Urban Forestry Program - Research Publication Circulation

Title: Introduction to Urban and Community Forestry in the United States of America: History, Accomplishments, Issues and Trends

Authors: Yadong Qi *; Zhiqiang Zhang

Date: 2003

Source: Forestry Studies in China, Vo1.5, No.4:54-61

Description: The urban and community forestry movement in the United States has matured over the last 20 years from managing street trees, to understanding the benefits of trees in urban ecosystems, and now to managing urban green infrastructure. This paper introduced the history, development, and major accomplishments of the urban and community forestry movement highlighted the economic, ecological, environmental, and social values of forests and trees to communities, and discussed issues and trends of the urban and community forestry program in the United States.

KEY WORDS: urban and community forestry, urban forest, benefits and values, history, accomplishments, issues, trends, United States

Full paper: Attached Here

For Information:
Dr. Yadong Qi
Professor of urban forestry
Urban Forestry Program
Southern University
Baton Rouge, LA 70813
Phone: 225-771-4408
E-mail: yadong_qi@suagcenter.com

Introduction to Urban and Community Forestry in the United States of America: History, Accomplishments, Issues and Trends

Qi Yadong[1*] *Zhang Zhiqiang*[2]

[1]Urban Forestry Program, Southern University Agricultural Research and Extension Center, Southern University, Baton Rouge 70813, USA

[2]College of Soil and Water Conservation, Beijing Forestry University, Beijing 100083, P. R. China

ABSTRACT The urban and community forestry movement in the United States has matured over the last 20 years from managing street trees, to understanding the benefits of trees in urban ecosystems, and now to managing urban green infrastructure. This paper introduced the history, development, and major accomplishments of the urban and community forestry movement, highlighted the economic, ecological, environmental, and social values of forests and trees to communities, and discussed issues and trends of the urban and community forestry program in the United States.

KEY WORDS urban and community forestry, urban forest, benefits and values, history, accomplishments, issues, trends, United States

1 Introduction

The United States (US) is the third largest country in the world in size. The national territory is 9 629 091 km^2 and consists of three separate territories: the 48 continental states, Alaska and Hawaii. In July 2002, the estimated total population in the US was 280 562 489 (the World Factbook 2002). Within the 48 continental states, the total area is 8 080 704 km^2, and the national tree cover is 32.8% (Dwyer *et al.* 2000).

Urban and community forests are comprised of street trees, open space, patches of forested areas, trees in institutional properties, municipal parks, playgrounds, yards, and trees along highways. These forests are vital to a majority of Americans, because nearly 8 out of 10 Americans live in urban metropolitan areas. According to the latest urban forest assessment in the continental 48 states by the US Department of Agriculture Forest Service (USDA-FS) (Dwyer *et al.* 2000), urban areas (cities, towns, and villages) cover 3.5% of the total area and contain 75% of the total population. In urban areas, about 3.8 billion trees cover 27.1% of the land. On a broader scale, metropolitan areas (urban counties) represent the broadest extent of urbanization in the US, including 24.5% of the total area and about 80% of the total population. With an average tree cover of 33.4%, metropolitan areas collectively support nearly 25% of the nation's total tree canopy cover. A metropolitan area is defined as a county, or a group of counties, that contains a large population nucleus as its core and can include adjacent counties that have a high degree of economic and social integration with the core (US Department of Commerce, Bureau of the Census 1994).

The urban and community forestry movement has matured over the last 20 years in the US. This paper reviews the history, development, and major accomplishments of the urban and community forestry; highlights the ecological, environmental, and social-economic benefits of urban and community forests; and discusses issues and trends of the urban and community forestry program in the US.

2 History

Urban and community forestry is an integral part of the US history. The importance of tree planting and care was formally recognized with the creation of Arbor Day in 1872. In 1962, urban forestry information was included in the President's Outdoor Recreation Resources Review Commission (ORRRC). In 1965, the White House Conference on National Beauty was established as the First Lady (the wife of President Johnson) actively pursued a nationwide beautification campaign. Further, Deputy Chief of the Forest Service, Philip Thornton, advocated an active urban forestry program, and in 1967, a USDA Forest Service interdepartmental task force presented a landmark report: "A Proposed Program for Urban and Community Forestry".

