Urban Forests:
New Tools for Growing More Livable Communities

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This paper is the fifth in the Livable Communities @ Work series published by the Funders' Network for Smart Growth and Livable Communities[1] to focus on the practical aspects of how we create smarter, more livable communities for all. The series highlights successful strategies, explores tensions created by competing issues, and generally helps spur informed debate on critical topics. This paper was written by Gary Moll and Jeff Olson from American Forests.[2] Previous topics in the series include vacant properties, the fiscal and competitive advantages of smarter growth development patterns, the role of environmentalists in city building, and community organizing.

Abstract

Trees, like the proverbial miner's canary, are indicators of environmental quality. Healthy trees and adequate tree cover produce a variety of benefits—ecosystem services—that offset the need for costly investment in facilities to manage stormwater, mitigate air and water pollution, and insulate against temperature extremes. Collectively, city trees comprise an urban forest that can be thought of as a city's green infrastructure just as a city's roads, sewers, bridges, and water treatment plants comprise a city's gray infrastructure. Investment in maintaining green infrastructure pays off in reduced spending on gray infrastructure, yet, the annual municipal budget and planning process address only gray infrastructure needs, leaving the green to wilt. Better and more livable communities—walkable neighborhoods; distinctive and attractive places with a strong sense of place; mixed land uses; open space and farmland preservation; protection of natural beauty and important environmental areas—rely on healthy green infrastructure. This paper provides a road map for improving urban environments and making cities better places to live by fitting natural resources more effectively into the foundation of the city, its infrastructure. Further, it describes specific tools available to help accomplish this goal. This paper is designed to raise awareness of this tool and the strategies that correspond to it among grantmakers, practitioners, policy-makers, and citizens.

Introduction

Cities, often thought of as the inverse of nature, are now recognized as the most environmentally-friendly place to house the world's population. In August 2002, a special feature in *The New York Times*[3] reported that the number of megacities[4] in the world would rise from 20 to 36 by 2015. The trend gives hope for balancing the needs of people with the abilities of the environment to house them.

Notwithstanding the enormous challenges associated with concentrated poverty and spread-out patterns of development that often accompany rapid urbanization, the fact is people who live in cities leave a smaller footprint on the environment per capita than other community arrangements. As the *Times* reported, "…environmental improvements can come quickly to cities."

Trees and Cities

There is a close relationship between how green a city is and how well the city meets its potential to reduce human impact on the natural environment. By virtue of their capacity to serve as non-structural stormwater management devices, air purifiers, and air conditioners, trees are city assets that provide largely untapped opportunities to reduce the costs of managing the city infrastructure. Greener cities are measurably better in terms of air, water, energy, and public health needs. A city's trees, then, represent asset-producing essential "ecosystem" services. These ecosystem services, though rarely accounted for by city managers, represent the output of the city's "green" infrastructure. As the green infrastructure is lost to sprawling patterns of development, city managers are forced to replace these services provided for free with capital projects, such as stormwater systems that require additional taxes on city residents.

Building and maintaining cities with a healthy green infrastructure is a challenge that plays itself out at two levels. The "big picture" decisions made by city elected officials manage the community as a whole. It is in this context that the role of trees as green infrastructure can be placed in context with the total mix of city infrastructure. It is this wider perspective of decision making that is the subject of this report. Tree management decisions, on the other hand, deal with the specifics of planting and caring for trees and are generally made by an urban forester or municipal arborist.

Gray and Green Infrastructure

The physical framework of a city is its infrastructure. Decisions about the composition of the infrastructure are the key to producing greener cities for the future. A city's infrastructure can be divided into two types, gray and green.

The gray infrastructure—roads, sidewalks, buildings, and utilities—is comprised of the man-made structures designed to facilitate transportation and provide housing. Gray infrastructure is impervious and inert. When impervious surfaces dominate a city's structure as they do in most cities today, their interaction with natural cycles of air and water become a costly problem. Impervious surfaces repel water quickly, causing flooding, expensive stormwater management problems, and lowering water quality. The gray infrastructure also heats up on hot summer days and holds its heat late into the evening. The added heat causes people to use air conditioning longer during the day straining local utility capacity, especially during times when energy providers are challenged by peak load demands.

