



URBAN FORESTRY: AN EVOLVING DISCIPLINE

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Introduction

Urban forests are important because of their size and scope, their impact on local economies, and the many social and environmental benefits they provide, due in large part to their proximity to people. According to the U.S. Forest Service, urban trees in the contiguous U.S. account for nearly one-quarter of the nation's total tree canopy cover—approximately 74 billion trees.¹

Urban forestry—sometimes referred to as urban forest management—is the planning and management of trees, forests, and related vegetation within communities to create and add value. Throughout the past two centuries in the U.S., the focus of urban forestry has shifted from one of beautification to one that includes the environmental, conservation, economic and social benefits of community trees and urban forests.

This report focuses on urban forestry and its continuing transformation into a discipline that mirrors many of the considerations and complexities of traditional forest management. Examples are presented that highlight real-world and 21st century urban forest management. Recommendations are offered as to how rural and urban foresters can collaborate to maximize benefits from all of our nation's forests.

Early History

Although *urban forestry* did not become a commonplace term until the 1960s, the discipline has been around a long time. Beginning in the late 1700s and early 1800s, Americans began to plant trees in towns and villages. Immigrants to the U.S. tended to favor trees from the “old country” such as Lombardy poplar, Norway maple, English elm and *Ailanthus*.² It wasn't until the mid-1800s that the concept of planting and propagating indigenous species became common. Even as urban forest management became more deliberate, the philosophy remained largely task-oriented. In 1910 a forester in New York City listed his main duties as tree planting and removal, tree maintenance and insect control. Even when the new

Urban Forestry and Community Forestry

This report focuses on *urban forestry* (urban forest management) as it is practiced in *urban areas* as defined by the Bureau of the Census. These areas include (1) urbanized areas with populations of 50,000 or more, (2) places that contain some urbanized areas within their boundaries, or (3) places with at least 2,500 people and located outside of urbanized areas.

Community forestry is a phrase that can mean one thing in Mexico or Nepal, and different things in the United States. For example, in the Pacific Northwest, where the federal government is the major landowner, community forestry might refer to the process by which loggers, environmentalists, and others come together to craft a vision for the management of public lands. In New England, community forestry can mean the management of predominantly rural *town forests* by local municipalities.

In this report, *community forestry* and *urban forestry* are used interchangeably to describe tree and forestry activities practiced in population centers, whether large or small.

¹ McPherson, E. Gregory. 2006. Urban Forestry in North America. Available at: <http://www.fs.fed.us/ecosystemservices/pdf/urban-forestry-2006.pdf>.

² Also known as “tree of heaven”, *Ailanthus* is a genus of fast growing deciduous trees native to Asia.

discipline of urban and community forestry developed into a science in the late 1960s and early 1970s by piecing together the knowledge of a number of fields, the urban forestry profession was dominated by task-oriented activities articulated in the early 1900s.

The concept of urban forestry as the management of a total urban forest *system*—compared to arboriculture which is focused on the individual tree—was spurred by the introduction of devastating diseases into the urban forest such as Dutch elm disease, phloem necrosis, and oak wilt. To respond to such challenges, professionals and municipal leaders had to adopt an integrated management program for the entire urban forest ecosystem.

Another factor that provided impetus to the initial development of urban forestry was the recognition by American foresters in the 1960s that the political power base had shifted to cities and that they had to deal increasingly with the demands of urban residents. The Citizens Committee on Recreation and Natural Beauty recommended to the President in 1967 that a national urban and community forestry program be created. Consequently, the Pinchot Institute for Environmental Forestry Studies of the U.S. Forest Service was created in 1970. However, it wasn't until 1978 that the federal government became formally involved in a nationwide urban forestry effort by giving responsibility, and funding, to the U.S. Forest Service to administer two efforts. First, the Forest Service provided financial assistance—albeit modest amounts—to state forestry agencies and some non-governmental organizations (NGOs) to meet county, city or town needs. Second, funding was provided to support Forest Service and university research on urban forestry topics.