The Cooperative Forest Management Act, amended in 1972, authorized the urban and community forestry program, but funds were not provided. The Cooperative Forestry Assistance Act of 1978 expanded the federal government commitment to

*Author for correspondence. Email: yadong_qi@suagcenter.com

urban and community forestry. It authorized the Secretary of Agriculture to provide financial and related assistance to State Foresters to encourage states to provide information and technical assistance to local governments. An allocation of $3.5 million was made to provide urban and community forestry assistance in 1978. However, the commitment to urban forestry on the part of the federal government did not change for more than a decade, and in fact declined to 1.5 million in 1984 (Casey and Miller 1988). The national commitment to urban forestry by the federal government was part of the 1990 Farm Bill that fundamentally changed this nation's approach to managing urban and community forests.

In 1990, Congress adopted a 10-year tree planting initiative proposed by President George Bush. The President's "America the Beautiful" program became a national tree program. The America the Beautiful Act of 1990 aimed at planting and improving trees in every rural area, town, and city across the country (USDA Forest Service 1991). Section 1 219, Urban and Community Forestry Assistance, amended the basic law, 16 USC. 2 105, the Cooperative Forestry Assistance Act, to:

1) expand the authority of the Forest Service to work with states to administer grants and technical assistance;

2) raise funds from $2.7 million in 1990 to $25 million in 1993;

3) create a 15-member National Urban and Community Forestry Advisory Council (NUCFAC) appointed by the Secretary of Agriculture;

4) establish the National Tree Trust (NTT) Foundation.

The NTT was established in 1990 and designated by President Bush to receive the support of the US Congress. The NTT is designed to mobilize volunteer groups, promote public awareness of trees and their benefits, provide grants, and unite civic and corporate institutions in support of local tree planting and education projects throughout the United States.

To fulfill the mandate of the 1990 Farm Bill calling for a national urban forestry research plan, the USDA Forest Service undertook an assessment of research needs and objectives in urban forestry. The Forest Service enlisted the assistance of the International Society of Arboriculture (ISA) to help achieve its legislative mandate for a national research agenda. In October 1991, "A National Research Agenda for Urban Forestry in the 1990s" was published, which included research needs for the 1990s, the research agenda for urban forestry, and the recommended priorities for new and expanded research efforts in urban forestry (ISA 1991).

The US Congress raised the appropriation for urban and community forestry to $21 million in 1991. These funds helped to create an urban forestry coordinator position in all 50 states plus the District of Columbia, Puerto Rico, the Virgin Islands, and the islands of the Pacific, to set up state urban forestry councils in all 50 states, the District of Columbia, Guam and Puerto Rico, and to establish the capacity to promote volunteer activities related to planting, maintaining or protecting the urban forest resources (Schoeneman and Doyle 1992).

The National Strategic Plan for urban and community forestry was completed by the NUCFAC in 1993. An accompanying action plan that breaks the strategic plan into implementation steps was completed in March 1994. To strengthen cooperation and coordination among the NUCFAC, State Foresters, nonprofits, municipal and other professional organizations, the USDA Forest Service developed a strategic direction to address urban and community forestry issues and opportunities. This strategic direction entitled "Urban and Community Forestry on Course into the Future: Vital Community through Healthy Ecosystem—A Strategic Direction" provided guidance for Forest Service Urban and Community Forestry efforts through the year 2005 (USDA Forest Service 1996).

The importance of urban and community forestry was well recognized by the Seventh American Forest Congress (1996a, b) and the issues were strongly addressed in the Congress's vision elements and principles.

3 Highlights of national accomplishments

As a result of urban forestry programs throughout the nation, communities have been improved and are becoming more livable. Tree planting, care, and maintenance activities involve local citizens and show that they can make a difference in their communities. Urban forestry has served as a catalyst to engage local citizens in the management of their local resources. This empowerment has enabled citizen groups to expand their involvement to many other issues that affect their communities. More than 8 200 communities participate in urban forestry programs and nearly 400 000 volunteers have been involved in urban and community forestry programs nationwide (USDA Forest Service 1998).

