STARKER LECTURES 2001

Visions of Natural Resources

Peeking into the Neighbor's Yard

Table Of Contents

Acknowledgements 2

Dedication 3

Film, Forestry and Our Global Backyard
Monty Bassett 4

Gentrifying Ecotopia: A Brown Girl Looks at Home, Landscape and Power
Debra Salazar 18

Iisaak: Respecting Forest Values—from Process to Products
Iisaak Panel:
Linda Coady,
Eric Schroff, and
Alton Harestad 36

Urban Forestry: Forestry's Final Frontier
Gregory McPherson 60

compiled by B. Shelby and S. Arbogast

Acknowledgments

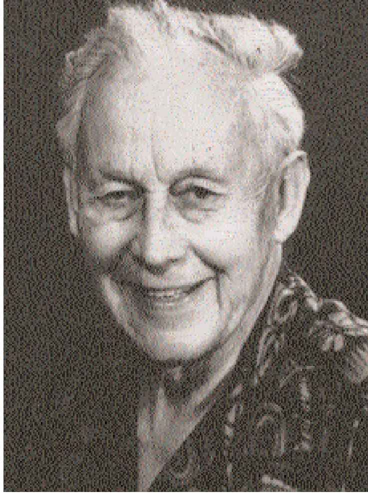
Natural resources are a crucial part of our world. This year's Starker Lectures theme, "Visions of Natural Resources, Peeking into the Neighbor's Yard," offers a unique attempt to look at complex resource issues among neighboring boundaries. Our speakers come from a variety of backgrounds and offer diverse and thoughtful views.

This lecture series requires a major effort on the part of the Starker Lecture Committee. I thank Norm Johnson, Phil Humphreys, Jeff McDonnell, Lisa Ganio and Sandie Arbogast for the dedication and creativity that turned disparate ideas into a coherent theme and an outstanding group of speakers.

Manuscripts were edited by Rosanna Mattingly, PhD, Portland, OR, and designed by Sandie Arbogast, Forestry Communications Group.

We recognize the encouragement and commitment of College of Forestry administrators, students, and friends who support the lectures.

DEDICATION



T. J. STARKER

BRUCE STARKER

Thurman James Starker, known to all as T. J., was born in Kansas and spent his childhood in Burlington, Iowa. He moved with his family to Portland in 1907 and began working in and studying forestry. T. J. graduated in the first class of foresters at Oregon Agricultural College (OAC), now Oregon State University, in 1910. He then studied two years for an MS degree in forestry at the University of Michigan and returned to Oregon to work for the USDA Forest Service. Subsequent employment with the forest-products industry and a variety of summer jobs while he was teaching forestry at OAC/Oregon State College (OSC), gave T. J. broad and thorough experience in all aspects of forestry.

In 1936, T. J. began purchasing second-growth Douglas-fir land, the beginnings of Starker Forests. Through his work experiences and teaching forest management, T. J. had a major influence on sound forestry and community development in Oregon.

Bruce Starker studied forestry at OSC, earning a bachelor's degree in 1940 and an MS in 1941. After service with the Coast Guard, Bruce joined his father, T. J., in acquiring and managing Oregon forest land, always with an eye for careful management, sound reforestation, and conservation for multiple benefits and values. He worked with private industry and university, state, and federal forestry agencies to improve reforestation and management, and developed taxation systems that improve forest practices. Bruce continued the family tradition of active community service in many ways, including participating in civic activities and regional forestry work and contributing to the Oregon Forest Practices Act.

Forestry in Starker Forests has changed with advances in knowledge, technology, and public environmental issues. But the constant value of tending the land remains unchanged. The community spirit and sound progressive forestry of T. J. and Bruce Starker continue today.

Urban Forestry: Forestry's Final Frontier?

E. Gregory McPherson, Ph.D
Director, Center for Urban Forest Research
USDA Forest Service, Pacific Southwest Research Station,
Davis, California

Although forestry and urban forestry share the word "forestry," they seem to occupy different worlds. Forestry connotes sylvan environments—timber, streams, wildlife, and a close connection with the land. Urban forestry evokes cognitive dissonance; the image of cities with buildings and pavement seems inimical to forests. Equally bizarre is the idea of forest management in cities. How can silvicultural practices applied in forest stands be adapted for specimen trees in cities? As America's population becomes more urban, answers to questions such as these are important to the future of forestry and urban forestry.

