higher bird populations, which then ate butterfly eggs and larvae (Singer and Gilbert 1978, 5). Of course, small parks are not in any sense pristine habitats, but care should be taken to balance the educational benefits of constant wildlife presence with larger ecological-management goals.

A second social tension over habitat is the problem of crime. As is outlined in Safety, pages 83–87, people are likely to feel less safe in areas with thick, dense vegetation; however, these are often the areas most suitable for wildlife. (For relevant crime-management strategies, see Management, pages 88–94.)

Guidelines

1. Reduce the proportion of edge habitat by creating transition zones of shrubs and ground covers between trees and surrounding land uses, but maintain adequate sight lines for safety reasons. Transition zones should be as wide as possible where space is available. In addition, consider connections with habitat beyond the park to include the surrounding urban matrix of backyards, institutional open spaces, and remnant woodlots.

2. If possible, preserve the vertical layering of vegetation to maintain habitat quality for wildlife, but maintain critical views for public safety. By increasing the complexity of the low-shrub layer, from 21 to 50 cm (8.27 to 19.69 inches) above the ground, the number of mammals will increase (Dickman 1978, 346).

3. Provide a water source to attract wildlife. This site could be good for environmental education.

4. If possible, maintain areas with deadwood, snags, and undergrowth to diversify habitat complexity. If an area is accessible to the public, try to make these areas look cared for to increase social acceptance. Areas that look neglected are usually not welcomed by the public.

5. Limit the number of paths and desire lines (preferred cuts-through) through habitat areas in a park to reduce fragmentation and rehabilitate remnant habitat. Locate paths on the edges of the habitat and natural areas, where possible.

6. Maintain a relatively open canopy along trails in order to improve the perception of safety. Create a gradient of vegetation structure from the trail to the interior habitat that gradually becomes more complex in species composition and abundance and is reflective of plant species in the ecoregion.

7. Where appropriate, encourage neighbors to take part in backyard-wildlife programs that provide additional feeders and water sources for birds and other animals. Morneau et al. (1999, 119) found that feeding increased the number of bird species in small areas in Montreal parks. However, this practice is controversial and can cause problems when migratory animals fail to migrate due to these food sources (Singer and Gilbert 1978, 5).

8. Find good scientific information about the potential wildlife species that occur in the metropolitan area's small parks. Such information is available at natural history museums, nature centers, libraries, and governmental agencies. Information about threatened and endangered species, as well as species of concern, are of particular interest. Integrate this information into management plans to prioritize regional habitat management goals and the role of small parks with desirable habitats.

9. Plant a wide range of deciduous and evergreen plants for habitat in parks region-wide. Pay special attention to selecting pollution tolerant evergreen plants, where these provide important habitat (Jokimäki and Suhonen 1998, 260). This should include such priorities as maintaining tree and cactus cavities for cavity-using bird species.

GUIDELINES FOR IMPROVING BIRD HABITAT IN METROPOLITAN AREAS*

- Increase the foliage height diversity within fragments. . . .
- Maintain native vegetation and deadwood in the fragment. . . .
- Manage the landscape surrounding the fragment (matrix), not just the fragment. . . .
- Design buffers that reduce penetration of undesirable agents from the matrix. . . .
- Recognize that human activity is not compatible with interior conditions. . . .
- Make the matrix more like the native habitat fragments. . . .
- Actively manage mammal populations in fragments. . . .
- Discourage open lawns on public and private property. . . .
- Provide statutory recognition of the value of complexes of small wetlands. . . .
- Integrate urban parks into the native habitat reserve system. . . .
- Anticipate urbanization and seek creative ways to increase native habitat and manage it collectively. . . .
- Reduce the growing effects of urbanization on once remote natural areas. . . .
- Realize that fragments may be best suited to conserve only a few species. . . .
- Develop monitoring programs that measure fitness. . . .
- Develop a new educational paradigm.

Guidelines for Improving Wildlife Habitat in Stormwater Ponds and Wetlands†

- Impoundments with gently sloping sides (on the order of 10:1) are preferable to impoundments with steep slopes. In our Columbia study, ponds with average side slopes of 16:1 were superior to ponds with average side slopes of 3:1. Gently sloping sides will encourage the establishment of marsh vegetation. Vegetation will provide food and cover for wildlife and help to enhance water quality. Impoundments with gently sloping sides are safer than steep-sided ponds for children who might enter the impoundments.
- Water depth should not exceed 24 inches (61 cm) for 25–50 percent of the water surface area, with approximately 50–75 percent having a depth not less than 3.5 to 4 feet (1.1–1.2 m). A greater depth may be advisable for more northern areas subject to greater ice depths.
- An emergent vegetation/open water ratio of about 50:50 should be maintained (Hobaugh and Teer 1981, Weller 1978).
- For larger impoundments (approximately 5 acres: 2 ha or more), one or more small islands are recommended. The shape and position of islands should be designed to help direct water flow within the impoundment. Water flow around and between islands can help to oxygenate the water and prevent stagnation. Water quality can be enhanced by a flow-through system where water is continually flushed through the impoundment (Harris et al. 1981). Islands should be gently sloped, and the tops should be graded to provide good drainage. Appropriate vegetative cover should be established to prevent erosion and provide bird nesting cover. Consideration should be given to including an overland flow area in the design of large impoundments. . . .
- Impoundments should be designed with the capability to regulate water levels, include complete drainage, and with facilities for cleaning, if necessary.
- Locating permanent-water impoundments near existing wetlands generally will enhance wildlife values of impoundments.

**Marzluff and Ewing 2001, 285–289, Blackwell Publishing.*

†Adams et al. 1986, 258.

FINE PRINT FACTS

Forest birds in certain types of urban vegetation groupings over others

A theoretical analysis of vegetation spacing based on island biogeography found that vegetation clumps are preferred to more simple types of groups such as individual specimen and border plantings:

"Essentially, all the elements of vegetation which are present in urban situations can be placed in three groups: *borders*—usually continuous plantings many times as long as they are wide, *individual specimen plantings* (of shrubs or trees) which may follow a lot boundary, or may exist as individual plants located anywhere on the lot, and *vegetation clumps* in which the foliage of adjacent plants touches or nearly touches, just as occurs in natural woodlands.

"Species' tolerances vary, but generally, from the point of view breeding forest birds, these three groups are of quite different degrees of usefulness. . . . Specimens are simply too small to provide much habitat to a woodland bird, and their spatial separation form other specimens means that birds have both psychological and energetic barriers in foraging between specimens. Borders generally do provide continuous vegetation, but their ultra-narrow, strip-like geometry also entails both psychological and energetic problems for birds.

"Only vegetation clumps hold much promise of providing the range of needs that a wide variety of forest birds must have to successfully reproduce" (Goldstein et al. 1981, 116).

Streets and parks provide different quality of habitats

In a study of three types of habitats in Madrid, Spain, including streets without vegetation, wooded streets, and urban parks, researchers found urban parks had the most suitable habitat of the three types:

"The number of species recorded increased from the least suitable (control streets without vegetation) to the most suitable habitats (urban parks), with wooded streets being intermediate landscape elements" (Fernandez-Juricic 2000, 513, Blackwell Publishing).

Fernandez-Juricic also found that bird species have different abilities of moving easily along wooded corridors:

"Species may differ in their probability of movement along corridors; for instance, species with short natal and breeding dispersal distances could face high mortality rates while moving through corridors relative to the amount of time spent within the corridor (Tischendorf and Wissel 1997). Thus, any management undertaking ought to evaluate the requirements and abilities of individual species to survive in a fragmented landscape supported by corridors (Saunders & de Rebeira 1991; Saunders & Hobbs 1991)" (Fernandez-Juricic 2000, 514, Blackwell Publishing).

However, bird species diversity decreased along wooded streets compared with urban parks. Fernandez-Juricic reported that the density of a species must reach a certain threshold before individuals will move into corridors:

"Provided a species follows a density-dependent pattern of corridor occupation, it could be argued that density in fragments needs to reach a certain threshold before individuals begin spilling into corridors. Therefore, species density in fragments should be evaluated before corridor implementation, as an alternative indicator of the probabilities of corridor occupation. If the density of species in fragments is small, corridors may end up being useless, and alternatives (such as reintroduction) would be far more effective" (Fernandez-Juricic 2001, 286, Blackwell Publishing).

Breeding birds, age of neighborhoods, and habitat conditions

Based on the age of the neighborhood, DeGraaf and Wentworth (1986, 408) found important habitat preferences for different groups of birds:

"Insectivores (except air screeners) were strongly associated with measures of tree cover and showed affinity for woodlots (i.e. were negatively correlated with distance to the nearest woodlot). Seed eaters and omnivorous ground foragers were strongly associated with the area of herbaceous growth and with large shade trees; but seed eaters avoided woodlots, i.e. were positively correlated with distance to the nearest woodlot. . . .

"Ground/herb nesters were negatively correlated with most tree variables and positively correlated with area of weed growth and area of mowed lawn. Shrub nesters showed a strong negative correlation with the density of coniferous shrubs but were positively correlated with coniferous shrub height, suggesting that the maturity and development of shrubs were more important than the number of shrubs present. Shrub nesters were also negatively correlated with the height to crown of trees, indicating a possible affinity for lower tree branches by members of this guild, or that they used the lower portion of a vertical foliage continuum. The tree twig, tree branch, and tree cavity guilds all displayed similar habitat associations, showing a strong positive affinity for all measures of tree canopy development. In addition, all three were negatively correlated with lawn area. . . . Finally, building nesters, which were not associated with housing density, were associated with large open-grown trees (low height to crown) and lawn area particularly. Species that commonly nest on buildings were here associated with ornate older homes. . . . So, architectural style seems to determine avian nesting more than mere number of buildings" (DeGraaf and Wentworth 1986, 408).

Mild disturbance can increase butterfly species diversity but reduce the abundance of species from the predevelopment state

Blair and Launer looked at the distribution and abundance of butterfly species in six sites across an urban gradient in Palo Alto—specifically, butterflies of the oak-woodland community of the central California coast. They found:

"The species richness and Shannon diversity of butterflies peaked at moderately disturbed sites while the relative abundance decreased from the natural to the urban areas. Butterfly species thought to be the most representative of the original, predevelopment butterfly fauna progressively disappear as the sites become more urban" (Blair and Launer 1997, 113).

The Shannon Index "combines the number of species within a site with the relative abundance of each species" (Blair and Launer 1997, 115).

They recommend cluster development as their preferred strategy to protect butterflies in oak woodlands:

"The pattern of deletion of species from the original oak-woodland community that occurs across this urban gradient suggests that any development is detrimental to the original butterfly assemblage . . . If planners aim to maintain predevelopment levels of biodiversity, then any development should be concentrated. A well-landscaped office park is not an environmentally friendly type of development. It would be better—from the point of maintaining original communities—to concentrate business endeavors in as small an area as possible such as a business district and then keep the land that is not developed in as natural state as possible" (Blair and Launer 1997, 119–120)*.

Mammalian, amphibian, and reptile richness decreases with certain settlement patterns

A study of species richness in fifty habitat patches sized 0.16 to 20 hectares (0.4 to 49.4 acres) and located in Oxford, England, found certain settlement patterns decrease mammal species richness:

"Mammalian species richness increased with increasing density of vegetation per patch, especially in the layer 21–50 cm above ground. This layer constitutes a habitat component used frequently in nonurban areas by at least fourteen of the twenty recorded species (Corbet & Southern 1977), and is well developed in scrub, orchard, long grass and woodland, but sparse in other habitats. However, increasing patchiness in the vegetation structure reduced mammalian species richness, perhaps because this increases the intensity of predation from cats, dogs and raptors within patches" (Dickman 1987, 346, Blackwell Publishing).

Dickman also had results that contradict ideas about diversity in large patch versus several small patches with the same area: "For all the vertebrate taxa, more species were usually retained in two small habitat patches than would be expected in a single larger patch equal to their combined area" (Dickman 1987, 346, Blackwell Publishing).

* Reprinted from R. B. Blair and A. E. Launer. 1997. Butterfly diversity and human land use: Species assemblages along an urban gradient, *Biological Conservation* 80: 113–125. © 1997 with the permission of Elsevier.

He also prescribes minimum patch sizes for mammals, amphibians, and reptiles. For the mammals in this study, Dickman notes:

"The minimum woodland area should be at least 0.65 ha, since all species of mammals except the dormouse *Muscardinus avellanarius* were recorded at least once in patches of this size of larger. The species richness of urban amphibians and reptiles can probably be conserved in habitat patches that provide permanent sources of water. As for mammals, these patches need not be large. Except for the palmate newt *Triturus helveticus* which occurred only in a patch of 7.4 ha, all species were recorded at least once in patches of 0.55 ha or larger" (Dickman 1987, 346, Blackwell Publishing).

Management strategies can improve the quality of habitat in vegetation fragments

Marzluff and Ewing provide these suggestions for improving species richness and habitat conditions.

"Key elements that should be present in restored fragments include: standing deadwood, complex woody debris, complex vertical and horizontal structure, protected interior areas, undeveloped riparian zones, undeveloped slopes and cliffs, high native plant diversity, invasive plant control, minimal lawn area, high diversity of shrubs that produce berries, nuts, or nectar, control of exotic mammals including house pets, reduced supplementation of native predator and parasite populations, monitoring programs that measure fitness and dispersal, and integrated education, research, and outreach activities that foster citizen support" (Marzluff and Ewing 2001, 285).

8

Climate and Air

Issues

Park use is deeply affected by the weather, time of day, and season. However, the design of individual parks, especially the use of trees, can moderate air temperature and air quality at a neighborhood level. If many parks are scattered across a metropolitan area, they may also modify the urban heat island effect. It is not just a matter of the more trees the better—to achieve benefits requires very careful tree selection according to such variables as location, arrangement, leaf type, and maintenance requirements.

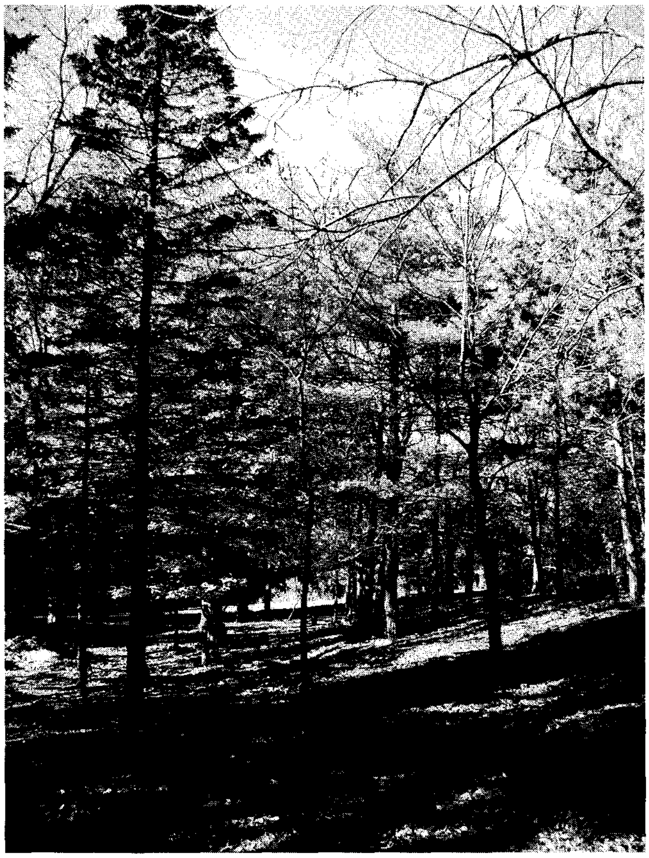
Background

There are three main urban air-quality and climate problems that small parks can help solve: the urban heat island effect, local air pollution, and potentially global warming. Other emerging issues include ultraviolet radiation and energy conservation. These issues are interconnected.

Social and Ecological Issues

Urban Heat Island: The urban heat island is the term for increased temperatures in urban areas due to greater absorption and storage of heat in the hardscape of building and paving materials, as well as heat generated though combustion from vehicles, lawn mowers, and industries (Spirn 1984, 52–55).

The urban heat island increases minimum temperatures and extends warm periods in each day and each year (Baker et al. 2003, 196; Brazel et al. 2000, 134). The urban heat island influences air quality by (1) increasing ozone formation (exacerbating respiratory ailments, such as asthma), and (2) increasing the precursors of ozone (volatile organic compounds, or VOCs) (Stone and Rogers 2001, 188). In warm climates, this is a particular problem, adding to air-conditioning loads in buildings. For example, in desert climates of the United States, this occurs when the number of cooling days increases in the seasonal shoulder months of April, May, October, and November (Baker et al. 2003, 195–197).



A mixture of coniferous and deciduous species is ideal for improving air quality because of the density and shape of needles in coniferous trees.

Trees reduce air temperature, particularly in the afternoons (Henry and Dicks 1987, 27). As Spirn explains:

> The microclimate of a large, tree-filled park resembles that of a woodland. It shows up as a "cold spot" on the infrared photograph. . . . Although daytime air temperatures are similar to those above adjacent city streets, the park feels cooler because there is more shade, less glare, and less heat radiated from lawn and trees. (Spirn 1984, 60)

However, grass alone has a less clear effect. Reflective, light-colored building surfaces are also very effective at reducing heat build up (Akbari et al. 1990, 1386; Garbesi et al. 1989). While metropolitan areas are generally warmer than rural environments, "in desert cities, urban landscaping may produce more evapotranspiration than the surrounding desert, actually lowering the temperature of the city below that of the surrounding area," creating what is called an oasis effect (Garbesi et al. 1989, 4–5; Akbari et al. 1990, 1385).

Further, people do seek out warmth in outdoor spaces, particularly on cooler days and in cooler climates, so it is important to provide "sun pockets," protected from the wind, so that people can enjoy outdoor spaces in colder periods (Spirn 1984; Whyte 1980; Zacharias et al. 2001, 309). A study of seven downtown plazas found that not until the temperature reached a warm 24°C (75°F) was there "an apparent decline in presence [of people] and in sun seeking" (Zacharias et al. 2001, 306).

Local Air Pollution: Local air pollution comes from a variety of sources. For example, as the Fine Print Facts (page 72) explain, most hydrocarbon emissions come from "tailpipe exhaust, [but] approximately 9.7 tons per

Shading parked cars is an effective way to reduce 16% of hydrocarbon emissions that are released from parked cars in warm areas, such as California (see McPherson and Simpson 1999). *Source: Ann Forsyth, used by permission.*

day (16%) are from evaporative emissions that occur during the daytime heating of fuel delivery systems of parked vehicles" (McPherson and Simpson 1999). Thus heat is a factor in this form of air pollution coming from parked cars and trees can provide shade to reduce this form of pollution at the source.

Once pollutants are in the air, vegetation can play a role in removing them. Based on a literature review, Smith concluded that "there are six natural mechanisms by which gaseous air contaminants are removed from the atmosphere: (1) soil absorption, (2) absorption by water bodies, (3) absorption by rock, (4) rainout and washout (scavenging), (5) chemical reaction in the atmosphere, and (6) foliar absorption by vegetation" (Smith 1976, 292). For vegetation to remove pollutants, it needs to have "dense branches, rough bark and twigs, and hairy leaves with a high ratio of surface to volume" to be planted in "soil covered in leaves and plants, rather than pavement" (Spirn 1984, 72). However, not all pollutants can be removed using vegetation. The most easily absorbed are "hydrogen fluoride, sulfur dioxide, nitrogen dioxide, and ozone," and absorption is best in the daytime when plants are damp (Smith 1976, 294–295).

The importance of urban forests for air pollution control also varies with region. For example, a study in California found tree canopy greater in urban than in rural areas, and recommended increasing planting densities in metropolitan areas where pollutants are generated (see Scott et al. 1998, 229–230).

Global Warming: As is explained in Fine Print Facts (page 71), the combination of good maintenance and short-lived urban trees may mean that urban trees release more carbon than they sequester, though trees in small parks should be longer lived than street trees. However, trees can play a significant role in the reduction of carbon emissions by reducing energy consumption in cooling. As Akbari et al. explain:

> A fast-growing forest tree sequesters carbon at the rate of approximately 13 lb. carbon per year. Therefore, 100 million trees could directly sequester 0.65 million tons of carbon, or only one-fifteenth of the energy saved through their reduction in cooling energy use [if planted in urban areas]. To directly sequester the amount of carbon saved by the planting of 100 million urban trees would require planting 1.5 billion forest trees corresponding to 1.5 million hectares of forest (by comparison, the total area of Connecticut is about 1.3 million hectares). (Akbari et al. 1990, 1387)

Other Issues

Other important issues have been less well researched but may become more important. With ozone depletion, particularly in the southern hemisphere, shade has become an important factor in preventing skin cancer. Trees are also important in local energy conservation, although this has generally been examined in relation to buildings. However, plants can provide wind breaks, cutting heating costs, provide shade, and evapotranspirate to reduce cooling loads. This is a complement to their temperature-moderating effects in relation to the urban heat island.

Guidelines

1. Buffer activity areas from polluted streets: "Sitting areas, and playgrounds should be set back beyond the polluted zone, more than 150 feet (45.7 m) from the street edge whenever possible, and separated from the roadway by belts of trees, which should be spaced far enough apart to permit the free movement of air under their canopies" (Spirn 1984, 72). Large buffers of up to 150 meters (492 feet) in width may be needed for significant air pollutant removal (Smith 1980, 297–298), see Connections and Edges, pages 23–32.

2. Create small sun pockets. While it is important to plant trees for shade for both people and paving, some sunny areas are needed for sheltered, outdoor warmth on colder days. These should not just be sunny spaces but spaces protected from winds and with hard surfaces to absorb sunlight (Cooper Marcus and Francis 1998, 91; Spirn 1984).

3. Maximize tree canopy, even if it is thin. Based on a study of the urban heat island in Atlanta: "A thin but well distributed canopy of trees is likely to be more thermally efficient than a dense cluster that leaves a large proportion of the property completely unshaded. Street trees should be required to provide shading over hot street surfaces, sidewalks, and houses" (Stone and Rodgers 2001, 194).

4. Use efficient parking-lot designs, light paving materials, and incorporate shade trees into the design to cool the lot in summer. Creating a parking lot that is a park for cars is not only aesthetically pleasing but will reduce pollutant emissions.

5. For removal of air pollutants throughout the year, use a mixture of tree species that are drought resistant and can withstand urban conditions.

   - "For particulate removal, species with high ratios of leaf circumference to area and surface to volume, and with leaf surface roughness, should be favored" (Smith 1980, 297). Conifers have high surface to volume ratios (Smith and Dochinger 1976, 56–57).
   - Conifers and deciduous trees with lots of twigs can help remove particulates during winter. Species with long petioles, or leaf stems, such as ash, aspen, and maple, can also be efficient in removing particulates (Smith and Dochinger 1976, 56–57).
   - "A balance must be struck between a stratified forest and a forest impermeable to air mass movement. A multilayered forest—soil, herb, shrub, and tree layers—is a more effective pollutant sink than an unstratified forest. If the edge strata are overlapping and dense, however, the stand of trees may force air masses up and over and be a relatively ineffective sink. Careful silvicultural practice will be necessary to maintain appropriate structure and density" (Smith 1980, 298, © 1980 American Forests).

FINE PRINT FACTS

Removal of air contaminants by plants—key factors for different pollutants

In a review essay, Smith (1980) makes the following summary of the key findings about the removal of air contaminants by plants:

"1. In general, plant uptake rates increase as the solubility of the pollutant in water increases. Hydrogen fluoride, sulfur dioxide, nitrogen dioxide, and ozone, which are soluble and reactive, are readily absorbed pollutants. Nitrogen oxide and carbon monoxide, which are very insoluble, are absorbed relatively slowly or not at all by vegetation.
2. When vegetative surfaces are wet (damp), the pollutant removal rate may increase up to tenfold. Under damp conditions, the entire plant surface—leaves, twigs, branches, stems—are available for uptake.
3. Light plays a critical role in determining physiological activities of the leaf and stomatal opening and as such exerts great influence on foliar removal of pollutants. Under conditions of adequate soil moisture, however, pollutant uptake by vegetation is almost constant throughout the day, as the stomata are fully open. Moisture stress sufficient to limit stomatal opening, relatively common in various urban environments, would severely restrict uptake of gaseous pollutants.
4. Pollutants are absorbed most efficiently by plant foliage near canopy surface where light-mediated metabolic and pollutant diffusively rates are greatest.
5. Sulfur and nitrogen dioxides are taken up by respiring leaves in the dark, but uptake rates are greatly reduced relative to rates in the light.
6. Models of vegetative removal pollutants may show limited removal relative to the total pollution load but do demonstrate effective reductions in ground level concentrations, the site of most immediate health concern" (Smith 1980, 294–295, © 1980 American Forests).

Sun pockets and shady havens

Spirn suggests parks designed around sun pockets have a more pleasant microclimate that encourages more activity:

"A sunpocket, a protected place that feels 10 degrees to 40 degrees Fahrenheit warmer than a more exposed spot nearby, can extend the use of an outdoor space by two or three months in a cool climate. It is a paved, south-facing corner, protected from the wind; its walls catch sunlight and reflect it back into the space. . . . Sunpockets have a desertlike microclimate—warm and dry while the sun is out, cold on a winter night after sunset—so plants chosen for such a place must be able to tolerate these extremes.

"Shady havens, like Paley Park, and sunpockets are based upon the same principles of heat exchange.

"Shady havens prevent heat gain and encourage heat loss by blocking direct sunlight, by preventing the absorption of heat in surrounding surfaces and its subsequent reradiating, and by encouraging evaporation and the penetration of breezes. Sunpockets enhance heat gain and retard heat loss by capturing sunlight, by facilitating the absorption of heat in surrounding walls and pavement, and by blocking wind. . . . Ideally, shady havens and sunpockets should be located throughout the city, integrated into plazas and parks" (Spirn 1984, 76–77).

Urban heat island definition

In a review of the literature, Stone and Rogers outline the major role that the urban heat island effect plays in urban design:

"Through a climatological phenomenon known as the *urban heat island effect*, large urbanized regions have been shown to physically alter their climates in the form of elevated temperatures relative to rural areas at their peripheries. Similar to the effect of global warming, such 'urban warming' can have substantial implications for air quality and human health within affected regions. Indeed, while global warming forecasts predict a rise in temperatures of 3.5 to 6°F (1.9 to 3.5°C) over the next century (Intergovernmental Panel on Climate Change 1995), large urbanized regions are already routinely measured to be 6 to 8°F (3.3 to 4.4°C) warmer than surrounding rural regions (U.S. Department of Energy 1996). Increasing at a rate of 0.25 to 2°F (0.1 to 1.1°C) per decade, the heat island effect within the urban cores of rapidly growing metropolitan regions may double within 50 years (McPherson 1994)" (Stone and Rodgers 2001, 187).

Smog formation and urban heat islands

Warmer temperatures will exacerbate smog episodes in urban areas: "In major cities, smog episodes are absent below 70°F, but they become unacceptable by 90°F, so a rise of 10°F because of past or future heat island effects is very significant" (Akbari et al. 1990, 1381).

Direct and indirect effects of urban trees on climate modification and carbon sequestration rates

Akbari et al. continue in their overview that trees can aid in climate modification, energy savings, and carbon sequestration:

"Parker (1981) measured cooling savings resulting from well-planned landscaping and found that properly located trees and shrubs reduced daily air-conditioning electricity by as much as 50%.

"Trees affect energy use in buildings through direct processes such as (1) reducing solar heat gain through windows, walls, and roofs by shading, (2) reducing the radiant heat gain from surroundings by shading and view factor reduction; and (3) reducing infiltration by shielding a particular building from wind. Deciduous trees are beneficial because they allow solar gain in buildings during wintertime.

"On the other hand, the indirect effects of trees include (1) reducing rate of outside air infiltration by increasing surface roughness and decreasing urban wind speeds and (2) reducing the heat gain of buildings by lowering ambient air temperatures through evapotranspiration (the evaporation of water from soil-vegetation systems). On hot summer days, trees act as natural 'evaporative coolers,' using up to 100 gallons of water a day each, thus lowering the ambient temperature. *A significant increase in* urban trees leads to increased evapotranspiration, thus producing an 'oasis effect' and significantly lowering urban ambient temperatures" (Akbari et al. 1990, 1385).

Street networks and urban temperatures

In a study of Atlanta, Georgia, Stone and Rodgers found that street-network density has "significant negative effect on net thermal emissions" and "tree canopy cover." However, they found that "higher intersection densities are associated with lower levels of heat production and reduced tree canopy per parcel," so "configuration of trees throughout a neighborhood may be more significant to heat production than the total number of trees" (Stone and Rodgers 2001, 194).

However, urban tree maintenance may mean greenhouse costs outweigh benefits

Longer lived urban trees need to be used in order to increase the benefits of carbon sequestration:

"In recent studies by Dr. David Nowak and Dr. Greg McPherson of the USDA Forest Service, it has been suggested that if urban trees are properly maintained over their lifespan, the carbon costs outweigh the benefits. Tree maintenance equipment such as chain saws, chippers, and backhoes emit carbon into the atmosphere. Carbon released from maintenance equipment and from decaying or dying trees conceivably cause a carbon benefit deficit if it exceeds in volume the amount sequestered by trees."

"To maximize the carbon storage/sequestration benefits of urban trees, the USFS suggests planting larger and longer-lived species in urban areas so that more carbon can be stored, mortality rates can be decreased and maintenance methods can be revised over time as technology improves." (© 2004 American Forests)

Local pollutants and heat

McPherson and Simpson studied temperatures in parking lots and used these to calculate emissions from parked cars. They outlined how "ozone is a serious air pollution problem in most large cities. In Sacramento county metropolitan area, motor vehicles are a major source of ozone precursors, contributing approximately 59 tons per day (TPD) (68% of total) nitrogen oxides (NO_x), and 59 tpd (49% of the total) anthropogenic hydrocarbon (HC) emissions.

"While the bulk of HC emissions are from tailpipe exhaust, approximately 9.7 tpd (16%) are from evaporative emissions that occur during the daytime heating of fuel delivery systems of parked vehicles. Evaporative emissions, as well as exhaust emissions during the first few minutes of engine operation (primarily NO_x) are sensitive to local microclimates." (McPherson and Simpson 1999) "*Peak daytime temperatures at the shaded parking lot averaged 1 to 2°C cooler than the unshaded site.* Temperature differences were considered conservative due to the relatively sparse tree cover. *Fuel tank temperatures of the shaded car were 2 to 4°C than fuel tank temperatures of the unshaded car. . . . Average vehicle cabin temperature was 26°C cooler in the shaded vehicle for the period 1300 to 1600 PST*" (McPherson and Simpson 1999).

Local pollutants in areas where tree canopies are denser in urban than rural areas

Urban areas are not always warmer than rural ones, and in dry locations the urban area may have significantly more tree cover than the surrounding countryside. In a study of Sacramento, California, Scott et al. Conclude:

"Urban land uses with the highest rates of pollutant uptake include residential areas, institutions (e.g., parks, campuses), and vacant unmanaged, or natural areas. Furthermore, the institutional, commercial/industrial, and vacant/wild land uses for the city and suburban sectors also have high potential for additional tree planting (McPherson 1998). Unlike urban areas in the Midwest or eastern United States, canopy cover decreases along an urban-to-rural gradient. Therefore, estimated pollutant uptake rate per unit land are were highest for residential and institutional land uses, compared to natural or unmanaged lands. Possible management implications of these estimates are that air pollutant uptake benefits from tree planting may be optimized by planting in areas where air pollutant concentrations are elevated and where relatively high planting densities can be achieved" (Scott et al. 1998, 229–230).

9

Activities and Groups

Issues

People vary in how they use parks, the activities that they engage in, and the groups that they visit parks with. In small parks, there is a large potential for conflicts between these activities. Some activities do not take up much space, for example, sitting on a park bench. However, others require larger areas. Some people go to parks as individuals and pairs; but others use parks with peer groups or with large, extended families. Recently, the role of parks in active living has come to some prominence, and while it is not clear that access to parks increases physical activity, parks do provide unique opportunities for recreation. Careful design can go some of the way toward enabling spaces to be used

Parks can provide space for informal groups of people to relax and socialize. *Source: Ann Forsyth, used by permission.*

Parks provide a place for people of all ages to gather and socialize and are particularly important for children and older people. The men in this photo enjoy a game of dominoes. *Source: Ann Forsyth, used by permission.*

by multiple groups and for different activities, particularly if such sharing can occur over the course of a day, week, season, or year.

Background

Small parks typically accommodate activities that are part of the daily and weekly cycle of life, occurring close to home or work. For example such activities might include having lunch in the park, walking the dog, or using the playground. Some activities are intense, conducted with close friends, and others let people see and hear each other without further interaction (Gehl 1987, 17). The exact activities that any particular park needs to support will vary with location and demographics.

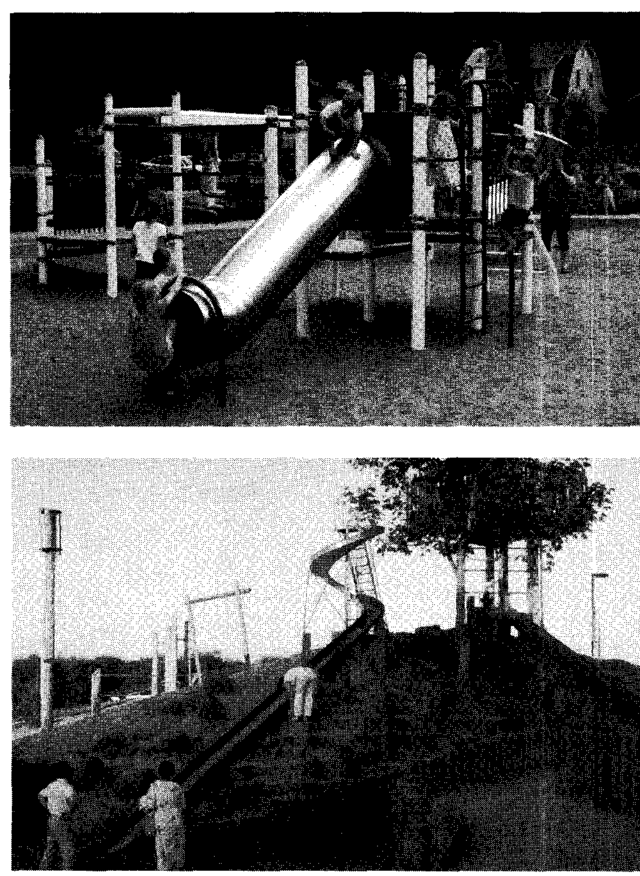
Systematic Differences

Numerous studies have found systematic differences among people of different residential locations, ages, ethnicities, genders, and class and income levels in terms of what they do in parks and in what kinds of groups.

Residential Location: A number of studies have found a broad pattern that many adult, suburban residents have more interest in wildlife and the outdoors than center-city residents; more liking for naturalistic designs; and tend to treat parks as scenery rather than as a place for activities. For these people, looking at a park is an important activity. In contrast, residents of the center city see parks as a location for "active recreation and socializing" (Schroeder 1989, 104, 105). Research from Europe emphasizes that many people in cities value social, cultural, and historical activities in "smaller, neatly cultivated parks where people can see and encounter the cultural expressions and values of society and where they can see and meet people" (Van Herzele and Wiedemann 2003, 114). Of course, this is a generalization.

Age: Urban-recreational activities are also distinguished by people's ages, with parks providing an important setting for children's play and for socializing and connections to nature for seniors (Cooper Marcus and Francis 1998, 93–95).

Children living in the core of the metropolitan area, have a special relationship with parks. For those in central cities, parks may be the main area where they can move around as fewer children in center cities have large backyards for free play, play equipment, digging, planting, and other similar activities. However, in suburban areas, parks provide opportunities for social interaction that may not be provided by the yard of a house or suburban apartment. Play itself comes in various forms, ranging from games with rules, to construction, to fantasy (see Fine Print Facts, page 80). As Moore et al. (1992, 4) outline, child development theory and empirical studies indicate six key opportunities that should be provided by play environments: motor skill



Children's play areas are often found in small parks, and are an activity center for both children and their parents. *Source for 9.4: Ann Forsyth, used by permission.*

development, decision making involving some control over the environment, learning, dramatic play, social development, and fun.

Overall, it is crucially important to provide opportunities for different types of play appropriate to different age groups and levels of physical competence (Barbour 1999, 96). However, in general, children prefer " 'adventure' playgrounds [that] incorporate various types of moveable materials and tools for children to use in constructing their own play structures" (Barbour 1999, 76). Classic adventure playgrounds are quite different from the static equipment in many parks, but they allow children to interact with the environment (Hart 1974, 1979; Moore 1974; Francis 1995). As Hart recounted, following his two-year participant observation study in a Vermont town, "Places are built by the children more for the joy and challenge of building than for their uses as finished artifacts" (Hart 1974, 360). At a minimum, play structures should encourage creative options for imaginative play as well as opportunities for muscle and large motor-skill development. Children also like a sense of enclosure from shrubs or structures and to have access to distinctive spaces for different ages—preschool, elementary, and teens—and even special spaces for friendship groups within these age categories (Kirkby 1989, 11; Loukaitou-Sideris 2003).

Older people also use parks, and parks may be important social centers for seniors. However, seniors are not a homogenous group; there are significant differences among men and women and among ethnic groups in terms of park usage. Tinsley et al. (2002) conducted a study that is typical of work focusing on such differences. The researchers examined use of parks by older people from four ethnic groups via interviews of visitors in the 1,208 acre (488 hectares) Lincoln Park in Chicago. They conducted a total of 463 interviews with people aged 55–93. The researchers found significant ethnic differences among these older people in their use of parks, with Asians and Hispanics coming to the park in larger groups of friends and family and rating "affiliation" as a much more important benefit of park visits than exercise and self-enhancement, which was quite different from the goals of Caucasian and African-American park users.