At the national level, the federal funding for urban and community forestry has been around $35 million annually in recent years. The cooperation of USDA Forest Service with State Foresters provides national leadership in the management of natural resources in the urban and community environment. With the assistance of federal funding and national guidance State Forestry agencies, non-profit citizen volunteer groups, and conservation and professional organizations engage more than 7 000 community-based, volunteer organizations in making positive changes in their communities through improvement of the nation's urban and community forests. The detailed national accomplishments have been documented annually by the NUCFAC reports and reports of the USDA Forest Service.

Since 1992, the National Tree Trust (www.nationaltreetrust.org) has planted more than 10 million trees in all 50 states and the District of Columbia. Over 504 000 volunteers have partnered with National Tree Trust through its Community Tree Planting program. More than 783 000 students have grown their own trees through the Growing Together program.

The USDA Forest Service has recently completed the first national assessment of urban forest resources in the continental 48 states (Dwyer *et al.* 2000). The report revealed that the average percentage of the total tree canopy cover for both metropolitan areas (33.4%) and urban areas (27.1%) is close to that for all land in the continental 48 states (32.8%) thereby demonstrating that urban areas and urban influence can coexist with a significant tree canopy. This assessment will serve as a baseline for evaluating changes in the urban forest over time.

To quantify the benefits and values of urban forests, American Forests (a nonprofit citizen conservation organization, www.americanforests.org) has developed Geographic Information System (GIS) software called CITYgreen used for urban ecosystem analysis. Using this computer program, American Forests is analyzing urban forests across the country. So far more than 20 cities have completed their urban ecosystem analyses, including Atlanta, New Orleans, Houston, Washington DC, and San Antonio. These analyses quantify urban forest ecological benefits on air quality, carbon storage and sequestration, energy use, and stormwater management, and convert the benefit values into economic values in dollar. This effort has significantly increased public awareness of the benefits of urban trees and forests. Most importantly, results of the analyses assist decision-makers at various levels in recognizing the value of urban green infrastructure and in making better and informed decisions to management of urban green infrastructure for a healthier community and cleaner environment throughout the country. The CITYgreen GIS software is also becoming a tool of urban forestry and environmental education for many cities, citizen tree groups, schools of secondary education, and institutions of higher education.

Over the last 20 years, national educational programs in urban forestry, arboriculture, and related fields have increased significantly. The International Society of Arboriculture (ISA, 1995) has compiled a computerized database of curricula of all the institutions of higher education (universities, community colleges, and equivalent institutions) in urban forestry and related fields worldwide. In the United States, about 50 institutions located in 26 states provide urban forestry related curricula. These institutions are crucial for producing urban forestry professionals (urban foresters, arborists, horticulturists, research scientists and managers) and providing career-training opportunities in urban forestry and related fields; among them is the nation's first BS degree program in urban forestry at Southern University and A&M College established in Baton Rouge, Louisiana in 1992. This program has so far graduated more than 80 African-American students with BS degrees and 20 with MS degrees in urban forestry who have been entering the job force in urban forestry and related fields. In addition, federal, state, private sectors and professional organizations like International Society of Arboriculture, American Forests and Society of American Foresters, are working together to provide continuing education opportunities and information in urban forestry to the general public and tree groups.

Stimulated by federal, state, and private funding for urban forestry and environmental studies, research activities in urban forestry have increased significantly in recent years and involve many research entities such as the USDA-Forest Service, the Environmental Protection Agency, professional organizations, many institutions of higher education, and local groups. The research findings have contributed much more knowledge to our current understanding and management of urban forests. The USDA Forest Service takes a leadership role in providing urban forestry research and information dissemination such as USDA Urban and Community

Forestry Grants Program, the NUCFAC's Challenge Cost-Share (CCS) Grants Program, the Chicago Climate Project, and the USDA-FS National Urban Forest Assessment Project.