A city's green infrastructure is made up of trees, shrubs, open spaces, and soils. The benefits—ecosystem services—are produced by trees and other living plants for free. Those services range from cooling, insulating the city from temperature extremes, filtering pollution from the air and water, and managing stormwater flows, to carbon sequestration and improving the aesthetic beauty of a community.

Urban infrastructure needs to be both green and gray, but establishing a complementary portion of each element of the infrastructure is the key to maximizing the city's assets and minimizing costs like increasing energy usage during peak load periods. When trees cover a substantial portion of the city, their benefits are substantial. When tree cover is low, not only are the benefits low, but also the stress on the existing tree resource is high. Consequently, cities that have excessive amounts of gray infrastructure work against the natural cycle of air and water and, therefore, are more expensive to manage. Cities become hotter and dryer as the percentage of gray infrastructure increases. Balancing between green and gray infrastructure makes good sense from the financial and community health point of view.

To establish a healthy balance of green and gray infrastructure, it is useful for citizens and practitioners to advocate that city officials:

1) Think of trees as a public utility during the budget process;
2) Establish a tree canopy goal or target (25 to 40 percent tree cover) that is considered as part of every growth, development, and maintenance project;
3) Create a formal process for measuring tree cover and a data layer in the city's geographic information system devoted to trees; and
4) Adopt public policies, regulations, and incentives to increase and protect the green infrastructure.

The following sections will address each of these areas in turn.

Trees as a Public Utility

As a component of a city's infrastructure, trees can be thought of as public utilities providing services to residents of a community for which those residents can be assessed a maintenance fee. In Garland, Texas, for example, city officials established a stormwater utility fund to support flood control measures, improve groundwater recharge, and to encourage ecological preservation projects. They recognized that increasing the tree cover would reduce the impervious surfaces in the city. Therefore, they established a fee system to direct the stormwater management costs to owners of property based on the amount of impervious surfaces on the property. The fee system created incentives to reduce impervious surfaces, and to both plant more trees and site them in places better suited to growing trees. Such incentives, combined with public encouragement through advocacy by community groups and community leaders, helped property owners recognize the community-wide benefits of planting and maintaining trees and encouraged them to take action to help build green infrastructure.

Scientific research and long-term engineering studies document the work trees do to improve water and air quality, manage storm runoff, and conserve energy. Trees reduce the movement of stormwater and cut peak flow rates that cause flooding and tax stormwater sewers. Large metropolitan areas could easily save hundreds of millions of dollars by increasing their tree cover by just 5 to 7 percent. Unfortunately the trend in tree cover is going the other way. A recent analysis by American Forests of the tree cover in the ten county Atlanta metro area revealed that $2 billion in stormwater facility construction was needed to offset the tree cover removed over a recent 25-year period.

Trees, Stormwater, and Air and Water Quality

Like other public utilities, a dollar value can be placed on the services trees provide. For over 50 years, the USDA Natural Resource Conservation Service has monitored the movement of stormwater across various land covers and measured the effects of the land on the water. As a result of these studies, not only can the amount of stormwater produced from identical rainstorms on different land cover be measured, but also the specific volume (a measurement from which facilities construction costs can be calculated). Using these stormwater runoff figures, the effect of trees on water quality can also be measured. Using the U.S. Environmental Protection Agency's and Purdue University's model, increases in pollutant concentrations are measured when trees are removed. A dollar value can also be placed on air quality using the research model developed by Dr. David Nowak of the USDA Forest Service. This model has been derived from measurements taken in 50 cities. Trees also provide cities with substantial aesthetic and social values which, while difficult to quantify, should be acknowledged by community leaders.