This paper describes what forestry and urban forestry share in common. By working together, both professions can become stronger and benefit from a shared sense of purpose. Constructing healthier habitats for humans could provide a focus for such collaboration.

The first section of this paper introduces urban forestry as an emerging institution. Although the public no longer regards trees as solely ornamental, and funding for tree planting has increased dramatically, implementing successful urban and community programs has not been particularly successful. This section identifies some obstacles to success.

The second section discusses concepts of forest structure, function, value, and management, and their application in urban forestry. Like foresters, urban foresters manipulate the composition of species, stand density, and structure to achieve management objectives. Although management concepts, such as forest stand and stocking level, have relevance in both fields, economic rotation is not useful in urban forestry, because public attitudes often make it difficult to remove healthy trees. Aspects in which expertise in forestry can enhance the science and practice of urban forestry are described as cross-over areas.

The final section summarizes the ways in which forestry can benefit from expertise shared by urban forestry, and vice versa.

Urban Forestry: From Frontier to Emerging Institution

Seventy-five percent of Americans live in metropolitan areas, and the urban forest is where most of them work and play. It is the forest that they experience on a daily basis. Urban forestry is the planning and management of trees, forests, and related vegetation in our communities to create or add value. Urban

forests are important because they account for about 25 percent of the total tree canopy cover in the United States and contain approximately 75 billion trees (Dwyer et al. 2000). These trees clean the air we breathe and the water we drink, protect us from the elements, and heal us emotionally, spiritually, and psychologically. They are integral to the quality of life in our communities.

One definition of frontier is "a new or unexplored area of thought or knowledge." Compared to forestry, urban forestry is a frontier. Silvicultural theory and the profession of forest management are hundreds of years old, and forestry is an established institution worldwide. Urban forestry is young in theory but old in practice (Miller 1997). Although people have managed trees in cities for eons, academic and scientific interest didn't reach a critical mass until the 1970s. For example, in 1978, over 100 papers were delivered at the nation's first National Urban Forestry Conference (Hopkins 1978). Now more than 50 universities offer courses in arboriculture and urban forestry within departments of forestry or horticulture (Wingate et al. 1995).

Interest among professionals in urban forestry is growing. Membership in the International Society of Arboriculture (founded in 1924) is 14,000, only 4,000 less than membership in the Society of American Foresters (founded 1900). Although urban forestry is a relatively new area of thought and practice, it continues to deepen and broaden its base of human interest, professional participation, and intellectual capital (Bradley 1995).

During the past decade, there has been a shift in the way many people perceive trees in their communities. Trees have always been viewed as ornament and beautification, but they are now seen as providing social, economic, and environmental benefits as well. This shift has led to new partnerships, such as the tree planting program between Portland General Electric and Friends of Trees. They are training 40,000 volunteers to plant 350,000 trees to reduce atmospheric carbon dioxide (Friends of Trees 1995). In the process, residents realize a new sense of empowerment and satisfaction from the positive influence they have on their environment.

Rapid urbanization and increased affluence is driving the development of our urban forests. Population growth in the Pacific region increased 8 percent in central cities and 15 percent in the urban-rural interface areas during the 1990s (U.S. Census Bureau 2000). Because of sprawling cities, fragmentation of habitats and loss of critical natural resources have occurred. This gradual chipping away of the natural resource base has led

to urban growth boundaries and smart growth initiatives.

Many Americans have experienced greater affluence and increased standards of living during the past several decades. At the same time, they have experienced increased air pollution, more congestion on our highways, loss of biodiversity, and occasional shortages of energy, water, and other resources. And pockets of poverty still exist within inner cities and rural communities. Because urban forestry is integral to land use planning, environmental quality, economic growth, and social justice, it has the potential to mitigate some of these problems.