4 Benefits and values

The urban and community forest resources are directly associated with 80% of the US population and provide enormous ecological, environmental, social and economical benefits to the majority of Americans including air pollution removal, energy saving, carbon storage, enhanced real estate values, reduced heat island effects, recreational opportunities, wildlife habitat, visual and sound barriers, and aesthetic. Many studies regarding the benefits and values of the urban forests in the US have been documented in a joint publication by USDA-FS and National Association of State Foresters (Qi *et al.* 1998) and in a publication by the International Society of Arboriculture (ISA 1993). A recent study by Nowak *et al.* (2002) shows that, based on national urban forest tree cover data, the total compensatory value for the urban forests of the 48 continental states in the US is estimated at $2.4 trillion. Compensatory values represent compensation for tree losses to owners. In North America, the most widely used method for estimating the compensatory value of trees was developed by the Council of Tree and Landscape Appraiser (CTLA 2000).

In the US, many of these urban forest benefits have been quantified and given price tags. For example, urban forests in the Atlanta metro area have 29% canopy coverage. These forests provide significant ecological and economic benefits including $85.9 million for annual stormwater mitigation value, $47 million for annual air pollution removal and storage, $2.82 million for annual energy conservation, and 8 million tons of total carbon storage, and 58 000 tons of annual carbon sequestration (American Forests 2001). Recent urban ecosystem analysis in New Orleans, Louisiana shows that the current tree cover is 24.5% and the benefits include 1 294 439 kg of annual air pollution removal with net worth of $7 103.173, $741 001 672 for total stormwater mitigation value, 1 291 700 tons of total carbon storage, and 10 000 tons of annual carbon sequestration (American Forests 2002).

Polluted air threatens public health, property, animal, and plant life. Trees can remove air pollution by intercepting particulates and absorbing gaseous pollutants. For example, Forest Service research (Nowak 1994a) shows that the urban forests in Chicago in 1991 removed an estimated 15 metric tons of carbon monoxide (CO), 84 tons of sulfur dioxide (SO_2), 89 tons of nitrogen dioxide (NO_2), 191 tons of ozone (O_3), and 212 tons of particulate matter less than 10 microns in size. The estimated value of pollution removal was $9.2 million. Increasing levels of atmospheric carbon dioxide (CO_2) and other "greenhouse" gases are thought by many to lead to increased atmospheric temperatures through the trapping of certain wavelengths of radiation in the atmosphere. Trees in urban areas offer the double benefit of direct carbon storage and the avoidance of CO_2 production by fossil-fuel power plants through energy conservation from properly located trees. Trees throughout the Chicago area store approximately 5.6 million tons of carbon (Nowak 1994b). Rowntree and Nowak (1991) have estimated that approximately 800 million tons of carbon are stored in US urban forests, with an annual increase of 6.5 million tons. Using control costs of $28 per ton of carbon (California Energy Commission 1993), it can be calculated from these estimates that the carbon-storing capacity of US urban forests exceeds $22 billion. Thus, planting and maintaining urban forests is a cost-effective tool for cities to offset the increasing CO_2 level in the atmosphere.

5 Issues

Urban and community forests are found in the more than 45 000 communities where people live and work. This includes incorporated cities, unincorporated suburbs, villages, and, in some cases, subdivisions. With 280 million people, the US population growth rate is 0.89% per year (The World Factbook 2002). The population of the United States is migrating internally from the Northeast and Midwest to the South and West. Minority populations are growing more rapidly than Anglo populations. More than 30% of the total population change over the last decade was due to immigration. Additionally, the population is aging and projected to have higher proportion of females (Murdock 1995).

Each year, thousands of acres of rural land are converted to urban uses. Development is encroaching on many of our remaining open spaces. Between 1950 and 1990, metropolitan areas in the 48 continental states nearly tripled in size and urban areas doubled in size over the past 20 to 25 years (Dwyer *et al.* 2000). Development pressure in the wildland and urban fringes causes loss of forest cover and biodiversity

and associated problems with air and water quality and wildlife habitat. Additionally, inner city environmental conditions are declining as residents move out and investments decline. Economic stress and social stability, as well as environmental pressures are causing significant declines in urban forest health. Moll and Young (1992) reported that more street trees die than are planted each year and the average life span of a downtown tree is only thirteen years. Budget cuts and significant backlogs of maintenance work help create unhealthy forest conditions. A new study by American Forests (Moll 2001) shows that more than 634 million trees are currently needed in America's urban areas.