America the Beautiful Program

In addition to the numerous activities and programs occurring in the nation to positively impact urban forestry in the 20th century, the “watershed” event—especially as it relates to U.S. laws—took place in 1990. President G.W. Bush, in his State of the Union message, proposed the America the Beautiful program, which was enacted in the 1990 Farm Bill. Concurrent with promoting the annual planting of one billion trees for ten consecutive years, the America the Beautiful program increased funding *ten-fold* for urban forestry technical services. The program also (1) created the Urban and Community Forestry Assistance program administered by the Forest Service to provide education, technical assistance, and grants to municipalities and local groups through state forestry agencies, (2) formed the National Tree Trust to stimulate public awareness, volunteerism and local tree planting, and (3) established a National Urban and Community Forestry Advisory Council (NUCFAC) to provide direction, guidance and a voice for the urban forestry movement.

Also, during the 1970s, organizations such as the International Society of Arboriculture (ISA) and the Society of American Foresters (SAF) played a leading role by promoting urban forestry. In 1974, the SAF recognized urban forestry as a specialized branch of forestry. In 1978 a landmark event was held in Washington, D.C.—the first National Urban Forestry Conference with a 4-day attendance of approximately 450 delegates. Due to the success of this conference, the American Forestry Association (AFA) made a commitment to champion a national urban forestry movement, including sponsorship through the years of additional national conferences and the establishment of the National Urban Forestry Council.

Another boost for urban forestry in the later part of the 20th century was the role played by citizen groups and activists. TreePeople in Los Angeles, for example, organized volunteers to plant and

care for trees with the goal of planting one million trees prior to the 1984 Olympic Games. Efforts such as these brought to light the role of trees in improving future air quality.³ During this same time period, research showed a direct connection between trees in urban areas and the recovery rate of hospital patients. Clearly, urban forestry was evolving into a discipline with recognizable environmental, economic and social benefits beyond just beauty, aesthetics and a feel-good attitude.⁴

Textbooks Trace a Movement

The first textbook that focused on urban forest management was published just over three decades ago. In the preface to *Urban Forestry* (Grey and Deneke 1978) the authors write, “Optimum management [of the urban forest] ... requires a system that considers both the needs of individual trees and the forest as a whole. Ideally, it must be a system that provides for the social values of the forest...” Chapter and section headings in *Urban Forestry* range from traditional forestry topics such as tree selection and planting, landscape design and pest control to more integrated aspects of urban forestry including tree inventories, pollution abatement and administration.

Robert Miller’s 1988 textbook, *Urban Forestry: Planning and Managing Urban Greenspaces*, builds on the work of Grey and Deneke by introducing topics and applications common to traditional forestry. These included cover type mapping, management simulations, and urban silviculture (including even-aged versus uneven-aged stands, natural succession, intermediate treatment and regeneration systems).

Urban and Community Forestry in the Northeast (Kuser, ed., 2007) was a follow-up to an earlier version published in 2000. Both editions included chapters written by various experts on a number of popular urban forestry topics. The scope and depth of the chapters reflect the continuing development of urban forestry and highlight its importance as a branch of traditional forestry. For example, the second edition includes the following chapter titles and authors: Understanding the Benefits and Costs of Urban Forest Ecosystems (D. Nowak and J. Dwyer, U.S. Forest Service); Integrated Pest Management (D. Smith-Fiola, Landscape IPM Enterprises); and Recycling Urban Tree Removals (E. Lempicki and E. Cesa, New Jersey Forestry Services and U.S. Forest Service, respectively). Also, “standard” urban forestry topics are covered in detail such as tree ordinances, selecting and specifying nursery stock, pruning, planting and maintenance, and tree appraisal.

³ For more information on TreePeople, see <http://www.treepeople.org/>

⁴ For more information on the early history of urban forestry in the U.S., see (1) Moll and Gangloff’s 1987 report at: <http://www.fao.org/docrep/s1930E/s1930e05.htm#urban%20forestry%20in%20the%20united%20states>, and (2) Johnston, M. 1996. “A Brief History of Urban Forestry in the United States”, *Arboricultural Journal*, 20(3):257-278.