Parks have different functions for people of various ethnic groups. Latinos often use parks for large social gatherings. *Source: Ann Forsyth, used by permission.*

Ethnic Differences: As can be seen from the previous paragraph, while there is much individual variation among people of any particular ethnic group, study after study in major cities such as Los Angeles and Chicago finds a strong intersection between ethnicity, group type, and activity. Latinos often use parks in large family groups, and they conduct social activities such as picnics in these parks. African Americans go to parks in peer groups and frequently play sports. Whites often go alone to parks, except for groups of elderly or if watching children, and they often value aesthetics (Schroeder 1989, 104; Gobster 2001; Gobster and Delgado 1993, 76; Loukaitou-Sideris 1995, 94–96). For example, Gobster observed 898 black, Latino, Asian, white users of Chicago's Lincoln Park and found large differences in

Small parks can provide space for solitary activities such as reading. In the United States, those of European descent are more likely than other groups to go to parks alone.

Recreational facilities, such as this basketball court, are often a central-activity area in small parks, and they are frequently used by groups of age peers.

group size. Average group size for whites was 1.6 people, compared with "3.7 for Blacks, [and] 4.4 for Latinos," with significant numbers of Latinos coming in groups of 10 or more (Gobster 2002, 147).

Asians are a more diverse group, and so it is even harder to generalize. Work from Chicago found large family groups, with an average group size of 5.0, and comparable to Latinos, over 10% of those in groups of 10 or more (Gobster 2002, 147). Work from Los Angeles found little use of parks by Asians and where it did occur it was primarily older men—socializing. This lack of use was partly because ethnic Chinese valued gorgeous garden design, which was not available in the parks observed (Loukaitou-Sideris 1995, 94–96). Studies of the park usage of the Hmong in Wisconsin found fishing to be a major activity (Hutchinson 1993b).

In terms of activities, research up to the late 1980s, found African Americans are more oriented to using urban environments for recreation than whites and less interested in the outdoors and environmental concerns (Schroeder 1989, 103–104). This is a pattern similar to center-city residents in general, and so it is hard to disentangle the effects of ethnicity versus location in these studies. More recent work by Gobster and Delgado (1993, 78) in Chicago has shown variation among African Americans, depending on their history. Although their sample size was small, those with southern roots visited Chicago parks more than those from the north, and they also did so more frequently on foot. This demonstrates some of the differences between people in one ethnic group.

Overall, there are obviously important ethnic differences in preferences from recreational kata and rugby to lacrosse and cricket. In small parks, it can be a challenge to fit in a soccer field as well as a baseball diamond. Careful design, as well as some flexibility to changing usage over time, are key.

Gender: There has been much less work on gender and parks. However, Hutchinson (1994) examined women and the elderly in Chicago's public parks, using observations in 13 parks of varying sizes. Hutchinson found that women came in much larger groups than men—twice the size—and that men were far more likely to be involved in individual activities. However, overall both women and the elderly were underrepresented in the "neighborhood, regional, and lakefront parks included in this study. Although females accounted for more than half (52.5%) of the total Chicago population in 1980, they composed less than a quarter of the groups observed during the summer. Similarly, the elderly, who composed more than 14% of the total population, represented only 6% of park users" (Hutchinson 1994, 243).

While there were probably safety concerns leading to this absence of women and older people, Hutchinson proposed that this absence of populations was in part because of the dominance of single-use sports facilities, such as baseball and softball diamonds, in the parks observed. Such facilities cater to activities not of interest to elderly users, female parents of small children, or family groups. For those groups, playgrounds and picnic tables that might include arrangements that could accommodate larger family groups, as well as activities for both casual socializing and watching activities would be preferable. However, not all large families desire this kind of arrangement. For example, some Muslim immigrants to Minnesota value separation of men and women in such facilities as picnic areas as well as in sports facilities (Ramadhyani 2004).

Class and Income: Class differences are also important. A large survey study in Australia found that people with a low socioeconomic status had "superior spatial access to many recreational facilities, but were less likely to use them compared with those living in high SES areas" (Giles-Corti and Donovan 2002a, 601) Research from the United States also found that low-income people used parks less than others due to fear of crime, health and transportation problems, costs, and a lack of people to visit the park with (Scott and Munson 1994).

Active Living

Parks provide important spaces for recreational activities such as ball games, jogging, walking, and walking the dog. There has been a great deal of research on the activities people engage in once they get to a park, but far less on how much parks affect activity levels in the general population (including those not visiting parks). While parks certainly create options for sports and play activities that are generally not available in other locations, there is very little research evidence to show that access to parks actually increases overall physical activity rather than the perception of it (Handy 2003). Further, unless buildings and open spaces are carefully designed, large open spaces can lower densities, making getting around much more difficult. At low densities, it is hard to walk between destinations, because they are too spread out, transit cannot attract enough ridership, and cars become the only option for transportation.

Physical activity research in general is hampered by data collection that has until recently used primarily self-reported data and has focused on either physical activity for exercise or transportation and has largely ignored physical activity for work or chores. However, in the area of walking, the preponderance of research shows that walking is most sensitive to environment in the area of active transportation or utilitarian walking, and that walking for exercise does not vary much with environment. The results are similar for overall physical activity.

For example, McCann and Ewing (2003) used a simple but objectively measured county-level sprawl index and self-reported leisure-time physical activity, using the national data from the Behavioral Risk Factor Surveillance System (BRFSS) and pooling three years of data for over 206,000 respondents. They concluded that "the degree of sprawl does not influence whether people get any exercise in their leisure hours. When asked about running, golf, gardening, walking, or any other leisure-time physical activity in the last month, people in sprawling and compact areas were equally likely to report that they had exercised in some way" (McCann and Ewing 2003, 17).

In another often-quoted study, Brownson et al. (2001) surveyed 1,818 economically diverse respondents about physical activity. The most important environmental variables associated with self-reported physical activity varied by income with lower-income people valuing enjoyable scenery and higher-income people, sidewalks, perhaps representing what was missing from their respective environments. While low-income groups reported 40% more exposure to crime, there was not a statistically significant relationship with physical activity.

In addition, environmental features thought to support physical activity, may not have the same effect across all socioeconomic groups. For example, in a survey of recreational physical activity among 1803 people, Giles-Corti and Donovan (2002) found that low socioeconomic status (SES) populations in Perth, Australia, perceived that they had better spatial access to recreational facilities and better perceived access to sidewalks, but they were less likely to engage in recreational-physical activity than those from high-SES groups, blaming traffic, attractiveness, and other supports.

This does not mean that parks are unimportant in physical activity. They certainly provide options for different forms of exercise and have other benefits, such as stress reduction. However, it does mean that caution should be used in basing claims for increased park investment on increasing overall physical activity. It is also obvious that an absence of parks reduces choices for physical activity, particularly among those who are less affluent or who do not drive (including seniors and children). This is an area of extensive current research, and so much more will be known in coming years about the way that parks affect public health.

Guidelines

1. Design parks so that people can share them over time so that a small space can accommodate many activities over a day, week, year, and even over decades (see Fine Print Facts, page 79).

2. Provide spaces for activities appreciated by a variety of users, not only those involved with adult-active recreation. Multipurpose sports areas, interspersed with seating areas and paths are a solution in tight sites (see Renovating a Suburban Park for Water Quality, Wildlife Habitat, and Active Recreation, pages 116–122). Make these comfortable for those of varying ages, e.g. benches with backs for seniors and bathrooms and drinking fountains for seniors and children (Cooper Marcus and Francis 1998, 93–94)

3. Provide walking paths with different loop lengths to encourage physical activity among the elderly and others with different levels of mobility. Such paths may be shared by walkers other than the elderly, but the paths should be wide enough to avoid conflicts with activities such as jogging (Cooper Marcus and Francis 1998, 90).

Small parks offer a spot for large groups of people to gather during social events. The people in the image above are enjoying an outdoor concert and below a festival in Columbia, Maryland. *Ann Forsyth, used by permission.*

4. Picnic tables should allow use by both small- and large-family groups. Movable chairs and tables for different social groups may be one option. Although picnic tables mounted to concrete pads may reduce theft, the lack of mobility reduces opportunities for social interaction. Scattered picnic tables that seat four to six people assume everyone comes from a typical American nuclear family (parents and children only).

5. Benches in shaded areas are appreciated by elderly park users. For some, benches should be "arranged to facilitate conversation and personal contact" (Hutchinson 1994, 243). Movable chairs are preferable. Others appreciate scattered benches that allow

some solitude to watch people, plants, and animals (Cooper Marcus and Francis 1998, 90–91).

6. Provide options for children to engage in different forms of play. Moore et al. (1992, 9–26) outline several key design principles (in the following list some have been reordered and combined):

   - Accessibility from outside and within the park
   - Safe and graduated challenges
   - A diversity of settings and spatial experiences including retreats and opportunities to play above ground
   - Flexibility and open-endedness in terms of elements that can be moved and manipulated by both children and adults
   - Defensible, visible space for safety
   - Supervision to enable a greater range of activities
   - Permanence in terms of having a familiar, identifiable space
   - Elements that mark change over time in terms of seasons and events; design for year-round use
   - Multisensory stimulation and cues
   - Shelter
   - Spaces for social interaction among groups of many sizes and different ages
   - Defined play areas for children of different ages
   - Spaces for interacting with plants and animals
   - A set of orienting devices, including visible completion points and landmarks

7. Provide spaces for teenagers where they can test the physical properties of nature and hang out without too much adult supervision but also without disrupting other users (see Thompson, 2002). Having two spaces for people to congregate at opposite entrances to the park can provide separate spaces for seniors and teens, while accommodating both groups' desires for social interaction. Separating teens from young children is often appreciated (Cooper Marcus and Francis 1998).

8. Allow spaces for people watching and for seeing and being seen, for example promenade space that may have spatial designs that are culturally and socially specific. Some cultures may have a tradition of using the public street or streetlike feature in a park, while others would prefer areas in the park (Thompson 2002).

9. Carefully consider access to parks. Where possible, locate access points close to transit so low-income people and those too young or too old to drive or walk long distances can gain access.

10. Manage edges between different activities and between the park and adjacent areas to minimize conflicts (see Connections and Edges, pages 28–32). Clearly demarcate spaces so that the potential for tension over ambiguous 'turf' is minimal.

FINE PRINT FACTS

General social issues

Ordered competition for use of parks

Using a literature review and a review of an earlier study of 13 parks, Hutchinson described park use by different groups over time:

"On any given day, many different groups compete for the use of limited space within urban parks. Because a variety of inefficiencies and perhaps outright conflict would occur if this competition were decided on a day-to-day basis, a pattern of spatial and temporal 'ordered competition' develops in any particular urban recreation setting. In our observations, this was most noticeable in the accommodations between different age groups, and between the original residents and new immigrants within particular parks. In many parks, interaction among the different age groups has in time resulted in space [that] has been reserved for particular groups; for example, elderly park users may occupy the benches in one area of a park in the morning and then retire in the afternoon when teenagers enter the park. In other instances, the original residents of the local neighborhood may make use of park facilities during the morning hours, and then leave the park when young families from new immigrant groups come to the park during lunchtime and in the afternoon. By the evening, when the parks are used by teens and young adults, the older, original residents have left the park entirely" (Hutchinson 1993a, 8).

Age

Children's forms of play

In a study of children's play in housing courtyards with various levels of greenery, Taylor et al. coded eight forms of play, including several involving pretending, games with rules, repetitive play (like rolling a toy), constructing, and exploratory or "complex manipulation of objects without any obvious goal and in what appears to be an interested, exploratory fashion (e.g., hugging a tree and tugging on the branches, and tying string around a tree and then pulling on the string)" (Taylor et al. 1998, 9).

Playgrounds, three main approaches: traditional, adventure, and contemporary

Playground designs can take a variety of forms. Barbour summarized the three main approaches to playground design:

" 'Traditional' playgrounds are characterized by large, metal equipment, such as climbers, slides, and swings, on which children can exercise. 'Contemporary' playgrounds usually include multi-purpose and linked structures that provide various means for entry and exit, and areas or fixtures that promote dramatic play. 'Adventure' playgrounds incorporate various types of moveable materials and tools for children to use in constructing their own play structures. Each type of playground elicits different kinds or frequencies of behaviors (Campbell and Frost, 1985; Hayward, Rothenberg, and Beasley, 1974). And, when children are given the choice, they prefer adventure, contemporary, and traditional playgrounds in that order (Hayward et al., 1974)" (Barbour 1999, 76)*.

Benefits of play in rough areas

Fjortoft and Sageie observed types of play by Norwegian children, ages five to seven, in different environments. Forty-six of the children were playing in a 7.7-acre natural area and were observed by teachers over a school year for two hours per day, from September to June. A control of 29 children was also observed. The researchers found benefits from play in natural areas, observing that "by all-round playing in a diverse and rough landscape, the children's motor fitness was improved. Results from the experimental study showed considerable improvements in motor fitness in the experimental group (n = 46) compared to the reference group (n = 29). Significant difference ($p < 0.01$) between the groups was found in balance and coordination skills" (Fjortoft and Sageie 2000, 92)†.

Diverse vegetation and play

Fjortoft and Sageie outlined the links between environments and play opportunities:

"Different landscape elements afforded different and specific possibilities for play. There was a positive relation between play activities and the diversity in vegetation types and physiognomy of trees and shrubs, i.e. building dens was linked to scattered shrub vegetation, climbing trees was linked to pines in the summer time and young deciduous trees in the winter. [Snow made the branches more accessible.] The diversity of topography expressed as slope and roughness also provided diversity in play activities. Steep slopes were linked to sliding and steep and rough cliffs were challenging for climbing" (Fjortoft and Sageie 2000, 95)*.

Ethnicity

Ethnic differences among older park users

In interviews with older users of Chicago's Lincoln Park Tinsley et al. established that:

"Distinctive cultural differences among the four groups may be responsible, in part, for some of the results obtained in this research. . . . African-American park users were more likely to visit the park with their friends while Caucasian park users were more likely to use the park alone or with a member of their immediate family. Neither group visited the park with an extended family group or with an organized group. African-American respondents rated pleasure seeking, personal self-enhancement, and exercise as more important psychosocial benefits than Hispanic and Asian park users while the Caucasians rated exercise as a more important benefit than did these groups. These benefits reflect a focus on the individual rather than a larger group" (Tinsley et al. 2002, 208).

"Hispanic and Asian culture are regarded as collectivist, because of the greater emphasis given to the family unit in Hispanic culture and the importance of larger social organizations in Asian culture. Hispanic park users were likely to visit the park with their extended family or with an organization. This is consistent with the finding of Irwin and others (1990) that Mexi-

* Reprinted from A. C. Barbour. 1999. The impact of playground design on the play behaviors of children with differing levels of physical competence, *Early Childhood Research Quarterly* 14 (1): 76. © 1999 with permission from Elsevier.

† Reprinted from I. Fjortoft and J. Sageie. 2000. The natural environment as a playground for children landscape description and analyses of a natural playscape, *Landscape and Urban Planning* 48:92. © 2000 with permission from Elsevier.

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can-American users of a U.S. Forest Service-managed campground preferred significantly larger party sizes (M = 12.8 persons) than Anglo campground users (M = 6.9 persons). Asian park users tended to visit the park with much larger immediate and extended family groups, and with much larger groups of friends than African-American and Caucasian park users; they were least likely to visit the park alone. It is not surprising, therefore, that satisfaction of the need for affiliation was the highest rated psychosocial benefit for Asian park users and the second highest rated benefit for Hispanic park users. Furthermore, Hispanic and Asian park users rated exercise and self-enhancement, benefits experienced primarily by individuals rather than social groups, as less important than other user groups. These preferences for psychosocial benefits are consistent with the collectivist emphasis of Hispanic and Asian cultures" (Tinsley et al. 2002, 216).

Racial differences in activities

Dwyer pooled telephone interview data for 1987, 1989, and 1991 from a set of random-sample telephone surveys for the Illinois Department of Conservation. The overall pool included 2,510 whites, 342 blacks, 87 Hispanics, and 56 Asians. The nonwhite samples were still too small to look at differences within the group. While all groups thought outdoor recreation was important, whites were more likely than other groups to participate in many of the activities investigated in the survey. However, Dwyer notes:

"Notable exceptions include high participation by Blacks in softball/baseball, running/jogging, and basketball; high participation by Hispanics in soccer, basketball, and picnicking; and high participation by Asians in picnicking and tennis" (Dwyer 1993, 119).

Ethnic difference in social versus sports activities

Gobster examined park management for racial and ethnic diversity using a survey of park users, He sampled different parts of Chicago's Lincoln Park at different times of day. The study observed 898, black, Latino, Asian, and white users. Three of the most interesting findings were:

1. "All minority groups were more likely to engage in passive, social park activities than Whites. As mentioned, picnicking was a frequent activity of Latinos and Asians; other frequent passive social activities included talking and socializing by Blacks, engaging in organized festivals and parties by Asians, and watching organized sports by Latinos" (Gobster 2002, 147).
2. "Whites were the most involved with active-individual sports. Walking and bicycling have already been mentioned; other activities in this category with high participation by Whites included jogging and walking the dog" (Gobster 2002, 147).
3. "All groups participated in active-group sports, but differed in some specific activities." In this case, Blacks played basketball; soccer was played by Latinos; volleyball and golf by Asians; and golf, tennis, and game playing by whites (Gobster 2002, 147).

Differences among Latinos

Gobster also noted differences within particular groups:

"There are few differences in use patterns among Latino groups, but Mexicans, Puerto Ricans, and Central and South Americans did differ in some of the activities they pursued in the park. The biggest difference of these was soccer, played by 26% of Central and South Americans, 14% of Mexicans, and no Puerto Ricans. In other activities, basketball was played more by Puerto Ricans (7%) and Central and South Americans (6%) than by Mexicans (1%); there was more swimming among Puerto Ricans (47%) than Mexicans (31%) or Central and South Americans (23%); and more picnicking by Mexicans (40%) and central Americans (32%) than by Puerto Ricans (13%)" (Gobster 2002, 152–3).

Gender

Gender and recreation

A study of women and elderly in 13 Chicago parks revealed:

"More than half of all female groups observed during the summer were engaged in stationary activities, such as the use of playground facilities, sitting on benches, and picnicking; fewer than 30% of male groups were observed in similar activities. The predominance of the types of activities among women is related to gender-based child-care roles; a majority of the female activity groups observed in playground areas, for example, consisted of mothers or older female children taking care of toddlers" (Hutchinson 1994, 236).

Class

Income and parks

Scott and Munson (1994) examined income differences in park use through a phone survey with 1,054 people and established that "income was the single best predictor of perceived constraints to park visitation. Individuals with low incomes reported that their use of parks was limited by fear of crime, lack of companionship, poor health, transportation problems, and costs. A disproportionate number also stated they might use parks more if they are made safer and located closer to home, travel time to parks is reduced, public transportation to parks is provided, costs associated with going to parks are reduced, and they are provided assistance in the care of children and other family members" (Scott and Munson 1994, 79).

Class and race differences in activities

Floyd et al. examined theories of race and class in relation to leisure in a 1985 national telephone survey that had 2,148 attempts, 1,607 full interviews and 104 partial interviews, with completion rate of 66.5% to 70.8%, including 60.4% female and 9% black (133 total). They found that:

"Cross-tabulation results indicated few statistically significant race or subjective class differences. Only two types of activities, team sports and associations-social differed by race. Sport activities such as bowling, basketball, and baseball and association-social activities such as church activities, clubs, voluntary organizations, and parties were reported more frequently by blacks than whites. Only three types of activities (hunting-fishing, exercise-health, and golf) differed by subjective social class. Individuals who defined themselves as poor or working class were more likely to report hunting and fishing related activities and less likely to report health-exercise activities than their counterparts who defined themselves as middle class" (Floyd et al. 1994, 165–166).

Active Living

Health benefits of small open spaces in very high-density urban areas

Takano et al. surveyed seniors' health and perceptions of the environment, including nearby green spaces, in very high-density areas in Tokyo in a five-year study of 2,211 seniors. They found that walkable green streets and spaces, even small ones, have health benefits for seniors in very high-density areas, but this benefit is not apparent in low-density areas typical of much of the United States. As they state:

"The quality of the physical environments near a residence—observed as the space for taking a stroll, tree lined streets, the number of hours of sunlight at the residence, and less noise from automobiles and factories—showed a positive association with the longevity of senior citizens. The factor of walkable green streets and spaces near the residence significantly and positively influenced the five year survival of senior citizens independent of a person's age, sex, marital status, attitude toward their own community, and socioeconomic status." (Takano et al. 2002, 916)

"The results with the factor of walkable green streets and spaces that are independent of personal characteristics suggested that the value of parks and tree lined streets near residences is particularly high in densely populated urban areas for the senior citizens living there. Takana et al. have demonstrated, by using aggregated data, a positive correlation between woodland/farmland area and lower mortality rates for residents of cities having a density of more than 4000 inhabitants per km2 [or 10,360 per square mile; 40 persons/hectare or 16 persons/acre], but not among cities having a sparse population density" (Takano et al. 2002, 916).

(Note, these densities were at the municipality or city-ward level [Takana et al. 1996, 881]. For comparison, in 1989, the City of Boston's density was 8,162, Houston's 7,284, New York 11,478, and Chicago 8,560 per square mile)*.

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10

Safety

Issues

Safety is an issue in parks in several ways, particularly crime and fear of crime, issues of territory and turf, and physical safety from accidents. Both vegetation and park structures need to be carefully designed and managed for safety.

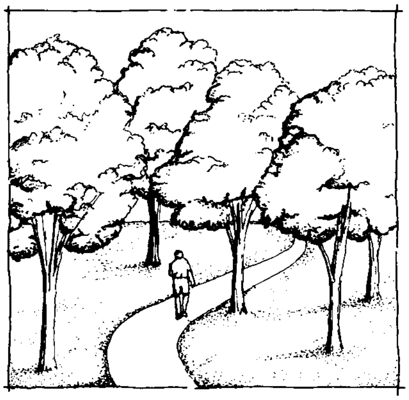
Background

Crime and Fear of Crime

The issue of personal safety is a core concern in the design of all public spaces, including parks. Since the 1960s, designers have been aware that different kinds of environments provide varied levels of support for criminal activity. Jacobs' (1961) book, *Death and Life of Great American Cities,* proposed that places with many activities had "eyes on the street," creating informal checks on problem behavior. In 1971, criminologist Jeffrey, coined the term crime prevention through environmental design or CPTED (Jeffrey 1971). The basic idea behind CPTED, and related approaches, is to make crime more difficult both to undertake and to get away with. This is done by modifying the physical environment and people's interactions with it. While criminologists point to the strong influence of social and economic factors on crime, proponents of CPTED argue that environmental modifications can limit opportunities for such behavior (Loukaitou-Sideris et al. 2002).

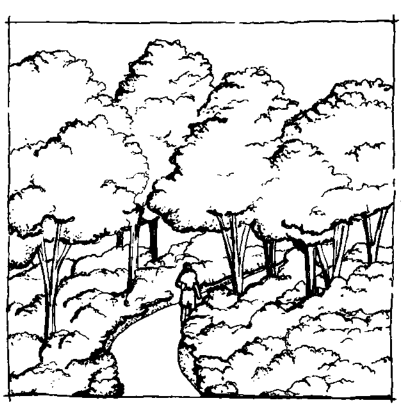
CPTED started with a focus on several key strategies, including creating identifiable territories so that it was clear who belonged, promoting natural surveillance of spaces where park users and people living and working nearby would watch over spaces as a natural part of their daily activities, limiting areas of entrapment for victims and concealment for perpetrators, and vandal-proofing or target hardening. Responding to some criticisms, it has evolved into a "second generation" approach that integrates these core practices with social-crime prevention strategies, such as events to help neighbors get to know each other (Sarkissian Associates Planners 2000; Wekerle et al. 1992).

The issue of personal safety has particular implica-



A

B



C

A. Canopy trees with no understory allow views to surrounding areas and keep hiding places to a minimum. B. Canopy trees with low understory away from the path allow visitors to scan the entire park and still provide some habitat value. C. While good for habitat, densely planted areas around heavily used paths create many areas for concealment. People may well fear to go along this path.

tions for park design. As Michael and Hull explained in a review of work on crime and open space:

> Currently two trends in the management of urban vegetation are in conflict with one another—one plants while the other removes vegetation. Some organizations are planting trees and other vegetation in urban settings because they wish to promote the benefits of nearby nature, other organizations are removing urban vegetation because they believe it promotes crime. Both these efforts are being implemented with considerable vigor and with considerable expense. (Michael and Hull 1994, 1)

Four key concepts structure thinking about environmental supports and limitations on crime in parks: surveillance, concealment, escape, and prospect (Michael and Hull 1994; Fisher and Nasar 1992).

> ***Surveillance*** involves noncriminals being able to see or hear perpetrators. It is assumed that offenders do not want to be caught.
>
> ***Concealment*** refers to a criminal's ability to hide before, after, and possibly during a crime.
>
> ***Escape*** relates to a crime victim's capacity to flee.
>
> "***Prospect*** . . . involves the ability to observe one's surroundings. It differs from surveillance in that it is used to describe the victim of the offender rather than persons in the surrounding area" (Michael and Hull 1994, 6; Fisher and Nasar 1992; Wekerle et al. 1992).

In this situation, small parks have some advantages over large ones, as surveillance from outside the park is likely high because of nearby buildings, streets, and sidewalks. In addition, there may well be fewer places where perpetrators can be concealed, such as in heavily vegetated areas. Michael and Hull (1994, 12) describe the phases of crimes in parks:

- Arriving at the site
- Searching for a victim
- Approaching the victim (or victim's property)
- Perpetrating the crime
- Escaping
- Examining illegally gained goods
- Discarding evidence (e.g., pocketbook or wallet).

While a minority of people see natural wooded areas as low in crime, for most people, more openness means more safety. This requires control of understory or vegetation up to about eye level, and it is often incompatible with native habitat in areas where woods and forest predominate.

In this case, tree density matters. As Kuo et al. (1998) remark in their research on increasing tree densities, trees have contradictory safety implications—making places feel more cared for but disrupting views. In a study of a low-income housing development, they proposed that increasing tree density increased perceptions of safety. However, the highest tree density studied by Kuo at al., was a fairly low 22 trees per acre (55 per hectare), which would be classified as a very low-density forest, almost a savanna. As Dorney et al. (1984, 81) outline, citing other studies, a tree density of 43 trees per hectare (or approximately 17 per acre) qualifies as savanna.

The presence of law enforcement officials, in a nonthreatening way, can add to the sense of safety in an park. However, at best, parks should create a sense of safety without a police presence.

Overall, parks need to be designed to minimize concealment of perpetrators and maximize surveillance, prospect, and escape by potential victims and others. Of course this needs to be weighted against the need for some mystery (see Appearance and Other Sensory Issues, pages 33–41), preferences for large trees, children's desire to play hide and seek, and habitat needs. A savanna-type landscape can perform well for crime prevention, though it may not reflect local vegetation types. Simply making major paths wide enough for police cars to drive along can help.

Territory and Turf

Rather than crime pure and simple, one problem in parks is groups of users taking over one area and making other groups feel uncomfortable when using a park. These may be legal groups, as in teens hanging out and dominating an area, or illegal activities, such as dealing drugs. Cooper Marcus and Francis (1998, 107–108), citing William Whyte, suggest increasing overall activity to dilute these concentrations so that they are not threatening but can continue. In the case of illegal activities such increased overall activity can discourage people from negative behaviors. Other options for group turf are explained in Activities and Groups, pages 73–82.

Child Safety

Child safety is an important issue. Parents and others are becoming increasingly concerned about accidents in playgrounds. However, the desire to protect children from accidents needs to be balanced against the developmental needs of children to explore, test skills, and manipulate their environment.

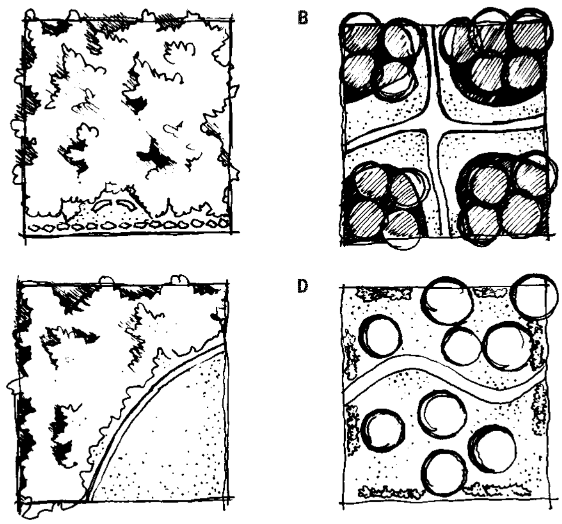
Guidelines

1. Lighting is a complex issue in parks. It is important to light areas that are intended for night-time use. But it can be misleading and dangerous to light

areas not intended for use, particularly if they are isolated.

2. Maximize views to aid park users and others to avoid becoming victims (Michael and Hull 1994, 28–29). Prune shrubs, particularly near circulation routes, so potential victims are not surprised by concealed perpetrators. This is not only an issue in the park but also around nearby buildings, from which residents and workers can look out and provide natural surveillance. In high-crime areas, do not leave dense patches of vegetation but allow views through.

3. When considering the small park as wildlife habitat, consider the effect of vegetation structure on the perception of safety. Find ways to accommodate both the need to teach people about the ecological structure and function of the landscape and the need for people to feel safe. This is especially important in areas where intensity of use is high, for example, along recreational trails. In temperate climates, a narrow trail corridor through dense forested vegetation will feel less safe. However, a wider corridor will feel safer, but it will create a larger gap in habitat, which may have an effect on the connectivity of vegetation and habitat. These trade-offs need to be considered in relation to goals and practices for management and maintenance.



The manner in which vegetation is used can greatly influence safety in a park.
A. A densely wooded park with minimal access may be good for habitat quality, but it may present safety issues.
B. A park with open paths provides views through the park. Edges planted with low shrubs create enclosure, provide shade, and increase habitat value.
C. A partially wooded and partially open park may provide both habitat value and a place for people to recreate. Special attention should be paid to the edge of the woodland for safety concerns.
D. A park with canopy trees and some low shrubs allows clear views throughout the park, minimizing safety concerns; but this design reduces habitat opportunities.

4. Carefully consider child safety, balancing the need to protect from accidents with developmental aims that emphasize skill development and exploration. However, it is important to have appropriate surfacing under play equipment (see Fine Print Facts, below).

FINE PRINT FACTS

Weak relationship between parks that feel safer and park aesthetics with majority and minority views

Schroeder and Anderson examined safety in urban parks by having 68 college students rate photographs of recreation areas, finding notable differences in the perception of safety. For example, Schroeder and Anderson note:

"The majority of observers seem to perceive greater safety in developed urban parks and feel least safe in densely forested areas, while a minority of observers hold roughly the opposite view feeling safest in the densely wooded areas. For scenic beauty the relations are reversed: the majority favors natural-appearing forested areas and a minority gives high ratings to urban parks and low ratings to undeveloped forests" (Schroeder and Anderson 1984, 184).

"In general, high security is associated with open areas with long view distances and with signs of development and nearby populated areas. On the other hand, high scenic quality depends on the presence of natural vegetation, in either forests or park-like settings, and is lowered by manmade features. Overall the correlation between security and scenic quality is low, meaning that some settings are high on both dimensions, others are low on both, and still others are high on one and low on the other" (Schroeder and Anderson 1984, 191).

Findings of safety at "higher" density in a low-income public housing development, where high is 22 trees per acre (55 per hectare) with no understory, which is still a fairly wide spacing.

A study of low-income African Americans and tree density in public housing used interviews with 100 residents looking at photographic simulations of different tree densities and lawn-maintenance approaches. Images illustrated 0, 12, and 22 trees per acre (0, 30, and 55 per hectare). Kuo et al. found that "residents responded extremely positively to the presence of trees, both in terms of preference and sense of safety. Of the three tree densities tested, residents responded most positively to the highest density (22 trees per acre)" (Kuo et al. 1998, 45).

Kuo et al. conclude:

"Trees may affect sense of safety in two opposing ways—both *decreasing* sense of safety through decreasing view distances and *increasing* sense of safety through increasing the civilized, cared-for character of a space. Thus, in urban settings with a strong 'no man's land' character (e.g., inner-city outdoor spaces, abandoned city lots), the positive impacts of trees on sense of safety may far outweigh the negative; in contrast, in the more affluent urban settings typical of much previous research, the negative impacts of high tree densities might be expected to outweigh the positive" (Kuo et al. 1998, 55).

DROP HEIGHT AT WHICH A FATAL INJURY CAN OCCUR FROM A FALL, BY SURFACE AND DEPTH OF SURFACE

Surface	Depth of surface*	Drop height†	G-force†
Concrete	5 in	1 in	210
Asphalt	4 in	2 in	210
Foam matting	1.25 in	4 ft	200
Rubber matting	1.75 in	5 ft	225
Sand (coarse)	9 in	6 ft	235
Sand (fine)	9 in	8 ft	215
Wood chips	9 in	11 ft	220
Gravel (medium)	9 in	12 ft	190
Wood mulch	9 in	12 ft	135

*At ambient temperature, not compressed.

†The threshold for serious injury is a force of 50g, the threshold for fatal injury is 200g.

Source: from Bond And Peck (1993, 732). Ramsey and Preston. Reprinted with permission from the American Public Health Association.

Playground injuries and surface materials

Bond and Peck cite unpublished data from Massachusetts showing that "falling is the most common mechanism of injury in playgrounds, accounting for 70 to 76% of injuries. The severity of head injury due to falls is associated with the surfacing material at the point of impact. The maximum acceptable impact force is 50g; an impact force of 200g will deal a fatal blow. A fall from heights ranging from 3–12 inches onto concrete could result in death" (Bond and Peck 1993, 731).

From a field check of 47 public playgrounds, 25% of those in the city of Boston, Bond and Peck concluded that: "surfacing materials in all of the observed playgrounds were unsafe, 63.8% (30) having predominantly appropriate but poorly maintained material (matting, sand or wood chips) and 36.2% (17) having predominantly unsuitable surfacing material (asphalt, grass, bare ground)" (Bond and Peck 1993, 732).

Safety in a natural playground

Fjortoft and Sageie's study, described in Activities and Groups (page 80), outlined the issues of safety in natural areas:

"A natural environment as playscape for children may represent a challenge demanding new attitudes in policy and planning. In existing planning directives, there tend to be three main criteria for playground planning: distance from residential areas, kindergartens, schools etc., area size, and safe access to the sites. The physical planning of playgrounds has not addressed children's needs for a diverse and stimulating playscape. . . . In such a perspective, it is also necessary to discuss an acceptable level of risks. Playscapes with the highest level of security tend also to represent areas with the lowest affordances and challenges. Consequently, diversity in landscape elements, affordances for play, challenges and safety, accessibility and wear resistance may be important criteria in the planning and management of future playscapes for children" (Fjortoft and Sageie 2000, 94)*.

* Reprinted from I. Fjortoft and J. Sageie. 2000. The natural environment as a playground for children landscape description and analyses of a natural playscape, *Landscape and Urban Planning* 48:94. © 2000 with permission from Elsevier.

11

Management

Issues

With regard to small parks, when people hear the word "management," they naturally think of the physical maintenance of a park. Yet parks are social and ecological resources that require much more attention than just physical maintenance. Parks need management in multiple dimensions to protect their integrity for future generations. Managers monitor long-term social and ecological issues in relation to their management goals and make sure these goals are adequately funded. However, too often management of the overall green space system is fragmented among different agencies, often with competing goals, and so park management does not achieve all its potential benefits (Flores et al. 1998).

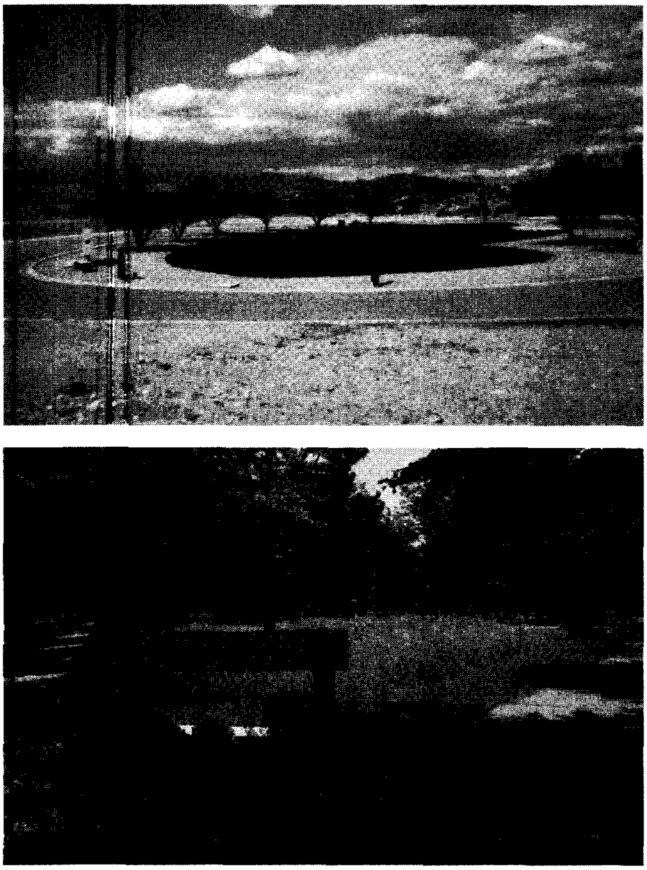
Background

Management is a very broad category that encompasses many activities and cannot be covered in great detail here because of space limitations. We have selected four of the most important themes and reviewed them in this section: (1) management zones, (2) costs, (3) maintenance of habitat, (4) and ecosystem management.

