URBAN FORESTRY

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Contents

Summary

Urban forestry is the management of vegetation, particularly trees, in urban and suburban areas (e.g., cities, towns, villages, etc.). Goals of urban forestry include sustaining tree health, minimizing costs, and enhancing the physical, biological, economic, and social environment of the community. Urban areas occupy 3.5 percent of the conterminous United States and, on average, have 27 percent of their area covered

by tree canopies. Urban forests are a significant and growing natural resource with about 3.8 billion urban trees found across the United States.

Good resource management can enhance numerous benefits received from urban forests, including improved air and water quality; reduced air temperatures, noise, ultraviolet radiation at ground level, and building energy use; improved wildlife habitat; increased psychological, physiological, and community well-being; enhanced aesthetics; improved outdoor recreation; and increased worker productivity and property values. These benefits can have direct economic implications in urban areas and can lead to improved environmental quality and human health and well-being.

Urban forest managers are for the most part public employees that directly manage and care for the public tree resource, but they can also influence and help sustain forest health and benefits throughout the urban and urbanizing area. As most urban trees are on private property, ordinances and education are critical tools in helping to guide the management of private tree resources. Urban foresters often use tree inventories to gather information about the forest resource and how it is changing; and devote much of their time to tree care and maintenance activities (e.g., planting, pruning, tree removal). Urban foresters also develop management plans that help guide forest management and designs in the future.

Since urban forestry is a relatively new area of scientific management and study, improvements in urban forest knowledge and how that knowledge is shared can significantly enhance future urban forest management and resource health, sustainability, and benefits. Emphasis areas to improve future management focus on developing management strategies that are collaborative and adaptive, and that incorporate improvements in inventory, dialogue, collaboration, information, and information dissemination.

1. Introduction

Urban forestry is the management of vegetation, particularly trees, in urban and suburban areas (e.g., cities, towns, villages, etc.). Urban forests include all trees within these areas and are often found among high concentrations of people and within an intricate fabric of natural and human-made structures and processes. Urban foresters work to sustain a healthy tree population to meet the increasingly diverse needs of an urban society. Good resource management and design of urban forests can lead to improved environmental quality, enhanced individual and community well-being, a wide range of services to individuals and communities, and a more healthy and comfortable environment for the vast majority of the nation's population.

2. Urban Forest Statistics

Urban areas occupy 3.5 percent or 281 000 square kilometers of the conterminous United States, and have doubled in area between 1969 and 1994. Nationally, urban areas have an average tree cover of 27 percent. One of the dominant factors that affects the composition and extent of urban tree cover is the surrounding climate, particularly precipitation. Urban tree cover tends to be highest in urban areas within regions where

forests naturally occur (34.4 percent), followed by urban areas within grasslands (17.8 percent), and desert areas (9.3 percent).

Two other factors contribute significantly to the amount of vegetation found in urban areas: population density and land use. Percentage of tree cover in urban areas tends to decrease as population density increases, primarily due to the increased amounts of impervious surfaces that are often associated with increased population density. Land use distribution also significantly influences the extent of the urban forest. Tree cover is typically highest on park and residential land, and in vacant land within forested regions. Commercial, industrial, and institutional lands typically have the lowest percent tree cover.

The number of trees within urban areas of the United States is estimated to be 3.8 billion, with approximately 60 million trees along urban streets. States with the highest estimated total tree population in urban areas include Georgia, Alabama, and Ohio (Table 1). At the local scale, individual city tree species composition and total numbers of trees vary significantly based on local conditions. Current estimates of individual city tree populations across seven major U.S. cities range from 1.2 million trees in Boston to 9.4 million trees in Atlanta (Table 2).

Estimated number of urban trees, urban trees per capita, tree cover in urban areas (%), proportion of total state tree cover in urban areas, amount of urban land (km^2), and proportion of total state area occupied by urban land, by state, in the conterminous United States. From**:** Nowak D.J., Noble M.H., Sisinni S.M. and Dwyer J.F. (2001) Assessing the U.S. urban forest resource. *J. For*. **99(3)**, 37-42.

State	Urban trees	Urban trees/	Urban tree cover	Portion of state tree	Urban area[a] Km^2	Portion of
	------	----------	---------- Percent ----------			Percent
Georgia	232,906,000	49	55.3	4.7	8,338	5.4
Alabam	205,847,000	69	48.2	4.7	8,487	6.3
Ohio	191,113,000	22	38.3	7.0	9,923	8.5
Florida	169,587,000	13	18.4	5.5	18,407	10.8
Tenness	163,783,000	49	43.9	5.1	7,382	6.8
Virginia	156,545,000	27	35.3	4.9	8,869	8.0
Illinois	155,544,000	14	33.7	5.5	9,165	6.1
Californ	148,612,000	5	10.9	2.2	27,348	6.4
New	143,869,000	20	41.4	22.3	6,916	30.6
Texas	140,709,000	8	10.5	3.6	26,573	3.8
Pennsyl	139,020,000	16	34.4	4.2	8,363	7.0
North	138,606,000	36	42.9	3.4	6,419	4.6
New	132,466,000	8	26.3	3.5	10,127	7.2
Minneso	127,767,000	33	37.4	2.2	6,775	3.0
Michiga	110,858,000	17	29.7	1.6	7,494	3.0

