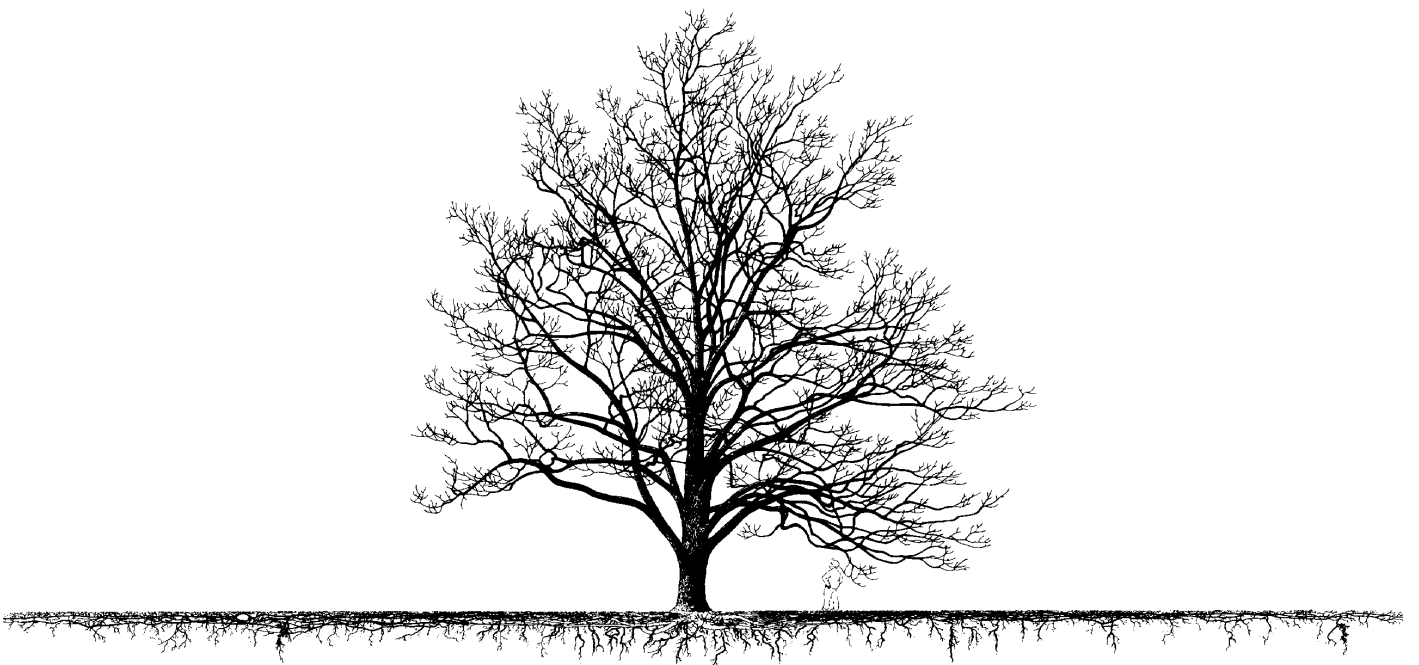


GEORGIA MODEL URBAN FOREST BOOK

Georgia Forestry Commission



Acknowledgements

This document was created to help communities better understand, preserve, plant, and maintain trees and forests as an important community resource. We hope that this document inspires citizens, local officials, foresters, landscape architects, engineers, and planners to shift their focus from the existing development model to an urban forest model, recognizing the importance of trees and other vegetation for improving communities and restoring natural areas.

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INTRODUCTION

The Model Urban Forest

This handbook was created to provide communities and citizens with the information, tools and references necessary to begin to plan development with the “green infrastructure” of the urban forest in mind.

Trees are an integral part of both our communities and the ecological systems in which these communities exist. They provide significant economic, social and ecological benefits. They are as necessary as water, roads, and energy to sustaining healthy communities.

The collection of trees in and around our communities make up what is called the urban forest. We are rapidly losing this resource and must rethink the way we plan and build our communities in order to stop and eventually reverse this trend.