Urban Forest Inventory

Urban forest inventories, with an emphasis on small cities and towns, were developed in the early 1970s. These inventories became popular because they enabled city officials to make management decisions based on the tree resource, including health and maintenance costs. The advent of personal computers in the 1980s enabled complex analyses to be performed including detailed economic evaluations of short- and long-term tree management scenarios. It was also during this same time period that communities began hiring individuals with titles such as City Forester, Municipal Forester or Arborist, and Urban Forester. In recent years, urban tree inventories have continued to take advantage of emerging technologies, including the use of mobile phones and digital applications to engage citizens, such as the “Urban Forest Map” project in San Francisco (see: <http://www.urbanforestmap.org/>).

The textbooks by Grey and Deneke, Miller, and Kuser clearly demonstrate the evolution of urban forestry over the past 30 or so years. Also, universities, colleges and post-secondary technical schools have developed urban forestry programs in recent years. As examples, Southern University had 82 urban forestry students in 2010 and the University of Wisconsin-Stevens Point graduated 614 urban foresters between 1976 and 2009. For 2010, the Society of American Foresters accredited educational programs of ten universities that offered urban forestry concentrations or options as part of their broader forestry major.⁵

Urban Forestry in the 21st Century

Today, as we enter the second decade of the 21st century, urban forestry is a much more integrated discipline than even 30 years ago. The U.S. Forest Service's urban forestry Research Work Unit NRS-08, located in Syracuse, New York, carries the descriptor "Urban Forests, Environmental Quality and Human Health."⁶ Five scientists are working with numerous cooperators to: 1) quantify urban forest structure (e.g., number of trees, species composition); 2) determine how urban forest structure and its management affect ecosystem services (e.g., air and water quality, carbon sequestration, air temperatures, soil-nutrient cycling); and 3) develop appropriate vegetation management strategies and tools to improve urban natural resources stewardship and consequently human health and environmental quality in urban and urbanizing areas. See the accompanying sidebar on "Urban Tree Effects on Water Flow and Quality" for a short description of one of the research focus areas in urban hydrology and urban stream ecology.

Urban Tree Effects on Water Flow and Quality

Urban runoff, in addition to causing severe water quality problems, is highly damaging to infrastructure and aquatic habitats. Impervious surfaces (roofs, streets, parking lots) reduce infiltration, increase runoff, reduce groundwater flow and transport urban pollutants (e.g., bacteria, metals, pesticides, organics, salts, nutrients) to streams. Thermal pollution can also occur when the temperature of runoff is elevated relative to the temperature of the receiving water. Oppositely, trees and other urban vegetation decrease runoff and increase groundwater flows by increasing infiltration and below-ground storage, reduce sediment loads from landscape and channel erosion, reduce thermal shocks to streams through their cooling effects on surfaces and air, and provide organic matter (food) resources to stream ecosystem food webs. Their leaves, when transported to streams, may also enhance ecological functioning by increasing beneficial microbial activity (e.g., denitrification) and helping to convert various water pollutants into less toxic forms.

http://nrs.fs.fed.us/units/urban/focus/water_quality_quantity/

⁵ See "SAF Accreditation of Educational Programs in Forestry and Forest Technology" at http://www.safnet.org/education/Handout_2010-AllAccr030910.pdf

⁶ See <http://nrs.fs.fed.us/units/urban/?source=gif/trees.pdf>.

Other Forest Service research locations around the country are investigating a range of urban forestry topics including the development of “i-Tree,” an analysis tool for urban forest managers that uses tree inventory data to quantify the dollar value of annual environmental and aesthetic benefits including energy conservation, air quality improvement, CO₂ reduction, storm water control and property value increase. The Center for Urban Forest Research at the Pacific Southwest Research Station in Davis, California developed a tree carbon calculator that is now national in scope. Users can enter tree sizes (i.e., diameter at breast height) or age and receive information on the amount of biomass and carbon stored in the tree, as well as benefits associated with energy conservation projects.⁷