In 1995, for example, California's urban forest contributed $3.8 billion to the state's annual sales, about one-third of the $12.5 billion contributed by the state's forest product industry (Templeton and Goldman 1996). However, California cities spent $70 million annually on problems created by conflicts between street tree roots and hardscape (McPherson 2000). That expenditure ($2.68/capita) was more than half the total average annual amount ($4.36) cities spent on their tree programs (Thompson and Ahern 2000). The green industry is an important part of the economy, but when trees are unwisely selected or mismanaged, they can create costly problems for communities.

California's 177 million shade trees in cities reduced annual air conditioning energy use by 6,400 GWh, equivalent to 7.3 100-MW power plants and $500 million in wholesale electricity purchases (McPherson and Simpson 2001). Yet, some species of trees emit highly reactive hydrocarbons that are involved in the formation of atmospheric ozone. In southern California, an estimated 15 percent or more of total hydrocarbon emissions come from landscape trees (Corchnoy et al. 1992). This level of emissions could make it impossible to achieve ozone attainment after other hydrocarbon emission reduction measures are instituted and the relative contribution by trees increases to 40 percent. Trees can be part of the answer to our environmental problems, but they can create problems if we fail to understand or consider how they interact with the urban environment.

During the past 20 years, U.S. Forest Service spending on urban and community forestry programs has increased from $2 million to $36 million. Despite greater support at local, state, and federal levels, many of the same obstacles that limited development of healthy and extensive urban forests 20 years ago still hinder efforts today.

Available growing space is limited in city centers, and this problem is compounded by pressure to convert greenspace, parks, and vacant lots

into building sites. Studies by American Forests and others indicate that as cities in temperate climates sprawl outward, there is loss of tree canopy cover. Land around Puget Sound, Washington, once heavily forested, now has less than 20 percent tree cover (American Forests 1998). This de-greening has resulted in a loss of critical natural areas and the ecological services they provide. Constraints to planning and managing healthy urban forests include:

- Inadequate funding for municipal tree care programs, which includes resources for responding to natural catastrophes (e.g., ice storms, hurricanes), conducting urban forest inventories, developing management plans, enforcing ordinances, and monitoring tree health
- Inadequate space for trees within the urban infrastructure
- Overuse of park and natural spaces
- Harsh growing conditions that make tree survival a challenge
- Lack of information on the tolerances of urban tree cultivars to environmental constraints, such as de-icing salts and ozone
- Poor tree selection, which creates maintenance problems
- Poor nursery stock and failure to provide adequate care after planting
- Domination of many municipal urban forests by relatively few species, along with limited genetic diversity
- Poor tree care practices by citizens and untrained arborists
- Too few communities with working tree inventories; very few with urban forest management plans
- Limited adoption and enforcement of ordinances that regulate street tree removal and types of species planted, protect trees during construction, preserve heritage trees, and require planting with new development
- Jurisdictional complexity that frequently results in agencies working at cross-purposes or duplicating each other; lack of development of regional policies and standards for best management practices
- Limited outreach to professionals and residents
- Limited grass-roots participation in tree planting and stewardship
- Lack of public awareness about the benefits of healthy urban forests

Although urban forests can mitigate a variety of problems associated with development, several obstacles must be overcome before significant urban forest benefits can be realized. These constraints run the gamut from loss of planting space to lack of funding for tree programs. Resolving these limitations will require coordinated efforts among cities, regions, and states.

Structure, Function, Value, and Management: Cross-Over Areas

Structure

Forest structure refers to species composition, age diversity, and the spatial arrangement of trees and associated vegetation in the landscape. Forest structure is determined largely by natural factors such as climate, soil types, seed sources, and dispersal processes. Just as influential in urban forests, however, are development patterns that create space for trees, and human management that determines what is planted and removed, as well as how vegetation is manipulated (Sanders 1984). Street tree populations are intensively managed, while forest stands on urban vacant land develop in ways similar to rural forest stands (Rowntree 1984). Urban environments are heterogeneous, a complex mix of different land cover types and uses. Growing conditions for trees are highly variable. Where trees are well-adapted and sites are favorable, growth rates of city trees can be twice those of nearby forest trees, because of watering, fertilizing, and reduced competition (Jo and McPherson 1995).