In the urban forest, a single tree may be as important as a patch of forest remnant. We must preserve existing trees, plant new ones and maintain them to sustain the urban forest system.

A Call To Action

The State of Georgia experienced rapid population growth in the late 90's, becoming the fastest growing state in the South. Four counties in or near the Atlanta metropolitan area ranked among the top 10 fastest growing counties in the U.S. One effect of this rapid growth is declining air quality, most notably metropolitan Atlanta's battle to reduce airborne emissions and ground level ozone. Another effect of rapid growth is the loss of tree cover and as a result, some Georgia communities are no longer able to meet clean air and water standards. Increasing flooding is another result of the loss of tree cover. In 1999, metropolitan Atlanta lost about 50 acres of tree cover daily. However, loss of tree cover is not confined to metropolitan Atlanta and is occurring across Georgia.

The Savannah Tree Foundation found that in Chatham County, between 1973 and 1992, 27% of the county's acreage lost a significant amount (defined as 20% or more) of tree canopy. While 60% of tree canopy loss occurred in unincorporated areas of Chatham County, almost 20% occurred within the City of Savannah. In addition, the study showed tree canopy loss accelerated

“THE CREATION
OF A
THOUSAND FORESTS
IS IN
ONE ACORN.”

-RALPH WALDO EMERSON
1803-1882

The Model Urban Forest



The best of Savannah's wonderful shaded squares - an example to the nation of well-placed trees in an urban area.

4



Beyond the historic district Savannah abandons its tree heritage and follows the sprawling development patterns typical of other Georgia towns and cities.

during the last 8 years of the study compared to the previous 11 years. Communities of all sizes across Georgia are experiencing loss of tree cover due to growth. The importance of this issue was highlighted on April 16, 2000, when Governor Roy Barnes signed Senate Bill 399— Georgia Greenspace Program Act. The Act provides the framework for Georgia communities to preserve at least 20 percent of their land base as open space or "greenspace" for use as passive recreation and natural resource protection – ideal space for trees and forests.

Trees provide communities with many economic, ecological, and social benefits. Trees shade and cool, increase property values, prevent water runoff and soil erosion, improve water quality, reduce energy use, clean the air, and enhance wildlife habitats. Trees even help reduce stress and help us recover from illness more quickly. These benefits are why it is important to create and sustain urban forests, maintain undeveloped land and plant trees for future generations. The urban forest is both a collection of individual trees in a traditional landscape setting, as well as forest remnants in parks and open space. It is the tree in your backyard, the street trees on Main Street, and the trees that grow along a stream. Together these trees create a functional canopy that provides us with these economic, ecological, and social benefits.

Project Purpose

This report is the work of the Georgia Forestry Commission and those who participated in the Model Urban Forest workshops held in the spring and summer of 2000. The purpose of this report is to provide information on how trees and forests can improve communities and their natural systems. It is intended to serve as a model for citizens and local officials on how to incorporate trees in the development process. This report will help organize community support for better urban forests. Planning and designing spaces with trees and forests in mind can help create revitalized communities and natural areas.

In January 2000 the Georgia Forestry Commission published Georgia's Urban & Community Forest – An Assessment and Five-Year Strategic Plan 2000 – 2004. The plan outlines a multi-step strategy to improve Georgia's urban forest. The Georgia Model Urban Forest is intended as