Another example of urban forestry research in the 21st century is the work being conducted at the Landscape and Human Health Laboratory (LHHL) at the University of Illinois at Urbana-Champaign. Dr. Frances Kuo (LHHL Director) is examining the impacts of natural features such as trees, grass, flowers and green spaces on:

- Safety, crime, violence, and aggression
- Strength of community
- Well-being, coping, and vitality
- Attention, executive functions, self-control, and learning

Kuo’s research settings include urban parks, neighborhoods, commercial areas, public housing projects, public schools, and home and play-settings from across the U.S. Findings are being used to:

- Increase the use and care of green landscaping to help individuals, families and communities flourish
- Suggest locations for green landscaping
- Aid in the design of green landscapes so that they are as effective in promoting human health as possible⁸

Urban forestry, as practiced by professionals in the real-world, has become a more integrated discipline. Urban foresters, city arborists, and other municipal forest managers have seen their roles expand beyond tree planting, maintenance and pest control. Also, traditional rural forestry practices are becoming more commonplace in urban settings.⁹ The following serve as examples.

⁷ For information on the Center for Urban Forest Research, see <http://www.fs.fed.us/psw/programs/cufr/>.

⁸ For more information on the Landscape and Human Health Laboratory, see <http://lhhl.illinois.edu/index.htm>.

⁹ Another critical factor in the merging of urban and rural forestry interests is the expansion of urban areas throughout the country. An estimate in 2005 projected that by 2050 the amount of U.S. forestland to be subsumed by urbanization was equal to an area approximately the size of Pennsylvania (Nowak and Walton 2005).

Baltimore Ecosystem Study

Scientists from the U.S. Forest Service, U.S. Geological Survey, U.S. EPA, universities, NGOs, and others are principal investigators on one of the first National Science Foundation-funded urban long-term ecosystem research projects. Coordinated by the Cary Institute of Ecosystem Studies (<http://www.ecostudies.org/index.html>) this project investigates the long-term effects of urban vegetation on city ecosystem processes. Much of the research in the Baltimore Ecosystem Study monitors long-term tower measurements of carbon dioxide flux, water flows and vegetation in Baltimore to help understand how urban vegetation is changing and its impacts on environmental quality and human health. (For more information, see <http://www.beslter.org/index.html>).

Urban Forestry in Milwaukee, Wisconsin and Rochester, Minnesota

In Milwaukee, Wisconsin, forestry services manager David Sivyer is experiencing the “pull” in both directions. Sivyer notes, “The core services we provide throughout the city are about the same as in the past—tree planting, tree removals, pruning and so forth. However, we have adopted new technology to be aggressive with the arrival of the emerald ash borer.” The “new technology” involves high-resolution remote sensing image analysis for mapping of all ash trees—public and private—within the Milwaukee city limits. Since each tree species has a unique energy reflective “signature,” the remote sensing provides a GIS “layer” that identifies ash trees and facilitates decision-making. The technology (Hyperspectral Imagery) supports Milwaukee’s emerald ash borer management strategies including ash tree injections to manage public risk while transitioning the city’s 33,000 ash street trees to resistant species over the next 10-15 years, and an aggressive outreach campaign to notify and educate residents with ash trees. In addition, Sivyer has used UFORE (a computer model developed by the U.S. Forest Service) to measure the ecological service benefits of the Milwaukee urban forest.

Sivyer is also involved in water conservation issues through his role as forestry services manager. Urban gardening and the adoption of “green roofs” in the city require unique strategies to “harvest” water on-site versus tapping into fire hydrants. The development of bio-swailes (rain gardens) on boulevards to capture rainfall and then have it slowly percolate into the soil is also a responsibility of the job.

In Rochester, Minnesota, city forester Jacob Ryg has experienced an evolution in his day-to-day duties. “Coordinating volunteers in a time of shrinking budgets, developing social networking sites, and coordinating about 300 acres of prairie burns per year,” says Ryg, “are parts of my job that I didn’t study in forestry school.” Although Ryg acknowledges that traditional urban forestry practices are still a huge part of his job, he’s also asked for his expertise on subjects outside his comfort zone. He says, “One thing I’ve learned is that I need to be an expert on all natural resources issues in the City. This includes management and control of exotic plants like buckthorn, the relationship between shade trees and storm water management, timber stand improvement in park areas, and urban wood utilization.”