While the science and engineering models are complex, cities currently apply complex mathematical models to infrastructure issues using Geographic Information System (GIS) technology. By using satellite or aerial imagery a green layer of information can be developed and included in the city's GIS system.

While stormwater management benefits alone are often enough to demonstrate the functional value of trees to a community as a whole, urban forests provide a number of essential ecosystem services. Trees reduce urban heat island temperatures, improve air quality, and reduce energy consumption. Trees improve air quality by reducing troubling pollutants like sulfur and nitrogen as well as trapping particulate matter and removing it from air. Hot summer city air not only produces discomfort and results in people using more energy to cool buildings, but also results in air quality problems as smog is formed when airborne chemicals mix at higher temperatures.

Trees cool urban areas "indirectly" as leaves evaporate water and air moves under shaded tree crowns. Trees cool homes and buildings directly by shading, which can result in energy savings that average 20 percent when compared to a house not shaded by trees. The potential of trees to cool a neighborhood was dramatically illustrated by a project developed by Habitat for Humanity in Atlanta. Its Mount Zion Manor project built seven new homes with minimal landscaping. The Georgia Forestry Commission developed a landscape plan that recommended removal of unhealthy trees, selected additional species, and sited new trees to maximize energy conservation. When trees were modeled to 30 years growth, the environmental benefits were dramatic. Tree canopy increased from 6 to 21 percent. Energy savings grew from $50 to $951 annually. With less energy needed to cool homes, local utilities generated less energy and produced less atmospheric carbon pollution. This "avoided carbon" increased from 25,000 pounds to 427,000 pounds. The increased tree canopy would reduce air pollution valued at $119 annually. An additional 60 pounds of carbon will be sequestered annually. The site is also projected to save an additional $3,000 on stormwater management costs.

Recent U.S. Environmental Protection Agency (EPA) air and water quality standards for cities have called more attention to the contribution of trees to air and water quality. Being classified as a non-attainment city for air quality[5] results in fines and loss of federal funding for capital projects.

Unfortunately, while maintaining robust tree canopy cover makes good economic, social, and environmental sense, the functional role of trees in cities is not adequately documented or widely known. The size, shape, and location of a city's green infrastructure can be measured and the ecosystem services it provides can be accurately calculated. Taking the measurements, doing the calculations, and applying the dollar values of the work of trees to the city budget is the process that will produce better cities in the future. Some cities are starting to recognize that trees are public utilities. As of March 2004, American Forests has analyzed tree cover and determined the value of trees as public utilities for 26 cities in the United States. Looking at air pollution filtration benefits alone, trees in seven cities—San Antonio, Texas; San Diego; Atlanta; Buffalo, N.Y.; Philadelphia; Charlotte; and Knoxville, Tenn.—filtered out pollutants valued at more than $582 million dollars in avoided health care costs.[6]

Cities can also use ecological and economic benefits of trees to guide planning and redevelopment of their communities. Philadelphia's Green City Strategy, which preserves and increases green infrastructure, not only can revitalize this city, it can change sprawling patterns of development in the Delaware Valley region. For example, among the Mayor's Neighborhood Transformation Incentive projects, the Townhouses at Frankford Creek infill development project is intended to revitalize Philadelphia's neighborhoods. This five-acre brownfield[7] will be transformed into 50 new homes with a green open space buffer adjacent to Frankford Creek.

The Townhouses at Frankford Creek are located in a combined storm sewer overflow system, typical of older cities. Stormwater storage facilities for this type of system cost approximately $52 per cubic foot, seven times the cost of detention ponds used in systems that separate sewage from stormwater. The site currently has 4 percent tree cover, 86 percent impervious surfaces, and 14 percent open space. When redeveloped with townhouses and vegetation, the site schematic could have a 25 percent tree canopy, 52 percent impervious surfaces, and 48 percent open space.

