

# A NATIONAL ASSESSMENT OF THE URBAN FOREST: AN OVERVIEW

John F. Dwyer and David J. Nowak

**ABSTRACT.** Urban forest management promises to play a critical role in the management of our nation's forest resources in the 21<sup>st</sup> century. Urban forests are significant and diverse ecosystems with intricate connections among their physical, biological, and social components; as well as with other elements of urban and natural resource systems. Urban forests are also dynamic systems, shaped by the relatively slow growth and development of trees in the context of rapidly changing urban environments. To sustain forest structure, health, and benefits over the long-term, comprehensive, and adaptive management approaches are needed. The management of urban forests has important implications for the health and well-being of the residents of urban and urbanizing areas; but its influence on forest management extends well beyond the boundaries of urbanizing areas.

**KEY WORDS:** Adaptive management, urban ecosystems, urban forests, sustainability

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This paper is based on an assessment of urban forests that was carried out as part of the 1999 USDA Forest Service RPA Assessment (Dwyer *et al.* in press). The purpose of the assessment is to provide background information to help guide future policies and programs for sustaining the structure, function, and benefits of urban forests. Assessment findings highlight: 1) the large and increasing extent and significance of the nation's urban forests; 2) the broad scope, complexity, dynamics, and connectedness of urban forest resources; and 3) the need for comprehensive and adaptive management to sustain these increasingly important resources.

## ATTRIBUTES OF THE URBAN FOREST

The key attributes of urban forests that emerged from the assessment are their significance, diversity, connectedness, and dynamic character.

### Significance

The urban forest covers a large and expanding area. Approximately 3.5 percent of the United States is currently classified as urban (urban areas); while nearly 25 percent is either located in, or functionally tied to urban areas (metropolitan areas). Urban and metropolitan areas have grown tremendously over time. Between 1950 and 1990, metropolitan areas increased three-fold in extent; while between the late 1960's and early 1990's urban areas doubled in size. Significant population growth in areas outside urban and metropolitan areas continues to extend urban influences to forest resources across the landscape, particularly in places with considerable scenic and recreational value (i.e., amenity migration).

Urban and metropolitan areas include substantial forest resources that have the potential for significantly improving the quality of the urban environment and well-being of its residents. Across the United States, tree canopy cover in urban and metropolitan areas averages 27 percent and 33 percent respectively, approaching the national average tree cover over all lands of 33

percent. With approximately 74.4 billion trees in metropolitan areas, and 3.8 billion trees in urban areas, the magnitude of the urban forest resource is substantial.

Urban forests can make a considerable difference in the quality of life in a sizable portion of the United States, and can directly influence the daily lives of nearly 80 percent of its population. Further, what happens in urban areas can have a profound impact on forests and forestry across the urban to wilderness landscape. The increasing extent and significance of urban influences across the United States calls for resource policy makers, planners, and managers at the national, regional, and local levels to focus attention on forest resources in urban settings.

### **Diversity**

Diversity is one of the most distinctive attributes of the urban forest. This diversity is a function of variations in land uses, land ownerships, residents and visitors, and management objectives across and between urban systems. Urban areas are characterized by multiple land uses and diverse populations. The management of activities on numerous land uses by several different individuals and groups creates a complex landscape pattern, which includes a wide range of tree species and sizes, ground covers, soil types, microclimates, wildlife, people, buildings, infrastructure, and other developments. These elements are found in almost unlimited combinations that characterize diverse forest environments across an urban system. The mixture of natural and human-made resources in complex urban ecosystems broadens the scope and complexity of urban forestry. The objectives and issues facing managers of the urban forest are wide-ranging, encompassing wildlife management, mitigating air pollution, enhancing aesthetic value, and providing recreation, flood control, fire prevention, and other important benefits.

Several factors serve as catalysts for increased diversity in urban forest ecosystems. Shifts in population, changes in economic activity, improvements in transportation and communication, and other developments increase the range of land uses, broaden the spectrum of people involved, and complicate the mixture of old and new, artificial and natural, and native and exotic natural resources in urban areas.

### **Connectedness**

Connectedness among its resource components, and with other resources, activities, and functions within and beyond the urban environment is another key attribute of the urban forest. Urban forests are connected to other elements of urban environments, including roads, homes, people, industrial parks, and downtown centers. Whether connected by the logistics of managing urban infrastructure (for example, coordinating maintenance of urban trees and power lines, sewers, sidewalks, and roads), or by contributing to the overall character of the area; urban forests link "landscape" with "architecture," and become an important component of urban planning.