Management Zones

Small parks may include a wide range of management zones related to three issues that affect the long-term quality of the landscape: human activities, ground and surface conditions, and vegetation types. One of the major concerns for park designers, planners, and managers is how intensely parks are used and by whom, and if this use is causing any unusual patterns of wear and tear or potential safety concerns.

A small park may have just one of these management zones. For example, a square in a densely populated central neighborhood probably only has cultivated landscapes. In contrast, a larger park on the urban edge may have open, grassy areas for sports but, also, other areas that are managed rather than groomed or, even, wild areas on the edges of water courses, wetlands, forests, grasslands, shrublands, or deserts.



These two parks have different zones of management. In the top image, a clearly defined lawn area is surrounded by a desert-style area of decomposed granite. From an ecological perspective, this design has little wildlife habitat value for desert animals or plants. The trees and lawn combine to create the look of a park in a temperate climate, but the high-maintenance area is restricted to a small zone. In the lower image, natural prairie plantings require little maintenance and provide habitat and color in the park. Areas of lawn require more maintenance, but they are desired by people who use the park for recreational activities. Plantings of annual flowers also have maintenance requirements, but they also create an attractive formal entrance to the park. The mix of maintenance levels allows the park to appeal to a variety of people who use the park for different reasons and keeps overall costs down. *Source: Laura Musacchio, used by permission.*

In addition, a park may itself be just one management zone within a larger green-space strategy, that prioritizes such activities as tree planting and habitat restoration in the larger urban landscape (Flores et al. 1998). Having different public agencies cooperate in green-space management is often difficult but remains an important goal.

Cost

The size of small parks may well result in more intensive use over time on a per acre (hectare) basis, and thus more expensive maintenance. Managing some of the park area for native landscaping potentially reduces costs, counterbalancing the size premium. How much is saved depends on how degraded the site is initially, how much money has been invested in standard maintenance equipment, such as mowers, and how flexible maintenance crews are in learning how to deal with native landscapes (e.g., learning how to do a controlled burn) (Ramadhyani 2004). In addition, small parks may have fewer wasted areas and more people using each acre, meaning that per capita costs may be lower than larger, less intensively used parks.

Another argument is that some of the increased maintenance can be offset by the increase in property values that accrues to homes close to parks. Compton (2001) reviewed the evidence and found a premium of approximately 20%. Thus parks can be seen to be paid for by those living nearby (or in the case of athletic fields, by those living a short distance away). For more detail, see Fine Print Facts, page 92.

Maintenance for Habitat

Typical management activities in small parks include mowing turf and clipping shrubs. It is important to note that clipping shrubs into an unnatural shape, such as balls, often stimulates the shrubs to create a low, dense, twiggy, leafy canopy. People can see over these low shrubs, but much is sacrificed in terms of aesthetics and ecology. From a preference standpoint, people would like tall shrubs as long as the canopy is open and allows prospect to the surrounding landscape while minimizing concealment for criminals. From an ecological standpoint, allowing shrubs to achieve their natural habit of growth would likely improve habitat, because there would be more opportunities for better cover for a wider range of species as well as more flowers and fruits for food sources. People would also appreciate the greater range of seasonal interest, because plants are allowed to bloom and fruit. Plants that are too messy in terms of flowers and fruits that may cause a maintenance issue on hard surfaces.

Management of small parks can influence the diversity and complexity of the park's ecology. For more information, see Size, Shape, and Number, page 14; Water, page 48; Plants, page 55; Wildlife, page 60; and Climate and Air, page 67.

Ecologically-based management approaches

In the last decade, the management of regional open space has integrated ecologically-based principles of land management. Ecosystem management is one of the most well known approaches that park designers, planners, and managers have integrated into their activities at different levels, especially in the planning of regional conservation corridors and greenways. This approach was originally developed for application to federal land management in the United States during the 1990s, such as old growth forest management and endangered species (Christensen et al. 1996). The approach emphasizes integrating ecological principles into land management.

One of the major problems that ecosystem management addresses is the causes, effects, and potential mitigation strategies for landscape fragmentation. Saunders et al. (1991, 26), who have studied fragmented landscapes in Australia, advised that management activities should focus on these two components: "(1) management of the natural system, or the internal dynamics of remnant areas, and (2) management of the external influences on the natural system. . . . For small remnants . . . management should be directed primarily at controlling the external influences." Given that small parks are remnants of a regional landscape, the advice of Saunders et al. (1991) is very applicable. The Ecological Land-Use Management Guidelines, page 9, and Fine Print Facts, page 93, have additional examples of some of the other important ecological principles that are associated with ecosystem management. These ecological principles are also applicable to adaptive management, which is another ecologically-based management approach that structures management problems like iterative, scientific experiments, where management strategies are actually scientific hypotheses that are to be tested through a process of continual refinement (Holling 1978).

Guidelines

1. Cultivated small parks are expensive to maintain so managing some of the park in a wilder state or with lower maintenance planting designs should be considered.
   - Develop landscape-management plans that take into consideration the natural succession of plant communities in a park. Replace lawn with native plantings that have a habit of growth that reduces maintenance and is socially acceptable. This will require additional information for decisionmaking, but it will lower maintenance costs in the long-term if planned and implemented well. Some additional planting may be needed to improve the appearance of such areas.
   - As an alternative use planting approaches that emphasize low maintenance native or other trees, shrubs, and ground covers. These can provide a neater appearance while providing habitat variety as well as provide the kinds of plant structure that can help reduce air pollutants (See Climate and Air, page 68).

2. With existing plantings, selectively prune to allow trees and shrubs to achieve their natural habit of growth. This will likely be a more open shape than that achieved through trimming. Care must be taken that good sightlines are maintained and that shrubs and tree limbs are not perceived as a danger.

3. Manage for the long-term care of trees. Provide adequate soil and nutrients (see Plants, pages 55–56). As Jim explains:

   In landscape projects, the uneven allocation of resources with the lion's share allotted to planting materials and the above-ground installations, and with soils only given token attention, should not continue. The fictitious and factitious belief that any soil material is expected to support soil growth should be obliterated. (Jim 1998c, 246)

4. Survey existing conditions carefully to target maintenance on key problems. A soil survey is highly recommended and informative, especially in central-city parks where tree growth is subpar. The county soil survey is a good starting point, but soil tests are an essential item to understand variation in soil productivity and conditions on site. Accurate site surveys, such as soil tests, are often needed for tree, shrub, and herbaceous plantings in restoration projects (Lane and Raab 2002, 247).

5. Follow ecologically-based, land-use management principles and guidelines created by leading ecologists:
   - *Time principle:* "Ecological processes function at many time scales, some long, some short; and ecosystems change through time" (Dale et al. 2001, 6).
   - *Species principle:* "Particular species and networks of interacting species have key, broad-scale ecosystem-level effects" (Dale et al. 2001, 7).
   - *Place principle:* "Local climatic, hydrologic, edaphic, and geomorphic factors as well as biotic interactions strongly affect ecological processes and the abundance and distribution of species at any one place" (Dale et al. 2001, 9).
   - *Disturbance principle:* "The type, intensity, and duration of disturbance shape the characteristics of populations, communities, and ecosystems" (Dale et al. 2001, 10).
   - *Landscape principle:* "The size, shape, and spatial relationships of land-cover types influence the dynamics of populations, communities, and ecosystems" (Dale et al. 2001, 13).

6. Lack of information is one of the major problems in managing parks. Good research about social and ecological costs and benefits can justify funding.

ECOLOGICAL LAND-USE MANAGEMENT GUIDELINES

A committee of leading ecologists has provided advice about applying ecological principles to real world situations:

> Ecologically based guidelines are proposed here as a way to facilitate land managers considering the ecological ramifications of land-use decisions. These guidelines are meant to be flexible and to apply to diverse land-use situations. The guidelines recognize that the same parcel of land can be used to accomplish multiple goals and require decisions be made within an appropriate spatial and temporal scale. For example, the ecological implications of a decision may last for decades or even centuries, long outliving the political effects and impacts. Furthermore, all aspects of a decision need to be considered in setting the time frame and spatial scale for impact analysis. In specific cases, the relevant guidelines can be developed into prescriptions for action. One could think of these guidelines as a checklist of factors to be considered in making a land-use decision:
>
> - Examine the impacts of local decisions in a regional context.
> - Plan for long-term change and unexpected events.
> - Preserve rare landscape elements, critical habitats, and associated species.
> - Avoid land uses that deplete natural resources over a broad area.
> - Retain large contiguous or connected areas that contain critical habitats.
> - Minimize the introduction and spread nonnative species.
> - Avoid or compensate for effects of development on ecological processes.
> - Implement land-use and land-management practices that are compatible with the natural potential of the area. (Dale et al. 2001, 15)

GUIDELINES FOR THE MANAGEMENT OF FRAGMENTED LANDSCAPES AND BIODIVERSITY WITH LIMITED BUDGET RESOURCES

Saunders et al., who have studied fragmented landscapes in Australia, provide four management guidelines for remnant landscapes and limited budget resources:

"1. The initial step must be to determine the minimum subset of the existing remnants that are required to represent the diversity of a given region (Margules et al. 1988; Margules and Stein 1989). . . .
2. The system must then be managed to maintain the diversity of species or ecosystems. . . .
3. Priorities of management must be established. . . .
4. Continuous management is needed to maintain remnant areas in their current state, due to constant pressure of altered internal dynamics and external influences. Here again, the allocation of scarce resources must be considered. Effort should go into maintaining some remnant areas in as near a 'natural' state as possible, but it will not be feasible to do this for all remnants. There is a strong case to made for letting some areas degrade so that they become less natural but are easier to manage and still retain some conservation value (Bridgewater 1990)" (Saunders et al. 1991, 26).

FINE PRINT FACTS

Recouping costs of parks

Compton reviewed approximately 30 studies of the effect of parks on the values of nearby properties. He summarizes

"As a point of departure, the studies' results suggest that a positive impact of 20% on property values abutting or fronting a passive park area is a reasonable starting point. If it is a heavily-used park catering to large numbers of active recreation users, then the proximate value increment may be minimal on abutting properties, but may reach 10% in properties two or three blocks away" (Compton 2001, 1).

Study confirms benefits of planting trees can outweigh costs

Based on a study of the costs and benefits of trees in Chicago, McPherson concluded:

"Are trees worth it? Energy savings, air pollution mitigation, avoided runoff, and other benefits associated with trees in Chicago can outweigh planting and maintenance costs. Given the assumption of this analysis (thirty years, 7 percent discount rate, 95,000 trees planted), the projected NPV [net present value] of the simulated tree planting was $38 million, or $402 per planted tree. A benefit-cost ratio of 2.83 indicates that the value of projected benefits was nearly three times the value of projected costs" (McPherson 1995, 190).

When do benefits start accruing for tree plantings in Chicago?

McPherson suggests that benefits accrue 9 to 18 years after tree planting:

"How many years does it take before trees produce net benefits in Chicago? Payback periods vary with the species planted, planting location, and the level of care that trees receive. C-BAT [Cost-Benefit Analysis of Trees, a computer model] findings suggest that discounted payback periods for trees in Chicago can range from nine to eighteen years. Shorter payback periods were obtained at lower discount rates, while higher rates lengthened the periods" (McPherson 1995, 191).

Strategic management and ecosystem approach for urban forests

However, in a review of urban forestry, Dwyer et al. suggest it is important to consider human dimensions in urban forest management:

"The long life of urban trees and forests mandates planning with a view to future needs. Investments in the planting and care of trees represent a long term commitment of scarce dollars, and improper plantings can increase costs and reduce benefits. Therefore, it is important to do it right and plan for future management. The effectiveness of urban trees and forests in providing benefits to people depends on their species composition, diversity, age, and location with respect to people and other elements in the landscape. An ecosystem approach that recognizes people as the central component offers the best means to assess the complex interactions between urban trees and forests and the well-being of urbanites, linking management actions with their effects on urban forests and the associated benefits" (Dwyer et al. 1992, 227).

COSTS OF DIFFERENT PARK MANAGEMENT APPROACHES, PART 1

The costs of establishing and maintaining three types of open space (£/ha)

Type of scheme	Capital cost Mean, Range	Estab. cost (0–5 yrs) Mean, Range	Maintenance cost (5–10 years) Mean, Range
Native	4482, 609–9854	1767, 519–3870	640, 303–2160
Naturalistic	36166, 6734–57091	10600, 2560–15718	3578, 738–5950
Amenity	20679, 4952–56000	7488, 1450–20942	5513, 1450–17592

Key
Native—derelict areas that have colonized adequately to allow minimal reclamation thus retaining the colonized vegetation.
Naturalistic—derelict areas that have been treated so that they simulate natural habitats.
Amenity—derelict areas that have had traditional reclamation to grassland with or without trees and shrubs.

Source: from Groundwork Trust (1986). Reprinted from Kendle, T., and S. Forbes. 1997. *Urban Nature Conservation* (London: E & FN Spon), page 286.

COSTS OF DIFFERENT PARK MANAGEMENT APPROACHES, PART 2

Approximate maintenance costs of various landscape vegetation types

Vegetation type	Typical annual maintenance in hours/100m² Small units, Large units	Cost of maintenance relative to lowest cost vegetation type Small units, Large units
Gang mown general recreational turf (5 unit gang mower 24 cuts per annum)	0.24, 0.14	2, 1
Recreational turf and widely spaced trees (as above)	1.5, 0.9	10.7, 6.4
Rough grass (flail mown 4 times/year)	0.20, 0.17	1.4, 1.2
Intermediate mown turf on steep banks (rotary cut, 500 mm, 12 times/year)	8.0, 5.0	57.1, 35.7
Ground cover and shrub massing (mulched and hand weeded)	8.0, 5.0	57.1, 35.7
Annual bedding (2 plantings per year and weed control)	80, 80	571.4, 571.4

Notes: Figures reflect labour only and do not take into account the cost of equipment. Ground cover costs can of course vary depending on species and stage of establishment. Some established cover may require almost no annual maintenance. Information on how mowing costs change relative to slope is hard to come by for flail mown vegetation. The costs of flail mown vegetation may of course be greatly influenced by the costs of disposal of cuttings, if these are not to be allowed to lie.

Source: Hitchmough (1994b), adapted from Wright and Parker (1979). Reprinted from Kendle, T., and S. Forbes. 1997. *Urban Nature Conservation.* (London: E & FN Spon), page 288.

The shift from managing the urban forest as single-tree management to ecosystem management

In a paper reviewing approaches to urban tree-cover measurement, Zipperer et al. also propose an ecosystem approach to urban forest management:

"Despite urban morphology and environmental factors, humans ultimately decide tree-cover patterns in urban landscapes through active and passive management decisions. . . . Humans decide which vegetation remains (remnant), when and what sites are cleared for development, which species are planted and where (planted), and which areas are allowed to develop naturally (emergent). Whereas management of urban vegetation and its ecosystem and its consequent benefits have been the traditional focus of urban forestry (Grey and Deneke 1986; Miller 1988), a call for a systems approach to inventory and manage the resource has occurred for several decades (Stearns and Montag 1974; Dorney et al. 1984; Richards et al. 1984). Only recently, however, has there been a shift from a single tree management to an ecosystem or landscape approach to account for interactions within and among patches (Zipperer et al. 1995)" (Zipperer et al. 1997, 233).

Management of urban forest for wildlife habitat

Dunster, in a summary article and a call to arborists and others to rethink how the urban forest can be better managed for habitat, makes the following proposals:

"Management of trees within greenway systems requires a focus beyond simple pruning and health care. In many cases, a dead or dying tree is just as important to the overall health of the ecosystem as the live and healthy trees.

"The traditional response to dead or dying trees has been to remove them either because they are hazards, or to 'tidy up' the landscape to avoid an anthropocentric perception of unkempt appearances. But this tidying-up approach can be ecologically damaging and arborists need to better understand the role of dead or dying trees as a source of habitat. For example, large pieces of a tree, known in forest management as coarse woody debris, provide a source of food for many insects and fungi. Insects are a food source for the birds, which themselves help maintain insect populations at endemic levels. Small mammals find refuge and breeding areas in decayed logs, and it has been shown that dispersal of beneficial forest mycorrhizae is a direct function of small mammal populations and the dispersal of spores in their fecal pellets (Maser 1988; Machmer and Steeger 1993)" (Dunster 1998, 161).

The benefits of leaving trees and brush to decay

Dunster further outlines the habitat benefits of decaying plant materials, noting that "there is always the question of how much clean-up should be undertaken. This will depend on the area, the species, and the goals of the management plan. In an urban situation, it is generally wise to clean up smaller branches and twigs to reduce the potential for fire hazards. This material can be chipped on site and the mulch blown back in a thin layer. Avoid large mulch piles: they might spontaneously ignite due to the heat of decomposition or will decay anaerobically and produce undesirable fermentation products. Evenly distributed thin layers decay rapidly and help stabilize the forest floor" (Dunster 1998, 166).

Examples of management to improve growing conditions for urban trees by intermeshing trees and built-up areas

In a study of urban trees in Hong Kong, Jim argued for attention to soils:

"Stressful site conditions can be improved by measures such as soil improvement and replacement (Dudle 1986). High-caliber existing trees affected by construction should be carefully evaluated and preserved in situ by a sympathetic building plan, failing which, transplanting should be recommended. Statutory planning measures are needed to preserve growing space (Profous et al. 1988) and to institute a coordinated setback of buildings by zoning to supply more roadside amenity strips. A long-term greening strategy should aim at providing good-quality planting sites (Kelcey 1978) to be disseminated throughout the city in a matrix enmeshing built-up areas" (Jim 1998b, 150)*.

* Reprinted from C. Y. Jim, 1998, Urban soil characteristics and limitations for landscape planting in Hong Kong, *Landscape and Urban Planning* 40:150. Reprinted with the permission of Cambridge University Press.

12

Public Involvement

Issue

Members of the public participate in small parks by using them. However, the public also increasingly lobbies for park funding, gives input on park design and rehabilitation, and even helps with park cleanup and light-maintenance activities. Designing for and maintaining this public involvement is an important role for parks professionals. This encompasses many activities, including involving the public in design, developing friends groups and others to help upgrade parks, and providing environmental education.

Background

Public and Designers

Park planning and design is a complex process. This manual on the physical design of small parks deals with only part of that process. Before a small park is designed or redesigned, typically a needs assessment is performed, particularly if the main focus of the park is recreation. After parks are designed they are then constructed, maintained, programmed, and eventually rebuilt. Design affects all these later activities and is meant to support maintenance and programming, but it is also a separate endeavor.

While large parks are the emphasis of park planning at a metropolitan and regional level, many municipalities develop open space, parks, and recreation plans in which small parks play an important role, providing opportunities for play, athletics, socializing, and interacting with nearby nature. The public are often invited to participate in these wider planning processes as steering committee members, workshop participants, or in making formal responses to plans. At the more detailed stage of the physical design of small parks, designers frequently use similar strategies for public involvement.

Public involvement is often controversial. Public involvement with fundraising and advocacy can be seen as a poor substitute for reliable base funding. Public involvement in cleanup and maintenance activities may be seen as unreliable or, if too reliable, then threatening the jobs of government workers. In programming, many fear that well-organized proponents of particular

People who participate in the design process of parks may have a sense of ownership and be more willing to assist with maintenance issues. *Figure above, source: Ann Forsyth and the Urban Places Project, used by permission.*

activities may dominate the process of recreational-needs assessment, drowning out other voices. In the area of design, many professionals fear that public input may lead to mediocre design quality.

Only some of these areas of concern have been subject to systematic research. Crewe (2001) used archival data and interviews with 37 designers of Boston's Southwest Corridor to assess how the extensive participation in the design of this five-mile-long linear park, built along and over a railway line, affected designers' perceptions of design quality. Crewe found that designers generally (73% of them) perceived the corridor as having good design quality and marketability, though those working in the lower-income sections of the corridor, those in private practice, and those in senior positions were less positive (Crewe 2001, 447). Designers felt most comfortable with input into such issues as playground designs, small projects like vegetable patches and seasonal flower beds, and public art. They were less comfortable with input on what they perceived as either technical, or city-wide issues, such as overall corridor image and traffic issues (Crewe 2001, 448–449). However, most (97%) felt that a high level of participation—the corridor project involved hundreds of meetings and a long-running newsletter—had been a good thing, mainly because it "guaranteed project survival" (Crewe 2001, 449). Crewe reported that over a decade after participatory processes, residents were still involved with "weeding, cleaning, and vigilance" (Crewe 2001, 452). Overall, while participation increased long-term public engagement with the park, there were still significant areas where designers thought such participation was at odds with their own values. In small parks, such disagreements may be manageable, with designers working to fit the park into an overall context, but residents having input into important layout issues such as the location and type of recreational facilities and planting beds.

A more complex situation of a mismatch between professional and public design ideas, often occurs in a restoration context. Barro and Bright surveyed 563 residents of Cook County in Illinois and found them largely opposed to prairie restoration techniques in use, including "cutting down mature trees, using herbicides, or sacrificing wildlife habitat," and they also feared restoration might limit recreational use (Barro and Bright 1998, 60). As was indicated in Appearance and Other Sensory Issues (see page 35), environmental professionals frequently have different aesthetic opinions to the lay public.

Differences Within Public Opinion

However, the lay public also has differing opinions about design. Most parks professionals know this clearly, first hand, having attended contentious meetings over park design and redesign. A number of typical areas of conflict include conflicts over needed facilities, the place of dogs in parks, and more generally on who should be involved in park design.

Those doing different activities have different needs for facilities, which are often at odds; for example, joggers want wood chip paths and cyclists or while those in wheelchairs want paving. Children of different ages and abilities need opportunities for quite different kinds of play (Schroeder 1989, 106). In a small park, such conflicts can be particularly acute.

Dogs and their owners have particular needs in parks—access to park areas reduces boredom for dogs, expends "pent up energy," helps in their socialization, and gives exercise to their owners (Harlock Jackson et al. 1995, 5). Advocates for dogs emphasize managing potential conflicts between dogs and other park users through a number of design, time share, and management strategies (Harlock Jackson 1995). However, not everyone agrees that dogs have a place in parks.

In addition, there are often absent voices in such processes, particularly children. Forsyth et al. (1999) reviewed the literature on youth participation in open-space and garden design, arguing that children as young as three "have demonstrated the ability to use cognitive mapping to negotiate and build models," although such capacities are limited (Forsyth et al. 1999, 28; Blaut 1974; Blaut et al. 1970; Hart 1987). However, such perceptions vary with age, income, gender, location, and other factors (Lynch 1977).

The literature on participation by children lists a number of techniques for involvement, including having children create drawings or collages and discuss them, lead tours, take photos and label the plant life, create exhibitions, interview groups and individuals, and observe (Chawla 1998; Buss 1995; Lynch 1977; Urban Places Project 2000; Whiren 1995; Dandonoli et al. 1990; Sarkissian, et al. 1997). These can help aid physical and mental development (David and Weinstein 1987), but it can also help match facilities to children's wishes and desires.

Maintenance Responsibilities

Another important dimension of public involvement is how to manage the ecological and recreational resources of the park system with limited park and maintenance staff. Most importantly, parks have a constituency that has to be addressed, the residents of the local neighborhoods. These residents use the parks on a regular basis and often desire updates to their local parks in order to improve their appearance of their neighborhoods and improve civic pride.

However, while parks are generally owned by the public or by private groups with requirements for public access, with some exceptions—such as community gardens or organized friends of the park groups—the public is discouraged from maintaining the parks. They may not be fully aware of park design and management processes and, in particular, budget and staff limitations. Yet a well-informed local constituency can be an important advocate for park support in lean times and can be the source of volunteer help for community-based projects that upgrade the park. In particular, small parks are potentially of a scale where public maintenance or upgrading activities can make a difference and be manageable. Good examples of these projects are community gardens, trails, and vegetation management and restoration. Such projects are small in scale or time limited. In addition, these projects can address important social goals, such as environmental justice and community activism. Public participation in park design can increase commitment to the park, including interest in such maintenance (Crewe 2001; Lane and Raab 2002, 249; Towne 1998, 85).

When involving the public, care must be taken to ensure that local unions do not have regulations

Constructing small community gardens can be a good way of involving community members in a park—however, it is important to have clear responsibilities for ongoing maintenance. *Source: Ann Forsyth and the Urban Places Project, used by permission.*

preventing such participation and that parks departments can deal with insurance and liability concerns.

Environmental Education

Small parks can play an important role in environmental education in a number of ways. It is not unusual for a small park to be located next to a school, providing an opportunity to create a living laboratory for children. Hidden learning opportunities for children exist in small parks, perhaps either a stream buried in a pipe waiting to be restored, a neglected area with woodland vegetation to be investigated, or an unusual animal or plant waiting to be discovered. Some of these opportunities are readily available while others require vision and commitment to recreate a more indigenous landscape. For park designers, planners, and managers, these opportunities are ideal times to maximize the social and ecological benefits of small parks for neighborhoods.

Another popular environmental education program is citizen-based science, which uses volunteers, adults, and children to monitor ecosystems, such as water quality, birds, and habitat quality. In a time of limited municipal budgets and personnel, these programs fill an important niche for the documentation of ecosystem change. The data collected by volunteers is integrated in ecological databases and constitutes a valuable tool for park designers, planners, and managers. For example, Ecology Explorers, sponsored by Arizona State University's International Institute for Sustainability (formerly the Center for Environmental Studies), is an exemplary model for citizen-based science, in which children are involved in ecosystem monitoring in the Phoenix, Arizona metropolitan region.

Guidelines

1. Work to involve the public in key park decisions as a way of both building better parks and developing a constituency to support park funding.

2. Consider how small parks would be enhanced by retrofitting a park's design for environmental education programs into local school curriculums.

3. Friends-of-the-parks groups can help with basic maintenance, such as litter collection and tree planting. They can also lobby for maintenance funds. Such groups should be cultivated, which

requires developing a plan for community support and media exposure. Planting demonstrations are one idea for generating interest.

4. Consider how a citizen-based science program would be used to enhance the monitoring of ecosystems in small parks, how this data would be used as a tool to manage parks better, and how the experience could enhance the education of elementary and high school students.

5. Identify likely conflicts between different constituencies' park use and facilities, including those who are not typically involved in park design. In public meetings come prepared with specific options to respond to the different needs.

FINE PRINT FACTS

Effective management, park users, and urban forestry

In a reflection on the practice of urban forestry, Bradley argues for better research on educational programs:

"Much of our time in urban forestry is spent on programs, brochures, slide and video programs, and field trips. These information projects are often developed without an explicit purpose in mind, with little understanding of learning styles, and with minimal attempts to find out if they have any effect at all. If we are in the information age, and if we are to generate and disseminate knowledge about urban forests, then becoming critical scientists, effective transmitters of information, and perceptive listeners is essential to the success of the field (Kaplan and Kaplan 1989)" (Bradley 1995, 9).

Bradley emphasizes the importance of the development of grassroots support for urban forest and open-space protection:

"The development of supporters, or an enthusiastic constituency, is necessary to garner resources, do the work, and maintain urban forest landscapes. Interesting enough, while many social issues related to housing and health care are in the forefront, tree planting and fish and wildlife enhancement programs consistently attract large and diverse groups of people for local environmental improvement projects. As a catalyst for community activity, open space programs—programs related to 'green' issues—are effective and tend to be enduring, like the environments they create" (Bradley 1995, 9).

Differences within groups over park use

Gobster reviewed the literature on racial conflict and found conflict within groups, arguing for larger public participation processes. He found that "interracial tensions over park space: (1) can exist among minority groups as well as between majority and minority groups; (2) can serve to produce physical harm as well as feelings of fear and discomfort; and (3) can result in lowered use, temporal and spatial displacement of a group, and racial and ethnic segregation of users within a park" (Gobster 1998, 48)*.

* Reprinted from P. H. Gobster. 1998. Urban parks as green walls or green magnets? Interracial relations in neighborhood boundary parks, *Landscape and Urban Planning* 41:48. © 1998, with permission from Elsevier.

SUMMARY: LESSONS ABOUT SMALL PARKS

What Did We Learn?

Small parks play important roles in the metropolitan landscape as major open spaces and areas at the neighborhood scale. They provide crucial access to green space for many people, and they may be the main recreational spaces in central cities. This manual provides guidelines to enhance the value of such parks for people and for the wider natural world. This is not a simple process, but by considering the issues raised in this volume, park users, designers, and managers and ecologists can make more considered decisions about park-design options.

Social and Ecological Values

With increasing awareness about the natural environment, it has become apparent that while the ecological functions of small parks are limited by their size and by the space needs of the numerous human activities that such parks must typically accommodate, such parks can still play a useful role as part of a larger ecological network. Socially, while many such parks have been designed to cater for children's play and athletic activity, they can also serve the needs of more diverse populations—particularly for populations that are older or where new immigrant groups bring different cultural values.

Many social and ecological values lead to similar design prescriptions, but this is not always the case. Space for soccer fields or picnic areas is space that is not being used for rain gardens or groves of trees. Even within broadly social or ecological approaches to park design, there are differing design solutions—a park that focuses on active recreation may have little to offer older people from immigrant populations used to formal gardens. A park that emphasizes design for water quality may have vegetation that does not maximize air quality benefits. Which values are given priority will depend on the surrounding context of the park—e.g., how many other recreational facilities are available or where the park is located in relation to remnant-forest, desert, chaparral, prairie, or savanna areas.

After considering context, there are still likely to be conflicts over what various constituencies believe should be in a specific park, particularly when uses are space intensive. A naturalized wetland area and butterfly garden can likely coexist with picnic tables and benches but not a football field. In addition, nature is not always comfortable for people, and a park that reflects the local ecology alone may not function well as a park. For example, for reasons of shade and wind control, people may prefer parks with tall, spreading, bright green trees rather than drought tolerant, gray-green desert shrubs or low-growing, yellow-green prairies, even in places where deserts and prairies are the natural environments. Compromise solutions may be just that—compromises. However, at best, park designs reflect careful assessment of the park's place in the town or metropolitan community.

Small Parks and Sustainable Communities

Small parks can also play an important part in making cities more sustainable, providing benefits for habitat, air, and water quality. However, small parks can also be a feature of neighborhoods with high densities—made up of attached housing that is more energy efficient and with activities close enough to make walking and cycling viable means of transportation. Small parks, of course, can be part of low-density areas, but they can also make compact cities more humane.

While it is certainly important to have large open spaces, particularly large natural areas that provide habitat, small parks can contain many of the important features of larger parks while reinforcing compact-city design. They can help urban dwellers appreciate natural processes in their neighborhoods; but small parks also provide unique facilities that enable people to gather informally, as in seniors' dominoes groups, or more formally, as in organized play groups or team sports. Parks can connect people to the history of both the built environment and the natural processes in the area. They can be rich cultural resources that allow people to sustain community life over time.

With attention to habitat connectivity and other principles of landscape ecology, conservation biology, and island biogeography, small parks can also be designed to be part of an urban bioreserve system that connects into regional open space networks, such as greenways and ecological networks. More scientific research is needed to advance understanding about the role of small parks as habitats for organisms during each stage of their life histories, such as migrating birds that use small parks as stopover habitats. However, scientists could develop research questions and designs that better respond to the actual questions that designers, planners, and managers have about designing and maintaining small parks as good habitats for different organisms while also considering the needs of people. In the end, increased collaboration will help all parties gain a greater appreciation of the complexities of park design that are faced by all.

All in all, small parks can do much better than is currently the case in terms of responding to both social and ecological concerns, but they cannot do everything and choices must be made.

Overview of Park Planning and Design Process

2

Design Development Guidelines

Design Development Issues in Brief

inform designs of small parks. The sites represent a wide range of typical types and conditions, from a new suburban park with a stormwater pond serving as its central feature to an inner-city park located in the heart of a large Latin community to a temporary park, anticipated to last only a few years. The designs, while responding to their specific locations, were created to demonstrate a conceptual point—park designs turn out differently depending on the underlying priorities of the designers. To do this, each of the example sites was approached through three lenses: ecological, social, and a middle ground using both ecological and social perspectives. The ecological lens illustrates ways small parks can be designed to maximize habitat potential, improve water quality, and help air quality. The social lens takes into account the numerous studies about human preferences with regard to open space and how parks can be best designed for use by a wide variety of ages, ethnicities, and abilities. Finally, the middle-ground solutions illustrate the compromises that must often be reached when designing small parks. In some cases, elements are lost; while in other cases, elements are strengthened when ecological and social needs are similar.

scenario. In these examples, we show how different design outcomes can be produced for the same site, depending on the issues that are emphasized. The examples also show that the middle ground is not always the best of both worlds but reflects a distinctive compromise position. Each of the examples is organized in a similar fashion. An introduction describes the park, the context, and other background information about the park. Next, we list the core issues with regard to design of the park. Included are the key tensions between the social and ecological aspects of the park. Finally, three designs are presented for each site: an ecological, a social, and a middle-ground strategy. Key features are described in text and on annotated illustrations.

The designs for the examples incorporated several of the guidelines that were presented in the manual. For more detail on the guidelines, see each individual topic or Design Development Guidelines (pages 137–147).

The sites for the examples are located in the metropolitan area of Minneapolis-St. Paul, Minnesota, the location of the authors. While the site designs reflect the Midwestern locale, the design processes and use of guidelines can give insights into the design of parks in other landscapes as well.

1

Taking Advantage of Stormwater Management in a New Suburban Area

Eagle Valley Park, Woodbury, Minnesota

The Place

Located in a rapidly urbanizing suburb, Eagle Valley Park shows the potential for using stormwater infrastructure to create a wetland with habitat for birds. In ecological terms, the park is near a proposed wildlife corridor. This corridor, and the others that make up the regional corridor network, connect significant natural resource areas. This ecological corridor framework also suggests locations where habitat can be acquired and restored. Eagle Valley Park can help build these connections. To the north, the park is adjacent to a golf course. Before clearance for construction, the site was planted with a stand of pines approximately 15 years old. Few, if any, of these trees were saved as part of the development.

This park of 5.1 acres (2.1 hectares) sits at the edge of a new subdivision of 80 duplexes and 101 townhouses, arranged in an organic pattern with a landscape of trees and lawn. One cluster of units is designated as affordable homes. It is anticipated that the average resident of the townhomes and duplexes will be older, although there will be some children and teenagers.

A stormwater pond, serving the new development, is located within the park.

The Core Issues and Tensions

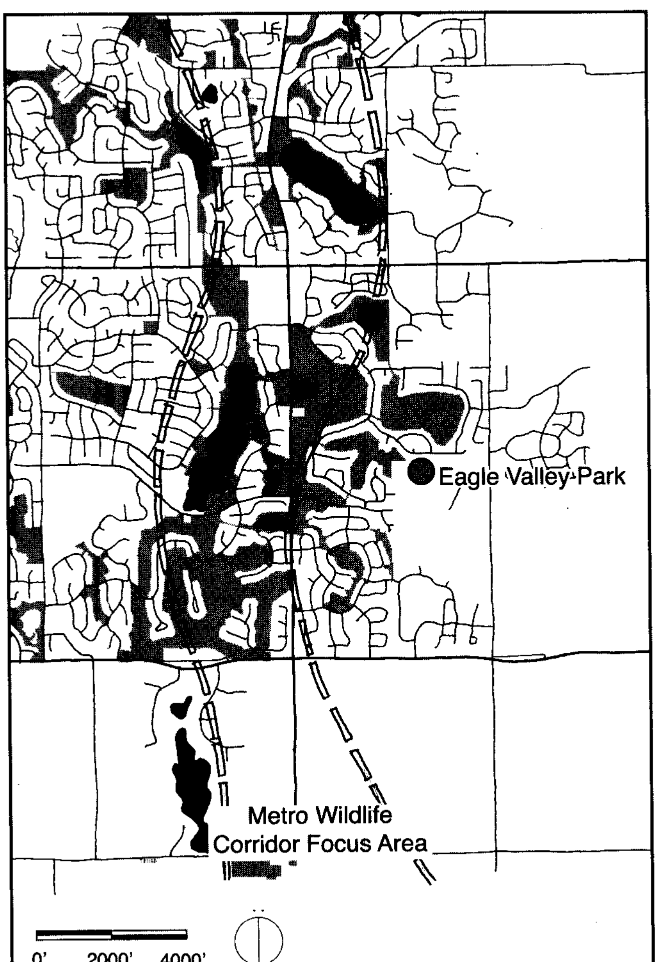
Ecological

- A key question is which animals the park habitat can and should serve.
- The stormwater ponds are difficult to plant—particularly in the bounce area, that is, the area subject to fluctuation in water height. In this case, there is a need to decide how important are native species. Can other species, including nonnative species, better survive the fluctuating water levels? Can the pond be designed to minimize fluctuations in depth?
- How can this small park enhance the ecology of the area, given its small size and the surrounding land uses?

Social

- Nearby facilities provide major ball fields and playing areas. Some recreational facilities are needed, but

RIGHT: This aerial view, looking south, highlights the site and the surrounding development. Existing wetlands and a small remnant natural area (A) are adjacent to the proposed stormwater pond (B). The new development (C) will include sidewalks along the street, something the surrounding, existing development does not include. **BELOW:** Eagle Valley Park is located on the edge of development in a rapidly growing suburban community. Agricultural lands lie to the east and south; these areas will be developed in the future. The park lies near a proposed regional wildlife corridor focus area. In some cases these wildlife corridors follow major open spaces such as the Mississippi and St. Croix rivers. However, as is the case with the corridor shown above, they can link small features such as lakes and parks to larger open-space areas. In these instances, small parks such as Eagle Valley Park play a particularly important role in creating a habitat network and a community green-space system.



these can be compact, for example, a volleyball court, a play area, or a half-basketball court.