“As a private consultant who provides forest and tree services for urban and suburban clientele, I apply forest science techniques on a small scale. My *small woodlands* program, which includes development of a stewardship plan, caters to landowners owning 3 to 5 acres. I see a great opportunity to apply forestry practices on these small acreages, especially since many of these woodlots connect to one another. Unfortunately, too many foresters overlook these properties.”

- Jay Maier, Maier Forest and Tree, Rochester, Minnesota

Urban Wood Utilization in Metropolitan Areas

An example of how rural and urban forestry are becoming integrated is the relationship between the Minnesota Department of Natural Resources, Division of Forestry, and users of harvested urban wood in the Minneapolis and St. Paul metropolitan area (Twin Cities). The Minnesota DNR has maintained a strong utilization and marketing staff for decades, resulting in a heightened awareness of urban wood use issues. Currently, five staff members have assigned duties either full

or part-time in utilization and marketing. One staff forester is responsible for wood utilization and related activities in the Twin Cities metropolitan area.

One of the services offered by the DNR Forestry Division is a “Sawmill and Dry Kiln Listing for the Metro and Surrounding Areas.” Available online and updated regularly, the “Listing” provides key information on businesses conducting sawing and lumber drying operations in the Twin Cities area. Names, addresses, phone numbers, services provided (including log buying and lumber sales), service area (metropolitan area vs. statewide) and general comments on approximately 30 firms are highlighted. Businesses buying and/or accepting urban logs for processing are noted in the Listing. One of the benefits of the Listing is that it connects owners and managers of small woodlands and individual trees with processors who specialize in community-based trees and logs. The sawmill and dry kiln Listing can be accessed at:

http://files.dnr.state.mn.us/forestry/um/twincities_sawmill_drykiln_listing.pdf.

Additional examples of wood utilization integration between rural and urban stakeholders is evident in areas where invasive species have been discovered, as in the case of emerald ash borer (EAB) in the metropolitan areas of Detroit and Chicago. In both instances, professional logging trainers were used to teach tree grading and felling, log grading and bucking, and forest product utilization techniques to urban foresters, arborists, park superintendents, road commission tree crews, tree service companies and others in the tree care industry. Although the logic of a logger training an urban audience would seem out-of-place, it is quite relevant in light of the need and opportunity to better utilize the urban wood resource. For an example of urban wood training workshops, see: <http://semircd.org/ash/training/previous.php>.

Blurring of the Lines

Rural/urban interface issues have contributed to a blurring of the lines between traditional forestry and urban forestry. Wildland fires, urban sprawl, fragmentation and exotic pests are examples of issues that impact foresters across the spectrum. These boundary-crossing issues may be best addressed through urban and rural collaborations. Current research—focused on perceptions and beliefs of SAF members—suggests that urban forestry and traditional forestry are becoming more integrated and that cooperation between the two is needed to provide solutions to the problems created by societal demands (Ricard and McDonough 2007).

The current urban forestry issues noted above—including air, water and soil quality, as well as carbon cycles—are mainstream issues in traditional forestry. In addition, urban residents affect traditional forest policy and hence forest management decisions and outcomes (via the ballot box as one example). Consequently, the blurring of the lines between urban and traditional forestry and the opportunity to improve professional interactions and public perceptions of forestry practices should be welcomed by all in the forestry field.¹⁰

¹⁰ Interestingly, an op-ed piece in the November 1991 issue of the *Journal of Forestry* (p. 56) noted that urban forestry wasn't important enough to be listed as a subject heading in the Reports section of the periodical (Ries 1991). Less than two decades later urban forestry was the eighth largest of the 28 SAF working groups (Ricard and McDonough 2007).