Dutch elm disease, gypsy moth, Asian longhorned beetle, blight, drought, fire, storms, pollution, loss of biodiversity and construction damage are just a few of the stresses placed on our aging community forests. These stresses may be observed in small towns as well as large metropolitan cities. Urban and community forest health decline has been a gradual result of a variety of resource, financial, jurisdictional, ecological, and management problems that are now reaching crisis proportions.

In many cities, trees are still a low priority in city budgets because their benefits have not been measured, understood, and communicated by leaders. Given the virtues of an urban forest, one might think that such ecosystems would be carefully protected. But in the last several years, shrinking municipal budgets have produced a crisis for the nation's urban forests. Downsizing of local governments has led to drastic cuts in spending for urban forest management and shifts in management control of the urban program. These cuts reduced the ability of urban foresters to care for urban trees, particularly to maintain adequate inspection and pruning schedules, and to guard against pests and diseases. Also, cuts in budget first and foremost, slash the tree planting programs.

Urban forest management requires investment of economic resources for establishment, preservation, and care of community trees. A survey on municipal tree management projects and managers of 1 228 communities across the United States shows clearly that, while municipal administrators believe the urban forest is important, especially for beautification and increased quality of life, funding for municipal tree management is on the decline and municipal budgets for tree care activities have decreased significantly from 1987 to 1994 (Tschantz and Sacamano 1994)

It is important for communities to seek alternative funding sources to maintain the health and benefits of the urban forest. As such, public support is essential to a successful program. Citizens not only influence decisions on how tax dollars are spent, they can also contribute money, labor and other resources to urban forests through volunteer programs. Networks of citizen's groups across the nation provide support for continued community action and assistance to new volunteer organizations as they begin developing their own local initiatives. A national coalition of grass roots tree groups such as the Alliance for Community Trees plays an important role in planting and management of urban and community forests across the cities and towns in the US. Volunteer action is essential to sustaining urban and community forest resources and program activities.

Educational programs reaching out to youth, the general public, private enterprises, and decision-makers need to be assessed and strengthened. As identified in the National Strategic Plan (NUCFAC 1993), public outreach and career training are important strategies to enhance urban and community forests. In order to so, youth education should stress hands-on activities with incorporation of national education programs such as Project Learning Tree, Arbor Day, Global ReLeaf Projects, Project Wild, Tree City USA, Urban Tree House Projects, etc. Use of diversified media to deliver urban forestry information, especially through information super highways like the Internet (worldwide web, E-mail, etc.) is one effective tool to reach all levels of audience.

6 Trends

The National Strategic Plan (NUCFAC 1993) calls for establishment of sustainable urban and community forests and improved ecosystems. The challenge facing urban and community forestry's future is to encourage all sizes of towns and cities to properly plant, maintain and preserve trees in greatly increasing numbers to help provide cooler summer air, warmer homes in winter, cleaner air and water, quieter streets, more peaceful neighborhoods, more community jobs, stronger urban economies, and an overall improved and expanded community environment. To be successful, the National Strategic Plan has developed six strategies, including public outreach, municipal and volunteer programs, career training, funding, research, and private and public partnerships along with the Action Plan (NUCFAC

1994). The health of the nation's urban and community forests depends on the successful execution of the plan.

The USDA Forest Service's Urban and Community Forestry Program Strategic Direction developed in 1996 has served as a major driving force to ensure the successful implementation of the National Strategic Plan. "Vital communities through healthy ecosystems" is the thrust of the program emphasis for the Forest Service strategy to address urban and community forestry management issues. A strong active effort needs to be made to continue federal funding for urban and community forestry at the national level by all interested partners. In addition, there is a need to stimulate additional funding from traditional and nontraditional sources, and to promote private sector funding for urban forestry.