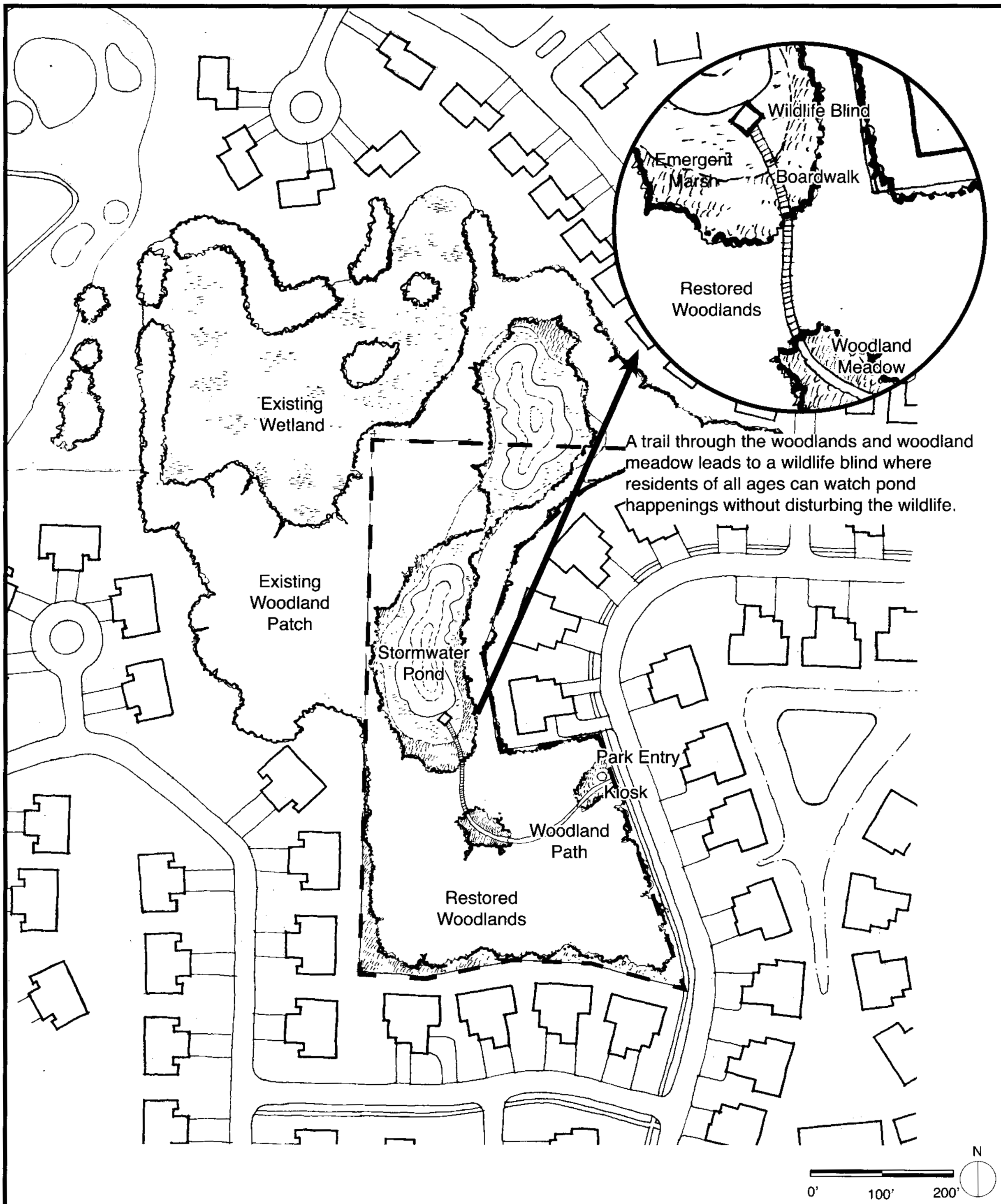
- When taking advantage of habitat potential, people need to be prevented from disrupting wildlife while still allowed some access to views of these species.
- People enjoy views of open water across areas that also have spreading trees and mown or smooth ground covers. It is anticipated that Eagle Valley Park will provide such views.

The Ecological Strategy

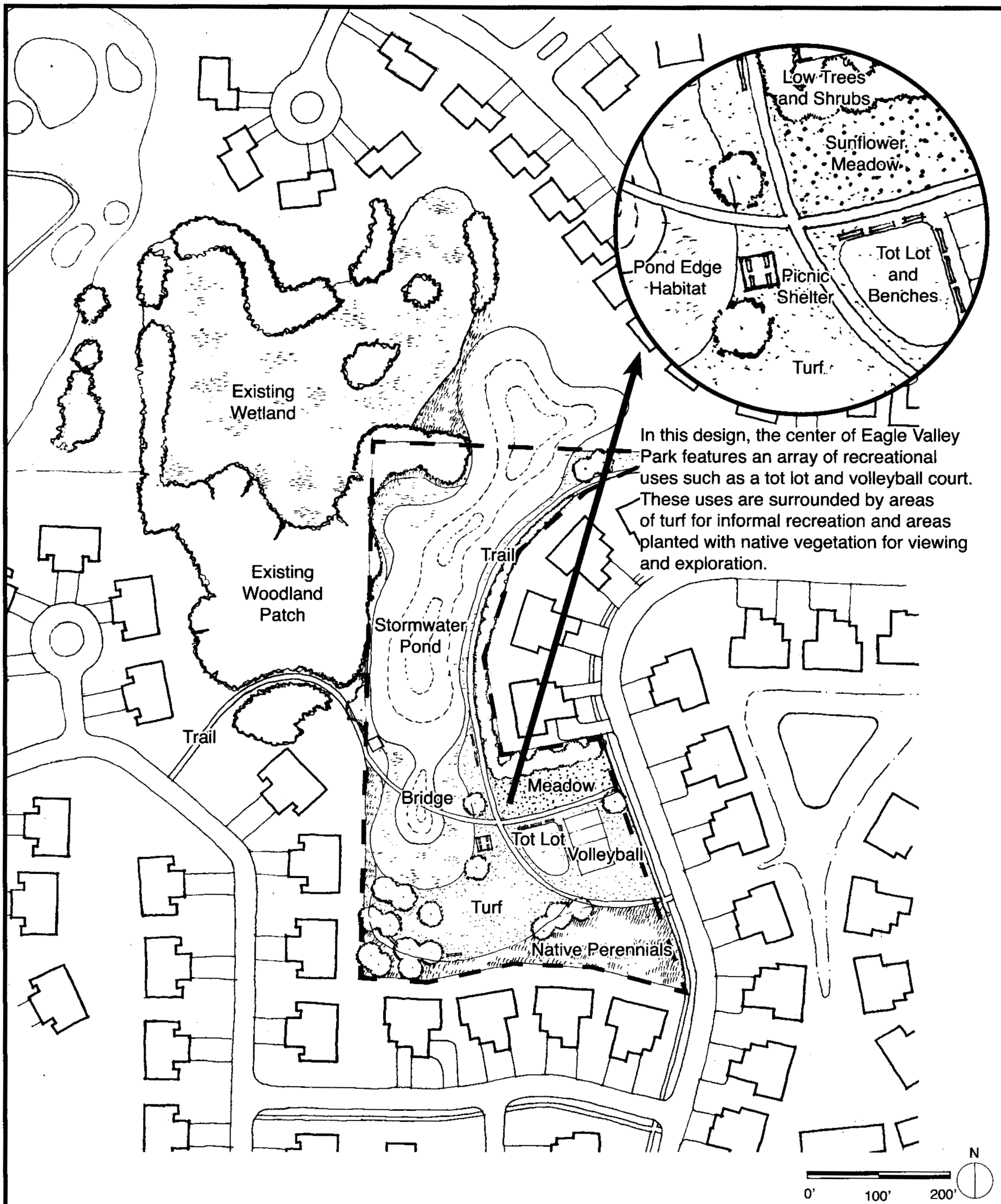
The ecological design concept for the park is of woodland ponds. The design includes six main areas: a woodland with meadow and path, boardwalk, pond, emergent marsh-wet prairie, wildlife blind, and park entry.

Park Entry, Woodland Path, Boardwalk, and Wildlife Blind

With people in mind, this part of the design has two objectives: (1) to create a unique landscape experience and (2) to enhance environmental awareness about the effects of rapid urbanization on native woodland and prairie habitats. The special features of the site include:



The Ecological Strategy: The design includes a path that goes through restored woodlands and a woodland meadow, ending at a wildlife blind. The path is designed to reduce habitat fragmentation of the restored woodlands and, also, to provide an experience of nature by buffering views of the surrounding neighborhood.



The Social Strategy: The design includes a variety of landmarks and activity areas. A trail network and pedestrian bridge provide access to the pond.

- A kiosk with environmental information about woodland-remnant environments and wildlife species tolerant of these conditions.
- A woodland path and boardwalk that increase the feeling of separation from suburban life through full enclosure by woodland and woodland meadows.
- Opportunities to view five types of habitats along the path and surrounding the wildlife blind.
- A wildlife blind that overlooks one of the ponds and allows people to observe directly wildlife.

Woodland, Woodland Meadow, Pond, and Emergent Marsh-Wet Prairie

By immersing people into a very different habitat type, the park creates a suburban wilderness experience. Special features of the site enhance the wildlife habitat of the site by:

- Increasing connections to the remaining woodland patches on the site by revegetating woodland in existing open areas.
- Reducing potential edge habitat by creating one larger patch.
- Increasing the diversity of habitats on the site, including woodland, pond, and emergent marsh-wet prairie.
- Providing cover for wildlife by locating the woodland edge close to each pond's edges.
- Reducing woodland fragmentation by creating just one path into and out of the park.
- Reducing human disturbance in the park by limiting access to just one pond.

The Social Strategy

The social design strategy for Eagle Valley Park adds a variety of activities and landmarks for people to enjoy. Recreational areas and places for people to socialize are incorporated around a large stormwater pond.

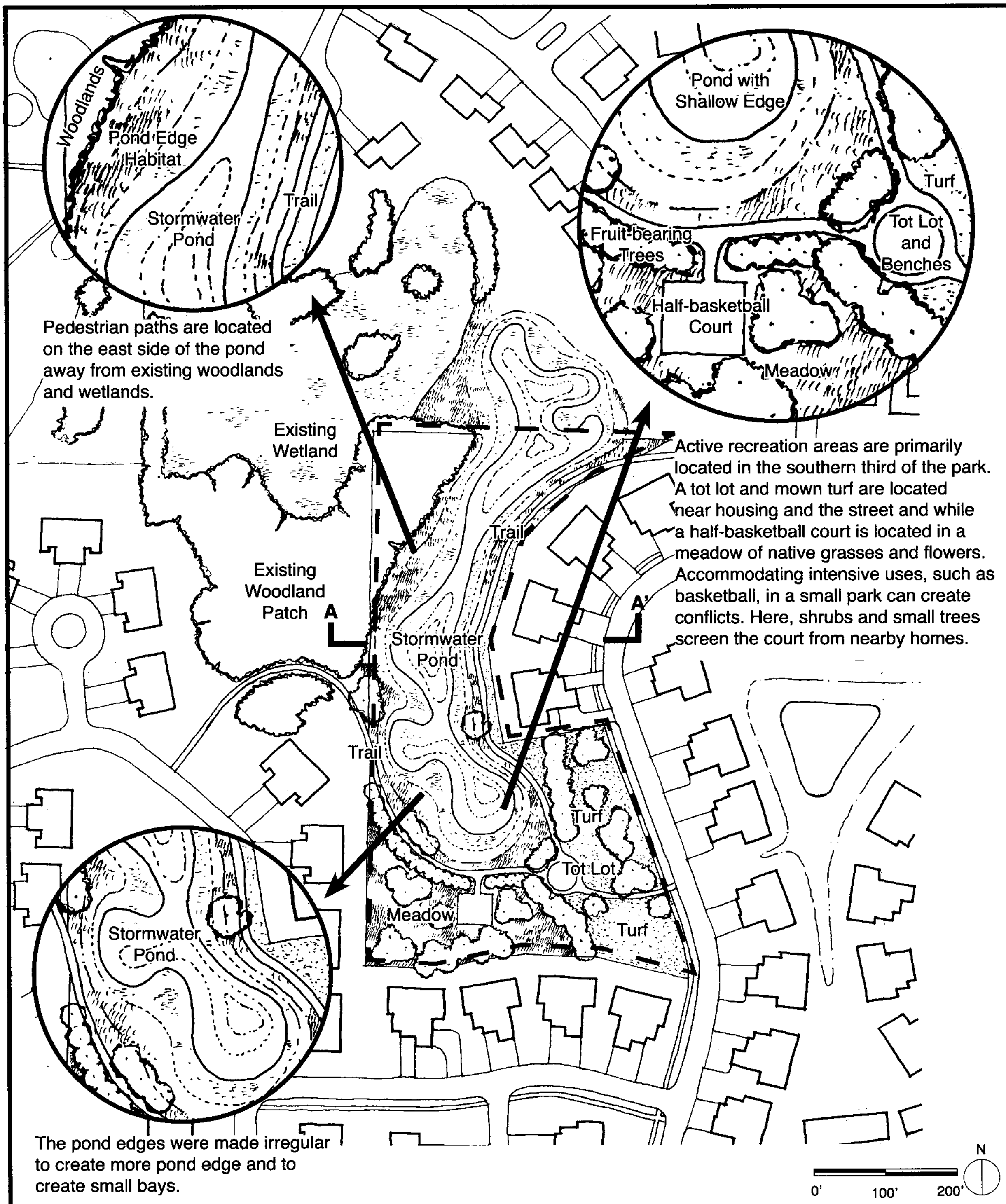
Social Interactions

- Volleyball courts and a play area provide a place for play and recreation.
- Two paths take visitors through the park, connecting to a neighborhood path system and offering multiple places to stop or view wildlife.
- Benches are located in high traffic areas as well as in more isolated areas to allow park users a choice of where they would like to sit.
- A significant area of lawn provides a place for informal recreation and a sitting area.

Stormwater Pond and Plants

- The stormwater pond encompasses a significant portion of the park. Edges are shallow and planted with trees and shrubs to provide wildlife habitat and to create human interest. A bridge and wildlife viewing platform allow park users to experience nature close-up.

This drawing represents a slice through the stormwater pond illustrated to the right. To enhance habitat potential, walking trails are located near residential properties, away from the area where the pond adjoins a stand of mature trees and an existing wetland, and the pond was designed with a shallow, undulating bottom.



The Ecological + Social Strategy: The design incorporates a stormwater pond intended to enhance its potential habitat value as well as activity areas, a lawn with canopy trees, and trails.

- Native shrubs and perennials are added along the southern edge of the park and to the north of the volleyball area to limit long-term maintenance and to provide a colorful edge to the park.
- Shrubs form a privacy hedge between homes and the pond-side path.
- Canopy trees provide shade in the southern part of the site and create an area with the widely preferred savanna appearance.

The Ecological + Social Strategy

The design incorporates four main areas: a stormwater pond, meadow, play, and lawn.

Pond

The core approach is to increase the habitat potential of what could be designed as a small, conventional stormwater pond.

- By changing the shape of the pond, the amount of storm water-pond edge was increased. Different bays improved the habitat value of the pond environment.
- Habitat diversity was also increased by making the pond shallower and varying the depth of water.
- People have been given access to the water; but by keeping the path to the built side of the pond, the design preserves an uninterrupted connection between the pond and the small, adjacent stand of trees and existing wetland.

Meadow, Play Area, and Lawn

The core approach is to reduce the amount of mown-lawn areas and to increase the area planted with native plants.

- The design uses rows of trees to create a strong edge between areas planted with turf grass and those planted with native grasses and flowers. This has a largely social function, showing that the native plantings are intentional, rather than having a weedy appearance. Large canopy trees shade the play area and the gathering spaces that are planted with lawn. Tables and benches are placed throughout the lawn.
- A meadow in the southwest corner of the park is planted with native grasses and flowers. A half-basketball court is located in the meadow. This location places the game activity away from the play area and other gathering spaces and gives the players a place away from others in the park. A trail that leads to the court and past the pond permits monitoring of the space, and benches located around the court allow spectators and players to watch the game. A row of fruit-bearing trees lines the walk from the play area past the court.

2

Rehabilitating a Park for Community Revitalization

Parque Castillo, St. Paul, Minnesota

The Place

Parque Castillo is a 1.3 acre (0.5 hectare) park that is located in a culturally diverse neighborhood with a large Latino population. The park is in the District del Sol, the historic, commercial hub of the West Side neighborhood. It is located where it can provide additional habitat along a linear corridor of steeply wooded slopes that run through the neighborhood near the Mississippi River. The park is also located across the street from a ball field and a larger recreational facility.

In 2004, the District del Sol was awarded a Livable Communities grant from the Metropolitan Council for transit, pedestrian, and bikeway improvements to include bump-outs, attractive bus shelters, and bike lanes. The work is aimed at improving connections between the neighborhood and the Mississippi River to the north.

This park and surrounding area have been the subject of a design charette—an intense, short workshop where a design and design alternatives are developed. Building upon the charette, a schematic plan for the park was developed by the city's parks department. Included in that plan are a change in the park's boundaries and the creation of a new street that can be converted to pedestrian use during large public events.

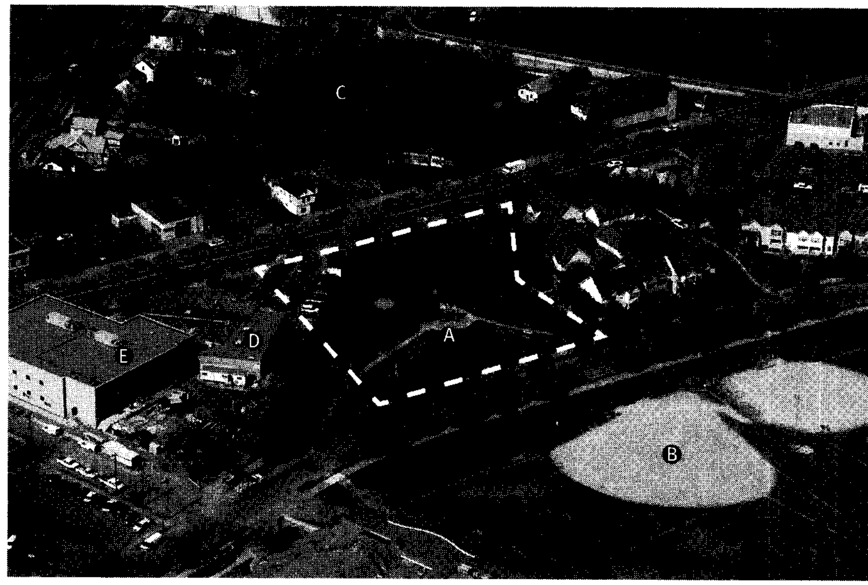
The Core Issues and Tensions

Ecological

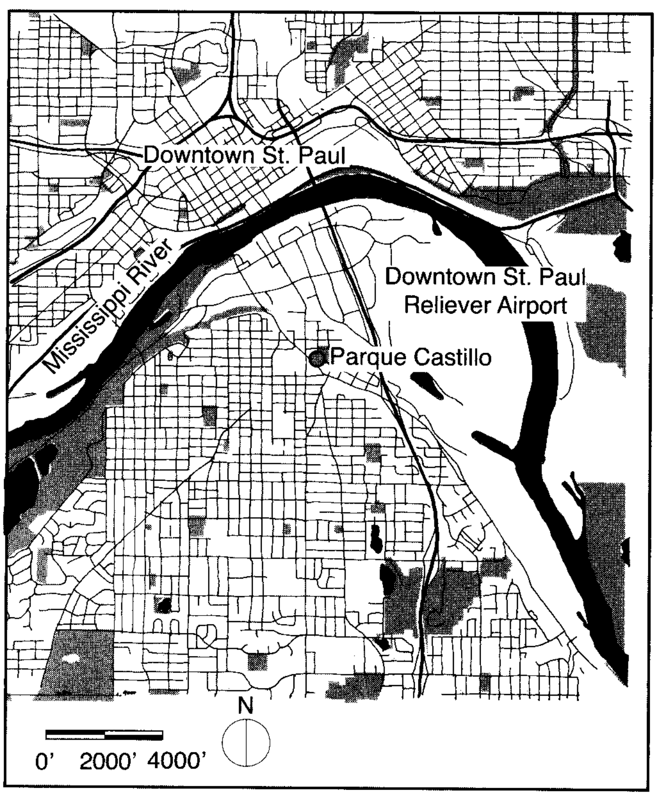
- This park provides an opportunity to build on two woodland remnants that provide habitat for small animals, birds, and insects.
- The Mississippi River, a major flyway for migrating birds, is located near the park as are regional parks along the river valley.

Social

- As research on the social use of space shows, Latinos often use parks in large multigenerational groups participating in social gatherings. Parks may also function as plazas and include large paved areas with formal plantings or be used for their play areas. It is anticipated that Parque Castillo will include a place for large gatherings.



RIGHT: Parque Castillo (A) is near a community athletic facility (B), wooded areas on steep slopes (C), and a neighborhood commercial area that includes an existing clinic (D) that is being replaced. The park boundaries, as illustrated above, will change with completion of the new clinic (E) and clinic parking lot.



BELOW: Parque Castillo is located approximately 1 mile (1.6 kilometer) from the Mississippi River. Large regional parks are located along the river, and the river corridor serves as a major flyway for migrating birds.

- The park is adjacent to a large athletic facility with sports fields and does not need to provide these activity spaces.

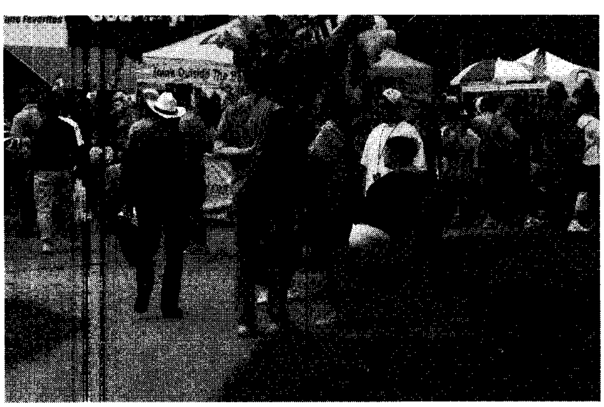
The Ecological Strategy

The design concept is to create a Big Woods grove and tallgrass prairie–butterfly garden. The design includes four areas: plaza, promenade, tallgrass–prairie butterfly garden, and Big Woods grove (see page 114).

Tallgrass Prairie–Butterfly Garden and Big Woods Grove

This part of the design has two objectives: (1) to bring nearby nature to neighborhood residents by planting two regionally significant plant communities and (2) to enhance environmental awareness about urban ecology. The design includes:

- Plant species that reinforce understanding of nature's seasonal cycles.
- A stylized version of a tallgrass prairie that has an expanded plant list of butterfly-attracting plants. The prairie is maintained as a garden, so it does not appear messy or neglected.
- There is no turf lawn in the design, but the understory of the Big Woods grove has informal trails and is underplanted with ferns, low-growing woodland



Parque Castillo is actively used throughout the year and especially during the annual Cinco de Mayo celebration, as shown above.

grasses, and flowers. Benches invite sitting and resting under the tree canopy.

Plaza and Promenade

Since the park's setting is in a center-city neighborhood and is a heavily-used cultural feature, preserving most of the existing social functions in the park's spaces are of primary importance. The special features of the design include:

- A small central plaza, with seating and a fountain, provides space for a ring of tallgrass prairie–butterfly garden. Porous pavement is used in the plaza to improve infiltration of runoff.
- Wide sidewalks, with benches along the streets, are shaded by the Big Woods.

The Social Strategy

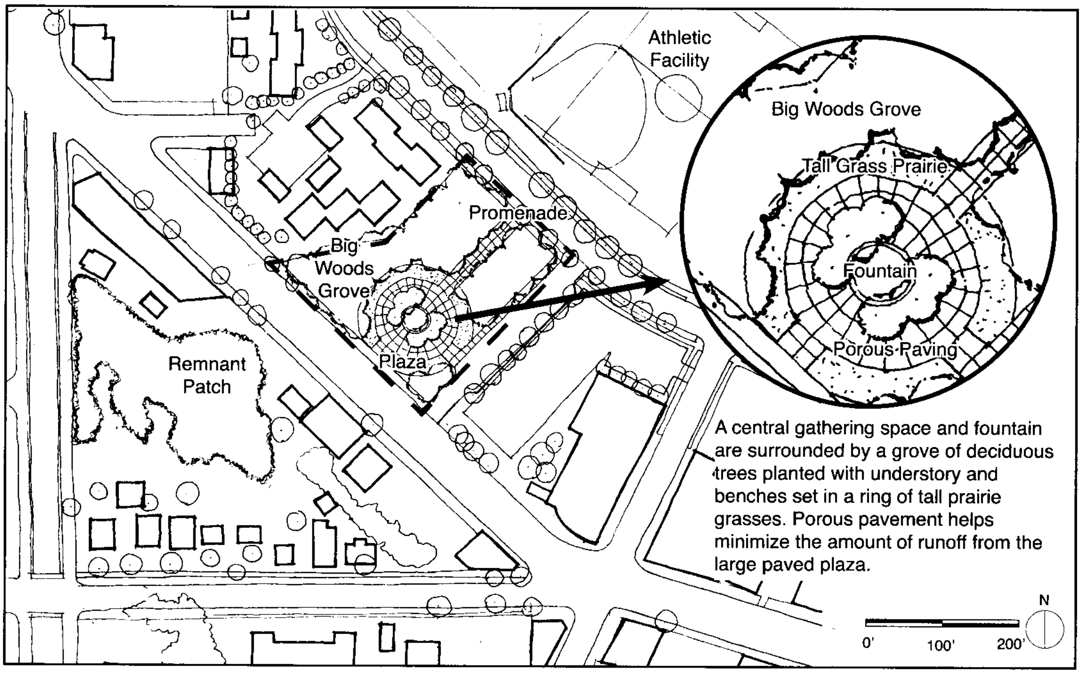
The social design for Parque Castillo incorporates several different spaces for people to interact using a formal design layout, colorful materials, and activity spaces reminiscent of parks and plazas in Latin America and the Caribbean (see page 114).

Social Facilities

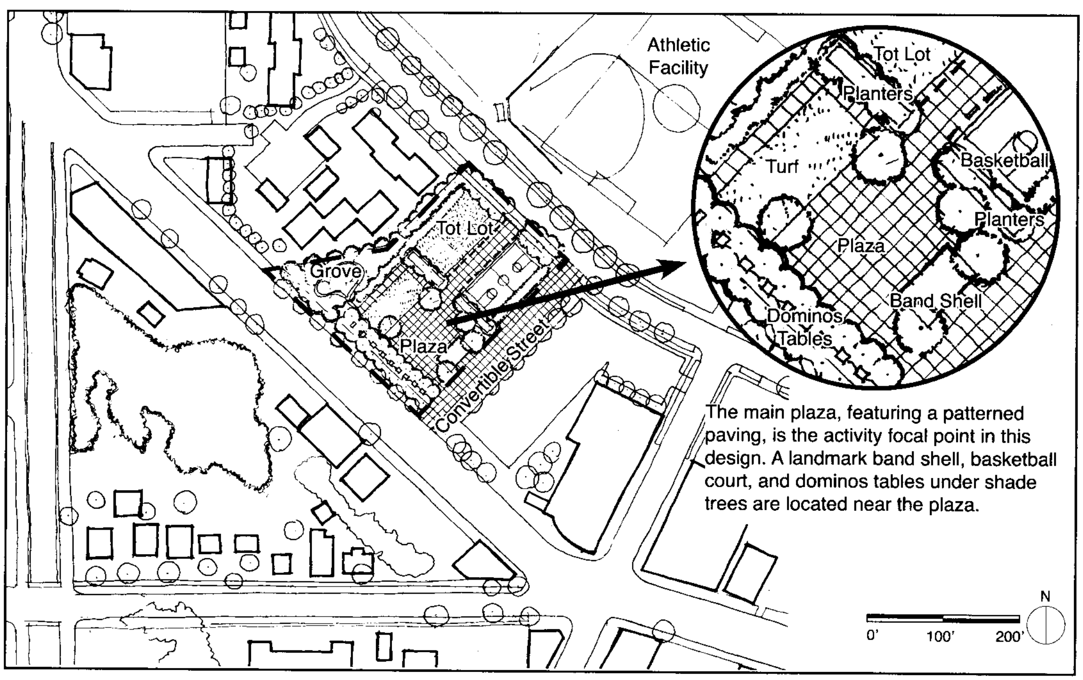
- Picnic and domino tables are located under a canopy of trees, allowing informal socializing among people of many ages.
- A play area provides a space for children to play.
- A paved plaza area and band shell creates a space for social gatherings for large groups and evokes the atmosphere of gathering spaces in Latin America.
- A basketball court, or other similar compact court area, provides a space for active recreation.
- Paving patterns provide color on the ground surface, reflecting Latino cultural traditions.

Plants

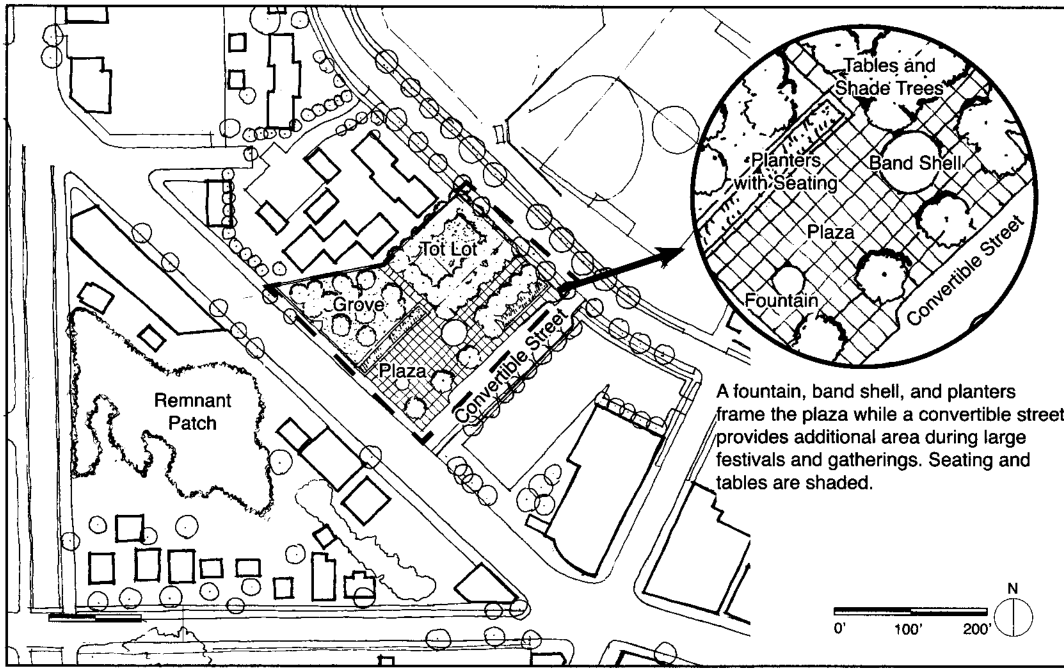
- A grove of trees provides a shady space for relaxing. An informal path provides access to the grove.
- Large-canopy trees shade the plaza, seating areas, and sidewalks.
- Planter boxes are planted with colorful flowers and flowering shrubs and can also be used for seating. Painted in bright colors, they provide year-round interest.
- Linear plantings of trees help frame the various spaces within the park and provide shade.



The Ecological Strategy: This design includes a large, paved plaza and promenade, as well as a Big Woods grove and a tallgrass prairie–butterfly garden. Habitat patches remain on steep slopes near the park. The Big Woods vegetation is a type of deciduous forest that is common in the Minneapolis-St. Paul region.



The Social Strategy: This design alternative includes a large, paved plaza and a basketball court adjacent to a new street. During large events, the plaza, basketball court, and street can be used for food stands, stages, et cetera.



The Ecological + Social Strategy: A small grove, large plaza, and play area are features of this plan. The formal plaza is surfaced with porous paving and shaded by large canopy trees.

The Ecological + Social Strategy

The design involved three components: creating a formal, paved plaza; increasing the tree canopy; and creating a small naturalistic grove.

Formal Paved Plaza

- A number of features reflect typical Latin-influenced plaza designs, including: patterns in the paving; brightly colored plaza furnishings; decorative, brightly colored fencing enclosing much of park; raised stucco planters that define the plaza's edges and provide seating; and a band shell and fountain located on axis in the center of the plaza.
- Several design features have been modified to increase ecological value while still maintaining the look and feel of a Latin plaza. Porous paving allows water infiltration, and planters have neat native shrubs and grasses that are not overly flowery and horticultural.
- A convertible street allows events to expand into the street, thereby extending the size of the plaza. This element had been included in the design by the parks department.

Canopy

- The formal quality of the park is emphasized by a linear arrangement of trees, which are ordered in an axial pattern and placed along the edges of plaza to define its space.
- The trees are grouped in groves to provide shaded spaces. Benches and game tables are placed in the plaza under the groves of trees.
- Canopy trees also surround the area with the lawn and the play structures.

Grove

- The grove is clearly demarcated by walking paths, fencing, and raised planters, and it includes layers of vegetation consisting of unmown-native grasses, shrubs, and trees.
- This "natural" area is adjacent to the play area.

3

Renovating a Suburban Park for Water Quality and Active Recreation

Tighe-Schmitz Park, Birchwood Village, Minnesota

The Place

Tighe-Schmitz Park is located on a former wetland that was intermittently filled, starting in the 1950s. The park still has large areas that are low and wet.

The 2.7 acre (1.1 hectares) park is separated from White Bear Lake by a street and a row of houses, although there are direct connections to the lake via two easements. While the lakeside houses were originally holiday homes, most are now year-round residences. The site includes facilities for numerous activities: a baseball field, soccer field, volleyball court, skating rink, and play structures. Very little extra space is available in the park and a number of facilities share space; for example, most of the baseball outfield overlaps the soccer field.

This is the largest park in the City of Birchwood Village, and many of the facilities in the park are the only ones in the city. After some controversy over the future of the park, the Open Space and Parks Committee conducted a survey with over 50% of households responding. The survey showed a strong preference for recreational spaces in the park. When asked how they felt about restoring a portion of the park to wetlands or leaving the park as is, most residents responded that they preferred to maintain the park in its current state. However, there was a favorable reaction to developing a rain garden in the park to help store and filter runoff.

The parks committee invited the Metropolitan Design Center to create design options for the park to spark public debate about future park improvements.

The Core Issues and Tensions

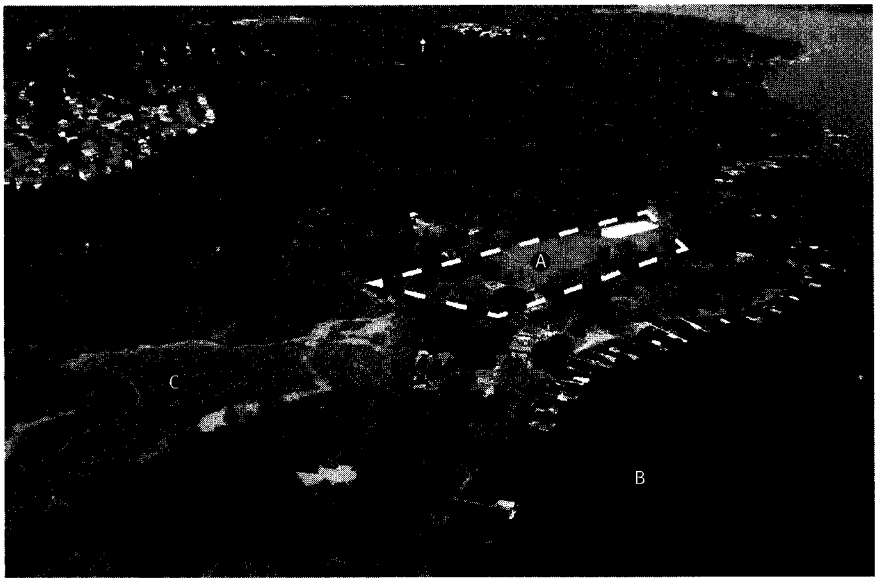
Ecological

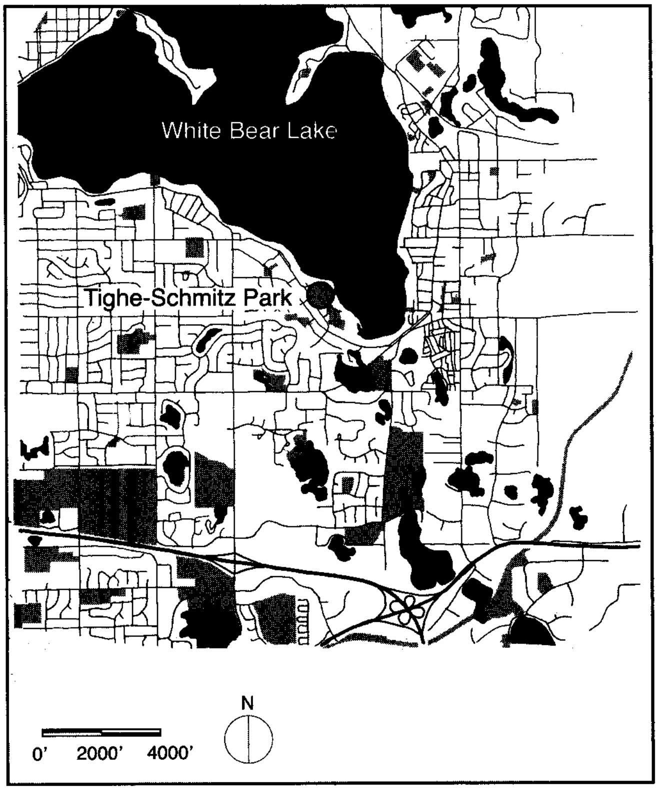
- The park has extensive wet areas; however, there is a community perception that returning a portion of the park to wetland or other natural areas is losing a portion of the park.
- While the park is near the lake, the easements that link the park to the lake are currently planted with mown lawn.