Montana	108,550,000	251	49.4	2.2	4,365	1.1
Washing	93,272,000	23	33.6	2.0	5,679	3.1
Marylan	89,434,000	21	40.1	11.1	4,525	14.1
Missouri	87,148,000	21	30.6	2.3	5,655	3.1
Massach	86,829,000	17	25.3	14.4	6,893	25.2
South	86,696,000	44	39.8	3.6	4,380	5.3
Indiana	78,498,000	21	31.2	4.2	5,000	5.3
Maine	68,550,000	110	47.7	2.2	2,887	3.1
Louisian	68,510,000	19	25.3	2.4	5,374	4.0
Mississi	65,520,000	48	38.6	1.8	3,365	2.7
Wiscons	59,344,000	18	25.8	1.5	4,565	2.7
Oklaho	58,204,000	16	14.5	3.6	7,940	4.4
Kentuck	56,681,000	23	33.4	1.9	3,374	3.2
Arizona	53,950,000	9	11.4	2.4	9,218	3.1
Iowa	52,474,000	29	33.1	1.9	3,148	2.2
Connect	44,800,000	14	21.8	14.0	4,085	28.5
Arkansa	43,412,000	32	25.0	1.5	3,435	2.5
New	41,455,000	60	49.1	4.6	1,678	6.9
Oregon	34,583,000	17	30.4	.6	2,280	.9
Colorad	28,149,000	7	13.0	.8	4,345	1.6
Kansas	26,677,000	17	20.5	2.9	2,575	1.2
West	22,871,000	33	42.2	.9	1,086	1.7
Utah	18,330,000	9	14.0	1.0	2,577	1.2
Nevada	15,834,000	9	9.9	.8	3,195	1.1
Delawar	13,257,000	27	46.3	9.0	566	8.8
Idaho	12,494,000	18	25.6	.3	966	.4
Nebrask	11,243,000	10	21.1	.9	1,061	.5
Vermont	7,558,000	42	36.0	.8	416	1.7
South	6,007,000	15	19.2	.5	617	.3
New	5,682,000	4	4.8	.3	2,316	.7
Rhode	4,155,000	5	8.9	6.0	926	23.2
North	1,774,000	5	7.8	.2	457	.2
Wyomin	1,392,000	3	3.6	.1	797	.3
Total,	3,820,491,00	17	27.1	2.8	281,00	3.5

[a] Includes land and water.

[b] U.S. total includes the District of Columbia, but not Alaska and Hawaii.

[c] Includes 492 square kilometers that crossed state borders and could not be assigned to an individual state.

Table 1. Urban tree populations by state.

	Number of trees		Tree density[a]		Tree cover (%)	
City	Total	SE	Mean	SE	Mean	SE
Atlanta, GA	9,420,000	749,000	276	22	32.9	na
New York, NY	5,220,000	719,000	65	9	16.6	0.3
Chicago, IL	4,130,000	634,000	68	10	11.0	0.2
Baltimore, MD	2,600,000	406,000	109	17	18.9	na
Philadelphia, PA	2,110,000	211,000	62	6	21.6	0.4
Oakland, CA	1,590,000	51,000	120	4	21.0	0.2
Boston, MA	1,180,000	109,000	83	8	21.2	0.4

[a] trees ha^{-1}

SE = standard error

na = not analyzed

From: Nowak, D.J., and Crane, D.E. (2000) The Urban Forest Effects (UFORE) Model: quantifying urban forest structure and functions. In: Hansen, M. and Burk, T. [eds.], Proceedings: *Integrated tools for natural resources inventories in the 21st century*. IUFRO Conference, 16-20 August 1998, Boise, ID. General Technical Report NC-212, U.S. Department of Agriculture, Forest Service, North Central Research Station, St. Paul, MN. pp. 714-720.

Table 2. Trees and tree cover for selected cities.

Urban forests are more than just an assemblage of trees; they are complex ecosystems that include other plants, animals, water, air, soil, people, and developments (e.g., buildings, roads, cars). Urban foresters manage the trees in context and concert with interrelated elements and processes to optimize numerous wide-ranging benefits for the urban population.

3. Urban Forest Effects - Benefits and Costs

Along with the numerous potential benefits of urban forests, there are a wide range of potential costs and, as with all ecosystems, numerous important interactions that must be understood to optimize the net benefits from urban vegetation. Through proper planning, design, and management, urban trees can mitigate many of the environmental impacts of urban development by moderating climate, reducing building energy use and atmospheric carbon dioxide (CO_2), improving air quality, lowering rainfall runoff and flooding, and reducing noise levels.

However, improper landscape designs, tree selection, and tree maintenance can increase environmental costs such as pollen production, emissions of volatile organic compounds from trees and maintenance activities, as well as increased building energy use, additional needs for waste disposal, increases in infrastructure repair costs, and water consumption. The urban forest can also generate costs associated with natural disasters, such as those associated with storms, and insect or disease outbreaks.

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Biographical Sketches

David J. Nowak is a Research Forester and Project Leader for the USDA Forest Service, Northeastern Research Station in Syracuse, NY. He leads a research unit investigating the effects of urban trees and their management on human health and environmental quality. He was a principal scientist on the Chicago Urban Forest Climate Project and is a recipient of the American Forests Urban Forest Medal recognizing outstanding national contributions in urban forest research. His research investigates urban forest structure, health, and change, and its effect on air quality and greenhouse gases.

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