The National Association of State Foresters' (NASF) Position Statement developed in 1994 calls for "an ecological approach to urban and community forestry management". The interrelationship of people, trees, forests, green spaces and other associated natural resources of urban areas are the lifeblood of urban systems. Federal, state and local governments working in partnership with community leaders, local businesses and volunteer groups must rise to the challenge of integrating urban and community forest resources management into community planning, park management, development and fiscal structure through an interdisciplinary team approach. Communities must develop a stewardship ethic that focuses on conserving, developing and maintaining functional, sustainable urban and community forest ecosystem. The adoption of an ecological approach in managing US urban forests will result in sustainable environments, but, more importantly, it will improve the living conditions for the citizens of the nation's communities (NASF 1994). According to American Forests (1996) and the National Strategic Plan (NUCFAC 1993), a vision of the future urban and community forestry should be:

1) Establish sustainable urban forests for all communities. These forests will provide jobs, healthier economy, stronger communities, and improved ecosystems;

2) Integrate the natural ecosystem into the built infrastructure. Account for ecosystem benefits in the planning, design, engineering, maintenance, and funding process to achieve sustainable urban communities;

3) Expand research and new technology that help us to quantify the values of the urban forest and to articulate these values to improve public policy and dedicated funding;

4) Continue to strategically plan biological diversity in the urban ecosystem;

5) Advocate healthy, sustainable urban ecosystems through citizen stewardship, and public education to strengthen the human connection to nature and their investment in the urban forest;

6) Increase organized tree plantings and foster more public-private partnerships to provide opportunities for public involvement.

The recently completed national urban forest assessment by Dwyer *et al.* (2000) indicates that the significance of the urban forest resource and the powerful forces for change in the urban environment make sustainability a critical issue in urban forest management. The dynamic planning and management model proposed by Dwyer *et al.* (2003) should be used to encourage decisions that will support sustainability through the implementation of collaborative and adaptive management of urban and community forest resources.

Based on the current development and issues, trends in urban and community forestry in the US are summarized as follows:

1) Foster strong partnerships between federal, state, local, and private sectors in implementing NUCFAC's National Strategic Plan;

2) Establish national, regional, and local initiatives and incentives that assist communities in the implementation of an ecosystem-based management of urban and community forest resources. Use modern technology (e.g., GIS-based programs such as CITYgreen and Global Position Systems) to help enhance our vision of future urban green infrastructure;

3) Develop long-term cost-effective management plans for urban and community forests at state and local levels to maximize ecological, economic, and social benefits of urban and community forest resources;

4) Increase the budget for management, education, and research in urban and community forestry at federal, state, and local government levels;

5) Develop and promote national, regional, and local education programs in urban and community forestry to increase public awareness and participation;

6) Encourage and support academic institutions of higher education and professional organizations to

offer urban forestry degrees and related programs and to provide and train urban forestry professionals to meet the national demand for managing urban forest resources;

7) Continue to support and expand urban forestry research and demonstration projects. Increase funding for urban and community forestry research and technology transfer as prioritized in the national research agenda;

8) Support and encourage citizen-based, volunteer organizations nationwide and recognize their roles in successful implementation of urban and community forestry programs and management for vital and healthy urban ecosystems;

9) Develop strategies to promote all communities to recycle, reduce, and reuse urban forest waste wood and residuals;

10) Develop disaster preparedness and mitigation strategies at the community level to reduce the cost associated with natural and human-induced disasters.

Acknowledgements

The authors would like to thank Dr. James McNitt, Professor of Agricultural Science, Southern University Agricultural and Research Extension Center, for reviewing and suggesting valuable changes to the manuscript.

The use of trade, firm, or product names in this article is only for the information and convenience of the reader, and does not constitute an endorsement by the author.

Literature cited

American Forests. 1996. Urban forestry movement: Current trends and a vision for the future. A fact sheet presented in the Seventh America Forest Congress, Feb. 20–24, 1996. Washington DC

American Forests. 2001. Urban ecosystem analysis Atlanta Metro area. American Forests Report. Website: www.americanforests.org

American Forests. 2002. Urban ecosystem analysis New Orleans, Louisiana metropolitan area. American Forests Report. Website: www.americanforests.org

California Energy Commission. 1993. 1993 Electricity Report, Air Quality. Sacramento, CA: California Energy Commission

Casey C J, Miller R W. 1988. State government in community forestry survey. *J Arboric*. 14: 141–144

CTLA, Council of Tree and Landscape Appraisers. 2000. Guide for plant appraisal, 9th edition. International Society of Arboriculture. Champaign, Illinois