Social

Large areas of lawn are necessary for the athletic fields and skating areas. In addition, there needs to be even

This aerial view, looking south, highlights Tighe-Schmitz Park (A) and its proximity to White Bear Lake (B) and Halls Marsh (C). The few trees and large, open turf areas of the park stand in contrast to the heavily-treed residential areas of the city.





Tighe-Schmitz park is located near the shores of White Bear Lake, Minnesota. The area surrounding the lake is developed, with no major natural areas located adjacent to the shoreline.

more grass or, at least, an unobstructed area around the athletic fields. Because this is a small park that has to support a number of different recreational or athletic activities, these mown and unobstructed areas currently dominate. This means that the park functions primarily for athletics and small children's play in the playground rather than other uses such as social gatherings or reflection (see page 119).

The Ecological Strategy

The design concept for this park is woodland. The design includes eight areas: woodland, wet prairie, trail, rain garden, ice rink, play areas, and support facilities.

Woodland, Wet Prairie, Trail, and Rain Garden

Since the site was a wetland and still has a drainage issue, approximately two-thirds of the site is returned to woodland and wet prairie. In addition, the park is a key connection between two easements and an existing wetland. Revegetating the site with woodlands and wet prairies would help to improve habitat connectivity between all of these sites and provide more diverse habitat types for wildlife. The major features of the design are as follows:

The park's many recreational uses are actively used; however, some parts of the park remain too wet for use after a rain. The western edge of the park is bordered by trees growing in an unused right-of-way.

The recreational amenities and associated facilities, such as the warming house, parking, and portable toilet, have left little space for greenery beyond turf and a few trees.

- Reducing patch isolation of the remaining woodland patches on the site by revegetating woodland in existing open areas. The easements connecting the park to White Bear Lake also need to be revegetated in a similar manner. The species planted in the woodlands need to be tolerant of wet conditions.
- Increasing the diversity and area of habitats on the site, including woodland and wet prairie.
- Consolidating and moving activities that attract people and produce noise into one location in the upper part of the park.
- Reducing woodland fragmentation and human disturbance by creating just one path into and out of the park.
- Adding a kiosk with environmental information about woodland-remnant environments and wildlife and plant species tolerant of these conditions.
- The rain garden remains in its current location due to its popularity and its compatibility with the other habitats.

Ice Rink, Play Areas, and Support Facilities

Since this is the only park in Birchwood Village with active-recreational facilities, the most critical elements are preserved, such as ice rink, play areas, and support facilities. The play area has been moved closer to existing recreational facilities. These facilities have good access from the adjacent road, and any noise is reduced by the surrounding woodland.

The Social Strategy

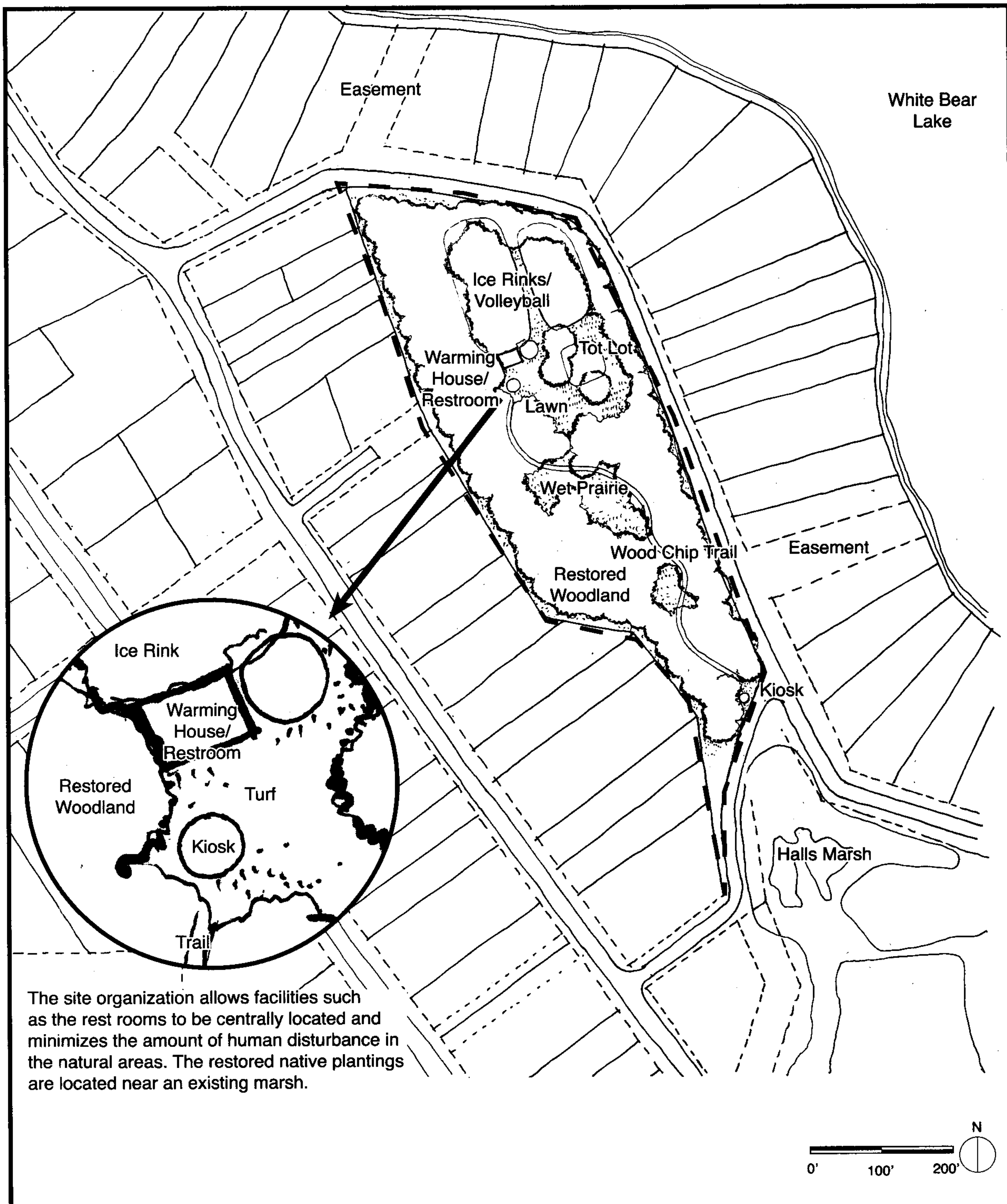
This strategy maintains existing recreational activities while enhancing opportunities for a variety of social interactions among a broad range of people. Plants are used to enhance spaces and to create different experiential qualities throughout the park (see page 120).

Social Enhancements

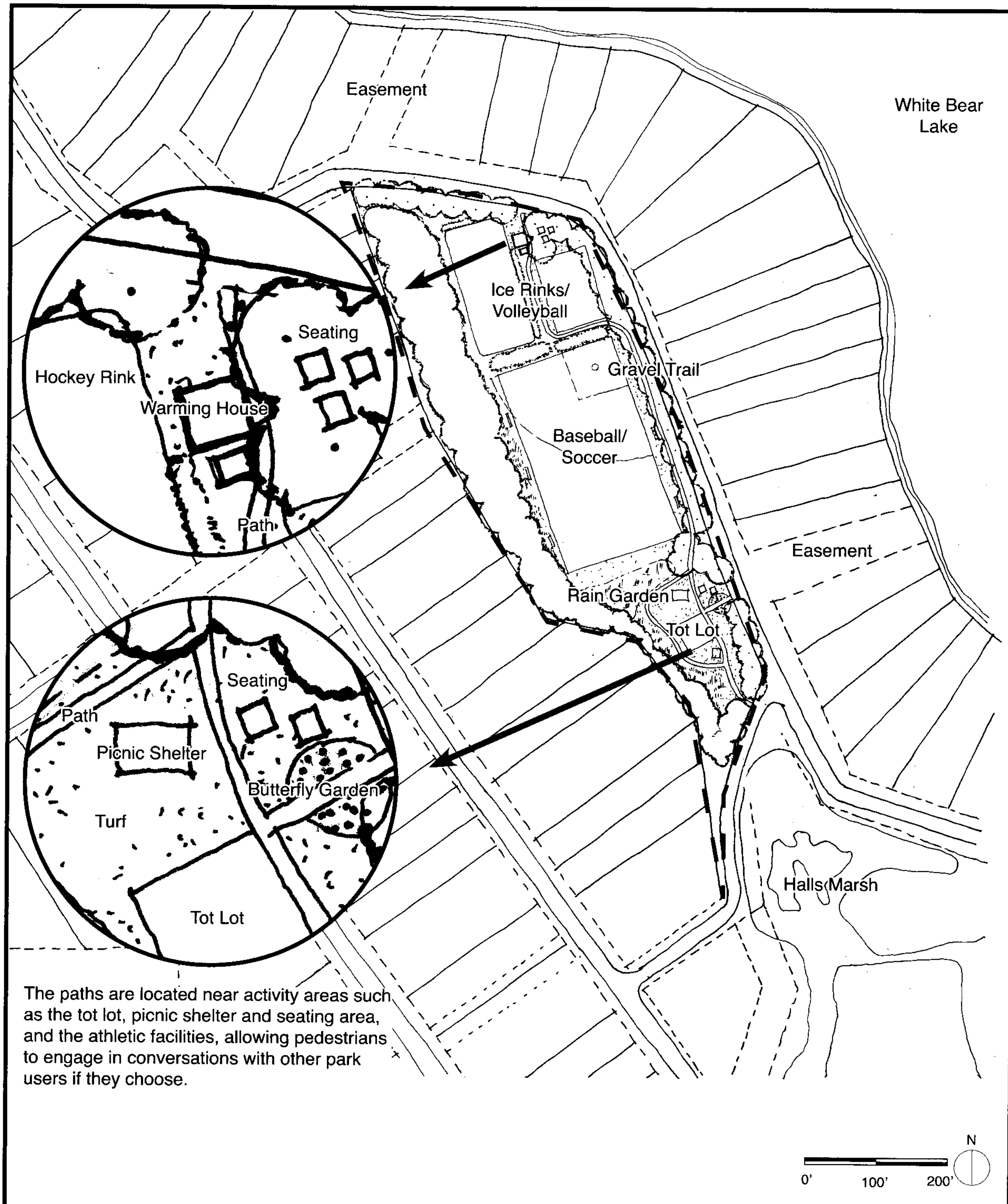
- Paths take people along the outer and middle parts of the various spaces of the park, allowing the option to stop or to continue along the path. As the paths pass by activity sites, such as the playing area, the paths provide opportunities for chance encounters with people in the neighborhood.
- Seating and picnic areas allow for varied activities by groups of different sizes and people of different ages. Additionally, areas for people to be alone without being isolated are added to the park, particularly along the back edges of the park.

Plants

- Colorful plantings with a neat and manicured appearance are used to create aesthetically pleasing spaces for

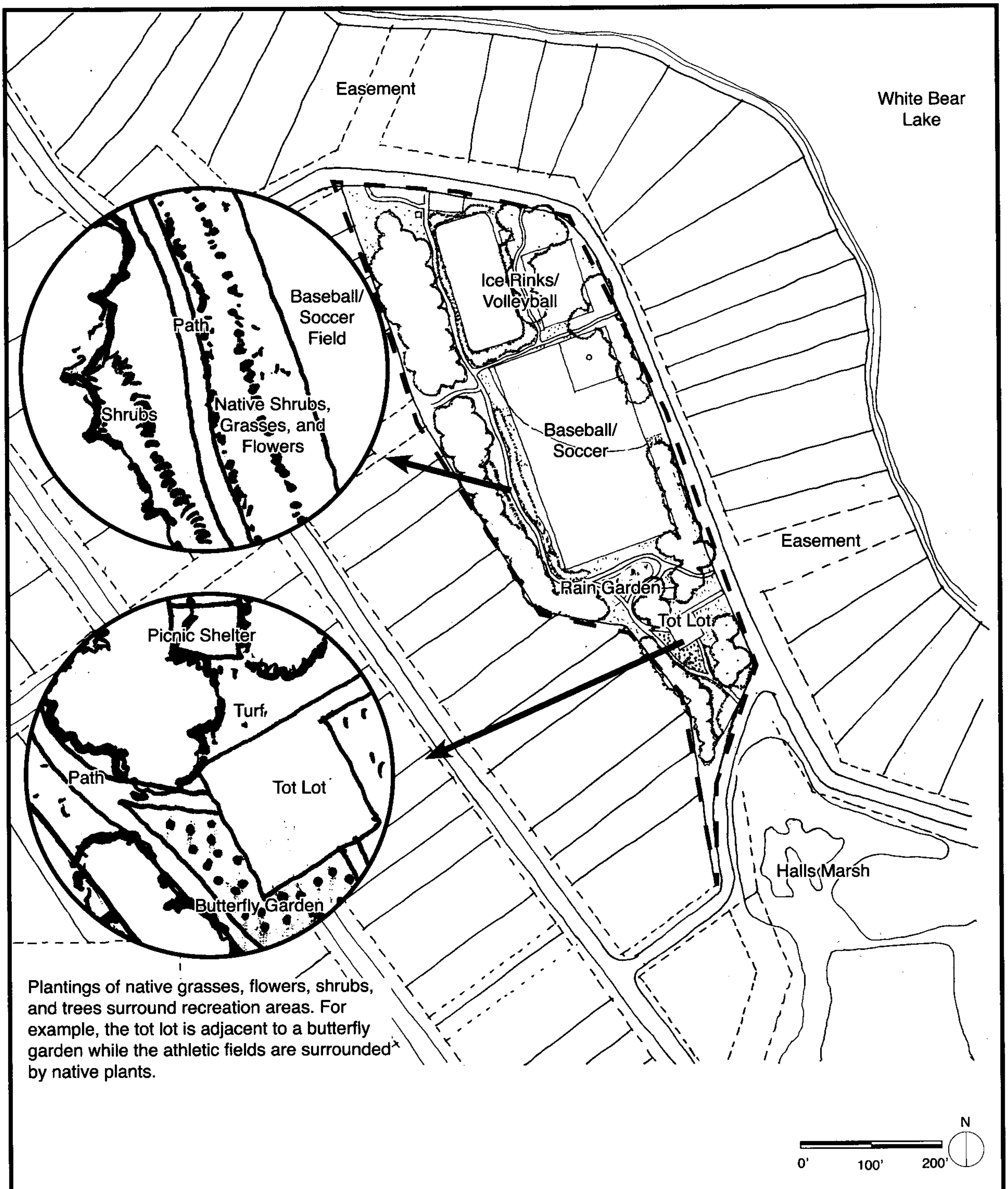


The Ecological Strategy: In this design some of the existing athletic facilities are replaced with a restored wet prairie and woodland. Activities that draw large numbers of people, such as the ice rinks and play area, are concentrated at one end of the park. A path made of wood chips in drier areas and a boardwalk in wetter areas provides an opportunity to appreciate nature and a physical link to all of the park's amenities for the neighborhood's residents.



The paths are located near activity areas such as the tot lot, picnic shelter and seating area, and the athletic facilities, allowing pedestrians to engage in conversations with other park users if they choose.

The Social Strategy: In this design all of the existing athletic facilities remain. Gravel paths and seating areas are added to allow for more varied activities by groups of different ages.



The Ecological + Social Strategy: In this design all of the existing athletic facilities remain; however, native grasses and flowers have been incorporated in between them so that the athletic fields are essentially "cut out" of a natural landscape.

people to enjoy. Showy flowers and shrubs create a backdrop to the recreational facilities within the park.

- Low-growing, water-tolerant shrubs, perennials, and sedges are planted in the wet areas between athletic areas. A mulched path or stepping stones will provide access between spaces and allow visitors to experience these plant communities.
- A butterfly garden is located near the play area for contact with nature and seasonal change.
- Street trees along the eastern boundary provide enclosure and frame views, while they maintain views to the surrounding neighborhood.

The Ecological + Social Strategy

This design maintains the existing athletic facilities, while it increases the number of natural areas in the park. This is accomplished by intensifying nature in the small spaces between the various activity areas. Recreational areas, such as the ball fields and play areas, are "cut" out of expanded natural areas. Native grasses and flowers extend right up to the edges of the play areas. Paths throughout the park minimize trampling of native plantings as people walk from one recreational area to another.

Intensified Nature

- Rain gardens and areas of natural plantings are added between the recreational uses.
- Native plantings, shrubs, and shade trees are inserted into any small, leftover space available, including along the borders of the park.
- A butterfly garden adjacent to the play area places this educational opportunity near children.

Social Enhancements

- The design includes the community baseball and soccer fields, because it is the only location for these amenities.
- Benches are added to allow more opportunities for socializing and reflection.
- A wood-chip path provides access through the park and allows users a way to stroll along the wooded edge of the park.

4

Redefining the New Urban Town Square

Central Square, Heights of Chaska, Chaska, Minnesota

The Place

Central Square is a 1.4 acre (0.6 hectare), formal town square in a proposed New Urbanist development in Chaska, Minnesota. The area had been planned at a conceptual level by an external consultant (Calthorpe Associates). This plan included an extensive open-space system; most of the planned area follows natural waterways, steep slopes, and a chain of created ponds. Surrounded by higher density housing, retail, and civic uses, the town square was included in the master plan as a contrasting formal element located toward the middle of one of two neighborhood centers. However, its design was unspecified in the plan.

While this is a theoretical project, the Design Center consulted with planning staff in the City of Chaska about the design.

The Core Issues and Tensions

Ecological

This area can demonstrate how to move from a decorative lawn to a park with both lawn and plantings that require fewer resources.

Social

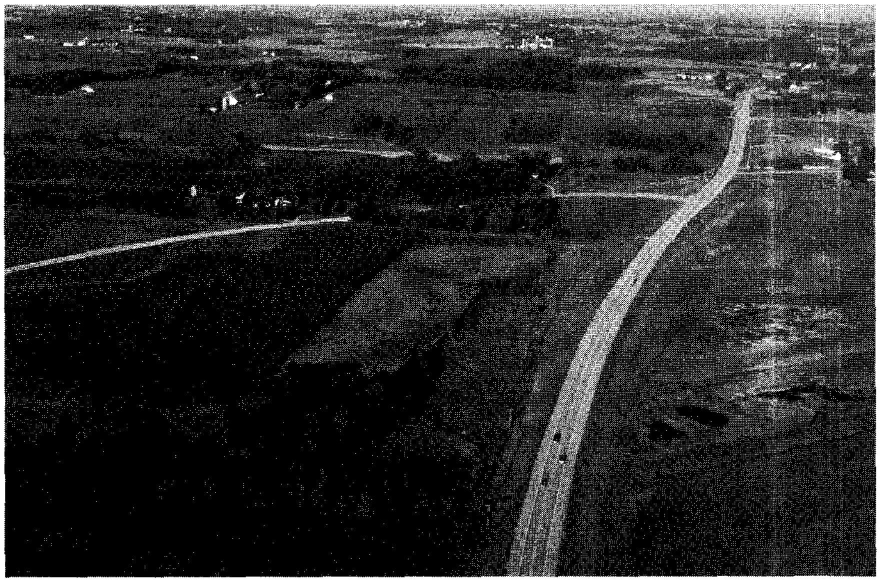
Typically such town squares contain formal lawns, street trees, and perhaps a built element, such as a band shell or a fountain. A more intricate design could maintain the civic scale and activities in some parts of the park, while it allows more diverse uses for people of different ages and in groups of different sizes.

The Ecological Strategy

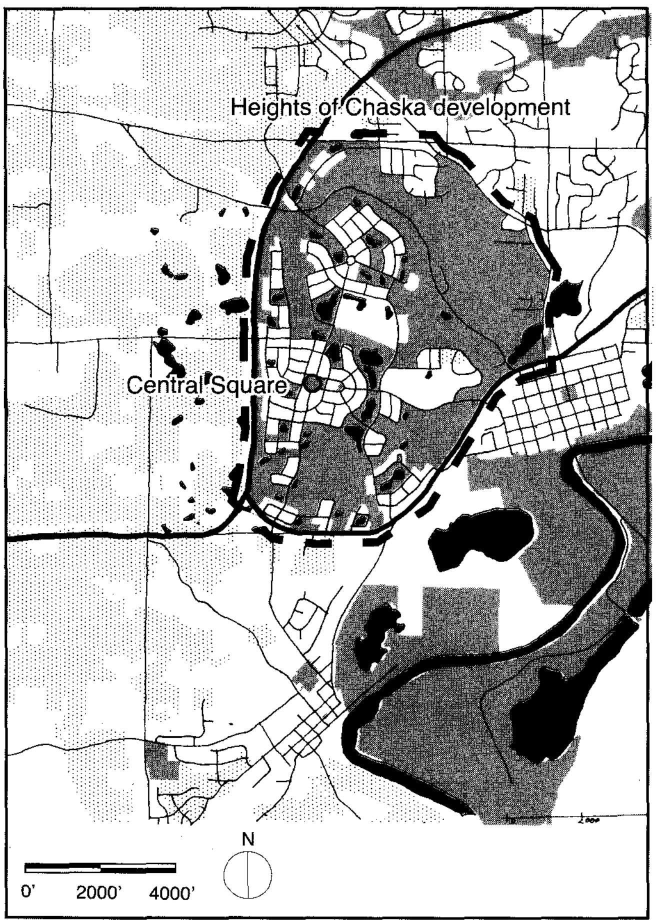
The design concept for the park is an urban-edge savanna with a secret spring embedded in a grotto (see page 126).

Tallgrass Prairie and Oak Savanna Edge

The curved geometry of the tallgrass prairie and oak-savanna edge contrasts with the linear geometry of the surrounding street layout. Given the small size of the square and its lack of connections to other open spaces, the revegetation of plant communities on the site is a symbolic connection to the community's ecoregion. The park does offer opportunities for people to learn



RIGHT: The Heights of Chaska is a proposed 1,000-acre development, approximately 25 miles southwest of Minneapolis, Minnesota. Currently agricultural land, the rolling topography, existing stands of trees, and natural waterways inform the conceptual design by Calthorpe Associates. This aerial view shows the approximate location of the proposed development.



BELOW: The Heights of Chaska is a new development designed with the principles of New Urbanism. The central square is one of two neighborhood squares in this development. The development features an open-space network that includes existing woodlands and green areas that manage storm water.

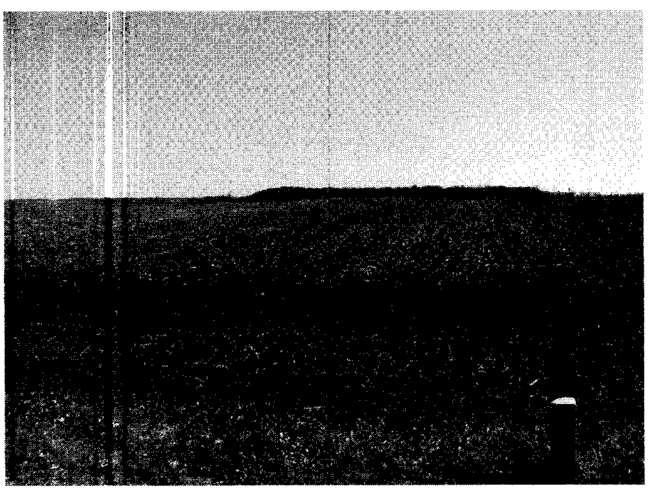
more about urban ecosystems. The special features of the design include:

- A tallgrass prairie intended to be one continuous patch, except where a path crosses it near its boundary with the oak savanna.
- An oak-savanna edge buffers the tallgrass prairie from the surrounding streets.
- A path that allows people to experience the full extent of the park visually. The path is located toward the perimeter of the park rather than bisecting it, to minimize fragmentation of the tallgrass prairie.

Rain Garden, Reflecting Pool, and Secret Spring in a Grotto

This part of the design is a symbolic approach to recreating habitats that are rare within prairie and oak-savanna landscapes. These spaces are also more private and contemplative than others in the design. The major features of these spaces include:

- A rain garden with blooming, wet-prairie perennials. This garden is bright and sunny.



A historic town square is located in the heart of downtown Chaska, *above, top.* The site of the proposed Heights of Chaska development includes agricultural lands as well as natural areas that will be preserved, *above, bottom.*

- A small pool where sun and clouds reflect in the surface of the still water.
- A grotto, with a secret spring, that is planted with ferns. This space is the coolest and shadiest space in the park.

The Social Strategy

This strategy creates a variety of spaces for people to gather for different types of events. A simple planting plan will enhance the gathering spaces, lower long-term maintenance costs, and provide an aesthetically pleasing experience.

Social Enhancements

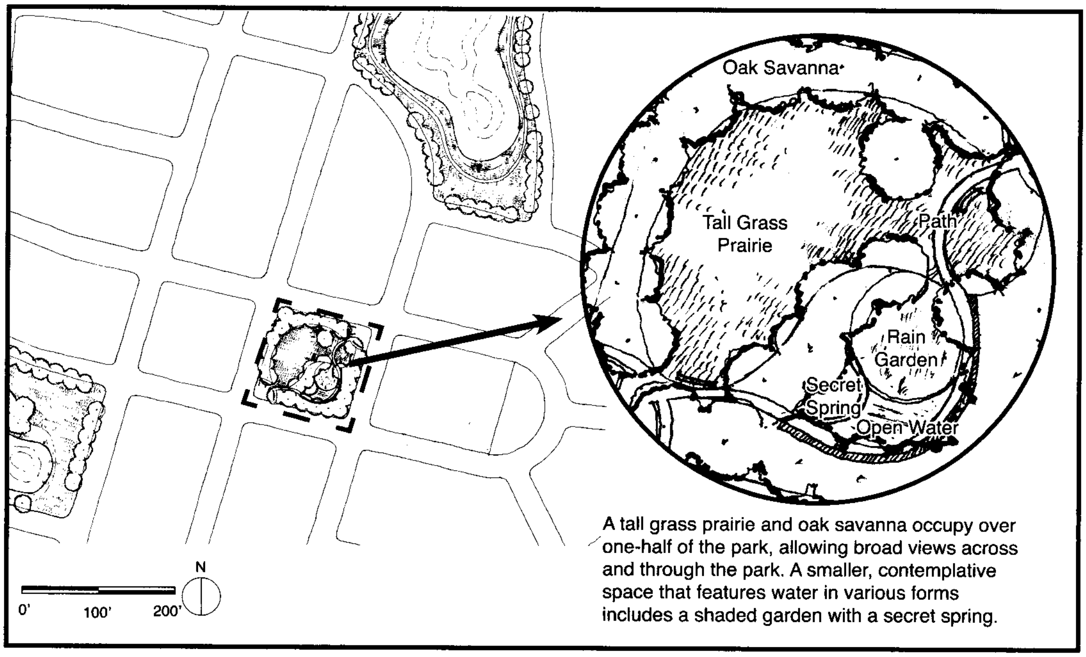
- Benches are placed throughout the park, allowing people to sit near areas of activity or in more quiet areas.
- Children's play areas are located close to the center of this park, away from the traffic.
- A "great lawn" will allow an area for recreational activities or relaxing and can be the setting for civic functions.
- A wide path through one of the axes of the park can be used for community-building events, such as markets or fairs.
- A band shell provides a landmark for meetings and events.
- A fountain-and-plaza area creates a place for sitting and for social interaction.

Plantings

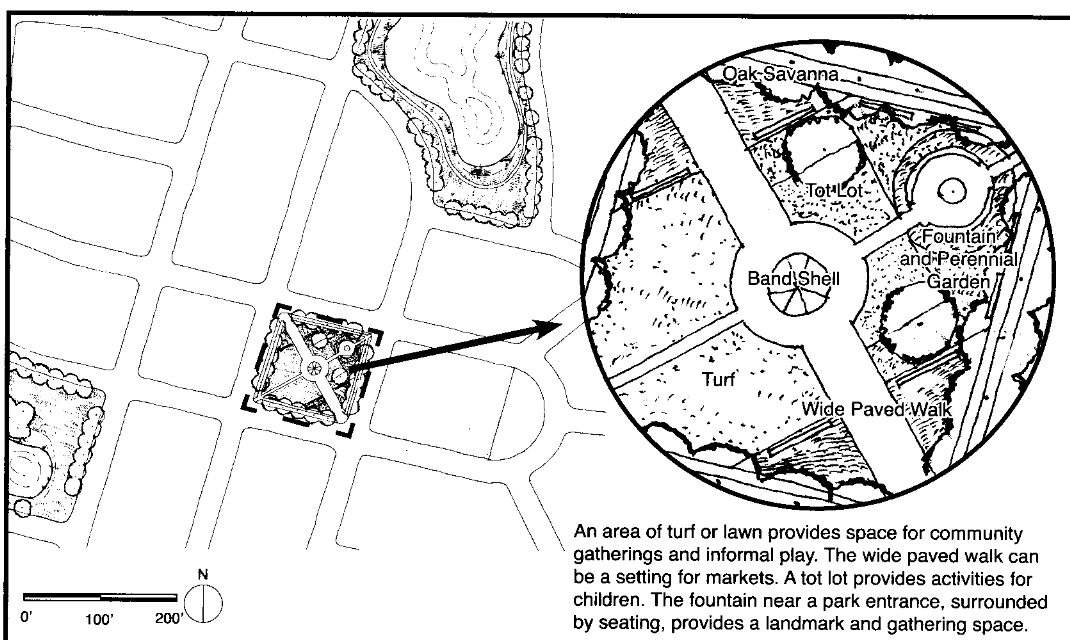
- Perennial beds are planted along entrances and seating areas, introducing "urban nature" to the park and including seasonal change. These also reduce maintenance costs.
- Canopy trees within and along the edge of the park frame views and provide shade for pedestrians passing by or sitting in the park.

The Ecological + Social Strategy

The overall strategy is to rethink the traditional town square. Part of the town square is kept intact for civic events and features street trees along the park's edge and more informally planted canopy trees shading part of the lawn. However, a portion of the quintessential, nostalgic town-square lawn has been replaced with a perennial garden.



The Ecological Strategy: In this design, the planting plan for the park reflects a symbolic connection to the community's ecoregions that include tallgrass prairies and oak savannas.



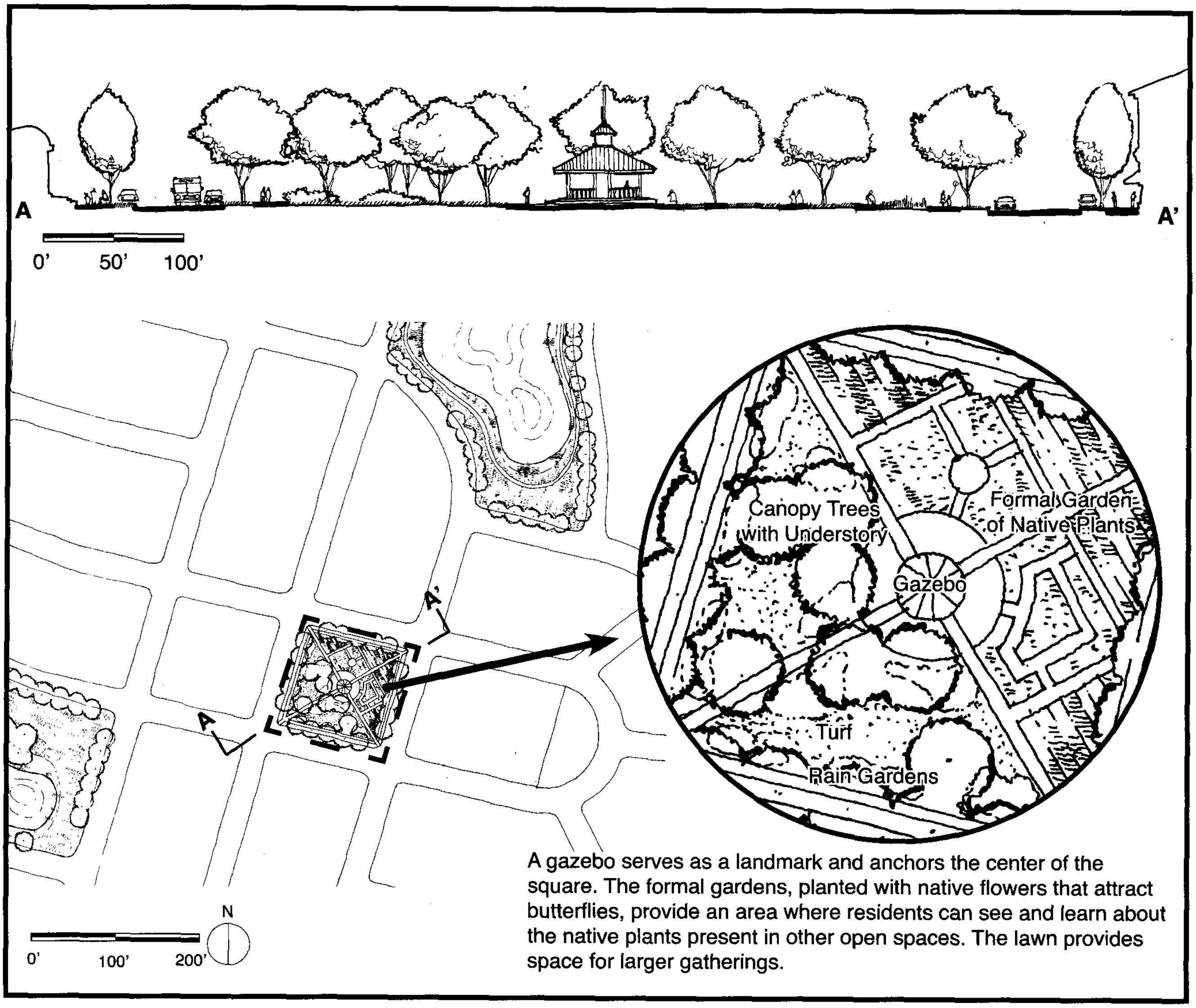
The Social Strategy: The design for the park provides opportunities for as many different activities as possible, ranging from benches for individuals to a wide, paved walk and a lawn suitable for larger events.

Plantings

- The perennial garden will include formal plantings of native flowers and grasses that relate to the formal layout of square—featuring a profusely flowering butterfly garden that attracts pollinators. These perennials will change with passing seasons and, once established, will lower maintenance costs, as they do not require frequent mowing.
- Shallow rain gardens along the perimeter of the park will also be planted in a formal style and will provide both ecological and social benefits.

Social Connections

Clear sight lines maintain views to and from the park, enhancing social connections and increasing the perceived safety of the park.



A gazebo serves as a landmark and anchors the center of the square. The formal gardens, planted with native flowers that attract butterflies, provide an area where residents can see and learn about the native plants present in other open spaces. The lawn provides space for larger gatherings.

The Ecological + Social Strategy: A formally planted wildflower garden with benches occupies one half of the park. The other half of the park includes the quintessential lawn with canopy trees, but it is augmented with an understory of small trees and shrubs to enhance its habitat potential and reduce runoff.

5

Reusing a Vacant Lot in the Center City

The Andrew-Riverside Temporary Park, Minneapolis, Minnesota

The Place

Due to significant structural problems, the historic Andrew-Riverside Presbyterian Church was demolished. Although planning to rebuild, the congregation needed to find a temporary use for its half-acre (0.2 hectare) site for two to five years so that it would be a neighborhood amenity and not an eyesore.

This is a very typical type of center-city site—a vacant lot in a neighborhood that will most likely be redeveloped but remains temporarily vacant.

The Andrew-Riverside congregation asked the Metropolitan Design Center to develop a design concept for this site that:

- Reflected their interest in international faith communities.
- Provided space for youth programs, including an exchange program where American, Guatemalan, and Palestinian youth painted murals to be displayed on the site.
- Created a space for the entire neighborhood to enjoy.
- Required low and inexpensive maintenance.

The designs, one of which was built in 2004, explore options for enhancing the site's ecology and providing a demonstration of design strategies for inexpensive, temporary parks. Resources for the park's rebuilding came from a watershed organization that stressed using native plants, as well as from volunteer laborers. The park won a community gardening award from the state horticulture society.

The Core Issues and Tensions

Ecological

- The park is several blocks from the Mississippi River, but it is cut off from it by an industrial area. Sandy soils underlying the site allow for easy infiltration of runoff, if it can be slowed down and captured. Rain gardens help infiltrate storm water and can be habitat for insects.
- The neighborhood has a mature tree canopy, but several large street trees beside the church property had to be cut down due to Dutch elm disease. The future construction made immediate replacement of

The Andrew-Riverside Presbyterian Church was demolished in late 2003. Until the church can be rebuilt, the site will be home to a temporary park (A). This example explores what can be done in temporary urban spaces with regard to improving the ecology of the site and providing an amenity for the congregation and neighborhood residents.

Andrew-Riverside Temporary Park is located in Minneapolis, near the University of Minnesota and the Mississippi River. The area is primarily residential and home to many long-time residents and students.

trees on the site difficult. Other options were explored for providing a variety of vegetation heights.

Social

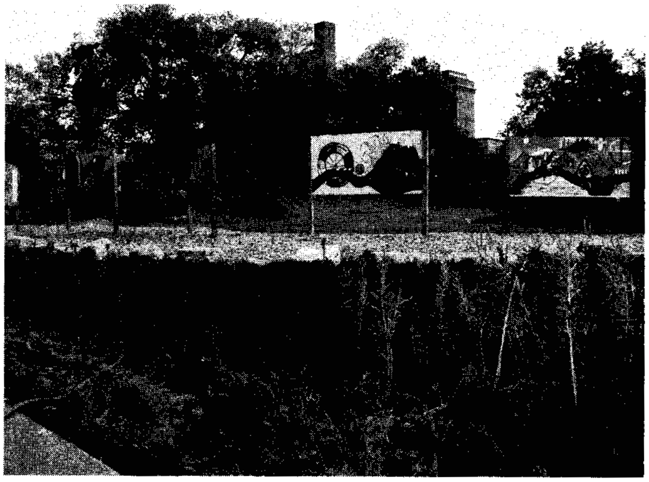
- Create a park that can be used by the congregation for services and events and by area residents as a neighborhood park, while keeping maintenance at a minimum. The inner-city neighborhood had a large number of lower income renters but relatively few children.
- Create spaces within the park that can be used from day one.