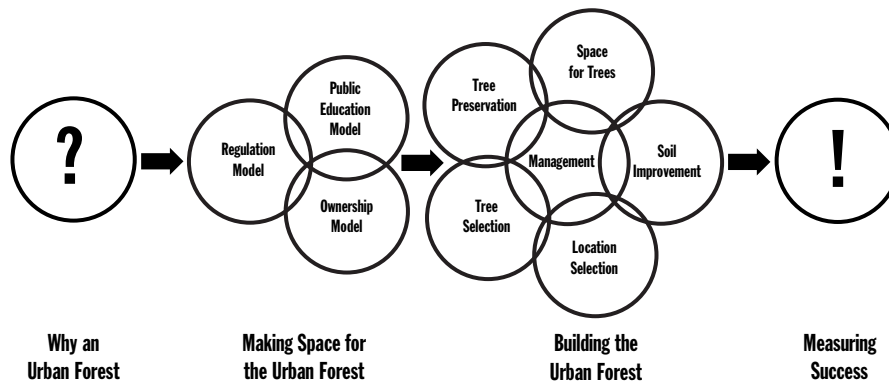
The Model Urban Forest

a significant tool in the implementation of that plan. As a tool for examining planning policies and implementation, this report will illustrate the urban forest opportunities and constraints in the city of Savannah, Georgia. Savannah, while famous for its historic city squares and graceful tree-lined streets, still faces the same development pressures and challenges as other Georgia cities. As such, Savannah is a poignant example of both urban forestry success and failure.

Along Abercorn Street in Savannah, four development types that can be found in most Georgia communities are represented: the urban core, older suburbs, recent suburbs, and rural areas. Abercorn Street begins near the Savannah River, runs through the historic district, through older suburbs and recent suburbs and ends in rural Chatham County, becoming State Route 204. These four general development types will serve as a framework to examine current development patterns and regulations, and to discuss potential development options and guidelines for creating and sustaining the model urban forest.

The Model Urban Forest

The model urban forest consists of four parts. The first part explains why we need a community vision for the urban forest in terms of economic, ecological, social, and aesthetic benefits. The second part develops policy models that will help communities develop political support and make the needed space for the urban forest while still respecting economic growth. The third part organizes the many skills and techniques that are required to begin to build and maintain the urban forest. The last part of the model provides tools for a community to measure its success whether just starting an urban forest program or evaluating an existing program. The diagram below summarizes the model urban forest.



“Georgia’s Urban and Community Forestry program is an essential component in the daily lives of the citizens of Georgia” from Georgia’s Urban & Community Forest – An Assessment and Five-Year Strategic Plan 2000 – 2004.

The Model Urban Forest

The goal of the model urban forest is to enlarge and improve the urban tree canopy to obtain the economic, ecological, and social benefits of trees.

PRINCIPLES TO IMPROVE THE URBAN FOREST

1. Preserve existing trees and forests.
2. Increase space for tree planting.
3. Preserve and improve the quality of the tree-growing environment.
4. Select trees for diversity and suitability.
5. Select efficient planting locations.
6. Manage the urban forest as a continuous resource regardless of ownership boundaries.

The model urban forest is based on the need to re-examine current development attitudes. It attempts to place trees at the same level of importance as other critical infrastructure elements like roads and utility lines. To do this, we will need to set a collective vision that includes the views and values of engineers and politicians. The following table highlights the existing urban development model compared to the proposed urban forest model.

Existing Development Model	Urban Forest Model
Trees have low priority	Trees have equal priority
Trees as ornament	Trees as infrastructure
Individual trees	Forest
Small and ornamental trees	Large canopy trees
Lawn and paving	Vegetative ground cover
Tree maintenance	Forest management
Aesthetics-based design	Soil/ Ecological-based design

Urban forests and forests in developing areas face a number of challenges that rural or wilderness forests do not face. A rural or wilderness forest area is often under single or limited numbers of owners and can be managed through relatively simple single-purpose policies. In these areas of managed forest, the natural forces of forest succession have a significant effect on the future health of the forest. In contrast, the urban forest is overlaid with a complex set of ownerships, values, and goals with differing maintenance levels and attitudes towards tree planting and preservation. Urban forest growing conditions vary greatly from natural forest processes and are often in conflict with human needs and management attitudes.

This document was created to help communities better understand, preserve, plant, and maintain trees and forests as an important community resource. We hope that this document inspires citizens, local officials, foresters, landscape architects, engineers, and planners to shift their focus from the existing development model to an urban forest model, recognizing the importance of trees and other vegetation for improving communities and restoring natural areas.

Notes

CHAPTER ONE

Why an Urban Forest?

Introduction

What do trees really do for people and the environment? Trees provide many economic, ecological, and social benefits. Trees provide shading and cooling, increase property values, prevent water runoff and soil erosion, improve water quality, reduce energy use, clean the air, and enhance wildlife habitats, to name just a few. While we tend to discuss economic, ecological and social benefits separately, they are actually quite interrelated. A tree that is serving a role in watershed protection, also connects people to the land, provides a shaded place to walk and increases property values in the community.