Environmental benefits increase dramatically when modeled using this new land cover configuration. With a 25 percent tree canopy, trees will reduce stormwater runoff by 5,826 cubic feet, which will save $303,000 in the cost of facilities that would otherwise have to be built to manage the stormwater runoff. The increased tree cover provides an additional 129 pounds of pollutant removal, valued at $343 annually and an additional 400 tons of carbon is sequestered annually.[8]

Establish Tree Canopy Targets

To maximize the benefits provided by urban forests and to track its condition in a specific location, the first step is to establish a goal for tree canopy cover. Tree canopy cover (the percent of a city's land area shaded by trees) targets provide a useful way to assess how close a city's green infrastructure comes to its potential. Such targets take into account factors such as local climate and other natural ecological conditions. While the ideal tree canopy for Philadelphia, for example, is very different than Phoenix, each has a tree cover target or goal that is ideal for them. To help guide city leaders in setting tree cover targets for their communities, American Forests produced the following generic guidelines for specific zoning categories for cities in the United States east of the Mississippi and in the Pacific Northwest:

- Metropolitan area—average tree cover counting all zones = 40 percent;
- Suburban Residential zones = 50 percent;
- Urban Residential = 25 percent;
- Central Business District = 15 percent.

Cities are starting to incorporate these guidelines into public policy. For example, less than a year after their urban ecosystem analysis revealed that the Roanoke, Va., area had only a 32 percent tree canopy, the city council passed an Urban Forestry Plan. The top priorities include reaching a 40 percent citywide tree canopy goal within ten years and requirements for more tree planting and tree protection during new land development. The city has also updated their zoning ordinance that specifies tree canopy cover by land use and specifies minimum tree canopy cover in parking lots.[9]

While these percentages are a good starting point for communities, they should be used only as a guide. Geography and local climate are important factors in establishing more precise local targets.

The average urban tree cover for 20 states in the northeastern quarter of the country is 30 percent. American Forests analyzed tree cover in about a dozen metro areas nationwide and found them to be 25 to 35 percent depending on their underlying environmental conditions. As you might expect, cities in the Southwest United States have less tree cover than cities in the Mid-Atlantic states. From the analysis, American Forests was able to identify potential, if somewhat generalized, tree cover targets. These recommendations find that average tree cover in metro areas east of the Mississippi and in the Pacific Northwest should be about 40 percent, while cities in the dry Southwest and Plains states with much smaller natural tree covers should shoot for tree targets of about 30 percent.

A decision to maintain a specific percentage of the green infrastructure must be made at the highest levels of government so that the managing departments can carry out the detailed actions needed to meet those goals. The tree cover targets and the challenge to incorporate trees into all growth and development activities must be shared by key departments of city and county governments as well as by the private building industry. Allowing construction practices that damage, kill, or remove trees—whether they occur on public or private property—without replacing them should no longer be acceptable. Assuring trees will live is not a small challenge, but one that must be accepted by everyone that builds infrastructure.

Develop a Formal Process for Measuring Tree Cover

Cities can measure their tree cover and develop a "green data layer" or theme in their geographic information database. Geographic Information System (GIS) technology allows a

Table 1: Tree Cover Targets—Fairfax County, Va.

Tree cover percentages for broad land use categories

Land Use Category	Recommended percent tree cover	Percent tree cover required by ordinance	Typical percent tree cover provided	Recommended goal for tree cover percentage
Low-density residential (57 percent of land area)	50	20	30 to 35	50
High-density residential (6 percent of land area)	25	15	15 to 20	15
Central business districts (7 percent of land area)	15	10	10 to 15	15
Other categories (30 percent of land area)	N/A	Varies	10 to 100	N/A
County wide	40	Not more than 20	Varies	40

Category descriptions:

- *Low-density residential*—residential uses with a density of up to five dwelling units per acre;
- *High-density residential*—residential uses with five or more dwelling units per acre;
- *Central business districts*—commercial and industrial uses;
- *Other*—public, institutional, recreational, floodplain, and vacant.

city to determine not only existing tree cover, but also can calculate the dollar costs and benefits of changing the tree cover. In Fairfax County, Va., for example, the urban forestry department evaluated the tree cover based on land-use and developed tree cover targets in five categories. Table 1 on page 7 shows the recommendations of the county of Fairfax.