Species richness, the number of species in a population, is usually greater in urban forests than in rural forests. In southern California communities, open-grown street tree populations frequently contain over 200 species. Richness decreases in colder climates, where minimum temperatures reduce the numbers of broadleaf evergreen and palm species (McPherson and Rowntree 1989). However, species composition is similar in both forests and cities when the distribution of individuals among species is considered. In both cases, a few well-adapted species tend to dominate (Richards 1982/1983).

Ecologists have found that forest structures vary along urban-to-rural gradients that extend from city centers, through suburban development, and into the rural hinterlands (McDonnell et al. 1993). Significant variations in climate, soil, flora, and fauna along the gradient reflect the influences of pre-settlement vegetation, people, development patterns, and natural factors (McBride and

Jacobs 1984). Our urban ecosystem studies in Chicago and Sacramento revealed that tree density, basal area, and canopy cover increased along the urban-rural gradient in Chicago but decreased in Sacramento, where surrounding rural lands were largely grassland communities instead of forests (Nowak 1994, McPherson 1998).

Most ecological measures applied to forests can be fruitfully applied to urban forests. For example, urban forestry studies have described canopy cover, species composition, species diversity, age diversity, dominance, importance, stocking level, and health (McPherson et al. 1999). Many instruments developed by foresters are also used by urban foresters to measure basal area (diameter tape), tree height (altimeter, clinometer), and tree spacing (range finder). Urban foresters also apply remote sensing, GIS, and GPS technologies to measure land cover, identify tree types, and detect canopy cover change.

Our research focused on understanding the growth and architecture of open-grown trees. We developed new techniques for measuring leaf area with digital photography and image processing (Peper and McPherson 1998). To better estimate how much rainfall different tree species intercept we measured gap fractions and surface detention storage capacities (Xiao et al. 2000). We used measurements of crown density to estimate the effects of tree shade on building energy use. In Longview, Washington, we developed data on growth rates and corresponding dimensions of different street tree species to project benefits from time of planting to removal for communities in western Oregon and Washington (McPherson et al. 2002).

Preliminary results suggest that the architecture of open-grown trees differs fundamentally from that of forest trees. Open-grown trees have substantially more above-ground biomass in their foliage and branches, whereas forest trees have more biomass in their boles. If this is the case, applying forest-derived biomass equations and deposition velocities to calculate air pollutant uptake by urban forests could lead to inaccurate findings.

Cross-Over Areas Related to Structure

Characterizing the urban-wildland interface. Very little is known about the structure of this frontier between forest and city. For example, we need information on relations among population density, building density, and tree density to better assess the cost-effectiveness of fuel management strategies. Also important is the use of remote sensing to detect the location of critical and threatened habitats. Field studies would help us understand how the structure of these habitats is affected by urban

processes such as development, introduction of exotic species, and management practices.

Canopy change detection. Forests abound in the Pacific Northwest, and nowhere is it more imperative to know how they are changing in both extent and health. Foresters are familiar with the new generation of satellites that obtain hyperspectral, high-resolution data, but this technology has not been applied in cities. We need specific studies to determine the feasibility of using different types of imagery to identify urban tree species, vegetation height, and leaf area.

Disturbance mapping and restoration. Foresters and ecologists study the effects of disturbance in forests and natural communities on structure and function, but we know very little about disturbance and restoration in urban environments. There is no taxonomy of urban disturbances by disturbance agent and community type, and little understanding of effects on vegetation structure. Understanding the impacts of disturbances on structure is the first step towards developing restoration strategies. There are no better laboratories for studying disturbance ecology than our cities.