WHAT DO TREES REALLY DO FOR US?

Trees and forests come in a variety of forms, from forest stands to park groves to garden copses, and urban trees. Every tree has the natural ability to affect air currents, cool the air, and shade the ground. However, older larger trees maximize these benefits. A mature, continuous canopy is important as well, compared to a tightly trimmed canopy or ornamental trees. The model urban forest emphasizes trees as an equal priority in infrastructure. More trees and forest, large canopy trees, vegetative ground cover, soil design, and forest management are necessary to maximize the benefits of trees. The following are highlights of some of the many benefits provided by the urban forest. Use the references at the end of this chapter to discover even more benefits or to gather statistics on particular benefits relevant to your community.

Economic Benefits

Trees provide economic benefits in two important ways. One is by providing needed functions such as cooling or reduced runoff at lower cost than traditional engineering methods. The second is by improving the quality of community life such that the community value is increased. Trees significantly contribute to sustaining the economic vitality of the places where we live and work.

TREE BENEFITS

Adapted from **THE SIMPLE ACT OF PLANTING A TREE: A Citizen Forester's Guide to Healing Your Neighborhood, Your City, and Your World, Tree People.**

1. Provide oxygen. A large tree can provide the oxygen requirements for four people.
2. Clean the air by absorbing odors and pollution.
3. Conserve energy by shading and cooling homes and buildings and breaking up urban heat islands, thereby reducing the need for air-conditioning.
4. Reduce water consumption and increase atmospheric moisture.
5. Reduce water runoff and soil erosion by breaking rainfall and holding soil.
6. Provide a canopy and habitat for wildlife.
7. Transform barren areas and provide buffers from harsh urban landscapes.
8. Increase property values and improve business traffic.
9. Add unity, identity, landmarks, and pride to communities working together.
10. Absorb noise, dust, and heat.
11. Reduce glare.
12. Provide employment.
13. Turn vacant lots into parks and playgrounds.
14. Provide protection against the increase in cancer-causing ultraviolet rays.
15. Serve as friends, companions, playmates, and teachers.
16. Provide spiritual and creative inspiration.
17. Provide social, psychological, health and recreational benefits.



Only 100' wide but several miles long, this forest corridor between a major highway and new housing serves as wildlife habitat as well as providing a noise buffer and shade for residents.

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One recent study compared the urban forests of two Florida cities, Gainesville and Ocala. The study focused on the urban forests effects on reducing pollution and heat island effects from residential electrical use. Residential electrical use was 935-kilowatt hours per month in Gainesville versus 1,075-kilowatt hours per month in Ocala. The resulting yearly savings was about \$126 per household. Gainesville's tree ordinance is mostly credited for the savings, due to the strict and effective tree preservation and planting guidelines compared to Ocala's less strict tree ordinance.

Another study looked at the costs and benefits of the urban forest in Modesto, California. The study demonstrated that the benefits of the city's 90,000 plus trees exceeded management costs by a factor of nearly two, helping to justify the annual municipal tree budget of over \$2 million (\$14.36/resident, \$28.77/tree). Seventy-four percent of this budget was for mature tree care. Aesthetics and other benefits had an estimated value of \$1.5 million (\$17/tree), along with annual air pollutant uptake with an implied value of nearly \$1.5 million (\$16/tree). Next, building shade and cooler summertime temperatures saved over 110,000 MBtu, valued at \$870,000 (122 kWh/tree, \$10/tree). Smaller benefits resulted from reductions in stormwater runoff (292,000 cubic meters or 845 gallons/tree, valued at \$616,000 or \$7/tree) and atmospheric carbon dioxide (13,900 tons or 336 lbs./tree, valued at \$460,000 or \$5/tree). Due to the relatively even-aged structure of the tree population and heavy reliance on a single tree species for benefits, management strategies were suggested to increase the diversity and stability of their urban forest.