Collecting, storing, and using object-oriented gray infrastructure data are the standard business practices in most cities today. Adding a tree cover data layer to this information makes good sense. With this data, the location of a tree, light pole, or sidewalk can all be stored in the database and displayed on a map by any department at any time. By storing green and gray infrastructure data in one database using a GIS, all department heads and city wide decision-makers can view the same data and identify opportunities and conflicts before decision on specific actions are made.

Storing tree information in a spatial data file is a change from the past, but offers decision-makers many new management opportunities. The urban forestry division in the Parks Department in Cincinnati, Ohio, is using high resolution color aerial photography and GIS technology to measure the city's tree canopy in the city and incorporate the air quality and stormwater benefits of the tree cover into their decision making. The information provided by the urban forestry section defining the green infrastructure is available to other departments so they can consider the impact of their work on not only the trees, but also air and water quality requirements of the city.

Traditionally tree inventories have been conducted by cities to determine how many trees the city owns and what their maintenance needs are. While such data can be very valuable to the tree management department, data alone do not provide city leaders with the information they need to build budgets or manage the city's green infrastructure. Using GIS, however, allows a community to calculate the benefits of all the trees in the city not just the ones growing in the public spaces. The trees can be viewed as citywide assets when they are given a geographic address rather than a street address.

In the spring of 2002, the city of Washington, D.C., moved its tree inventory system from a street address system to an asset management GIS system. While its focus is daily maintenance of publicly owned trees, the collection system "talks" with the other city management data management systems and therefore offers city leaders opportunities for additional uses in the future. This concept is further strengthened by the fact that about 80 percent of the trees in a city are on private property. Since the entire tree resource is responsible for stormwater and air quality benefits, it is necessary to calculate the benefits of the entire tree resource before decisions are made.

Data describing the land cover in a community are the starting point for conducting an urban ecosystem analysis and applying the findings to daily decision making. High-resolution satellite imagery collected when the leaves are on the trees provides the data needed to measure the value of urban trees. When satellite data are classified into green and gray land cover elements, they describe the structure of the land and provide decision-makers with the information they need to determine the ideal canopy cover for their community and to develop the policies needed to establish and/or maintain it.

Creating a Green Infrastructure: A Green Data Layer for City Planning and Management

Adding a green infrastructure data layer to the decision making process introduces a new dimension to planning and development discussions, one that considers how to work with the natural environment instead of building costly infrastructure to manage air, water and energy systems. By developing and using a green data layer, future decisions will include better information about the full range of community resources.

The first step in creating a green data layer for use in GIS is to acquire land cover data from satellites or specially equipped airplanes. The data are acquired during the growing season, when the leaves are on the trees. Specialists classify the images into useable data. They analyze the images to determine the different land cover types—areas covered in trees, grass, or open space can be distinguished from parking lots, building and roads. This analysis produces a digital green data layer that can be added to the gray infrastructure data which is commonly used in GIS for local planning.

Two types of satellite imagery are useful for determining tree cover in cities. Landsat data are very useful for evaluating change over time in tree cover and providing the decision-makers with policy-relevant data. The Landsat satellite has been circling the earth since 1972 and therefore can provide a good view of the historic changes that have occurred. More recent satellites now carry high-resolution sensors which can make out individual trees and are useful for detailed decision making. Aerial imagery also offers a community an excellent opportunity to map tree cover and separate the landscape into gray and green objects. Landsat data are most useful in supporting general decision making while high-resolution satellite aerial images are needed to create a map of green infrastructure for daily decision making.

Once the green data are prepared into green and gray elements, they can be used by all the city management departments and planners for decision making. Many opportunities exist to plan more trees into new development and save them during daily maintenance activities. Many trees are lost now because departments have independent and sometimes conflicting goals. Trees are living city resources which are frequently damaged or killed by infrastructure maintenance. The solution to this problem and the recipe for greening up city infrastructure is for the city leaders to set tree cover targets.