Function and Value

Function refers to the dynamic operation of the forest. It includes biogeochemical cycles, gas exchange, primary productivity, competition, succession, and regeneration. In forests, these functions largely are natural processes. Intervention is usually limited to silvicultural practices. In urban environments, forest functions frequently are related to the human environment. Trees are usually selected, planted, trimmed, and nurtured by people, often with specific intentions. For example, a red oak is planted in a front sideyard to shade the driveway and frame the residence. The functional benefits provided by this tree depend on structural attributes such as species selected and location, as well as management activities that influence its growth, crown dimensions, and health. The value of these benefits is highly personal and may be quantifiable (e.g., cooling savings) or intangible (e.g., increased satisfaction). Urban forest functions frequently are oriented toward human outcomes, such as shade, beauty, and privacy (Rowntree 1986).

Perhaps the most fundamental difference between forestry and urban forestry is the way trees are valued. Most people believe that city trees are more valuable alive than dead, whereas trees in forests obtain their greatest market value after they are cut. Trees in cities are imbued with meaning; some are landmarks, others are memorials. People develop emotional attachments to trees that give

these trees special status and value. Removing hazardous trees can be difficult when it means severing the connection between residents and the trees they love. For many, feelings of attachment to trees in cities influences feelings for preservation of trees in forests.

Cross-Over Areas Related to Function and Value

Waste-wood utilization. Model waste-wood utilization programs exist in some cities. Lompoc, California, for example, uses a portable mill to make lumber for picnic tables, benches, and tables from urban saw logs. Nevertheless, most urban waste wood is chipped for mulch or taken to landfills. Foresters with expertise in wood science, forest products, and economics could assist urban foresters in developing new products from this resource, identifying new markets, and building a substantial consumer base.

Water and soil relations. We know little about soils in cities, how they are altered during the development process, and how development influences relations among soil, water, plants, and atmosphere. Foresters could assist with research aimed at restoring urban soils to conditions resembling forest soils.

Water is the lifeblood of our cities. Principles of watershed management applied in forests also apply to catchments along the urban-rural gradient. Foresters can help urban hydrologists develop and test the effectiveness of new ways of planning and managing urban forests to reduce runoff, improve water quality, and decrease flooding.

Urban wildlife. People enjoy seeing wildlife in cities. Wildlife provides a connection for people with nature. How are urban forest landscapes designed and managed to nurture desirable urban wildlife and prevent certain species from becoming a nuisance? Salmon is a key species because of its very high recreational and commercial value, as well as its endangered status. The streams it inhabits link urban and rural environments. Foresters who manage forest lands with salmon in mind can help urban foresters develop management plans for wooded riparian areas near cities. Also, they can assist in developing realistic guidelines for landscape design and management that will restore salmon to the area's streams.

Tree improvement. The Willamette Valley is one of the nation's largest producers of landscape trees. Many nurseries have selected new introductions for their ornamental or aesthetic attributes, such as flower color, fall leaf color, and crown shape or size. There are other attributes, however, that might reduce the costs associated with maintaining trees in cities. For example, deep rooting pat-

terns could reduce conflicts with sidewalks. Trees that drop their leaves within a short period of time could reduce clean-up costs and local flooding caused by clogged drains during the fall. Increased tolerance to heat stress might reduce loss rates. Foresters working in the field of tree improvement could work with local growers and other members of the green industry to develop improved trees for urban environments.

Forest Management

Forestry has a rich tradition of theory and practice related to forest ecosystem management. Urban forestry has borrowed and adapted some concepts from this body of knowledge. Silviculturalists view a forest as a collection of stands managed as an integrated unit (Smith 1962). Forest stands are relatively easy to identify because of their distinctive structure and species composition. They are more difficult to discern in cities because the boundaries between plant communities are vague, seldom following environmental gradients as they do in forests. Urban forest stands can coincide with neighborhoods developed during similar time periods (Palmer 1984). Trees in the same neighborhood are usually planted at approximately the same time and tend to reflect the horticultural preferences of that era (Whitney and Adams 1980).

Much like a forester, urban foresters manipulate the composition of species, stand density, and structure to achieve management objectives. They strive to obtain optimal stocking levels for each stand, recognizing that conditions can change from site to site within an urban forest stand (Richards 1992). One forest management concept that has not been very useful is rotation, or economic rotation. The urban forestry analog to economic rotation is “useful lifespan,” the idea that after a species reaches a certain age, the annual cost of maintaining it will exceed the value of benefits it produces. Urban forest plans have recommended planting tree species with different useful life spans to promote age diversity. However, this notion has failed in practice because the public seldom allows managers to remove healthy trees solely because they have reached the end of a predetermined useful lifespan.