The connectedness of urban forests is also evident in their role in a wide range of urban issues, programs, and initiatives. Urban forests and their management are often a part of programs for improving air and water quality, flood control, energy conservation, microclimate improvement, aesthetic enjoyment, recreational opportunities, urban renewal and community revitalization,

economic development, community empowerment, environmental education, and other important goods/services.

Urban forests are also connected to the condition, use, and management of natural resources in ex-urban areas. Management issues concerning wildlife, fires, insects, and disease do not heed community boundaries, and are shared among managers in both urban and rural environments. Further, many of the externalities from urbanization (such as pollution and acid rain) can affect the health of ex-urban forests.

Finally, urban forests represent a critical link between people and forest resources. Ownership and use of residential holdings, public parks, and forest preserves in urban areas are how many citizens experience, appreciate, and learn about natural resources. The experiences that urban residents have with trees and associated resources in the urban environment are likely to influence their perceptions, expectations, and use of more distant natural resource areas, such as National Forests, Parks, and Monuments.

### **Dynamics**

Like all forests, urban forests undergo significant change with the growth, development, and succession of their biological components over time. However, the development of urban forest resources occurs in the context of much more powerful and swift human-induced forces for change. Coupling the relatively slow biological processes with the swift human forces for change make the dynamics of the urban forest particularly challenging for its managers.

The expansion and development of urban areas over time brings important changes in vegetation and other resources. Alterations to the distribution of land uses, intensity of urbanization, and urban population characteristics result in different combinations of ground cover types (e.g. mixes of vegetation and artificial surfaces), increased/decreased opportunities for tree establishment and growth, changing environmental conditions, different resource-use patterns, and altered management objectives over time. New developments in transportation technology, or manufacturing and service industries can bring considerable change to the condition, function, and management of urban lands and associated resources. Changes in neighborhood residents can also prompt different approaches to the management of forests in residential areas, parks, and other open spaces. Further, the introduction of exotic plants and animals into interstate and international trade centers can have a profound influence on the urban forest, as evidenced by Dutch elm disease, gypsy moth, and the Asian longhorned beetle.

### **IMPLICATIONS FOR URBAN FOREST MANAGEMENT**

Because urban forests represent a substantial portion of the nation's natural resource base, their management is a critical component of preserving environmental quality across the country. Furthermore, urban forest planning and management represents an excellent opportunity to connect people with natural ecosystems, and enhance the quality of life for a significant proportion of the U.S. population. Given that urban forests in this country are substantial and growing; are complex ecosystems with diverse resources that are owned and influenced by a number of important groups; are connected to other urban and natural systems; and undergo

significant change over time, a number of implications for the planning and management process begin to emerge.

The diversity of urban forest resources and their extension across land uses, property lines, and political boundaries calls for management programs that bridge jurisdictions and employ multiple disciplines. Among the fields that may be involved in urban forest planning and management are: forestry and wildlife management; entomology and pathology; hydrology and soils; meteorology and atmospheric science; landscape architecture; recreation management; psychology and sociology; planning; economics; and political science. Each of these disciplines can contribute to the development of policies and programs.

Given the unique character of urban forests found in particular settings, effective management also requires different forest management strategies within an urban environment (for example, by land use, land ownership, degree of development, and population density), and among urban areas (with different ecoregions, populations, and other attributes). With the complexity of land uses, ownership, and resources, a "one-size fits all" urban forest management scheme is not appropriate for these complex ecosystems.

A key element in managing urban forests in a regional context is the coordination of activities among different owners and managers across jurisdictions. The participation of multiple stakeholders in urban forest management requires a forum to help link forest structures and their management throughout and beyond the urban system. Such collaborative stewardship should not only involve owners, users, and managers of natural resources, but also individuals and groups involved in the management of other urban components (for example, commercial developers, city planners, utilities, and residents). Collaboration among a wide range of decision-makers who affect urban forest resources provides opportunities for those involved to identify common interests, resolve potential problems, and coordinate efforts to meet multiple objectives.

The diversity and connectedness of urban forest resources demand comprehensive approaches to their planning and management. The complex interrelationships between urban forest components and air and water quality, wildlife habitat, utilities and other infrastructure, and the overall aesthetic character of the community suggests that focusing management activities on one aspect of the urban forest is likely to yield a decreased flow of some benefits, or other unanticipated complications. Thus, assessment findings support the adoption of an ecosystem-based approach to policy, planning, and management.