Dwyer J F, Nowak D J, Noble M H *et al*. 2000. Connecting people with ecosystems in the 21st century: an assessment of our nation's urban forests. Gen Tech Rep PNW-GTR-490. Portland, OR, US. Department of Agriculture, Forest Service, Pacific Northwest Research Station

Dwyer J F, Nowak D J, Noble M H. 2003. Sustaining urban forests. *J Arboric*. 29: 49–55

ISA, International Society of Arboriculture. 1991. A national research agenda for urban forestry in the 1990's. Urbana, IL, International Society of Arboriculture

ISA, International Society of Arboriculture. 1993. Consolidating and communicating urban forest benefits. Prepared by Davey Resource Group

ISA, International Society of Arboriculture. 1995. Catalog of curricula in arboriculture, urban forestry and related areas. Developed by M E P Wingate, J A Wagar, and C H Hamilton, Center for Urban Horticulture, Univ of Washington

Moll G, Young S. 1992. Growing greener cities. Los Angeles: Living Planet Press

Moll G. 2001. Make it official, trees are urban infrastructure. In: Proceedings of 2001 National Urban Forest Conference (C Kollin ed), September 5–8, 2001, Washington, DC. 3–5

Murdock S H. 1995. An America challenged. Boulder: Westview Press

NASF, National Association of State Foresters. 1994. An ecological approach to urban and community forest management: Position Statement

Nowak D J. 1994a. Air pollution removal by Chicago's urban forest. In: Chicago's urban forest ecosystem: results of the Chicago Urban Forest Climate Project (E G Mcpherson, D J Nowak, R R Rowntree eds). Gen. Tec. Rep. NE-186. Radnor, PA. USDA Forest Service, NEFES. 63–81

Nowak D J. 1994b. Atmospheric carbon dioxide reduction by Chicago's urban forest. In: Chicago's urban forest ecosystem: results of the Chicago Urban Forest Climate Project (E G Mcpherson, D J Nowak, R R Braintree eds). Gen. Tec. Rep. NE-186. Radnor, PA. USDA Forest Service, NEFES. 83–94

Nowak D J, Crane D E, Dwyer J F. 2002. Compensatory value of urban trees in the United States. *J Arboric*. 28 (4): 195–199

NUCFAC, National Urban and Community Forestry Advisory Council. 1993. The forest where we live: a National Strategic Plan. USDA Forest Service FS-543

NUCFAC, National Urban and Community Forestry Advisory Council. 1994. The forest where we live: An Action Plan. March, 1994

Qi Y D, Favorite J, Lorenzo A B. 1998. Forestry: A community tradition. A joint publication of USDA Forest Service and National Association of State Foresters. ISBN: 0-9662108-0-8

Rowntree R A, Nowak, D J. 1991. Quantifying the role of urban forests in removing atmospheric carbon dioxide. *J Arboric*. 17 (10): 269–275

Schoeneman R S, Doyle Z. 1992. Trees in the community; managing the urban forest. Management Information

Service. ICMAVol.24/No.5

Seventh American Forest Congress. 1996a. Final report (W R Bentley, W D Langbein eds). Office of the Seventh American Forest Congress, 205 Prospect St., New Haven, CT 06511

Seventh American Forest Congress. 1996b. Concurrent dialogue sessions and references, Feb. 20–24, 1996, Washington DC, Office of the Seventh American Forest Congress, 205 Prospect St., New Haven, CT 06511

The World Factbook. 2002. CIA - The World Factbook 2002 – United States. http://www.odci.gov/cia/publications/factbook/geos/us.html

Tschantz B A, Sacamano P L. 1994. Municipal tree management in the United States, a 1994 report. Davey Resource Group. Davey Tree Expert Company and Communication Research Associates, Inc

US Department of Commerce, Bureau of the Census. 1994. Geographic areas reference manual. Washington DC: Economics and Statistics Administration, Bureau of the Census

USDA Forest Service. 1991. People and tree growing together—America the Beautiful National Tree Program. FS-496

USDA Forest Service. 1996. Urban and community forestry on course into the future: vital community through health ecosystem—a strategic direction

USDA Forest Service. 1998. Report of the forest service. Fiscal Year 1997

(Received March 8, 2003 Accepted September 17, 2003)