The Ecological Strategy

The design concept for the park is a forest edge with several types of gardens. It was inspired by the trees that line the northern perimeter of the property. The major components of the design include a sumac edge, butterfly garden, rain garden, fire pit, trellis, and lawn areas (see page 130).

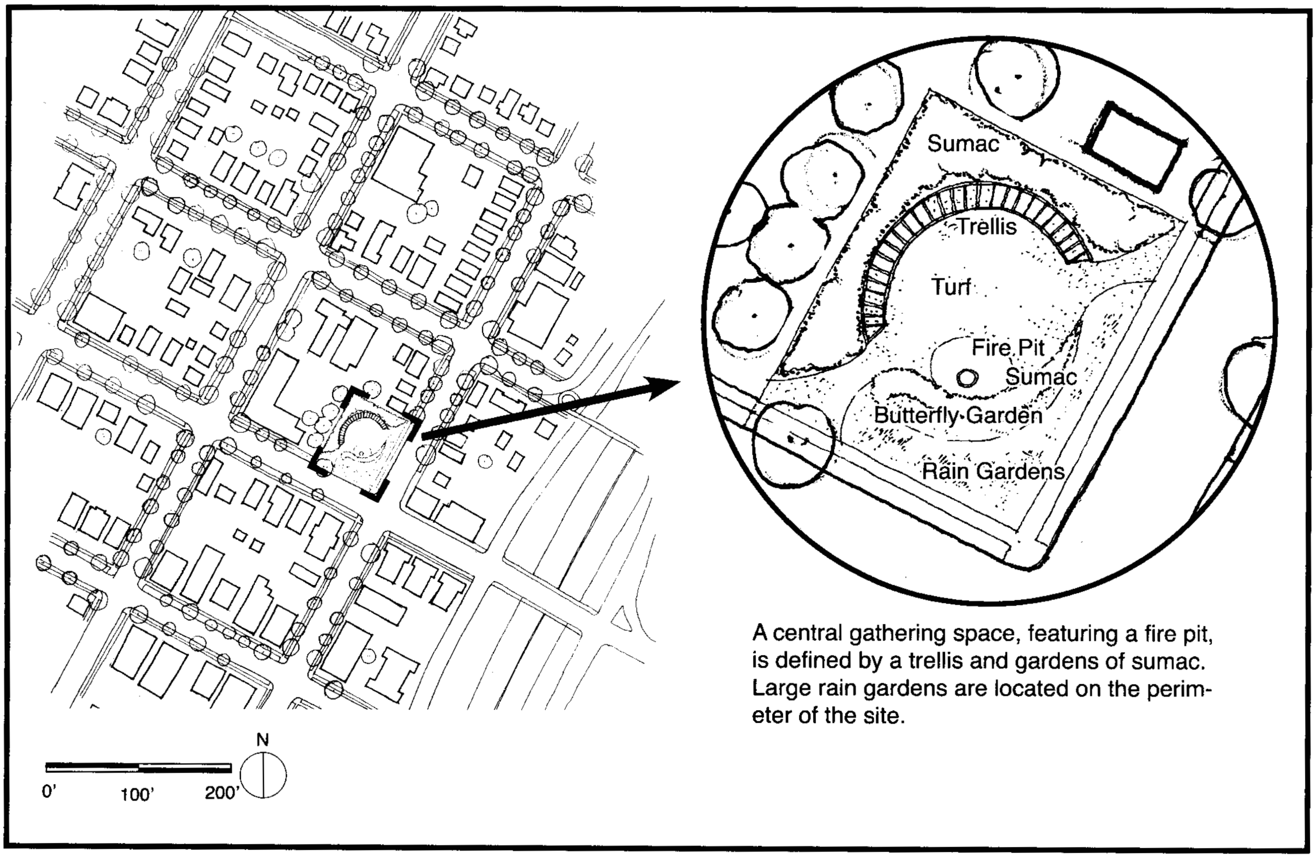
Sumac Edge, Butterfly Garden, and Rain Garden

Since the site is a temporary garden, the design concept uses plants that are associated with the transition zone



Four rain gardens are included in the built park. The largest rain garden, above, is located at the southeast corner of the park.

A wood-chip path leads visitors through the flower gardens and earth mounds.



A central gathering space, featuring a fire pit, is defined by a trellis and gardens of sumac. Large rain gardens are located on the perimeter of the site.

The Ecological Strategy: The design derives its inspiration from the structure of vegetation found at the edge of forests. Major features include a sumac edge, butterfly garden, rain garden, fire pit, trellis, and lawn areas.

of disturbance at the forest's edge. Highlights of the design include these components:

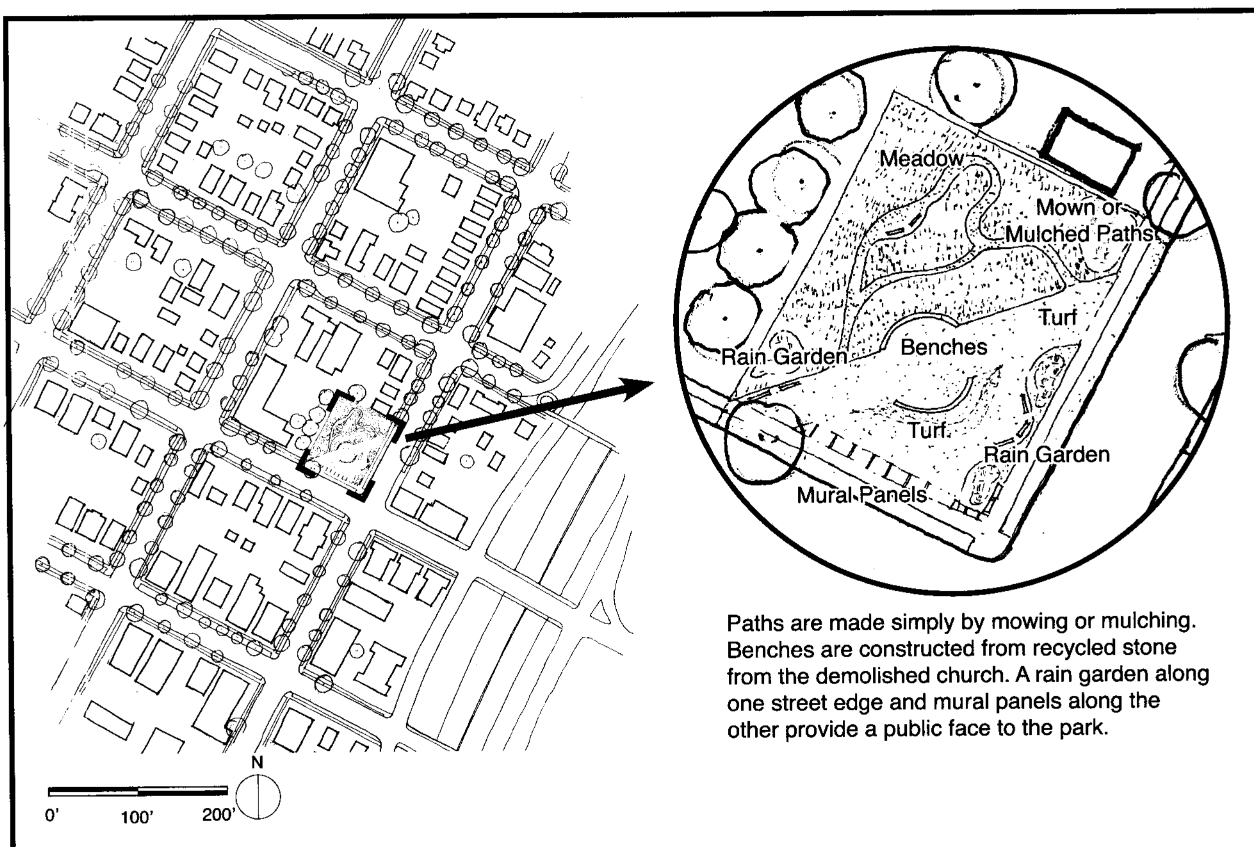
- The sumac edge creates a backdrop for the trellis and lawn areas and, also, provides a sense of enclosure in the lawn area. It is an attractive buffer between the park and neighboring residential properties, as well as between the park and the adjacent street intersection.
- The butterfly garden is located near the corner of the property, which is adjacent to a busy intersection. It is also planted with edible wild strawberries. The color of these plantings changes seasonally, and they are intended to teach children lessons about nature's cycles.
- The rain garden collects runoff from the site, and it is also planted with perennials, to create year-round visual interest.

Fire Pit, Trellis, and Lawn Areas

These components of the design are used for social functions for the neighborhood's residents and members of the congregation. The large lawn area provides space for people to mingle and gather. A trellis encircling the lawn area provides seating in a shady place. Finally, the fire pit is conveniently located adjacent to the lawn area.

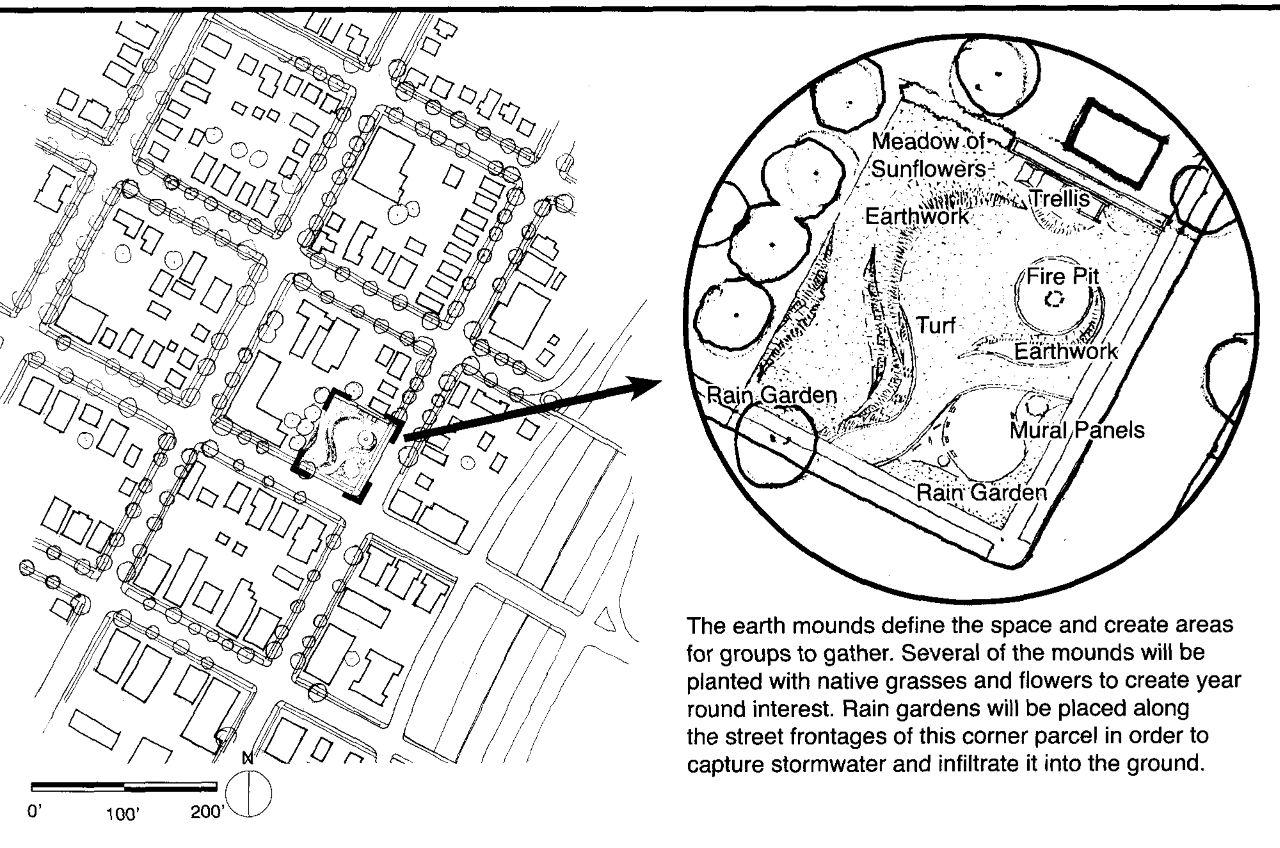
The Social Strategy

The design concept for the park incorporates areas for events and for informal recreation, with colorful gar-



Paths are made simply by mowing or mulching. Benches are constructed from recycled stone from the demolished church. A rain garden along one street edge and mural panels along the other provide a public face to the park.

The Social Strategy: This design strategy for Andrew-Riverside Temporary Park has two main areas—a meadow planted with flowers and a lawn planted with turf.



The earth mounds define the space and create areas for groups to gather. Several of the mounds will be planted with native grasses and flowers to create year round interest. Rain gardens will be placed along the street frontages of this corner parcel in order to capture stormwater and infiltrate it into the ground.

The Social + Ecological Strategy: Since the park will only be in existence for a few years, the design features earth mounds that will provide immediate interest. The largest mound will be planted with lawn, allowing people to walk and sit on it during gatherings. Other features include a fire circle and rain gardens.

dens. The park was designed to be easily constructed, to keep maintenance to a minimum, and to produce it at minimum cost.

Social Enhancements

- A 40-foot (12-meter) diameter gathering space edged with recycled rocks from the former church provides a focal area for events and celebrations.
- A mown lawn creates a space for informal play and seating across one-third of the site.
- A simple mown or mulched path creates a meditative walk through the flower meadow that covers more than half the site and provides colorful evidence of seasonal change.
- Benches and seating areas throughout the park allow for experiencing the different spaces of the park.
- A row of panels along the southern side contain spaces for murals painted by the youth-exchange program participants.

Plants

- A large meadow of seeded native and exotic plants adds seasonal color and attracts birds and butterflies. This meadow includes fast-growing, showy flowers that bring easy care native plants into this central-city area.
- Rain gardens planted with water-tolerant plant species collect water runoff from throughout the site.

The Ecological + Social Strategy

The plan for the site includes a sunflower hedge on the two interior sides of the lot; a central gathering space focused on a fire circle or council ring; sculptural, low-earth mounds planted with native grasses and native flowers; structures for displays; and large rain gardens. Rock from the demolished church is reused in the design to create small walls, a raised platform, and the garden edging. This design was constructed in the summer of 2004.

Earthworks

The design takes advantage of already-contracted earth-moving work to create sculptural landforms to define and create spaces. The park is only planned to be in existence for a short period of time, so slow-growing trees and shrubs were not an option for creating defined spaces.

Plantings

- Using inexpensive annual crops, such as sunflowers, the design provides screening, interest, and food for wildlife in a design that matures quickly.
- Rain gardens that will capture runoff have been placed in what will be the setbacks of the reconstructed buildings. These rain gardens are formally planted and are meant to demonstrate a neat-looking, large-scale application.
- Educational signage on-site explains the design.
- Prairie grasses and flower plants accentuate the seasons.

People

The park allows for a number of different activities, including large gatherings in the central space and small groups on benches and stones.

Overview of Park Planning and Design Process

Design Examples

3

Design Development Issues in Brief

Design Development Guidelines

1 Size, Shape, and Number

1. Attempt to preserve minimum widths and areas for ecological functioning: certain minimum dimensions increase the ecological value of small parks. However, the specific dimensions vary in terms of the specific issue being considered: water quality, air quality, or habitat for specific species. Minimum widths will likely also depend on the physical environment of a place, for example, a desert versus a temperate forest, steepness of slopes, and erodibility of soils. For examples of corridor widths for wildlife, water quality, and air quality conservation, see page 30.

   The following minimum areas and widths for habitat patches have been suggested in somewhat dated studies. Few recent studies provide such data (all relevant studies are cited in Raedeke and Raedeke 1995, 142). It is important to keep in mind that minimum areas and widths for habitat patches will vary from species to species depending on their life histories:

   - 1.4 acres (0.57 hectare) for amphibians and reptiles (Dickman 1987).
   - 1.6 acres (0.65 hectare) for small mammals (Dickman 1987).
   - 12.5 acres (5.05 hectares) with a minimum 200 meter (656 feet) diameter of patch for land vertebrates (Vizyova 1986)
   - 200 meter (656 feet) minimum diameter of patch for many birds that "prefer the interior of forests, and will not successfully nest in small forest patches that consist almost entirely of edge habitat" (Raedeke and Raedeke 1995, 142).

2. Work to create adequate dimensions for multiple programs. Socially, a number of common recreational facilities have required dimensions that, while moderately flexible, are not infinitely flexible. From ball fields to play and picnic areas, dimensions matter. This is particularly critical in small parks where there may be room for one baseball field but also a need for volleyball, ice skating, community gardening, and a play area. As we show in the Tighe-Schmitz Park design example, it is possible to overlay multiple programs on the same space, but it requires careful design attention.

3. To understand the origin of small parks in specific regions, historic patterns of urbanization and landscape fragmentation can be studied through the use of historic maps, documents, and oral histories. This can help identify how long existing parks have been isolated from the region's natural habitats,

what ecological features that can be restored, such as drained wetlands or buried streams, and how to link small parks to a larger open-space systems. For example, digital orthophoto quads (digital aerial photographs) are a valuable source of information about land-use and land-cover changes in the United States. University libraries often have archives of paper aerial photographs from the middle of the twentieth century and earlier historic maps that help to establish a baseline for a region.

4. During the planning stages of new communities, do all that is possible to maintain the integrity of large patches of habitat in the open-space plan to preserve effective patch size and protect core habitat from edge effects. In doing this, pay attention to where the park is located in relation to other natural areas. As many ecologists emphasize, larger patches have more species. However, small parks do have value as this manual outlines, and creating compact developments including small parks allows large areas of open space to remain undeveloped.

5. When acquiring land for a public parks system, the shape of open-space fragments is an important consideration for estimating the amount of interior habitat and types of ecological interactions with the surrounding matrix. Estimate the amount of interior habitat versus edge through calculation of the perimeter to area ratio of the park. Certain shapes naturally have more interior habitat, such as circles and squares, as opposed to linear shapes (Collinge 1996, 66–67). Please see Forman (1995) and Turner et al. (2001) for more specific spatial statistics for the calculation of patch, edge, and corridor characteristics.

6. An inventory of rare and threatened species, area-sensitive species, and clonal (or nonseed propagating) species in a metropolitan region is a helpful reference for management of fragments. It is helpful to know the life histories of these organisms, especially in relation to sensitivity to patch area, shape, and number as well as edge effects. This list could be compiled from local research studies, experts, and field guides. While one small park is unlikely to make a huge difference in species survival, this information is useful in park design. It also could be used as an educational tool for the public so they understand the effects of urbanization on regional biodiversity and landscape fragmentation and the importance of regional open-space planning to address these issues.

7. Consider why a habitat patch has a particular shape, because its origins may be crucial for understanding flows of water and nutrients as well as wildlife movement. Some naturally linear habitat patches are indicative of environmental gradients, such as riparian habitats or wetland edges, and they will have higher biodiversity on a per area basis (Saunders et al. 1991, 25).

2 Connections and Edges

1. Manage people's access to and from the park, including visual access so that positive connections are enhanced. For people, visual cues and signs should indicate what is within the park, if it is not immediately obvious (Kaplan et al. 1998, 85). Once within a park, views outside the park should show connections to the wider environment, although it may be useful to frame views to maximize the sense of being away by, at least, partially buffering such elements as parked cars.

2. Maximize the benefits for social connections, including sharing space without further interaction, by allowing nonthreatening coexistence between people who may share common interests. For example:

   - Place seating where people can watch a tot lot or pond, providing options for more intensive socializing if desired.

- Design paths that go past seating areas, allowing people to scan the area to decide whether or not to stop (Cooper Marcus and Francis 1998, 92–93).
- Place seating near heavily trafficked areas, such as park entrances, to allow opportunities for higher levels of interaction (Cooper Marcus and Francis 1998, 93).
- Create landmarks or areas that can be easily described to others. Such landmarks can become meeting place (Cooper Marcus and Francis 1998, 91).

3. Conceptualize the park as a patch in a habitat network and matrix, that is, as part of a system of parks; tree-lined streets; paths and trails; rivers, gullies, and creeks; remnant or volunteer stands of trees; and connected yards. While a small park has only limited ecological value on its own, it can help connect other green areas into a larger system. To maximize this value, it is important to reinforce any surrounding green areas. If there are such nearby green areas, then planting within the park should be placed nearby to increase the overall continuous areas of green. Also consider how ecological processes could be restored, by daylighting a stream or revegetating vacant lots.

4. When designing and planning corridors for wildlife to small parks, determine what the ecological function of the corridor will be, such as a habitat link or movement corridor (see Fine Print Facts, pages 29–32).

5. Become familiar with minimum and maximum core, habitat requirements of different plant and wildlife species in the region, especially those species that are most sensitive to land-use and land-cover changes. These corridor-habitat requirements can drive the minimum widths for corridors, especially if the goal is to provide habitat conditions that meet different species' survival and reproduction needs. Carefully weigh these minimum corridor widths against goals for water and air protection, which often require narrower corridors (see Fine Print Facts, pages 29–32).

3 Appearance and Other Sensory Issues

1. While an environment with spreading trees, little understory, smooth ground covers, curving sight lines, few incongruous buildings, and water will likely appeal to a broad public; it also is important to consider minority views. Such views may lead to more wild or more formal aesthetics in at least some parts of a park.

2. Where parks must incorporate elements that have ecological value but are unattractive, use design cues to reveal that these areas are intended (e.g., mown edges or a neatly planted border) and interpretive signage to explain it (Gobster 1994, 67–68). Compact flowering shrubs can provide some understory, while maintaining neatness and views. The most useful design cues will set "expected characteristics of landscape beauty and care side by side with characteristics of ecological health" (Nassauer 1992, 248). For example, in a case of rehabilitating an urban park (represented by Design Example 2, pages 111–115), the "ecological" option includes a formal path with a circular focal point, showing that the design for habitat does not need to look naturalistic and can have a more formal appearance.

3. Develop educational opportunities with interpretive signage to demonstrate how beauty and ecological function can be used as a communication tool for park management and maintenance. Novel approaches for framing the "appearance of ecological function" should be considered (Nassauer 1997, 78; 1992). For example, a butterfly garden can be

used to educate the public about the vital role of pollination and pollinators in the landscape. A second example is the daylighting of a stream that is buried in a culvert. The stream can be used as a living laboratory for students and as a stormwater management strategy.

4. Provide walking paths with different sensory experiences along the edges, for example, use flowering trees and shrubs. Along walking paths, consider how the habitats could be modified to reveal sensory experiences and ecological functions season-by-season. For example, the vegetation structure of the different types of plant communities could be modified. In temperate climates, gaps could be created along a woodland trail for flowering prairie perennials. In arid climates, additional plantings of drought-tolerant flowering perennials could be added.

5. Provide a variety of sensory experiences that change with time and vary across the park. Provide opportunities for watching urban wildlife, such as birds and other pollinators. A permanent water source can attract a wide range of organisms.

6. Consider microclimate in small parks season-by-season and provide park users with choices. In temperate climates, such parks should be comfortable for people to use with small sunny spots (Cooper Marcus and Francis 1998, 91). If necessary, consider additional shade options for activities during hot, humid summer days. In arid climates, small parks typically do not provide enough shade, especially during summer, which can last up to six months. Provide a wide range of shade options from trees to built structures, such as pavilions and shaded walkways. Consider the cooling effect of water in both climate types.

7. Do not expect everyone to agree on their preferred plants or structures in a park.

4 Naturalness

1. Small parks in different parts of the metropolitan area need to deal with different preferences of nearby residents. Schroeder reminds that "preference variations between urban and nonurban [i.e., suburban] individuals suggest that forest sites in suburban areas should emphasize attractive natural areas with few man-made features, while urban parks should provide a variety of recreation activities" (Schroeder 1982, 321).

2. When restoring a park area, do not change well-loved features or do so with great care.

3. With restorations back to an original, natural state, provide education about the reasons for the change and what it will mean to the park and to the park users (Ryan 2000, 222).

4. Do not restore everything at once to its indigenous state (Ryan 2000, 222). When restoring a park, consider the natural succession of the plant communities and changes in vegetation structure over time and space. Decide whether these changes will be socially acceptable in critical areas of the park, such as for picnic and play areas. Review management and maintenance plans for how best to tackle the changing needs of a plant restoration over time. Plans should be straightforward enough that trained volunteers can follow the process.

5. Consider adding very colorful native or even exotic plants even in "native" areas of urban parks to build support for restorations. This can provide more widely appealing vegetation and extend the flowering season (Hitchmough and Woudstra, 1999).

6. Identify the appropriate ecoregion for the area and consider it a tool for understanding more about the

ecological context of the particular region and for designing more sustainable landscapes. It will be particular helpful understanding the ecological history of the region.

7. Use the concept of the urban-to-rural gradient guideline as a framework for understanding how vegetation type and naturalness of small parks will vary in a region. The concept could also be used as the basis of an ecosystem management approach to small park stewardship at the regional scale.

5 Water

1. Develop a site analysis for each park to understand its geographic location in relation to its watershed and other water resources. The location of the park has implications for understanding potential opportunities, constraints, and risks. Is the park located in the headwaters (the part of the watershed with the highest elevation)? Or is it located lower in the watershed? Locate environmentally sensitive resources in the area, such as wetlands, streams, rivers, and aquifers. Do any of these items occur in or near the park?

   If water resource expertise does not exist in the parks department, the local flood-control district, watershed council, or department of natural resources will be able to provide more information and potentially expertise.

2. If a stream runs through the park site, use stream buffers to enhance beauty and ecological functions, such as infiltration, flood protection, and habitat.

3. Daylighting of streams can be an effective community-based project for environmental education and neighborhood beautification, but it is a major project and requires long-term planning and allocation of resources (see Advantages of Daylighting a Stream, page 50). Small grants are often available for these projects through local and state agencies.

4. Reduce impervious surfaces and replace with alternatives within the park, if possible, to improve infiltration and percolation. While some paved paths are needed for those in wheelchairs, these should be carefully located or porous-paving systems should be used, if the budget allows for it. Other paths can be of more pervious materials, such as wood chips or turf grass; although care should be taken to avoid problems of extreme soil compaction and erosion of informal paths. In these cases, paving may be a better option.

5. Use rain gardens and stormwater ponds to infiltrate water on site. See low-impact development in Fine Print Facts (page 50) for potential strategies.

6 Plants

1. When placing plants in urban parks it is crucial to create a good growing environment (McPherson 1995, 191). For example, extensive soil testing is needed to understand the condition of urban soils in a park. This step is often overlooked, but it can provide invaluable information for management and cost-effective decisions.

2. Select trees and other plants that are tolerant of urban conditions, especially pollution, and long lived in the particular location on the urban-to-rural gradient. In addition, carefully evaluate the benefits of trees that drop fruit and seeds if located where these need to be cleaned up. This will help increase benefits in relation to maintenance costs.

3. Compare locations of rare and endangered habitats to small parks. Few will be located in such parks, but when they are they will be an important con-

sideration in the design. In this case, a vegetation survey of remnant habitat is invaluable. Information about the extent of invasive exotic species is crucial if habitat rehabilitation or restoration is a goal.

4. Tree-well specifications should be large enough to ensure room for ample growth space for the root system. Care should be taken to protect trees from mechanical stresses such as wind and soil compaction.

5. Trees need adequate water in the summer because of increased maximum temperatures caused by the urban heat island in many metropolitan areas. Establish a watering regime especially for newly planted trees.

6. Consider planting a range of tree species rather than large plantings of a single species, to promote aesthetic appeal, habitat quality, and reduce disease susceptibility (Quigley 2004, 38).

7 Wildlife

1. Reduce the proportion of edge habitat by creating transition zones of shrubs and ground covers between trees and surrounding land uses but maintain adequate sight lines for safety reasons. Transition zones are recommended to be as wide as possible where space is available. In addition, consider connections with habitat beyond the park to include the surrounding urban matrix of backyards, institutional open spaces, and remnant woodlots.

2. If possible, preserve the vertical layering of vegetation to maintain habitat quality for wildlife but maintain critical views for public safety. By increasing the complexity of the low-shrub layer, from 21 to 50 cm (8.27 to 19.69 inches) above the ground, the number of mammals will increase (Dickman 1978, 346).

3. Provide a water source to attract wildlife. This site could be good for environmental education.

4. If possible, maintain areas with deadwood, snags, and undergrowth to diversify habitat complexity. If an area is accessible to the public, try to make these areas look cared for to improve appearance and increase social acceptance. Neglected looking areas are usually not welcomed by the public.

5. Limit the number of paths and desire lines (preferred cuts-through) through habitat areas in a park to reduce fragmentation and rehabilitate remnant habitat. Locate paths on edges of habitat and natural areas where possible.

6. Maintain a relatively open canopy along trails to improve the perception of safety. Create a gradient of vegetation structure from the trail to the interior habitat that gradually becomes more complex in species composition and abundance and is reflective of plant species in the ecoregion.

7. Where appropriate, encourage neighbors to take part in backyard wildlife programs that provide additional feeders and water sources for birds and other animals. Morneau et al. (1999, 119) found that feeding increased the number of bird species in small areas in Montreal parks. However, this practice is controversial and can cause problems when migratory animals fail to migrate due to these food sources (Singer and Gilbert 1978, 5).

8. Find good scientific information about the potential wildlife species that occur in the metropolitan area's small parks. Such information is available at natural history museums, nature centers, libraries,

and governmental agencies. Information about threatened and endangered species as well as species of concern are of particular interest. Integrate this information into management plans to prioritize regional habitat-management goals and the role of small parks with desirable habitats.

9. Plant a wide range of deciduous and evergreen plants for habitat in parks regionwide. Pay special attention to selecting pollution tolerant evergreen plants, where these provide important habitat (Jokimäki and Suhonen 1998, 260). This should include such priorities as maintaining tree and cactus cavities for cavity-using bird species.

8 Climate and Air

1. Buffer activity areas from polluted streets. Spirn recommends that "sitting areas, and playgrounds should be set back beyond the polluted zone, more than 150 feet (45.7 m) from the street edge whenever possible, and separated from the roadway by belts of trees, which should be spaced far enough apart to permit the free movement of air under their canopies" (Spirn 1984, 72). Large buffers of up to 150 meters (492 feet) in width may be needed for significant air pollutant removal (Smith 1980, 297–298), see Connections and Edges, pages 23–32.

2. Create small sun pockets. While it is important to plant trees for shade for both people and paving, some sunny areas are needed for sheltered, outdoor warmth on colder days. These should not just be sunny spaces but spaces protected from winds and with hard surfaces to absorb sunlight (Cooper Marcus and Francis 1998, 91; Spirn 1984).

3. Maximize tree canopy, even if it is thin. Based on a study of the urban heat island in Atlanta, Georgia, Stone and Rodgers recommend that "a thin but well distributed canopy of trees is likely to be more thermally efficient than a dense cluster that leaves a large proportion of the property completely unshaded. Street trees should be required to provide shading over hot street surfaces, sidewalks, and houses" (Stone and Rodgers 2001, 194).

4. Use efficient parking-lot designs, light paving materials, and incorporate shade trees into the designs to cool the lot in summer. Creating a parking lot that is a park for cars is not only aesthetically pleasing but will reduce pollutant emissions.

5. For removal of air pollutants throughout the year, use a mixture of tree species that are drought resistant and that can withstand urban conditions.
   - "For particulate removal, species with high ratios of leaf circumference to area and surface to volume, and with leaf surface roughness, should be favored" (Smith 1980, 297). Conifers have high surface to volume ratios (Smith and Dochinger 1976, 56–57).
   - Conifers and deciduous trees with lots of twigs can help remove particulates during winter. Species with long petioles, or leaf stems, such as ash, aspen, and maple, can also be efficient in removing particulates (Smith and Dochinger 1976, 56–57).
   - "A balance must be struck between a stratified forest and a forest impermeable to air mass movement. A multilayered forest—soil, herb, shrub, and tree layers—is a more effective pollutant sink than an unstratified forest. If the edge strata are overlapping and dense, however, the stand of trees may force air masses up and over and be a relatively ineffective sink. Careful silvicultural practice will be necessary to maintain appropriate structure and density" (Smith 1980, 298, © American Forests).

9 Activities and Groups

1. Design parks so that people can share them over time so that a small space can accommodate many activities over a day, week, year, and even over decades (see Fine Print Facts, page 79).

2. Provide spaces for activities appreciated by a variety of users, not only those involved with adult, active recreation. Multipurpose sports areas interspersed with seating areas and paths are a solution in tight sites (see Design Example 3, pages 116–122). Make these comfortable for those of varying ages, e.g., benches with backs for seniors and bathrooms and drinking fountains for seniors and children (Cooper Marcus and Francis 1998, 93–94).

3. Provide walking paths with different lengths of loops to encourage physical activity among the elderly and others with different levels of mobility. Such paths may be shared by walkers other than the elderly, but they should be wide enough to avoid conflicts with activities such as jogging (Cooper Marcus and Francis 1998, 90).

4. Picnic tables should allow use by both small and large family groups. Movable chairs and tables for different social groups may be one option. Although picnic tables mounted to concrete pads may reduce theft, the lack of mobility reduces opportunities for social interaction. Scattered picnic tables that seat four to six people assume everyone comes from a typical American nuclear family (parents and children only).

5. Benches in shaded areas are appreciated by elderly park users. For some, benches should be "arranged to facilitate conversation and personal contact" (Hutchinson 1994, 243). Movable chairs are preferable. Others appreciate scattered benches that allow some solitude to watch people, plants, and animals (Cooper Marcus and Francis 1998, 90–91).

6. Provide options for children to engage in different forms of play. Moore et al. (1992, 9–26) outline several key design principles, although in the following list some have been reordered and combined:

   - Accessibility from outside and within the park.
   - Safe and graduated challenges.
   - A diversity of settings and spatial experiences, including retreats and opportunities to play above ground.
   - Flexibility and open-endedness in terms of elements that can be moved and manipulated by both children and adults.
   - Defensible, visible space for safety.
   - Supervision to enable a greater range of activities.
   - Permanence in terms of having familiar, identifiable space.
   - Elements that mark change over time in seasons and events and design for year-round use.
   - Multisensory stimulation and cues.
   - Shelter.
   - Spaces for social interaction among groups of many sizes and different ages.
   - Defined play areas for children of different ages.
   - Spaces for interacting with plants and animals.
   - A set of orienting devices, including visible completion points and landmarks.

7. Provide spaces for teenagers where they can test the physical properties of nature and hang out without too much adult supervision but also without disrupting other users (see Thompson, 2002 for more details). Having two spaces for people to congregate at opposite entrances to the park can provide separate spaces for seniors and teens while accommodating both groups' desires for social interaction. Separating teens from young children

is often appreciated (Cooper Marcus and Francis 1998).

8. Allow spaces for people watching and for seeing and being seen, for example, promenade space that may have spatial designs that are culturally and socially specific. Some cultures may have a tradition of using the public street or a streetlike feature in a park while others would prefer areas in the park (Thompson 2002).

9. Carefully consider access to parks. Where possible, locate parks close to transit so low-income people and those too young and too old to drive or walk long distances can gain access.

10. Manage edges between different activities and between the park and adjacent areas to minimize conflicts (see Connections and Edges, pages 23–32). Clearly demarcate spaces so that the potential for tension over ambiguous "turf" is minimal.

10 Safety

1. Lighting is a complex issue in parks. It is important to light areas that are intended for nighttime use, but it can be misleading and dangerous to light areas not intended for use, particularly if they are isolated.

2. Maximize views to aid parkgoers and others to avoid becoming victims (Michael and Hull 1994, 28–29). Prune shrubs, particularly near circulation routes, so potential victims are not surprised by concealed perpetrators. This is not only an issue inside the park but around nearby buildings from which residents and workers can look out and provide natural surveillance. In high-crime areas, do not leave dense patches of vegetation but allow views through.

3. When considering the small park as wildlife habitat, consider the effect of vegetation structure on the perception of safety. Find ways to accommodate both the need to teach people about the ecological structure and function of the landscape and the need for people to feel safe. This is especially important in areas where intensity of use is high, for example, along recreational trails. In temperate climates, a narrow trail corridor through dense, forested vegetation will feel less safe. However, a wider corridor will feel safer, but it will create a larger gap in habitat, which may affect the connectivity of vegetation and habitat. These trade-offs need to be considered in relation to goals and practices for management and maintenance.

4. Carefully consider child safety, balancing the need to protect from accidents with developmental aims that emphasize skill development and exploration. However, it is important to have appropriate surfacing under play equipment (see Fine Print Facts, page 87).

11 Management

1. Cultivated small parks are expensive to maintain so managing some of the park in a wilder state or with lower maintenance–planting designs should be considered.
   - Develop landscape management plans that take into consideration the natural succession of plant communities in a park. Replace lawn with native plantings that have a habit of growth that reduces maintenance and is socially acceptable. This will require additional information for decision-making, but it will lower maintenance costs in the long-term if planned and implemented well. Some additional planting may be needed to improve the appearance of such areas.

- As an alternative use planting approaches that emphasize low-maintenance native or other trees, shrubs, and ground covers. These can provide a neater appearance while providing habitat variety and the kinds of plant structure that can help reduce air pollutants (See Climate and Air, page 68).

2. With existing plantings, selectively prune to allow trees and shrubs to achieve their natural habit of growth. This will likely be a more open shape than that achieved through trimming. Care must be taken that good sightlines are maintained and that shrubs and tree limbs are not perceived as a danger.