Managing costs is particularly important in urban forests because of the many potential conflicts between trees and the surrounding infrastructure. In California, municipal programs spend, on average, $19 per tree each year to plant, trim, protect, and remove public trees (Thompson and Ahern 2000). However, annual benefits from a large tree can exceed $100 (McPherson et

al. 1999). Like foresters, urban forest managers face trade-offs between short-term economic interests and long-term ecological issues. Short-term interests are frequently the time between elections or budget cycles, but net benefits from trees increase as they live 30 to 50 years or more.

The concept of sustained yield of benefits from the urban forest has theoretical application but is difficult to measure (Clark et al. 1997). Yield of benefits, measured as board feet of timber harvested, watershed values, or wildlife habitat has been more successfully quantified in forests than in cities.

A vision statement for a sustainable urban forest incorporates these concepts of benefits, costs, and sustained yield. An example vision statement is "providing for the cost-effective planting, management, and preservation of trees to promote public safety, control costs, and maximize the social, economic, environmental benefits produced for current and future generations."

Cross-Over Areas Related to Management

Small stand management. Most Pacific Northwest communities have been sculpted from a forest matrix. As a result, there are scores of small, relict, forest stands. In many cases, people and the development process have had heavy impacts on these stands. There is a need for foresters to develop principles and practices of silviculture for application to small stands. The linear shape of these small stands and their roles as connectors and refugia for native plants and animals will influence management prescriptions.

Decision support for planning. Foresters have developed sophisticated decision support tools such as GIS mapping, stand growth models, visual assessment simulations, and economic analysis programs. Although some urban foresters use tree inventory and management systems, these programs lack the decision support technology and visualization capabilities needed to project the future impacts of alternative management strategies.

Forest health monitoring. Urban trees are susceptible to threats from pests and disease and are subject to a variety of abiotic disorders. Although the U.S. Forest Service and partnering states spend millions of dollars annually to monitor forest health, they spend very little monitoring urban forests. Protection efforts are mounted in reaction to local crises, and remedies are often too late to curb the damage. Many of the concepts developed to monitor forest health apply to trees in cities. Foresters can help urban foresters develop statistically valid sampling approaches for urban areas.

Hazard tree reporting is relevant to foresters in high-use recreational

areas, as well as in cities (Costello and Berry 1991). Data from tree failures are recorded in a central database. Species profiles are developed that describe how, where, when, and why each species is likely to fail. This volunteer-based program deserves greater support from the forestry and urban forestry community.

Watershed restoration. Watersheds link the city with the surrounding forests and provide a definable organizing structure for study of a region's ecosystem. Foresters and urban foresters could work side by side to determine how the quality of water, air, soil, vegetation, and wildlife habitat changes from the headwaters of rivers to their confluence with downstream water bodies. To address this issue, we need to understand the individual and cumulative effects of urbanization and land management practices on land, air, and water resources (e.g., watershed health) along the urban-rural gradient. A second issue is determining the best management practices for sustaining healthy watersheds in urban, suburban, and rural lands.

Conclusions

As Americans become increasingly urban, urban forests become increasingly important. These forests where we live provide benefits related to local, regional, and global issues. Stewardship of urban forests connects people to nature and to each other. If a new land ethic is going to emerge during the 21st century, it will spring from our cities.

Although the paths of forestry and urban forestry might appear to be diverging, they are actually converging. Forest management will continue to be influenced by the changing attitudes, perceptions, and lifestyles of urban residents. This convergence offers mutual benefits to forestry and urban forestry.

Forestry can benefit from an urban public that is more accepting of management. Urban forestry can make residents more aware of why tree trimming and tree removal are necessary management activities. This awareness can translate into greater acceptance of forest management practices that reduce fire hazards and increase tree health.