One Forest and Regional Restoration

McPherson (2006) introduced the concept of One Forest to foster a stakeholder connection between rural and urban forestry. He writes:

The concept of One Forest provides a framework for linking ecosystem services and human values along the urban-to-rural gradient. One Forest emphasizes the continuity of our forests, landscapes and other ecosystems across all lands, from inner city forests to the most remote parts of our national forests and wilderness areas. The connection is demonstrated through associations within, and across, individual watersheds and expressed in the relationship each ecosystem has, whether rural or urban, to water, climate, invasive species, soils, wildlife, people, and the natural cycle of fire.

McPherson suggests that *watersheds* along an urban-to-rural gradient provide a definable organizing structure for understanding a region's ecosystem. The Chesapeake Bay watershed, which supports a population of over 16 million people, is an example of a watershed restoration project that targets watershed restoration efforts not only by conserving forests (both rural and urban) but also by reducing phosphorous in home lawn-care products and supporting Bay-friendly farming practices. The Upper Mississippi River Forest Partnership in the Midwest is another example of how the One Forest concept is being applied to solving current environmental problems. Key watershed issues being addressed by the Partnership that connect rural and urban forestry stakeholders include forest conversion in high growth areas, storm water runoff from city streets and discharges from sewage treatment and industrial wastewater plants.¹¹

Scarlett (2010) echoes McPherson's ideas but uses the terminology of Regional Restoration. In a recent report she states:

The landscape-scale nature of environmental challenges underscores that cities and countryside could benefit from ecosystem conservation and restoration efforts that transcend jurisdictional boundaries and link what cities are doing with what the nation and rural communities are doing to restore ecosystems.

One of Scarlett's examples of Regional Restoration targets storm water and its polluting effect in southwestern Wisconsin. The area's Regional Planning Commission helped develop a voluntary partnership between six watersheds (landscape-scale) while, at the same time, developing actions that "drill down" to the neighborhood level. Ultimately, 28 different municipalities engaged in an effort to coordinate actions and integrate municipal and non-urban watershed management.

These two conceptual examples—One Forest and Regional Restoration—are likely precursors of the way urban forestry and its relationship to rural—or traditional—forestry will be positioned, promoted and practiced in the future.

¹¹ For more information on the Upper Mississippi River Forest Partnership, see http://www.na.fs.fed.us/watershed/upper_mississippi_partnership/.

“Urban and community forests are likely to be the most influential forests of the 21st century.”

-Dave Nowak, U.S. Forest Service, 2005

Bottom Line

Urban forestry has evolved over the years from a program with a beautification focus to an integrated discipline that includes the environmental, conservation, economic and social benefits of community trees. Consequently, the role of the urban forester has expanded to include not only core services—tree planting, removal and maintenance—but also issues such as water flow and quality, air pollution mitigation, air temperature modification, carbon sequestration, and human health. All of these services are supported by an array of sophisticated technologies unimagined in the not-too-distant past. Not surprisingly, many of the same issues being addressed by urban foresters are key interest areas in the rural (traditional) forestry sector.

The time is ripe for rural forestry practitioners and their urban counterparts to work collaboratively to address issues common to both parties. Through collaboration, three critical forest management issues can be addressed in a more efficient manner.

1. Land Use Planning: Many areas of the U.S. with large urban expansions are heavily forested, and many threats to forest stability are strongly connected to expanding urbanization (exotic pests, fragmentation, wildfire, etc.).
2. Natural Resource Management: Many natural resources issues (water flow and quality as an example) need to be tackled on a landscape level by bridging the urban-rural gradient.
3. Policy and Public Engagement: As our population becomes more “urban,” people whose only first-hand experience with “forestry” is of the urban variety will increasingly make policy decisions impacting rural forest management.

In order to tackle these issues, urban and rural foresters need to engage in a number of efforts including: co-sponsorship of conferences (such as joint SAF and ISA programs), presentations at one another’s professional and trade association meetings, article development for appropriate magazines and newsletters, service on committees and advisory groups that address landscape-level natural resources issues, and, most importantly, embracing the One Forest/Regional Restoration mindset. These changes could also be reflected in curriculum and college forestry programs. These positive actions would be an excellent beginning to an expanding—and collaborative—professional relationship between urban and rural foresters.

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