3. Manage for the long-term care of trees. Provide adequate soil and nutrients (see Plants, pages 55–56). As Jim explains: "In landscape projects, the uneven allocation of resources with the lion's share allotted to planting materials and the above-ground installations, and with soils only given token attention, should not continue. The fictitious and factitious belief that any soil material is expected to support soil growth should be obliterated" (Jim 1998c, 246).

4. Survey existing conditions carefully to target maintenance on key problems. A soil survey is highly recommended and informative, especially in central-city parks where tree growth is subpar. The county soil survey is a good starting point, but soil tests are an essential item to understand variation in soil productivity and conditions on site. Accurate site surveys, such as soil tests, are often needed for tree, shrub, and herbaceous plantings in restoration projects (Lane and Raab 2002, 247).

5. Follow ecologically-based, land-use management principles and guidelines created by leading ecologists:
   - *Time principle:* "Ecological processes function at many time scales, some long, some short; and ecosystems change through time" (Dale et al. 2001, 6).
   - *Species principle:* "Particular species and networks of interacting species have key, broad-scale ecosystem-level effects" (Dale et al. 2001, 7).
   - *Place principle:* "Local climatic, hydrologic, edaphic, and geomorphic factors as well as biotic interactions strongly affect ecological processes and the abundance and distribution of species at any one place" (Dale et al. 2001, 9).
   - *Disturbance principle:* "The type, intensity, and duration of disturbance shape the characteristics of populations, communities, and ecosystems" (Dale et al. 2001, 10).
   - *Landscape principle:* "The size, shape, and spatial relationships of land-cover types influence the dynamics of populations, communities, and ecosystems" (Dale et al. 2001, 13).

6. Lack of information is one of the major problems in managing parks. Good research about social and ecological costs and benefits can justify funding.

12 Public Involvement

1. Work to involve the public in key park decisions as a way of both building better parks and developing a constituency to support park funding.

2. Consider how small parks would be enhanced through retrofitting a park's design for environmental-education programs in school curriculums.

3. Friends of the parks groups can help with basic maintenance, such as litter collection and tree planting. They can also lobby for maintenance funds. Such groups should be cultivated, which requires developing a plan for community support and media exposure. Planting demonstrations are one idea for generating interest.

4. Consider how a citizen-based science program would be used to enhance the monitoring of ecosystems in small parks, how this data would be used as a tool to manage parks better, and how the experience could enhance the education of elementary and high school students.

5. Identify likely conflicts between different constituencies' park use and facilities, including those who are not typically involved in park design. In public meetings come prepared with specific options to respond to the different needs.

Overview of Park Planning and Design Process

Design Examples

Design Development Guidelines

4

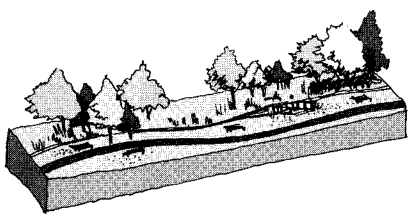
Design Development Issues in Brief

The sheets that follow are two-page handouts that condense the material covered in each of the twelve topics as well as the design-examples section. They are intended as information sheets that can be copied and distributed widely for uses such as public events, information campaigns, and design workshops. Each contains a list of references, so it can stand alone, but they can also be used in combination.

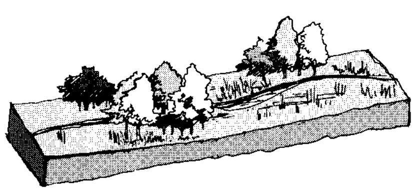
1

Size, Shape, and Number

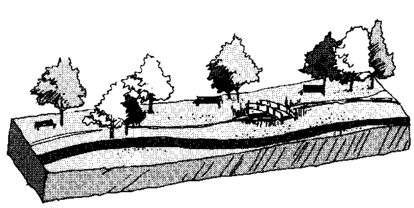
Small parks are varied in size and shape. They range from pocket parks of a tenth of an acre (0.04 hectare) or less to whole blocks of 5–6 acres (2–2.4 hectares), to linear and irregular paths and greenways hugging rivers, railways, and roads. The small size and relative isolation of small parks can be a problem in that the number of wildlife species that can successfully thrive in them is limited, and some human activities cannot fit in them. However, small parks have many benefits, the least of which is providing nearby nature for residents and habitat for some animal species deep within a metropolitan area.



Small parks cannot be everything to everyone; choices have to be made about the best uses and how to balance ecological and social needs.



While larger parks generally provide greater environmental benefits than do small parks, key natural areas along stream corridors, even small ones, can play an important role in creating a habitat network.



Small parks located adjacent to natural features provide an opportunity to engage local residents in the area's resources.

Ecological Issues

The size of small parks poses a challenge to those interested in their ecological value as nature reserves. Ecologists generally agree that small nature reserves are less preferable to large preserves. Lindenmayer and Franklin suggest their area is too small to (1) contain a full range of natural disturbance processes, such as fires; (2) be representative of regional ecosystems, landscape patterns, and land-use legacies; (3) maintain the populations of some species in the long-term; and (4) provide fewer opportunities for dispersal for species due to their distance from other patches.

However, small habitats are the reality in most metropolitan regions, either as leftovers or as planned open spaces, and they are the most accessible nearby nature for people in their daily lives. Small habitats can be useful if managers are aware of their ecological limitations and set reasonable management goals, given their large amount of edge habitat and high levels of disturbance and exotic species. For example, small parks can play a unique role in metropolitan landscapes as a tool for increasing public awareness about effects of urbanization on nature within their neighborhoods. In addition, the ecological value of small parks increases if they are part of a well-connected, open-space system.

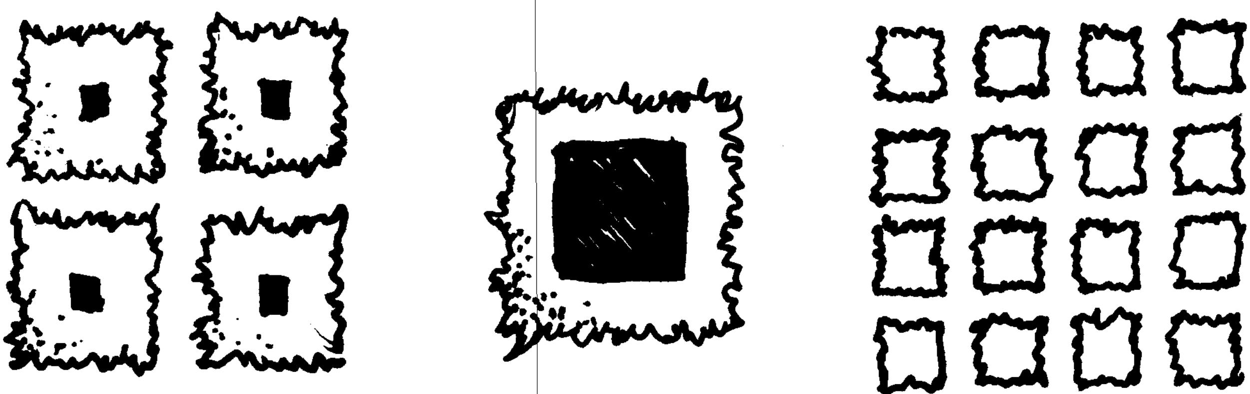
Social Issues

Some important social features, such as large sports fields, may not fit in small parks. Such parks may only be able to accommodate a limited range of activities appealing to a narrow demographic, such as a play area for parents and toddlers or a single ball field. These functions are even more difficult to accommodate if the parks also need to perform ecological function.

Yet small, neighborhood parks, which are more numerous than their large, regional, or medium-sized community counterparts, are well-suited to provide open-space opportunities for residents who live near them.

Balancing Ecological and Social Needs in Small Parks

Small parks cannot play every role, but they can (1) fill important gaps or (2) enhance the roles of other nearby parks and open areas. While it is tempting to say that a park



These diagrams illustrate that large patches have a greater amount of interior habitat (area shaded in black) than medium- and small-sized patches. Small patches may not have any interior habitat, but they act as a supplement to larger patches. Based on drawing from Peck (1998, 71) and Soulé (1991, 314).

that combines both social and ecological values is better than one emphasizing a single value, this is not necessarily the case, and each situation should be assessed individually.

In general, some considerations to include during the design of new small parks or the renovations of existing parks include:

- Attempt to preserve minimum widths and areas for ecological functioning—certain minimum dimensions increase the ecological value of small parks. While these dimensions vary with the species being designed for, in general with regard to habitat, "bigger is better." Also, a narrow park adjacent to a creek will have greater ecological value than one surrounded by structures.
- Work to create parks with adequate dimensions for multiple programs. In some cases, activities can be layered; activities that occur only occasionally or seasonally might share space with other activities.
- Attempt to maintain the integrity of large patches of habitat in the open-space plan during the planning stage of new communities. In doing this, pay attention to where the park is located in relation to other natural areas and consider how connections can be made. As many ecologists emphasize, larger patches have more species.

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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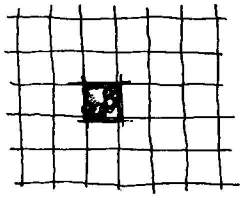
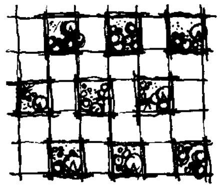
2

Connections and Edges

Small parks may seem like islands in a sea of houses, shops, and work places. However, they can make connections in the larger neighborhood and region in two senses—as small stepping stones or patches in a larger ecological network and as places where people can connect with others and nature. Combining social and ecological connections in a small park is not always easy as the social can be supported by a highly manicured and cultivated green space while the ecological demands that the maximum possible area be given over to native plants and wildlife habitat.



A single park with limited connections to other green spaces is isolated with regard to ecological and social benefits.



Parks may take up a large amount of area, but they still have a lack of connections to other parks.

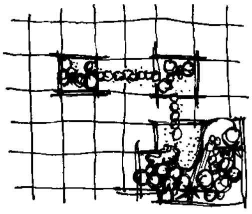
Ecological Aspects

While a small park has only limited ecological value on its own, it can help connect other green areas into a larger system. When considered in the context of the urban ecological network, a small park is part of a green-space network consisting of other parks; tree-lined streets; rivers, gullies, and creeks; remnant or volunteer stands of trees; and connected yards. To maximize this value, it is important to reinforce physical connectivity to any surrounding vegetation. If there are nearby green areas, then planting within the park should be placed nearby to increase the overall continuous areas of green.

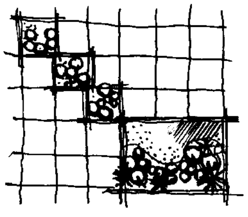
Social Aspects

Parks can connect people to plants, wildlife, history, and each other and thus support interactions. Some of these interactions are merely visual—but even views to green areas can improve health. Visual cues and signs should indicate what is within the park, if it is not immediately obvious. Once within the park, views out should draw connections to the wider environment. The following examples show how social connections can be maximized:

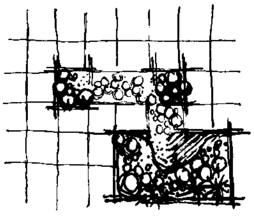
- Place seating where people can watch a play area or pond, providing options for more intensive socializing if desired.
- Design paths that go past seating areas, allowing people to scan the area to decide whether or not to stop.
- Place seating near heavily trafficked areas such as park entrances to allow opportunities for higher levels of interaction.



Parks may be connected by a thin corridor, such as tree-lined streets.



Several small parks may be connected to a larger park.



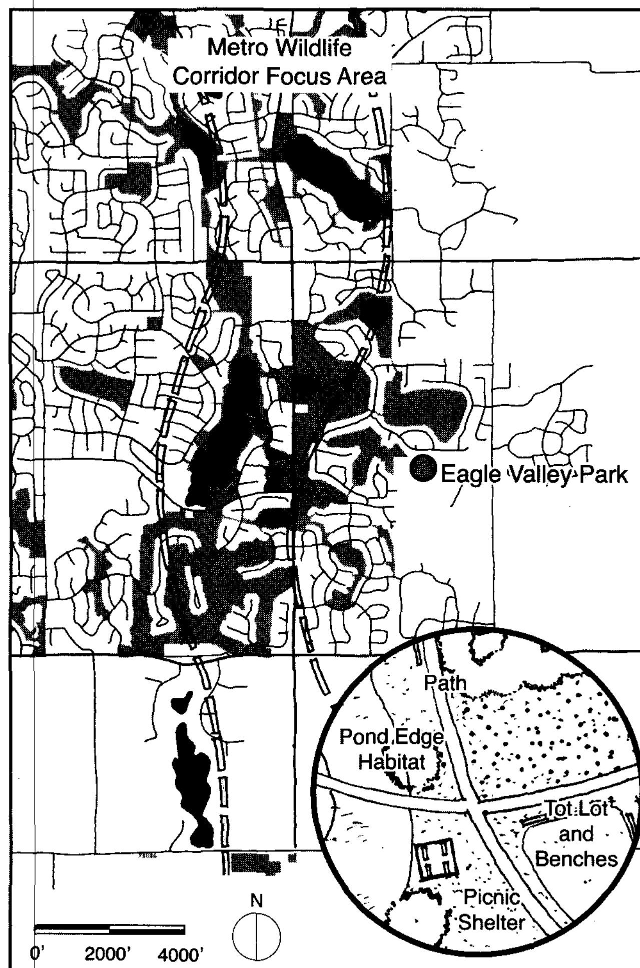
Parks may be connected by a wide corridor such as a greenway.

- Create landmarks or areas that can be easily described to others. Such landmarks can become meeting places.

Balancing Ecological and Social Needs in Small Parks

Small parks can be designed as specific places and as parts of a larger ecological or open-space network. Given their small size, they can only perform a limited number of functions, and so larger connections are important. Areas in which such links are made include:

- *Transportation:* Parks can be part of a pedestrian and cycling network, providing an opportunity for active living.
- *Human connections:* Parks can have an important function in creating a sense of neighborhood and a sense of place.
- *Natural systems:* Parks can help create larger patches of habitat. However, their small size does limit their ecological functioning and small parks have very specific and limited ecological roles.



From Design Example 1, pages 104–110

Eagle Valley Park is located on the edge of a development in a rapidly growing suburban community in Minnesota and near a proposed regional-wildlife corridor focus area. While some wildlife corridors follow major open spaces, such as river corridors, in this case, the wildlife corridor links small features, such as lakes and parks. In cases such as this, small parks like Eagle Valley Park can play a particularly important role in a habitat network and community green space system.

The light gray areas in the above illustration represent green space including: natural parks, some golf courses, and some recreation areas with large athletic facilities. The park-plan enlargement illustrates how social connections are incorporated into the design of the park through walkways.

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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3

Appearance and Other Sensory Issues

Parks are created to accommodate both people and natural systems, but it is a challenge for park designers to deal with the diversity of people's preferences. Some legitimate elements of urban parks—such as remnant-natural areas—will not be appealing to a majority of users in most places. The design of the natural area, in particular its edges, can provide what Nassauer calls "cues to care" that will make such places more acceptable to the public.

Social Aspects

In studies of open space from a human preference perspective, by far the most attention has been paid to what kinds of open space people think are attractive. Many articles describe a set of broadly shared and even cross-cultural preferences for certain aesthetic elements:

- Water.
- Trees that spread, with a vase-shape and a relatively open, fine-textured canopy.
- A tall overstory canopy with little understory.
- Ground covers that are smooth.
- High-maintenance levels with a relatively manicured look.
- Either an absence of buildings or ones that do not stand out.
- A balance between open areas and a sense of closure; that is, a space that is neither a vast, open field nor a dense, impenetrable forest, where it is hard to orient oneself and where criminals might lurk.

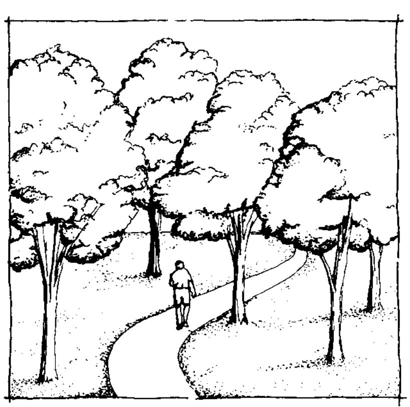
However, more recent research has examined a number of differences:

- While spreading trees are most liked, people around the globe also prefer the trees that they grew up with. Overall people have distinctive preferences either for or against the environments in which they grew up.
- Urban, low-income, African American, and child populations tend to like neater appearing green spaces.

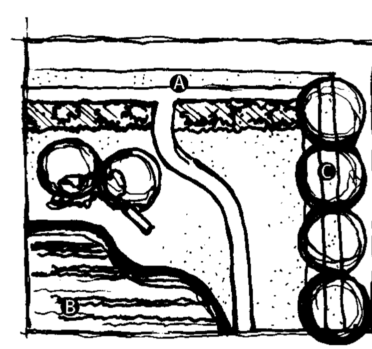
Parks can provide peace and quiet, fresh air, and spring blooms, all of which create sensory experiences that stand out from many other parts of metropolitan areas.

The design of small parks might include the following considerations:

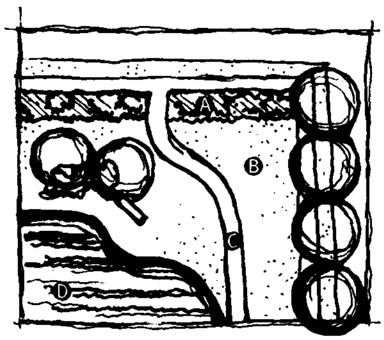
- Provide walking paths with different sensory experiences along the edges, for example, by using flowering trees



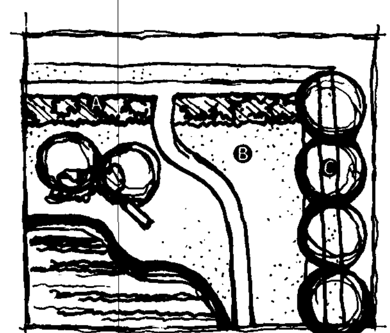
An expanse of lawn with scattered canopy trees is an aesthetic preferred by many. People see parks, but they also smell, hear, and feel them. These smells, sounds, and textures change throughout the day and the year. These can be important aspects of the experience of a park.



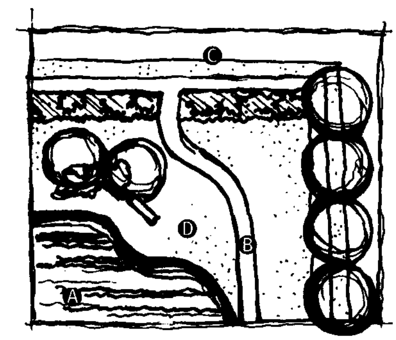
Sight: A. Flower beds provide a range of colors and textures. B. The view of water is calming and cooling. C. Leaves change color with the change of seasons.



Touch: A. A variety of flower types provides several textures. B. The expanse of lawn provides a soft area for relaxing. C. The rough texture of the gravel path contrasts with the soft lawn surrounding it. D. Water provides a cool and refreshing texture.



Smell: A. Flowering perennials and annuals provide a scented border along the sidewalk. B. Freshly mown grass can be smelled after the lawn has been cut. C. In the spring, flowering trees will perfume the air.



Sound: A. Sounds of ducks and splashing water can be heard near the pond. B. A gravel path crunches as it is walked on. C. The sound of passing vehicles can be heard near the street. D. A bench is located in a place of relative quiet.

and shrubs. Along walking paths, consider how the habitats could be modified to reveal sensory experiences and ecological function season-by-season.

- Provide opportunities for watching urban wildlife, such as birds and other pollinators. A permanent water source can attract a wide range of organisms.
- Consider microclimate in small parks season-by-season and provide park users with choices.

Balancing Ecological and Social Needs in Small Parks

To address the tension between a general preference for coherence and order in park landscapes and the "messiness" often associated with ecological landscapes, park designers and managers must develop management strategies that "label ecological functions with socially-acceptable signs of human intentions for the landscape, setting expected characteristics of landscape beauty and care side by side with characteristics of ecological health," according to landscape architect Joan Nassauer (1992, 248). Such signs include mown edges, supplemental plantings of native wildflowers in fields, and selective pruning along forest edges. Nassauer also suggests that public education about ecological systems is key to building public awareness and acceptance in these situations.

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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4

Naturalness

Naturalness is perhaps one of the most controversial aspects of open space in metropolitan regions. Ideas about nature and beauty are culturally ingrained, and scenic landscapes are often considered ecologically healthy by the public. Yet many lingering questions remain: How natural can they be in both appearance and function? What type of naturalness is socially acceptable based on socially derived goals?

Ecological Aspects

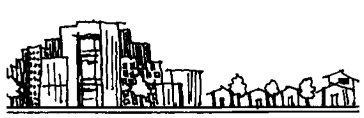
Ecologically, the capacity to bring nature into the city is limited by a park's size and shape as well as the number of parks in the vicinity. However, it is also constrained by the recreational, safety, and other needs of people.

The idea of the urban-rural forest gradient gives a way of thinking about the different purposes of green areas in different parts of the metropolitan area. As Bradley (1995, 6) explains in relation to the urban forest:

"The notion of an urban forest gradient running from the city center to wildland setting is useful in understanding the opportunities and limitations in developing urban forest landscapes. The most obvious differences across the gradient are those concerning people and plants. At the city center, people are abundant and plants are relatively scarce. At the other end of the gradient the opposite is true."

Metropolitan areas can be characterized as a gradient from rural to urban as one progresses from the metropolitan edge to the center city. How much "naturalness" can be brought into small parks is a question faced by park designers and managers.

On the outer fringes of a metropolitan area, agricultural and natural landscapes predominate.

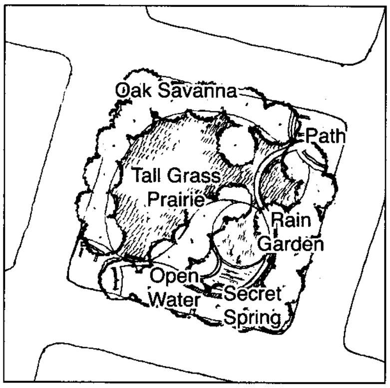


Near the city center, structures and people predominate with small pieces of nature tucked into left over spaces.

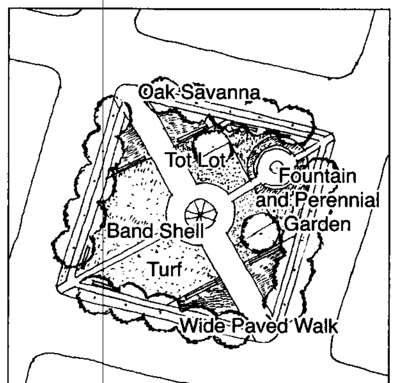
Social Aspects

Different kinds of people have different positions on the level of "naturalness" appropriate in towns and cities. For example, in a survey of 300 users of open spaces in Ann Arbor, Michigan—including such groups as open-space staff, volunteers, neighbors, and visitors—found that "staff and volunteer restorationists expressed a more conceptual attachment; that is, they were attached to a particular type of natural landscape such as prairie rather than to a specific place" (Ryan 2000, 213). Others were more attached to specific spaces, rather than to an idea of nature, wanting them to perform socially relevant functions, such as providing recreation and views, with some wanting a quite manicured look.

While preferences will differ by



A



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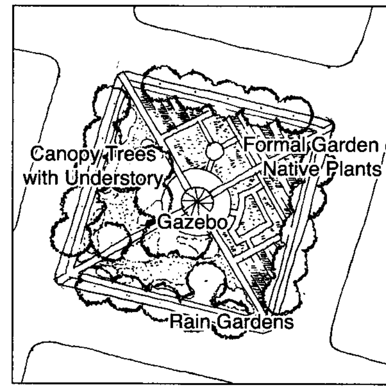

C

From Design Example 4, pages 123–127

Preference for how natural a park should look can vary by its location in the metropolitan area. Residents in suburban areas tend to prefer more natural areas while people living in the inner city tend to prefer parks that provide recreational activities. The above examples illustrate how a small square, one block in size, could be designed to reflect different preferences for "naturalness," from most natural (A) to most manicured (B). The "middle ground" design (C) provides the palette of native plants and plant communities found in option A but organizes them in large formal gardens. Open areas in option C include canopy trees with understory, again falling between the tallgrass prairie found in option A and the mown turf in option B.

region, park location, and demographics, park designers should attempt to understand local preferences. For example, small parks in different parts of the metropolitan area need to deal with different preferences of nearby residents. Research about the look of green spaces suggests that people in suburban areas prefer natural areas with few built features, while parks located in the inner urban areas should focus on recreation.

Balancing Ecological and Social Needs in Small Parks

Any restoration in which existing park land is converted to a more natural landscape will have to do so with great care. For example, many members of the general public dislike restoration that involves tree removal, seeing it as unnatural even when it is required for proper restoration. Providing education about the changes will help create acceptance of the project. Professionals who have experience with park restorations recommend that restorations take place in stages if acceptance is in question. In addition, when restoring an urban park, the natural succession of the plant communities and changes in vegetation structure over time and space should be considered. Deciding whether these changes will be socially acceptable in critical areas of the park, such as for picnic and play areas, is an important part of gaining public acceptance.

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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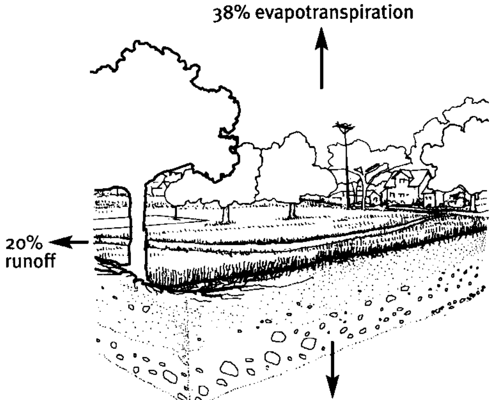
5

Water

People are attracted to water for its aesthetic beauty. Wildlife and plants need water to sustain life. Urban parks are one of the potential areas for natural infiltration of water into the ground. They are also places where streams that have been placed underground can be exposed, or daylighted, at least for a short space. All these factors mean that water is a big issue in small parks.



The above diagram illustrates the fate of rainfall on a small park that is 80%–90% green (10%–20% impervious). Limiting the amount of impervious surfaces helps to minimize the amount of runoff. Numbers adapted from Federal Interagency Stream Restoration Working Group (or FISRWG) (1998) and drawn by Bonsignore (2003, 4).

Understanding more about hydrological (water) processes in metropolitan areas and potential effects of urbanization on these processes is an important first step. Plants intercept rainfall and hold a portion of the water on their leaves and stems. Leaf litter, decaying tree branches and stems, and other organic matter on the ground surface also accumulate and hold water.

Ecological Aspects

At first glance, managing for water in small parks would not seem complex because of their size. Yet, the heavy use of parks magnifies potential water-related issues, such as increased soil compaction in play areas and soil erosion along paths and adjacent slopes, as well as reduced infiltration and percolation of storm water. Some of these issues can be addressed within the park, but others are caused by off-site issues. One of the major causes of these problems is increased urbanization in areas surrounding parks.

Social Aspects

Large quantities of impervious surfaces from hardscape—such as buildings, parking lots, streets, driveways, and sidewalks—contribute to many water resource problems. These surfaces limit infiltration of storm water and increase the amount of runoff. Often this runoff carries pollutants with it.

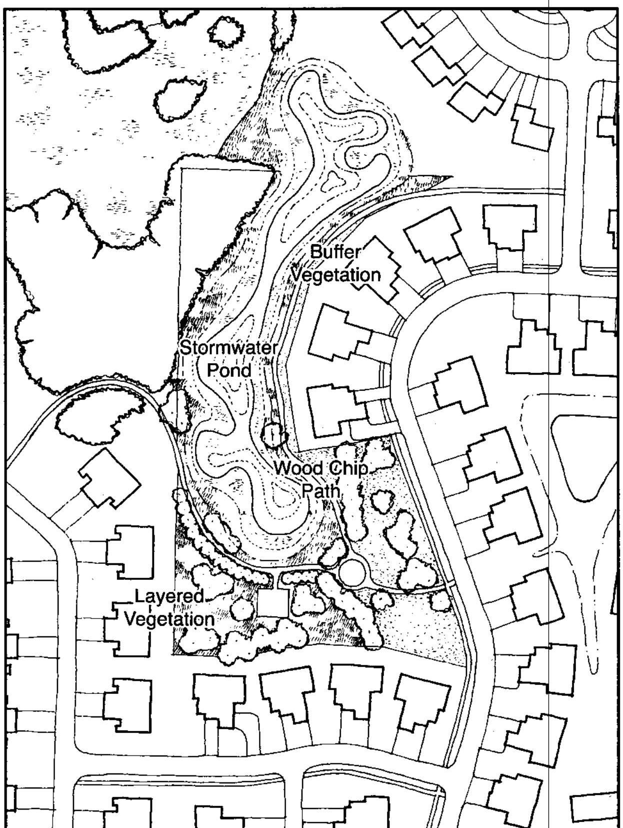
Other issues can include major alterations in stream corridors by the diversion of streams into a closed system of pipes or an open system of concrete-lined channels. These interventions may address flooding in the short-term, but valuable aspects of streams are lost, such as aesthetics, long-term flood protection, and wildlife habitat.

Balancing Ecological and Social Needs in Small Parks

Managing water in small parks requires balancing the need to shed water from areas, such as athletic fields, with the desire to hold and infiltrate as much rain water as possible and to include water bodies if possible.

Reduce impervious surfaces and replace with alternatives within the park, if possible, to improve infiltration and percolation. While some paved paths are needed for those in wheelchairs, these should be carefully located or porous-paving systems can be used. Other paths can be of more pervious materials, such as wood chips or turf and grass.

If a stream runs through the park site, use stream buffers to enhance beauty and functions, such as infiltration, flood protection, and habitat. Daylighting of streams can be an



From Design Example 1, pages 104–110

Water is a park amenity that is enjoyed by many. In many new subdivisions stormwater management ponds are created out of necessity, but if designed properly they can be an aesthetic and ecological amenity as well. The above example shows how a stormwater pond could be incorporated into a small park. By creating an undulating shoreline and bottom, the pond environment was made better for habitat. A buffer of native vegetation helps reduce surface runoff into the pond and provides habitat for a variety of wildlife. People have been given access to the water via a wood-chip path. However, by keeping the path away from the pond edge, the design has limited the disruption of habitat and helped reduce the amount of compacted soil near the pond edge.

effective community-based project for environmental education and neighborhood beautification; but it is a major project and requires long-term planning and allocation of resources. Small grants are often available for these projects through local and state agencies.

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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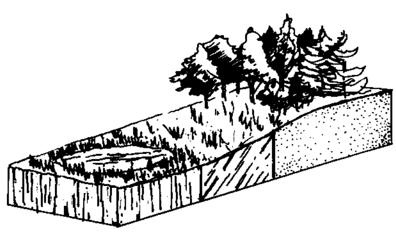
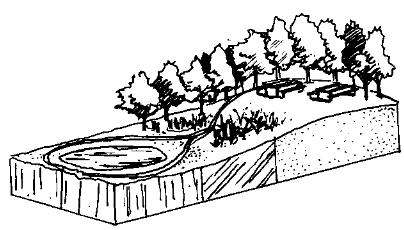
6

Plants

Plants are valuable for their aesthetic and ecological qualities. Trees are the most conspicuous form of vegetation in a park and help form the spaces for enjoyment, recreation, and habitat. Bushes, ground covers, and flowers are also significant for organizing and structuring open spaces. As a whole, vegetation provides many benefits, such as modifying microclimates, improving air quality, controlling storm water, and providing habitat. The challenge is that urban vegetation lives in a stressful environment comprised of contaminated soils, higher air pollution, a modified hydrological cycle, and other effects of urbanization.



Plants will be most healthy when the type of plant matches the existing conditions, e.g., the local soil composition and quality and the available moisture.



Selecting plants appropriate for the site conditions is just as important for active-recreation areas as it is for restoration projects.

Ecological Aspects

For many years, when people discussed the urban forest, they meant trees along streets and in urban parks. In the past decades, the definition of the urban forest has expanded to include the metropolitan area's body of vegetation.

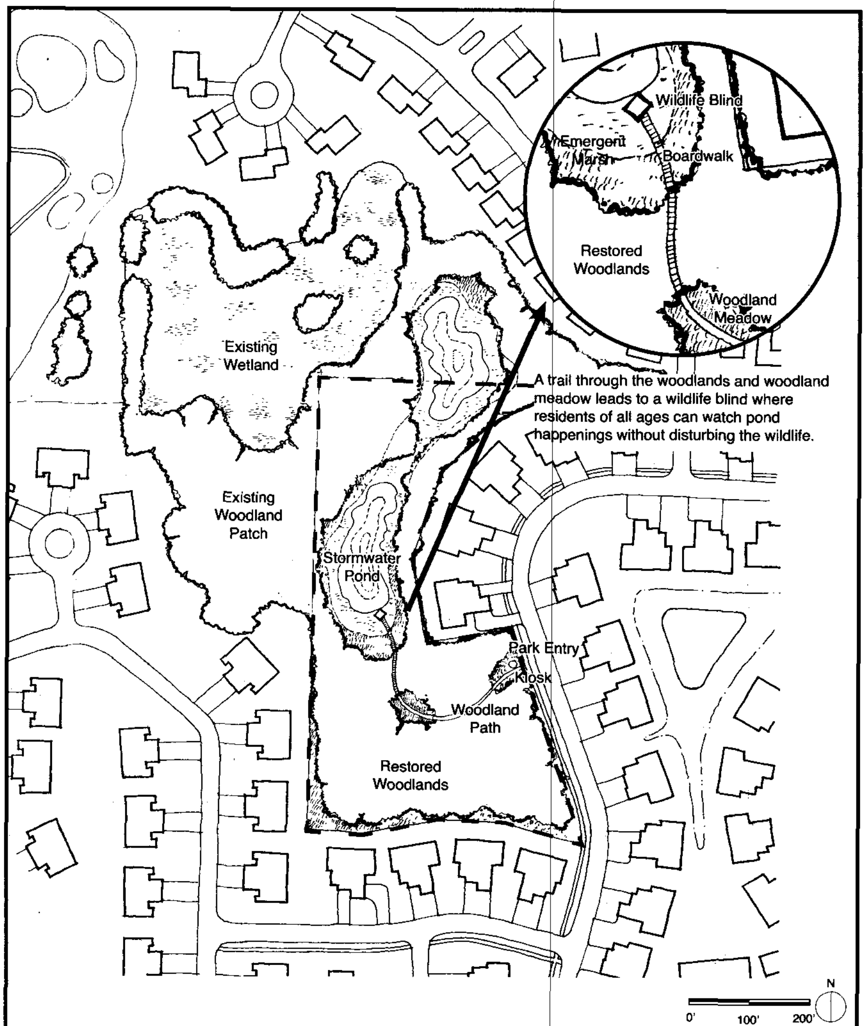
The selection of plants appropriate to the site conditions and careful planting are very important in terms of long-term survival. When selecting trees and other plants, it is important that they are tolerant of urban conditions, especially pollution, and that they are long lived. When planting plants in urban parks, it is crucial to create a good growing environment. For example, extensive soil testing is needed to understand the condition of urban soils in a park. This step is often overlooked, but it can provide invaluable information for management and cost-effective decisions.

Social Aspects

The management of a healthy urban forest is a major concern for foresters, scientists, and the public. The benefits of the urban forest are numerous if it is healthy, long lived, and well maintained. As Dwyer et al. point out, forests in metropolitan areas benefit air quality, climate, noise, and aesthetics. However, it is also important to manage some negative effects, such as water consumption, pollen, green-waste disposal, emissions from maintenance, and the spread of exotic species.

Balancing Ecological and Social Needs in Small Parks

One of the most critical issues faced in the urban forest is the fragmentation of the natural vegetation as cities grow. The fragmentation leads to habitat remnants that often provide homes for only limited native plants and animals. Whether this lack of native species is a severe problem or not depends on the local context. There is value in planting strategies that reflect historical patterns of urbanization, a region's ethnic heritage, or that use a mixture of local and exotic plants to highlight seasonal change and the sensory experience of a park. However, a park filled with invasive species with little habitat value provides a maintenance problem for many in the area.



From Design Example 1, pages 104–110

This plan highlights a potential design for a new park built with a constructed stormwater pond as its centerpiece. Located adjacent to a small remnant-woodland patch and an existing wetland, these nearby natural features provide cues as to what types of plants might be used in the new park. Here the planting strategy extends the woodlands into the park, which had been cleared. A path to a wildlife blind goes through restored woodlands and a woodland meadow. The path is set to one side of the park to reduce habitat fragmentation of the restored woodlands. It provides a sheltered experience of nature, buffered from the surrounding neighborhood.

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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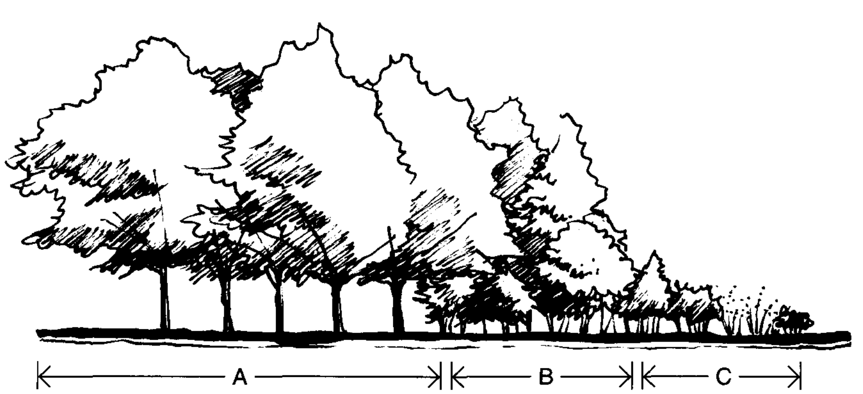
7

Wildlife

Urban wildlife may sound like a contradiction of terms, but cities are a place where certain types of wildlife can thrive, given the right resources. Small parks can provide some of that habitat. Granted, small parks will never have much wildlife; but they can be managed to bring generalist species—that is, wildlife that can survive in a range of environments—into the city.