Trees can also have a direct positive impact on the financial success of commercial areas. A recent survey completed at the University of Washington indicates that shoppers are willing to pay as much as 10% more for certain goods and services if the shops are located in districts with street trees and other plantings. Many of these economic benefits are also providing significant ecological and social benefits.

Ecological Benefits

The ecological benefits of trees are evident in stormwater and watershed planning. Trees are part of the larger ecological unit,

Why an Urban Forest

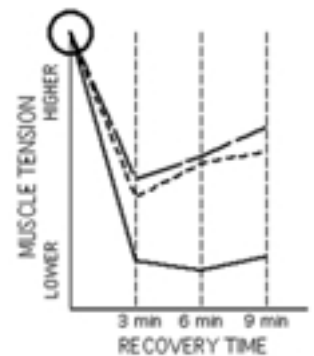
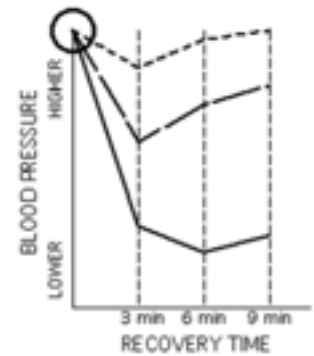
playing a sheltering role in the environment. Planting trees and forests, along with reducing impervious surfaces (such as roads, parking lots, driveways, and sidewalks) buffers water bodies from runoff and associated pollutants that can reduce water quality. Studies have shown that impervious cover greater than 15% greatly affects aquatic resources by reducing water quality. However, not all areas should be planned for 15% or less impervious area, this would be a recipe for sprawled development. Impervious cover greater than the standard should be allowed in urban areas, with impervious cover less than the standard in other areas to achieve a total standard for the watershed or area of concern that is less than 15%.

The spatial pattern of trees and forests matter. The arrangement of land uses and natural systems is critical to the success of planning, design, conservation, and management of trees and forests. One measure of ecological health is the connectivity of the natural systems present. Road and utility line corridors can be barriers to wildlife species, where the ability to move between habitat areas is an important aspect for survival. Wherever possible, forest and habitat corridors should be woven into the urban fabric for increased connectivity. For a detailed discussion of the application of ecological principles in the built environment, refer to **Landscape Ecology Principles in Landscape Architecture and Land Use Planning**.

Social Benefits

The primary mission of local government is the protection of the health, safety and welfare of the community it serves. Trees are an important part of a town's infrastructure contributing to community well-being.

The social benefits of trees have been demonstrated in several studies and these social benefits can often translate into economic benefits. A study at the University of Illinois found that the greener a residential building's surroundings, the fewer the total crimes reported. The types of crimes included both property crimes and violent crimes. Residential buildings with high levels of vegetation had over 50% fewer total crimes, compared to buildings with low levels of vegetation. In residential settings, vegetation enhanced feelings of



POINT OF INDUCED STRESS ○

SUBJECT EXPOSED TO NATURE SETTING _____

SUBJECT EXPOSED TO TRAFFIC _____

SUBJECT EXPOSED TO SHOPPING MALL _____

Controlled experiment where subjects were artificially stressed and then exposed to different environments.

[From Ulrich Et Al, 1991]

safety and worked to discourage crimes, since green neighborhood spaces were used more often. This sense of safety was associated with widely spaced, limbed-up trees and low plantings, rather than dense woods with shrubs and underbrush. Too much planting including tightly spaced trees and dense shrubs will reverse the perceived and real feelings of safety. The same study discussed the link between green settings and the reduction of mental fatigue, which contributes to aggressive and violent behavior.

Trees can improve physical health as well. Each year in the U.S., the health costs of human exposure to outdoor air pollutants is \$40 to \$50 billion. Each year, an estimated 50,000 to 120,000 premature deaths are associated with exposure to air pollutants. Air pollution is a risk factor for asthma attacks. People with asthma experience more than 100 million days of restricted activity due to air pollution. Asthma-related deaths number about 4,000 per year, with asthma costs exceeding \$4 billion a year. Trees help trap airborne particulates and reduce carbon dioxide, thus reducing the risk of asthma attacks.