Forestry can benefit from urban forest stewardship because it fosters a connection between people and nearby nature that can be a pathway for reinvestment in forest management. People who develop respect and love for nature in cities might adopt similar feelings for forests near their communities and thereby become better stewards and supporters of forest resources.

Forestry can benefit from the expertise that urban foresters have acquired working with diverse stakeholders in the public arena. Different

attitudes about trees come from different visions about how society should be organized. Many urban foresters have learned that understanding these attitudes helps articulate goals in ways that avoid misunderstandings and enlist support for their efforts. Finally, forestry can benefit from urban forestry that makes our cities more livable. By creating more livable cities and reducing sprawl, urban forestry can indirectly reduce the loss of forest land and the natural resource base it supports.

Urban forestry has a great deal to gain from convergence with the field of forestry. Forest management theory and practice, in many cases, applies to urban forestry. Most municipal arborists have little training in forestry. They apply horticultural and arboricultural practices to individual trees, but seldom plan these applications from a forest management perspective. There is need for more forest management theory in urban forestry.

Forestry has developed an impressive range of scientific expertise and technological sophistication. Because of the careful development of forest science over the last century, urban forest science has been able, in three decades, to achieve a comparable level of theoretical and empirical refinement. Further developments could be of mutual benefit to forestry and urban forestry.

Urban forestry could benefit from increased support by the forest products industry and the academic community. Both these groups have significant resources that, if brought to bear, could benefit both urban and community forestry.

The final frontier is where forestry and urban forestry join together to construct healthier habitats for humans. It is the nexus of forest ecology and human ecology, and from it will spring environments that nurture the human soul. Creating forests within our cities might well be one of the least expensive and most effective means of promoting our own health and well-being. Managing growth will increase population densities and reduce overall greenspace. We will need to meet the challenge of maximizing benefits from every square meter of greenspace by engineering trees and other vegetation into the infrastructure. We will have to argue persuasively for new greenspace, which cannot be done alone by foresters or urban foresters. We will need each other, as well as landscape architects, horticulturalists, planners, engineers, and developers. It will take a collaborative effort to turn cities of gray into cities of green. By spearheading this effort together, foresters and urban foresters will strengthen their professions and gain a new, shared sense of purpose.

Literature Cited

American Forests. 1998. *Regional Ecosystem Analysis Puget Sound Metropolitan Area*. American Forests. Washington, D.C.

Bradley, G. 1995. Integrating multidisciplinary perspectives. pp. 3-11 in Bradley, G. (ed.). U*rban Forest Landscapes: Integrating Multidisciplinary Perspectives*. University of Washington Press, Seattle.

Clark, J.R., N.P. Matheny, G. Cross, and V. Wake. 1997. A model of urban forest sustainability. *J. Arbor*. 23:17-30.

Corchnoy, S.B., J.A. Arey, and R. Atkinson. 1992. Hydrocarbon emissions from twelve urban shade trees of the Los Angeles, California, air basin. *Atmos. Envir.* 26b:339-348.

Costello, L.R. and A.M. Berry. 1991. The California tree failure report program: An overview. *J. Arbor*. 17(9):250-256.

Dwyer, J.F., D.J. Nowak, M.H. Noble, and S.M. Sisinni. 2000. *Connecting People with Ecosystems in the 21st Century: An Assessment of the Nation's Urban Forests*. Gen. Tech. Rep. PNW-GTR-490. USDA Forest Service, Pacific Northwest Research Station. Portland, Oregon.

Friends of Trees. 1995. T*ree Planting and Five-Year Planting and Education Plan*. Portland General Electric. Portland, Oregon.

Hopkins, G. 1978. *Proceedings of the National Urban Forestry Conference*. SUNY-College of Environmental Science and Forestry. Syracuse, New York.

Jo, H.K., and E.G. McPherson. 1995. Carbon storage and flux in urban residential greenspace. *J. Environ*. Manag. 45:109-133.

McBride, J., and D. Jacobs. 1986. Presettlement forest structure as a factor in urban forest development. *Urban Ecol.* 9:245-266.