Because urban forests are dynamic systems, their management must also accommodate rapid changes in the extent, health, and use of resources over time. Implicit in adaptive management of urban forests is the ability to monitor progress and evaluate the effectiveness of management decisions. To evaluate the efficiency of management activities, management plans should include a means by which managers can observe and review the outcomes of their efforts. By monitoring the effects of program activities on the extent, health, and use of the resource; identifying areas for improvement; and by modifying management plans to address problems; adaptive management provides the flexibility necessary to sustain and enhance important forest resources in changing urban environments.

The advantages of comprehensive and adaptive planning and management are clear; however, the implementation of this method is one of the most difficult challenges facing urban forest managers. Several factors complicate the application of this strategy to management of urban forest resources, including the diversity and fragmentation of the resource and its ownership; a lack of consistent information across the urban system and in rural areas; inadequate funding; and different types and levels of resource management across land uses and ownerships. Comprehensive and adaptive approaches are also constrained by limited knowledge of the goals and objectives of various urban landowners; how forest structure at the landscape level influences local and regional benefits; how urban forest resources have changed through time; as well as varying interest and willingness of landowners to participate in cooperative management programs involving multiple holdings. With these limitations, the narrow scope of many current urban forestry programs to maintain street trees and publicly owned vegetation is not surprising. Yet the current focus on maintaining forest structure on public holdings does not encompass the entire urban forest; nor does it address the concept of comprehensive management for urban forest sustainability.

The concept of urban forest sustainability involves maintaining healthy and functional vegetation and associated systems to sustain long-term benefits that are desired by the community. While maintaining forest health and survival has long been a goal of urban forestry, it only represents one component of urban forest sustainability. If management programs aimed at the health and survival of urban trees and associated resources are administered independently of community goals, they do not represent the convergence of what is socially desirable and ecologically possible. Because deciding what to sustain, for whom, and at what scale is the core of sustainability, management for urban forest sustainability needs to incorporate this decision-making process. This task involves broadening current management strategies from simply maintaining forest structure in a particular area to a community-wide effort to exchange information, prioritize benefits, design management objectives, coordinate maintenance activities, and evaluate progress.

Specific emphasis areas for the future that will facilitate the implementation of comprehensive and adaptive management include: improving inventory and monitoring of the urban forest resource; improving dialogue between urban forest owners, users, and managers; fostering collaboration among agencies and groups; improving the understanding of how forest configuration influences forest use and benefits; increasing knowledge about the factors that influence urban forest health; and improving the dissemination of information about urban forests, their benefits, and their management.

## CONCLUSIONS

Urban forests are significant and complex ecosystems with intricate links among their physical, biological, and social components; as well as with other elements of urban and natural resource systems. Urban forests are also dynamic systems, strongly influenced by the relatively slow growth and development of trees in the context of rapidly changing urban environments. To sustain forest structure, health, and benefits throughout the urban ecosystem over the long-term, comprehensive and adaptive management approaches are needed. The management of urban

forests has important implications for the health and well-being of the residents of urban and urbanizing areas; with its influence extending well beyond the boundaries of urbanizing areas.

The findings of the assessment go beyond some traditional perceptions of urban forestry from street tree planting and maintenance into an essential and highly-valued component of large-scale, long-term environmental and community sustainability. In developing management programs to maintain the resource and enhance important forest benefits; the diversity, complexity, connectedness, and dynamics of urban forests must be considered. These features have an array of management implications, particularly regarding the scale of policies and programs; types of management activities; duration of efforts; links with a wide range of urban initiatives; and number of individuals/groups involved in the planning and management of urban forests.

The assessment summarized here is the first step toward developing a comprehensive understanding of our nation's urban forest resources, and developing comprehensive and adaptive management plans. As urbanization will continue to expand, and urban populations increasingly dominate the social and political structure of the United States, understanding and managing urban forest resources will be a critical mechanism for connecting people with ecosystems in the 21<sup>st</sup> century.

#### **LITERATURE CITED**

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# **PROCEEDINGS**

of the

Society of American Foresters

1999 National Convention

Portland, Oregon

September 11–15, 1999

©2000  
Society of American Foresters  
5400 Grosvenor Lane  
Bethesda, MD 20814-2198  
[www.safnet.org](http://www.safnet.org)

SAF Publication 00-1  
ISBN 0-939970-81-3

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