This diagram represents the gradient of vegetation types that can be found in a park. A. Canopy trees can provide shade and frame views in a park, but the absence of an understory decreases their habitat value. B. Having layers of vegetation types provides habitat value, but may raise safety concerns in small parks. C. Low growing shrubs and flowers are ideal in small parks, as they help maintain sight lines while adding color and texture, but the vertical structure is inadequate for many urban wildlife species.

Park size (or area) is one of the most important determinants in species diversity. Given their limited size, the habitat in small parks is in general most suitable for primarily generalist species that are not area-sensitive. It will depend on the width and structure of vegetation at the surrounding edges of the park. If an urban park is surrounded thick vegetation, then a wider range of species may occur in the site than if it abruptly finished at a paved sidewalk. In general, the edge effect is reduced by creating transition zones of shrubs or bushes and ground covers between trees and surrounding land uses.



Ecological Aspects

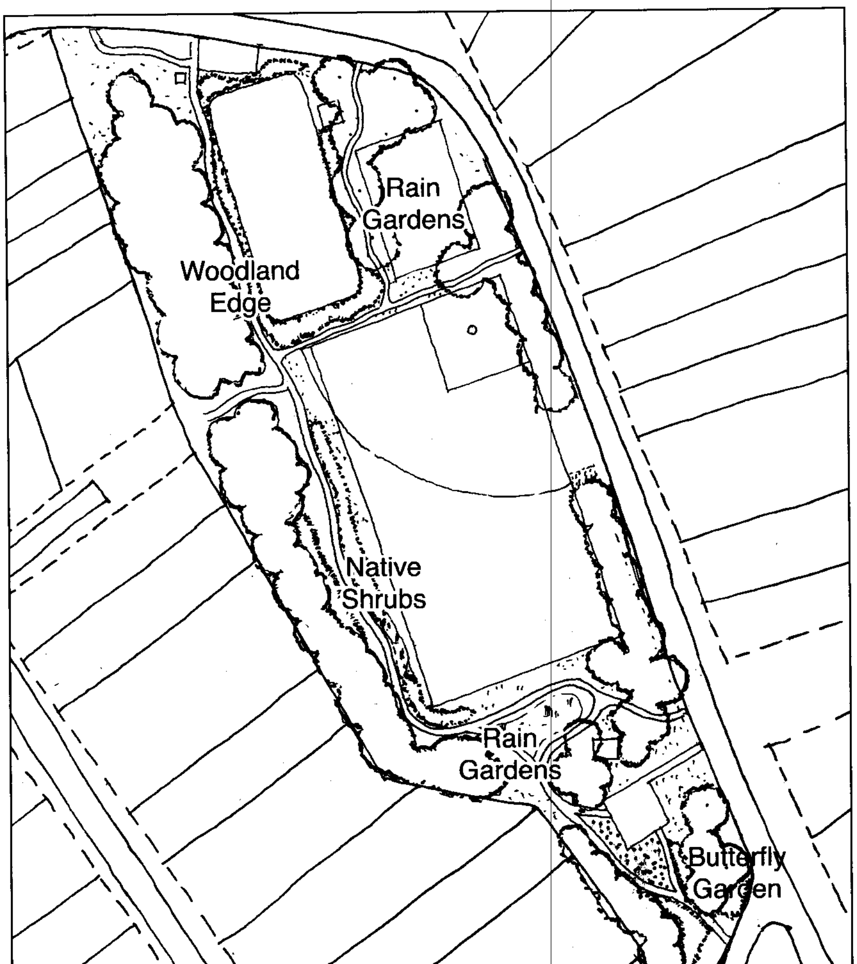
Animals need food, water, and cover to complete their life cycles. With cleaner water and air in cities, from recent environmental policies, the recovery of some organisms has continued to surprise and to educate the public about their resiliency. Yet the tolerance of species to urban conditions is variable and depends on their life history. Generalist species are more typically able to cope with urban conditions, because they can use a wide range of habitats for food and cover. Specialist species, which include many endangered and threatened species, usually have some special habitat requirement, such as patch size, vegetation structure, vegetation composition, food resource, or other environmental conditions, that limit their home range.

Social Aspects

People enjoy interacting with wildlife. One core tension in parks is the problem of crime—people feel less safe in areas with thick vegetation. However, as described above, these are often the areas most suitable for wildlife.

Balancing Ecological and Social Needs in Small Parks

Small parks will never have much wildlife, and most of it will be common, generalist species. However, even the most ubiquitous species are often appreciated by park visitors, and in some cases small parks can provide critical habitat for uncommon species. Often, trade-offs will have to be made. In some instances, a small park might be home to insects and butterflies only. However, if possible, preserve the vertical layering of vegetation to maintain habitat quality for wildlife but maintain critical views for public safety.



From Design Example 3, pages 116–122

Many parks include recreational facilities such as ball fields, play areas, and ice rinks. It requires careful design to ensure that these do not overwhelm a small park, limiting its habitat potential to only the most adaptable species. The above park design illustrates several small features—including rain gardens and natural plantings between recreational uses—that can be incorporated into a park to enhance habitat. Essentially, recreational areas, such as the ball fields, are "cut" out of natural areas. Native grasses and flowers extend right up to the edges of play areas. To enhance habitat potential, the park also contains a woodland edge with vertically layered vegetation, including ground covers, shrubs, and canopy trees and a butterfly garden. But the weakness of this design is that the playfields decrease an opportunity to restore the wetland that naturally occurs on this site.

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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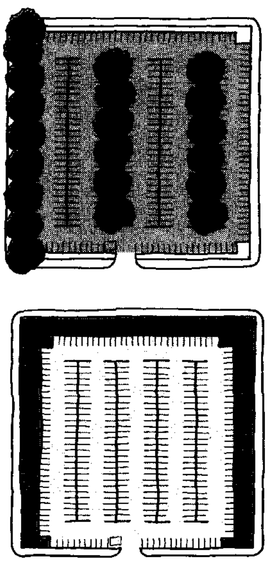
8

Climate and Air

The design of individual parks, especially the use of trees, can moderate air temperature and air quality at a neighborhood level, and if many parks are scattered across a metropolitan area, they may also modify the urban heat island effect. It is not just a matter of the more trees the better—to achieve benefits requires very careful tree selection according to such variables as location, arrangement, leaf type, and maintenance requirements.

There are three main urban-air quality and climate problems that small parks can help solve: the urban heat island effect, local air pollution, and potentially global warming.



Parking lots are often necessary in parks, and these parking lots illustrate contrasting strategies for improving air quality and climate. The design of these areas can affect air quality and climate. Trees that shade parking lots help to reduce the heat-island effect and evaporative emissions from the parked cars (above). Efficient parking-lot design that minimizes paved surfaces and light-colored surfaces can also help (below).

Trees reduce air temperature, particularly in the afternoons. In temperate climates, a thin tree canopy that covers a broad area is more effective than a dense cluster of trees that leaves areas unshaded. Street trees should provide shading of street pavement, sidewalks, and houses. Grass has a less clear effect. However, reflective, light-colored building surfaces are also very effective at lessening the heat-island effect.

Heat Island Effect

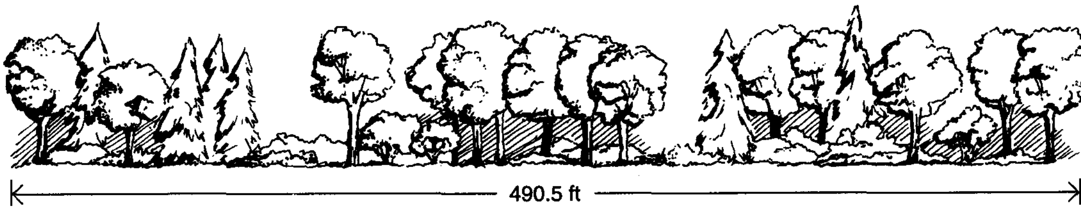
Urban heat island is the term for increased temperatures in metropolitan areas due to greater absorption and storage of heat in the hardscape of building and paving materials, as well as heat generated though combustion from vehicles, lawn mowers, and industries. The urban heat island increases minimum temperatures and extends warm periods in each day and each year. The urban heat island influences air quality by (1) increasing ozone formation and (2) increasing the precursors of ozone. While urban areas are generally warmer than rural environments, in desert cities, evapotranspiration from landscaping can lower temperatures.

Local Pollution

Local air pollution comes from a variety of sources. For example, most hydrocarbon emissions come from tailpipe exhaust; however, research conducted by landscape architect Greg McPherson has shown that approximately 16% of emissions are from the evaporative emissions that occur when the fuel-delivery systems of parked cars are heated.

Based on a literature review, Smith concluded that air pollutants are removed naturally in six ways: "(1) soil absorption, (2) absorption by water bodies, (3) absorption by rock, (4) rainout and washout (scavenging), (5) chemical reaction in the atmosphere, and (6) foliar absorption by vegetation" (Smith 1976, 292). As Spirn outlines, for vegetation to remove pollutants, it needs "dense branches, rough bark and twigs, and hairy leaves with a high ratio of surface to volume" planted in "soil covered in leaves and plants, rather than pavement" (Spirn 1989, 72). Coniferous and deciduous trees with numerous small branches and twigs can help remove particulate pollutants during the cold winter months.

A mixture of coniferous and deciduous species is ideal for improving air quality. Green spaces with vertical layers—low ground covers, shrubs, and canopy trees—are more effective pollution sinks than green spaces with a single layer of vegetation. Care must be taken, however, to ensure that the edge plantings are not too dense as this might force the air masses over the plantings, minimizing pollutant removal.



The ideal width of a corridor for improving air quality is 490.5 feet (150 meters) (Smith 1976). Ideally, a mix of deciduous and coniferous vegetation is present within the corridor.

Global Warming

The combination of good maintenance and short-lived urban trees may mean that urban trees release more carbon than they sequester, though trees in small parks should live longer than street trees, and trees can play a significant role in efforts to reduce carbon emissions by reducing energy consumption in cooling.

Other Issues

Other important issues have been less well researched, but they may become more important. With ozone depletion, particularly in the southern hemisphere, shade becomes an important factor in preventing skin cancer.

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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9

Activities and Groups

People vary a lot in how they use parks—the activities that they engage in and the groups with which they visit the parks. In small parks, there is a large potential for conflicts between these activities. Some activities do not take up much space, for example, sitting on a park bench. However, others require larger areas. Some people go to parks as individuals and pairs, but others use parks in peer groups or in large extended families. Recently, the role of parks in active living has come to some prominence, and while it is not clear that access to parks increases physical activity, parks do provide unique opportunities for recreation. Careful design can go some of the way toward enabling spaces to be used by multiple groups and for different activities, particularly if such sharing can occur over the course of a day, week, season, or year.

Small parks can serve a variety of socializing needs. Some people prefer quiet and solitude while others prefer the activity of large groups of people.

Social Aspects

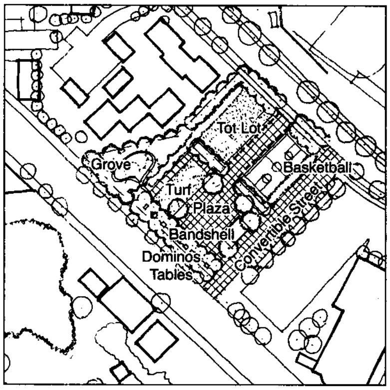
Numerous studies have found systematic differences among people of different residential locations, ages, genders, and income levels in terms of what they do in parks and in what kinds of groups. Parks provide an important setting for children's play and for socializing and connections to nature for seniors. Adult suburban residents have more interest in wildlife and the outdoors than center-city residents; more liking for naturalistic designs; and more likely to treat parks as scenery. For these people, looking at a park is an important activity. In contrast, residents of the center city see parks as a location for active recreation.

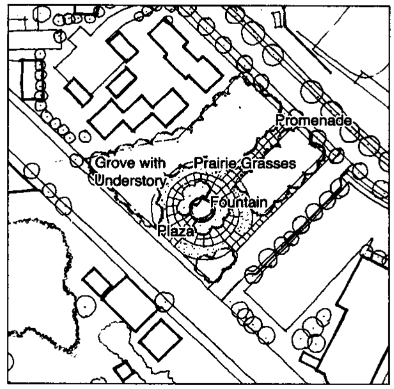
Studies in major cities such as Los Angeles and Chicago find a strong intersection between ethnicity, group type, and activity. Latinos often use parks in large family groups, and they conduct social activities such as picnics. African Americans go to parks in peer groups and frequently play sports. Whites often go alone to parks, except for groups of elderly or if watching children, and they often value aesthetics. Asians are a more diverse group. Work from Chicago found large family groups; but a study in Los Angeles found little use of parks, and where it did occur, it was primarily older men socializing.

While it is not clear how much parks contribute to increasing physical activity, they certainly provide options for different forms of exercise and have other benefits such as stress reduction. This is an area of extensive current research and so much more will be known in coming years about the way that parks affect public health.

When designing parks some considerations include:

- Provide spaces for activities appreciated by a variety of users, not only those involved with adult active recreation. Multipurpose sports areas interspersed with seating areas and paths are a solution in tight sites.
- Provide walking paths with different lengths to encourage physical activ-





From Design Example 2, pages 111–115

Parque Castillo is a 1.3 acre (0.5 hectare) park located in a culturally diverse neighborhood with a large Latino population. The park designs above illustrate two approaches to the design of this park where social factors predominate but where the incorporation of important ecological functions is desired.

A plaza with patterned paving is the activity focal point in the design on the left. A landmark band shell, basketball court, and dominos tables under shade trees are located near the plaza. The paved plaza area and band shell create a space for social gatherings for large groups and evokes the atmosphere of gathering spaces in Latin America. A convertible street provides additional area during large festivals and gatherings. A number of features reflect typical Latin-influenced plaza designs, including: patterns in the paving, brightly colored plaza furnishings, and a decorative brightly colored fencing enclosing much of park.

ity among the elderly and others with different levels of mobility.

- Picnic tables should allow use by both small- and large-family groups. Movable chairs and tables for different social groups may be one option.
- Benches in shaded areas are appreciated by elderly park users and arrange some to facilitate conversation. Movable chairs are preferable. Others appreciate scattered benches that allow some solitude to watch people, plants, and animals.
- Allow spaces for people watching and for seeing and being seen.
- Carefully consider access to parks. Where possible, locate access points close to transit so low-income people and those too young or old to drive or unable to walk can gain access.
- Urban children have a special relationship with parks. For those in central cities, parks may be that main area where they can move around. In suburban areas, parks provide opportunities for social interaction.
- It is crucially important to provide opportunities for different types of play appropriate to different age groups and levels of physical competence.

The design on the right emphasizes a more ecological approach while respecting the Latin American traditions of plaza design. A large plaza and promenade are made of porous pavement. The plaza, anchored by a large fountain, is surrounded by a ring of native prairie grasses. Tables and chairs are found under the canopy trees.

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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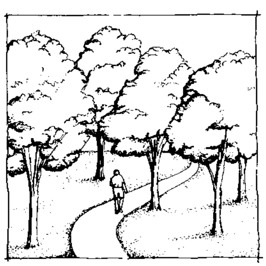
10

Safety

Safety is an issue in urban parks in several ways, particularly crime and fear of crime, issues of territory and turf, and physical safety from accidents.



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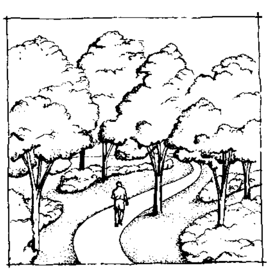

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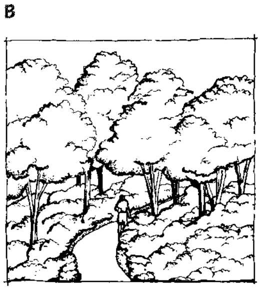


C

A. Canopy trees with no understory allow views to surrounding areas and keep hiding places to a minimum. B. Canopy trees with low understory, away from the path, allow visitors to scan the entire park and still provide some habitat value. C. While good for habitat, densely planted areas around heavily used paths create many areas for concealment.

Social Aspects

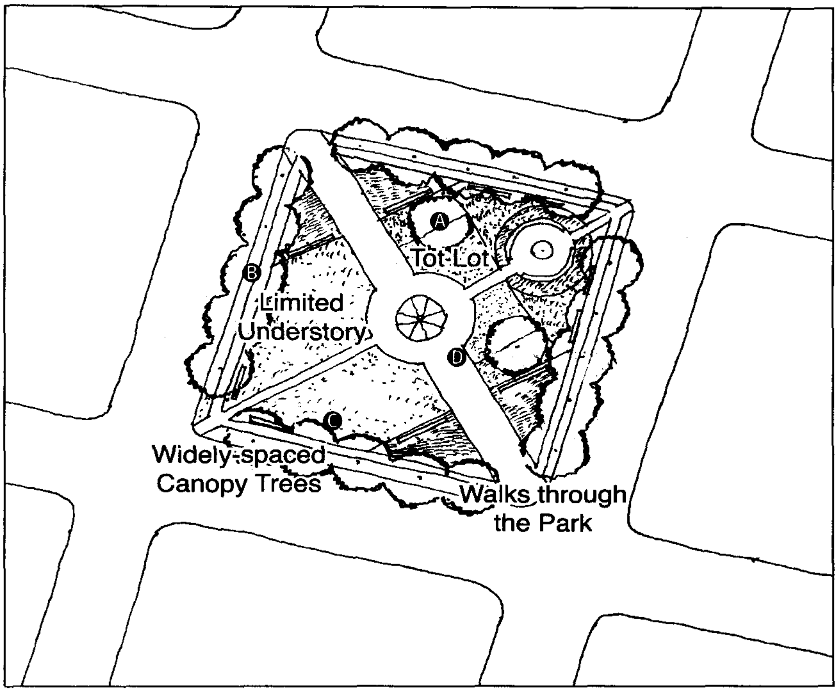
Four key concepts structure thinking about crime in parks: *surveillance, concealment, escape,* and *prospect.*

- Surveillance involves noncriminals' ability to see or to hear perpetrators. It is assumed that offenders do not want to be caught.
- Concealment refers to a criminal's ability to hide before, after, and possibly during a crime.
- Escape relates to a crime victim's capacity to free.
- Prospect refers to the ability of a victim to observe his or her surroundings.

While a minority sees natural-wooded areas as low in crime, for most people, more openness means more safety. This requires control of understory, and this is often incompatible with native habitat in areas where woods and forest predominate.

Overall, parks need to be designed to minimize concealment of perpetrators and to maximize surveillance, prospect, and escape by potential victims and others. Of course this needs to be weighted against the need for some mystery, preferences for large trees, and habitat needs. A savanna-type landscape can perform well for crime prevention, though it may not reflect local vegetation types.

- Lighting is a complex issue in parks. It is important to light areas that are intended for nighttime use, but it might be misleading to light areas not intended for use, particularly if they are isolated.
- Maximize views (prospects) and surveillance by potential victims and others. Prune shrubs, particularly near circulation routes, so potential victims are not surprised by concealed perpetrators.
- When considering the small park as wildlife habitat, consider the effect of vegetation structure on the perception of safety. Find ways to accommodate both the need to teach people about the ecological structure and function of the urban landscape and the need for people to feel safe. This is especially important in areas where intensity of use is high, for example, along recreational trails. In temperate climates, a narrow trail corridor through dense, forested vegetation will feel less safe. A wider corridor will feel more safe, but it will create a larger gap in habitat, which may have effects on the ecology. These trade-offs need to be



From Design Example 4, pages 123–127

The design of this small square includes several features that enhance safety:

A. A children's play area is located close to the center of the park, away from traffic.

B. Understory vegetation, such as shrubs, is limited; when it is used, it is kept to a height that limits hiding spaces.

C. Tree spacing is kept wide to allow views in and out of the park.

D. Two diagonal walks direct people through the center of the park where they can observe park activities.

considered in relation to goals and practices for management and maintenance.

- Carefully consider child safety, balancing the need to protect from accidents with developmental aims that emphasize skill development and exploration. However, it is important to have appropriate surfacing under play equipment.

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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11

Management

Parks need management in multiple dimensions to protect their integrity for future generations. This sheet focused on four important theme: (1) management zones, (2) costs, (3) maintenance of habitat, and (4) ecosystem management.

Management Zones

One of the major concerns for park designers, planners, and managers is how intensely parks are used and by whom and if this use is causing any unusual patterns of wear and tear or potential safety concerns. A small park may have just one management zone. For example, a square in a densely populated central neighborhood probably only has cultivated landscapes.

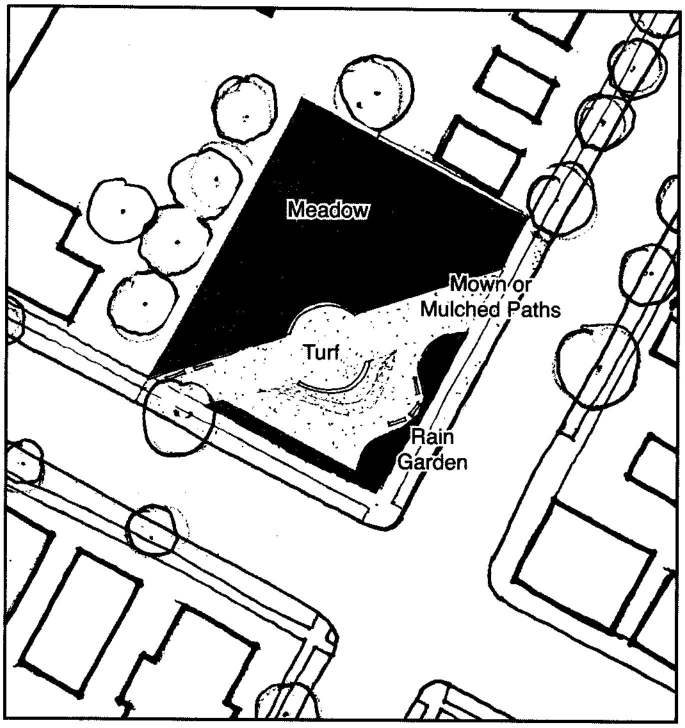
Cost

The size of small parks may well result in more intensive use over time on a per acre (hectare) basis and thus more expensive maintenance. Managing some of the park area for native landscaping potentially reduces costs, counterbalancing the size premium. In addition, small parks may have fewer wasted areas and more people using each acre, meaning that per capita costs may be lower than larger, less intensively used parks.

Maintenance for Habitat

Typical management activities in small parks include mowing turf and clipping shrubs. It is important to note that clipping shrubs into an unnatural shape, such as balls, often stimulates the shrubs to create a low, dense, twiggy, leafy canopy. People can see over these low shrubs, but much is sacrificed in terms of aesthetics and ecology. From a preference standpoint, people like tall shrubs as long as the canopy is open and allows prospects to the surrounding landscape while minimizing concealment for criminals. From an ecological standpoint, allowing shrubs to achieve their natural habit of growth would likely improve habitat, because there would be more opportunities for better cover for a wider range of species as well as more flowers and fruits for food sources. People would also appreciate the greater range of seasonal interest, because plants are allowed to bloom and fruit. Plants that are too messy in terms of flowers and fruits may cause a maintenance issue on hard surfaces.

Management of small parks can influence the diversity and complexity of the park's ecology. For example, their small size limits the number of wildlife species to generalist and edge species, but management for these species can provide more suitable habitat.



From Design Example 5, pages 128–133
Including areas of lower maintenance (shown as gray shading) plantings, such as native prairie plantings, can help reduce maintenance costs. The rain gardens and paths could be maintained by a neighborhood group.

Ecologically-Based Management Approaches

In the last decade, the management of regional open space has integrated ecologically-based principles of land management. One of the major problems that ecosystem management addresses is the causes, effects, and potential mitigation strategies for landscape fragmentation.

Key considerations with regard to management of parks include the following:

- Cultivated small parks are expensive to maintain, so managing some of the park in a wilder state or with lower maintenance-planting designs should be considered.
- With existing plantings, selectively prune to allow trees and shrubs to achieve their natural habit of growth. This will likely be a more open shape than that achieved through trimming. Care must be taken that good sightlines are maintained and that shrubs and tree limbs are not perceived as a danger.
- Manage for the long-term care of trees. Provide adequate soil and nutrients.
- Survey existing conditions carefully to target maintenance on key problems.
- Follow ecologically-based, land-use management principles and guidelines created by major organizations such as the Ecological Society of America (ESA).

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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12

Public Involvement

Members of the public participate in small parks by using them. However, the public also increasingly lobbies for park funding, gives input on park design and rehabilitation, and helps with park cleanup and light-maintenance activities. Designing for and maintaining this public involvement is an important role for parks professionals. This encompasses many activities, including involving the public in design, developing friends groups and others to help upgrade parks, and providing environmental education.

Participation in park design can build a sense of ownership among residents as well as enabling designers to respond to local needs and values. *Source: Ann Forsyth and the Urban Places Project, used by permission.*

Public Involvement in Design

Park planning and design is a complex process. Before a small park is designed or redesigned, typically a needs assessment is performed, particularly if the main focus of the park is recreation. After parks are designed they are then constructed, maintained, programmed, and eventually rebuilt. Design affects all these later activities and is meant to support maintenance and programming, but it is also a separate endeavor.

Public involvement is often controversial, and not everyone agrees with public involvement, evening fundraising. In the area of design, many professionals fear that public input may lead to a mediocre design quality. In small parks such disagreements over aesthetics may be manageable, and public participation has the benefit of providing important information on local values and needs.

Maintenance Responsibilities

Another important dimension of management is how to manage the ecological and recreational resources of the park system with limited park and maintenance staff. Most importantly, urban parks have a constituency that has to be addressed, the residents of the local neighborhoods, who use the parks on a regular basis and often desire updates to their local parks to improve the appearance of their neighborhoods and to improve civic pride. A well-informed local constituency can be an important advocate for supporting parks in lean times and can be the source of volunteer help for community-based projects that upgrade the park. In particular, small parks are potentially of a scale where public maintenance can make a difference and be manageable in locales where unions do not have regulations preventing such participation and parks departments do not fear liability. Public participation in park design can increase commitment to the park, including interest in such maintenance.

Environmental Education

It is not unusual for a small park to be located next to a school, which is an opportunity to create a living laboratory for children. Hidden learning opportunities for children exist in small parks; a stream buried in a pipe waiting to be restored, a neglected area with woodland vegetation, or an unusual animal or plant waiting to be discovered. Some of these opportunities are readily available at hand while others require vision and commitment to recreate a more indigenous landscape. For park designers, planners, and managers, these opportunities are ideal times to maximize the social and ecological benefits of small parks for neighborhoods.

Balancing Ecological and Social Needs in Small Parks

- Work to involve the public in key park decisions as a way of both building better parks and developing a constituency to support park funding.
- Consider how small parks would be enhanced through retrofitting a park's design for environmental education programs in school curriculums.
- Friends of the parks groups can help with basic maintenance, such as litter collection and tree planting. They can also lobby for maintenance funds.
- Consider how a citizen-based science program would be used to enhance the monitoring of ecosystems in small parks and how this data would be used as a tool to manage parks better.
- Identify likely conflicts between different constituencies' park and facilities use, including those who are not typically involved in park design. In public meetings, come prepared with specific options to respond to the different needs.

Information in this design sheet is taken from **DESIGNING SMALL PARKS:** *A Manual for Addressing Social and Ecological Concerns* (New York: John Wiley & Sons, 2005).

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KEY WORDS

Abiotic. An object or process that refers to nonliving things.

Active living. Integrating physical activity into daily life.

Anaerobic. A physical state of the environment that lacks oxygen.

Annual. A plant that persists for only one growing season.

Biodiversity. "[E]ncompasses genes, individuals, demes, metapopulations, species, communities, ecosystems, and interactions between these entities" (Lindenmeyer and Franklin 2002, 6).

Biogeochemical. Refers to the cycling of nutrients (e.g., phosphorus, nitrogen, and carbon) through an ecosystem or landscape.

Biogeography. The study of the geographic distribution of species in an ecosystem or landscape.

Bioretention. The process of retaining storm water in a pond to improve water quality by allowing pollutants to settle out and to slow the storm water's speed by allowing water to infiltrate.

Biotic. An object or process that refers to living organisms, such as animals and plants.

Boundary. The edge of an ecosystem that creates a transition zone with another ecosystem (Forman 1995, 38).

Brownfield. An abandoned industrial or commercial property that is environmentally contaminated and is available for redevelopment.

Center city. The central business district or downtown as well as adjacent neighborhoods of a city. In the U.S. Census, the core city or cities in a metropolitan area are called the central city or cities.

Chaparral. A plant community that may include different types of evergreen woody shrubs, forbs, grasses, cacti, and annual plants and which is adapted to a two-season climate pattern that is wet and dry.

Clonal. Plants that have a common ancestor and were reproduced through asexual reproduction, such as by root sprouts. An aspen grove is a good example.

Colonize. The dispersal of organisms, such as plants and animals, to new habitats.

Community (social). A broad term that encompasses a number of different types of human groups including collections of individuals in an area, a social group in a clearly defined area, a social network that is spread across a large region, and a feeling of belonging.

Community (plant). See plant community.

Connectivity. How connected or unconnected are vegetation areas to one another. "The fewer the gaps, the higher the connectivity" (Forman 1995, 38).

Core habitat. The habitat that is located in the interior of a patch; it is minimally influenced by the edge effect and fragmentation. It is important to note that not all patches of vegetation have core habitat due to their size or shape, such as a narrow, linear vegetation corridor or a small grove of trees.

Corridor. A linear strip of vegetation that differs from surrounding land use and land cover (Forman 1995, 38; Turner et al. 2001, 3).

Culture. Customs and civilization of a group.

Daylighting. The process of taking a stream that has been diverted and buried in a pipe and bringing it back to the surface by restoration of its natural horizontal alignment and vertical elevation. In an urban situation, the restoration of the stream course may not be possible, so in this context, restoration is an approximate interpretation of where the stream was once located.

Desert scrub. A plant community that is dominated by cacti, woody shrubs, forbs, and annual plants and one that is adapted to very low annual precipitation and severe droughts.

Ecoregion. A geographic classification based on the climate, geology, topography, soils, elevation, and plant communities of a region.

Ecosystem. A relatively homogenous environment, including biotic (living) and abiotic (nonliving) components, where organisms interact (Forman 1995, 38).

Ecotone. The transition zone between two ecosystems, especially aquatic and terrestrial ecosystems.

Edaphic. An object or process influenced by soils.

Edge. The area at or near the boundary of an ecosystem that differs in environmental conditions from the interior core (core habitat) of an ecosystem (Forman 1995, 38; Turner et al. 2001, 3).

Edge effect. The distinct environment at the edge of a vegetation area (patch) (Forman 1995, 39). The edge of farm field has different species composition or abundance at its edge versus its center.

Emergent marsh. See marsh, emergent.

Environmental determinism. An approach that argues that the environment determines behavior. This much attacked position is rarely held, however, many people agree that the environment can influence behavior.

Evapotranspiration. The amount of water loss from plants and soils.

Exurban development. The development that occurs beyond the suburbs at the fringe of metropolitan regions.

Forb. Small flowering plant that may be an annual or perennial and that is found in ecosystems dominated by grasses, such as a prairie or meadow.

Fragmentation. The spatial process of subdividing land, habitat, or ecosystems into smaller, unconnected parcels (Forman 1995, 39; Turner et al. 2001, 3).

Fragment (or remnant). A patch of vegetation that is still remaining after the spatial process of fragmentation.

Generalist species. A living organism that has few specific habitat needs and is very adaptable, such as a starling.

Geomorphic. An object or process related to geology and the earth's surface.

Grain. The texture of vegetation areas (patches) (Forman 1995, 39; Turner et al. 2001, 29).

Grassland (or prairie). A plant community that is dominated by different grass, forb, and annual species and occurs in semiarid and temperate climates.

Greenway. A vegetation corridor used for recreation and environmental conservation that is typically located along a river or abandoned railroad corridor and connects two different neighborhoods or communities.

Habitat. "[T]he ecosystem where a species lives, or the conditions within that ecosystem" (Forman 1995, 39).

Habit of growth. The branching structure of a woody plant, such as a tree or shrub.

Hardscape. See impervious surface.

Herbaceous. A plant that does not have any woody tissues, such as twigs, stems, branches, or trunks.

Heterogeneity (or spatial heterogeneity). "[Q]uality or state of consisting of dissimilar elements," such a landscape with many different habitats or a plant community with many different plant species (Turner et al. 2001, 3).

Home range. The territory that an animal uses on a seasonal basis and during its lifetime.

Homogeneity. The elements in a landscape that have a similar land use, land cover, or habitat (Turner et al. 2001, 3).

Hydrologic. An object or process related to water.

Impervious surface. Hard-built areas like roads, roofs, and sidewalks.

Interior habitat. See core habitat.

Island biogeography. A major scientific theory that proposes that the size and isolation of an island from the mainland are major controls that influence the dispersal of a species from the mainland and the extinction rate of a species on an island (Forman 1995, 56; Wu and Vankat 1995).

Land cover. The type of vegetation that is found in a place, such as a forest, meadow, or orchard.

Landscape ecology. The scientific study of the interactions between land use, land cover, and ecological process that causes a range of environmental conditions and variations (spatial heterogeneity) to occur across many scales, such as a landscape, region, or watershed (Turner et al. 2001) and the application of the science of landscape ecology to landscape conservation and sustainability (Wu and Hobbs 2002, 362).

Landscape. In cultural geography, "land modified for permanent human occupation" (Stilgoe 1982, 3) or, in other fields, a group of ecosystems with recognizable elements, such as stream corridors and forest patches, that are repeated across a square miles (kilometer squares) area (Forman 1995; Pickett and Cadenasso 1995).

Marsh, emergent. A wetland dominated by grassy vegetation.

Matrix. The most common land-use and land-cover pattern in a particular place, which is characterized by high connectivity (Forman 1995, 39).

Mesopredators. Intermediate-size carnivorous animals, such as raccoons, cats, skunks, and coyotes, that hunt small mammals and birds in urbanized places.

Metapopulation. A population of animals in spatially-separate patches of vegetation that are linked by movement of these animals (Forman 1995, 372).

Middlestory. The layer of vegetation in a forest that is found between the ground layer and forest canopy and consists of tall shrubs.

Mosaic. Patterns of different land uses and vegetation (land cover), such as a neighborhood with parks, residences, commercial areas, vacant lots, and streams (Forman 1995, 39).

Network. A system of corridors, such as the Mississippi River and its tributaries (Forman 1995, 39).

Overstory. The tallest layer of vegetation in plant community, such as trees in a forest.

Patch. A stand or area of vegetation that differs from adjacent vegetation areas, such as a pine stand surrounded by a deciduous forest (Forman 1995, 39).

Perennial. A plant that persists year after year.

Plant community. A group of species that commonly occur together and grow in particular environmental conditions, such as the maple-beech forest or cottonwood-gallery forest.

Prairie. A plant community that consists mainly of grasses and forbs.

Rain garden. A type of landscape design that is a small depression, with aesthetically-pleasing flowering plants, that collects water from a surrounding area, especially from lawns, paved surfaces, and roofs in an urban area.

Ramada. A pavilion-like structure that is often found in parks of the southwestern United States.

Reference ecosystem. A relatively pristine ecosystem that has typical grouping of plant and animal species and is considered to be within the historic range of a particular regional-ecosystem type. It is used as a baseline condition for ecosystem management and ecological-restoration activities that focus on changing the structure and function of a disturbed ecosystem to be more like the reference ecosystem.

Resiliency (resilience). The ability of an ecosystem or landscape to recover from a major disturbance (e.g., fire, hurricane, flood) while largely maintaining its predisturbance structure (e.g., vegetation) and function (e.g., biogeochemical cycles).

Riparian. An object or process that is related to a water course, such as vegetation or a stream bank.

Savanna. An open woodland interspersed with scattered trees, shrubs, and grasses.

Scale. Extent of thing or process such as the size of an area, or a time frame (Turner et al. 2001, 29).

Silviculture (forestry). The science and practice of tree cultivation for timber and other uses.

Sink. A habitat, patch, or ecosystem where the mortality and out-migration rates for a species exceeds birth rates and in-migration rates.

Source. A habitat, patch, or ecosystem where the birth and in-migration rates for a species exceed mortality and out-migration rates.

Succession. Distinct growth stages in the vegetative structure of a plant community, such as the stages from seeds to seedlings to full stature. An example is the change from an establishment of tree seedlings growing in an abandoned agricultural field that over time grow into a forest.

Specialist species. A living organism with particular habitat needs, such as a rare or endangered species.

Species. The most basic taxonomic classification of a living organism, such as a plant or animal.

Turf. Another word for grass or lawn.

Understory. The ground layer under the forest canopy that may include grasses, flowering plants, and small shrubs no more than 3 feet (1 meter) in height.

Urban. An urban area is a built-up area characterized by relatively high-population densities and a concentration of industries. Often opposed to rural. Sometimes indicates the core of a metropolitan region, in opposition to suburban areas. We use it to mean the entire metropolitan area.

Urban forest. The vegetation of a metropolitan area.

Watershed. A region that is defined by topographic high points and where water drains into a single outlet, such as a river system draining to a delta.

Wet prairie. A grassland or meadow that experiences an occasional inundation of water from a high water table or seasonal flooding.

Woodlot. A remnant patch of woodland typically found in an agricultural area.

Wilderness. In the early modern period (around the sixteenth and seventeenth centuries) "spaces beyond human control," in the wild forests and mountains (Stilgoe 1982, 10). Now wilderness means wild and uncultivated land.

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