Administrators can make simple work of complex calculation documenting the effect of the natural system on stormwater, air quality, and energy conservation by using a desktop GIS software application called CITYgreen software. CITYgreen calculates the dollar value of green infrastructure by engaging scientific and engineering models to the urban infrastructure. It provides decision-makers with facts about the value of their investment in trees and the related natural systems. While only local decision-makers know what factors need to be considered for any development project, CITYgreen helps by providing the facts about the financial impact of various decisions.

Establish Public Policies, Regulations, and Incentives

Public policies, regulations, and incentives are three powerful tools available to local administrators for improving a community's green infrastructure. Tree cover and green infrastructure can be considered the same resource in terms of the policies, regulations, or incentives. Designing policies that improve tree cover is probably the most efficient and logical way to make the most widespread improvement in the city's green infrastructure. Communities that are serious about improving their green infrastructure should consider adding a green data layer in the community's GIS system. This single change makes a huge difference in the future of a city's infrastructure because it changes the way every departmental manager sees the city's resources.

Some areas have changed stormwater management guidelines to allow non-structural devices to be used to abate storm flow. Such policy changes also address regulation and incentives. Regulations that affect public trees only provide the least effective protection of the green infrastructure. Tree ordinances often specify the compensation paid for tree removal during development or specify what kind of trees can be planted in a specific area. While these regulations may be valuable, they are very focused on a specific problem and do not address the larger issues of protecting overall tree cover. A better approach for city leaders is to distinguish between ordinances that regulate trees on public property and ordinances that affect tree canopy city wide. Which tools are right for a community must be determined locally.

A wide array of public policy tools which give trees a higher status in community operations are now in use by cities all across the country. None are perfect, but a community can use ideas from several different policy statements or ordinances.

In North Carolina, Charlotte Mayor Patrick McCrory is passionate about promoting green infrastructure as the region explodes in growth. The area lost 22 percent in both tree canopy and open space between 1984 and 2001 and stands to lose $6 billion in federal funding if it falls into non-attainment under the Clean Air Act.

Laura Brewer, an urban forester in North Carolina's Engineering Department, says that without the city's tree ordinance, which recently added new residential tree protections, the Urban Ecosystem Analysis (UEA) findings would have been drastically worse. With the new green data layer,[10] she can test the current tree ordinance to see if its canopy percentages and plantings meet environmental requirements. This will give ammunition to beef up their ordinance if need be.

The city of Salem, Oregon, is incorporating local ecosystems into urban forestry and riparian protection programs. The Willamette River and three tributaries that flow through the city provide essential salmon habitat to Winter Steelhead and Spring Chinook, two species currently listed as threatened under the federal Endangered Species Act. Recognizing the city's legal and ethical obligation to maintain water quality and conserve critical wildlife habitat, it created new policies and programs to increase tree canopy cover, preserve and restore riparian areas, and promote alternative stormwater treatment facilities.

An urban ecosystem analysis was conducted of Salem's entire Urban Growth Boundary, which included 12 sub-basins and riparian buffers at 50 feet and 200 feet along 50 perennial streams. These data provided quantifiable measurements on the relative health of Salem's watersheds and riparian areas since canopy cover directly relates to watershed function. Findings from the urban ecosystem analysis provided staff with information for two natural resource programs, one focusing on urban forestry and the other, riparian protection and enhancement. The city is in the process of updating its Tree Preservation[11] and Greenways[12] ordinances.

The number of new landscape and tree ordinances being established by communities is substantial, yet it must be noted that the tree deficit is growing a break-neck speed. This is not to suggest that a tree ordinance is not a good idea for a community, but rather that much more needs to be done.

But more than new regulations and ordinances are needed to maintain healthy tree cover for a community, and new policies and incentives in conjunction with the ordinances can help. Policies that recognize trees as a public utility, help establish a green data layer in the cities central database, set targets for balancing the green and gray infrastructure, and establish regulations and incentives to improve the tree cover are all needed for cities to be greener in the future.