Trees can help reduce stress in healthy people and can reduce hospital stays and heat-related illness and death. Surgical recovery patients, who looked out their window at a natural scene versus a brick wall, had shorter hospital stays by almost a day. In addition, those same patients took two-thirds fewer pain medications and received two-thirds fewer negative evaluative comments from nurses.

With higher temperatures, calmer winds, and more asphalt and concrete surfaces, air in urban areas is often 2 to 8 degrees warmer than rural areas. Trees shade paved surfaces and buildings, and cool the air by evapotranspiration. Automobiles parked under a shade tree will have an interior temperature 20 to 30 degrees cooler than an automobile parked in the sun.

Trees also block unwanted lights at night and reduce noise pollution between conflicting uses.

Trees and Development

Despite the overwhelming evidence supporting preservation and

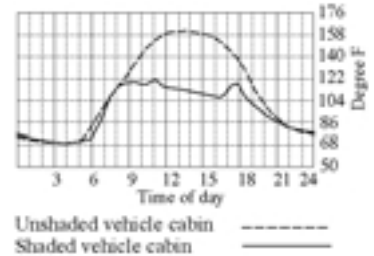
Why an Urban Forest

enlargement of the urban forest canopy, it is not practical to save all existing trees in our urban and suburban areas while still accommodating continued economic growth. However, it is possible to reduce the amount of existing canopy that is removed and replant enough trees to replace the canopy that is lost with only minor changes to development patterns. This will require changing the position trees hold in the development patterns of our communities and require that urban sprawl be controlled. The number of changes a community is willing to make will reflect their understanding of the value of the urban forest and their commitment to its future.

All of the above economic, ecological and social benefits combine to create a sense of wellness of place making people feel better about where they live. In addition, people are willing to pay for this most significant of benefits from the urban forest. As an example, the citizens of Berkeley Lake recently voted to increase their taxes to purchase 80 acres of urban forest in their community.

However, even the best development practices will require some reduction in canopy. While this canopy can be replaced in the future by planting new trees, the time it takes to restore mature trees is measured in generations not years.

Now that we have emphasized the importance of trees and forests in maximizing environmental benefits, we must also consider how to grow older, larger trees. Two important physical factors for mature tree growth include providing healthy soil for trees and providing growing space for trees both above and below the ground. Maintaining a healthy root system is critical to the long term health of any tree. This root system is very large and depends on healthy soil conditions to flourish. The space needed to grow large trees is at least as large as the area within its crown and most trees have roots that extend well beyond the drip line. Making space available for tree roots and crowns can be a challenge to achieve in the urban forest and most of the resources needed to enlarge the urban forest canopy will be used for this effort. The next chapter is devoted to offering solutions to this challenge.



Temperature inside cars parked in shaded versus unshaded parking lots.s.

[From Western Center for Urban Forest Research and Education]



Well-spaced, large trees in an urban core allow for good sign visibility and nearly continuous canopy.



Cheaper land on the edge of development make existing forests an easy target for developers unless strong tree preservation laws are in effect.

RESOURCES

Useful Web Sites

Centers for Disease Control and Prevention

www.cdc.gov/nceh/asthma/brochures/airpollu.html

Environmental Protection Agency (EPA)

www.epa.gov/eftpages/airpollutioneffects.html

Tree People

www.treepeople.org

US Department of Agriculture – Western Center for Urban Forest Research and Education

<http://wcufre.ucdavis.edu>

University of Washington, Center for Urban Horticulture

www.cfr.washington.edu/enviro-mind

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Marcus, Clair. **Healing Gardens**. New York, NY: John Wiley and Sons, Inc. 1999.

Petit, Jack, Debra L. Bassert, and Cheryl Kollin. **Building Greener Neighborhoods: Trees as Part of the Plan**. Washington, DC: American Forests and Home Builder Press, 1995.