McDonnell, M.J., S.T.A. Pickett, and R.V. Pouyat. 1993. The application of the ecological gradient paradigm to the study of urban effects. pp. 175-189 in McDonnell, M.J., and S.T.A. Pickett (eds.). *Humans as Components of Ecosystems: Subtle Human Effects and the Ecology of Populated Areas*. Springer-Verlag, New York.

McPherson, E.G. 1998. Structure and sustainability of Sacramento's urban forest. *J. Arbor*. 24:174-190.

McPherson, E.G. 2000. Expenditures associated with conflicts between street tree root growth and hardscape in California, United States. J. Arbor. 26:289-297.

McPherson, E.G., and R.A. Rowntree. 1989. Using structural measures to compare twenty-two U.S. street tree populations. Landscape J. 8:13-23.

McPherson, E.G., and J.R. Simpson. 2001. Effects of California's Urban Forests on Energy Use and Potential Savings from Large-Scale Tree Planting. Center for Urban Forest Research. Davis, California.

McPherson, E.G., J.R. Simpson, P.J. Peper, and Q. Xiao. 1999. Benefit-cost analysis of Modesto's municipal urban forest. *J. Arbor*. 25:235-248.

McPherson, E.G., S.E. Maco, J.R. Simpson, P.J. Peper, Q. Xiao, A. VanDerZanden, and N. Bell. 2002. *Western Washington and Oregon Community Tree Guide: Benefits, Costs and Strategic Planting*. Pacific Northwest Chapter, International Society of Arboriculture. Portland, Oregon.

Miller, R.W. 1997. *Urban Forestry: Planning and Managing Urban Greenspaces*. 2nd Edition. Prentice-Hall. Upper Saddle River, New Jersey.

Nowak, D.J. 1994. Urban forest structure: the state of Chicago's urban forest. pp. 3-18 in McPherson, E.G., D.J. Nowak, and R.A. Rowntree (eds.). *Chicago's Urban Forest Ecosystem: Results of the Chicago Urban Forest Climate Project*. United States Department of Agriculture Forest Service, Northeastern Forest Experiment Station, Radnor, Pennsylvania.

Palmer, J.F. 1984. Neighborhoods as stands in the urban forest. *Urban Ecol*. 8:229-241.

Peper, P.J., and E.G. McPherson. 1998. Comparison of five methods for estimating leaf area index of open-grown deciduous trees. *J. Arbor*. 24:98-111.

Richards, N. 1982/1983. Diversity and stability in a street tree population. *Urban Ecol*. 7:159-171.

Richards, N. 1992. Optimum stocking of urban trees. *J. Arbor*. 18:64-68.

Rowntree, R.A. 1984. Forest canopy cover and land use in four eastern United States Cities. *Urban Ecol*. 8:55-67.

Rowntree, R.A. 1986. Ecology of the urban forest – introduction to part II. *Urban Ecol*. 9:229-243.

Sanders, R.A. 1984. Some determinants of urban forest structure. *Urban Ecol*. 8:13-27.

Smith, D.M. 1962. *The Practice of Silviculture*. John Wiley & Sons. New York, New York.

Templeton, S.R., and G. Goldman. 1996. Urban forestry adds $3.8 billion in sales to California economy. *California Agric*. 50:6-10.

Thompson, R.P., and J.J. Ahern. 2000. *The State of Urban and Community Forestry in California*. Urban Forest Ecosystem Institute. California Polytechnic University, San Luis Obispo, California.

U.S. Census Bureau. 2000. Population Estimates Program. Internet address: http://eire.census.gov /popest/archives/metro/ma99-06.txt

Whitney, J., and S. Adams. 1980. Man as a maker of new plant communities. *J. Applied Ecol*. 17:431-448.

Wingate, M., A. Wagar, and C. Hamilton. 1995. *Catalog of Curricula in Arboriculture, Urban Forestry and Related Areas*. Center for Urban Horticulture. University of Washington, Seattle.

Xiao, Q., E.G. McPherson, S.L. Ustin, and M.E. Grismer. 2000. A new approach to modeling tree rainfall interception. *J. Geogr. Res. Atmos*. 105:29,173-29,188.