Conclusion

The green infrastructure represented by urban forests provides cities with a cost-effective means of managing stormwater, air and water quality, and urban heat buildup. Yet all too often, the green infrastructure is sacrificed to growth and development based on an incomplete set of facts and a lack of understanding of the value of natural capital. Understanding and quantifying the value of the natural capital represented by urban forests, and the services they produce, is key to assuring that development decisions respect the contribution of urban to developing livable communities.

Building and managing cities requires considerable engineering and financial resources which in today's city are electronically linked together in an enterprise database. Unfortunately that database is missing some critical information—a green data layer. The green data layer provides decision-makers with the information they need to create livable and lasting communities and the catalyst for funding, program, and policy changes.

To illustrate, American Forests conducted an urban ecosystem analysis of 636 square miles of the Washington, D.C., metropolitan area to build a "green infrastructure" data layer for use in community planning and development. The data were assembled using remote sensing images and data collected by satellite in the summer of 2001. The study produced detailed and reliable information about the region's land cover features, especially its tree cover (something that had never been done before). Over 100 local agencies and groups in the region can use the data for daily decision making.

As a result of the urban ecosystem analysis, several important changes have taken place in Washington, D.C. A $50 million donation was made through the Garden Clubs of America to finance a new group called the Casey Tree Endowment Fund. The Mayor elevated the city's concern for improving the tree cover by hiring a new city forester and increasing the city's support for the program. An aggressive new "Tree Bill" has been introduced into the legislature and is going through the public hearing process. And the National Capital Planning Commission is using CITYgreen software for reviewing tree cover for all new projects.[13]

Trees represent the natural capital of a community, an asset that pays the city dividends when properly valued and maintained. The technology is available today to measure a community's natural capital and calculate the benefits it provides. For city leaders, the challenge is to invest in enhancing natural capital by incorporating trees into their infrastructure.

Endnotes

1. This paper is published by the Funders' Network for Smart Growth and Livable Communities, whose mission is to expand funders' abilities to support organizations working to build more livable communities through smarter growth policies and practices. For more information, visit www.fundersnetwork.org.
2. Gary Moll is vice president, urban forests, and Jeff Olson is vice president, marketing and development, for American Forests, whose mission is to grow a healthier world. Its core strategy is designed to provide action opportunities to targeted audiences to enable them to improve their environment with trees. For more information, visit www.americanforests.org.
3. *The New York Times*. August 20, 2002.
4. Cities with populations of more than five million people.
5. The Clean Air Act requires the U.S. Environmental Protection Agency to set federal standards for six air pollutants at levels to protect human health. The six pollutants, termed "criteria pollutants," are carbon monoxide, ozone, nitrogen dioxide, mercury, lead, and particulate matter. Being designated as a non-attainment area under the Clean Air Act carries significant fines and penalties.
6. These reports can be found on the web at www.americanforests.org.
7. A brownfield is defined as an industrial or commercial parcel that is abandoned or underused and often environmentally contaminated, especially one considered as a potential site for redevelopment.
8. These estimates are based on analyses conducted by American Forests, using its CITYgreen software. The analyses regarding air pollutant removal and carbon sequestration, in particular, are derived from algorithms created for the U.S. Forest Service by David Nowak, Ph.D.
9. www.roanokegov.com/WebMgmt/ywbase61b.nsf/vwContentFrame/N254GHSJ0G3LWODEN.
10. Created by American Forests.
11. www.cityofsalem.net/~naturalr/Trees/Proposed_Ord_index.htm.
12. www.cityofsalem.net/~naturalr/Will_Greenway/willamette_greenway_index.htm.
13. CITYgreen software is a GIS application for land use planning and policymaking. The software conducts statistical analyses of ecosystem services and creates understandable maps and reports (www.americanforests.org/productsandpubs/citygreen/).

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Expanding funders' abilities to support organizations working to build more livable communities through smarter growth policies and practices.

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