CHAPTER TWO

Space for the Urban Forest

In Chapter 1, we discussed the environmental and economic benefits of maintaining a large and healthy urban forest canopy. In this chapter we explore and illustrate the space requirements for urban forests and discuss the feasibility of preserving and planting trees in different levels of development ranging from urban to rural. Development pressures vary with changes in the fabric and ownership patterns of an urban area. Maintaining a healthy urban forest canopy requires many different tools to respond to different situations. We will outline the policy tools available to promote a healthy urban forest and propose an evaluation of the community standard for maintaining canopy cover.

People and Trees

Generally, people like trees. Sometimes, however, we focus on the negative quality of trees rather than recognizing that trees are a key component of our ecological system. Trees with their intertwined root system, protective canopies, and enormous size are responsible for keeping much of our ecological system together. There is a long history in this country of the battle between humans and the forest that carries on to this day. Americans have also had a century long love affair with lush lawns—it may even be ingrained in the national aesthetic—these lawns are compromised by too much shade. Trees constantly drop things like sap, leaves, pollen, twigs, and fruit, not to mention their occasional catastrophic collapse. Trees are not tidy and tree litter bothers some that like the world to be neat and tidy. Also, trees can create places for people to hide by blocking lights at night, making people feel unsafe.

It will take a great deal of public education to convince people that the benefits of trees outweigh the challenges that come with increasing the urban forest canopy. For that, we need a strong educational component as part of the model urban forest.

The importance of trees has been lost in the economic structure that determines the shape of the world we live in. While most

**It will take a great deal
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Succinctly put, trees need dirt.

development regulations give cursory notice to the preservation and planting of trees, none preserve or plant enough trees to make a difference in the larger view of sustaining the life supporting systems that we depend upon. That life support system requires that enough trees be planted to create a forest, even in highly urbanized areas. While individual trees are very important, the sum of the effects of a continuous tree canopy provides the real benefit and is what we must strive to achieve.

To achieve this canopy we must start with large canopy trees that make up our native forest, planted in large quantities at spacings that will form areas of continuous canopy. There are many communities (Augusta, Savannah, and Thomasville) and neighborhoods (Druid Hills and Ansley Park) in Georgia where this is already happening. To no great surprise these communities and neighborhoods are often cherished places to live and work and also have strong property values.

While small tree species such as Dogwood or Crepe Myrtle are important design elements in the landscape, they will never become large enough to contribute to the primary urban forest canopy. The same can be said about larger trees that are planted in places with insufficient resources to allow them to live for long time periods and develop normal canopy sizes. Adding small trees, or trees that will never grow well in the landscape, does not contribute to the much needed urban forest canopy.

Trees Need Dirt

Most tree discussions focus on the parts of the tree above ground. To grow a large, long-lived tree we must refocus on the parts of the tree below the ground. Succinctly put, trees need dirt.

Trees need:

- Great quantities of good quality soil to support the structure above by storing and conveying water, air, and nutrients.
- Soil of sufficient quality to permit root penetration and interaction with its chemical and physical properties.

Space for the Urban Forest

- Soil that is as carefully understood as the breaking strength of a beam in a building and as protected and maintained as the foundations of a house. In most development projects this soil exists as a resource and only needs to be protected and used by the developer.

On projects where there are inadequate soil resources due to previous human activity, soil must be improved or imported to support the tree canopy. Protecting, using, improving, and importing soils will change the way new development is designed and constructed. It will also to varying degrees, increase the cost of construction. Whether a community values trees enough to make these changes and pay for them, will be a direct reflection of that community's values and recognition of the importance of trees.

Many of the development practices of the recent past, such as separated land uses, larger lots, bigger setbacks, wider roads, and engineered drainage systems, take away space and resources from trees by requiring more site grading and paved surfaces. These are the same development factors that contribute to urban sprawl. As we begin to recognize the cost of sprawl economically, socially, and environmentally development regulations must change. In the process of this re-evaluation, we must introduce requirements for preserving and planting healthy trees. Trees, and the soil to support them, must become as much a part of the infrastructure requirements of sound community building as water, roads, and energy. We must build our new communities to be "tree ready."

**We must build our new communities
to be tree ready.**



Trees have enormous root systems that must be given space to grow.

Illustration by Morton Arboretum

A community may assume it is planting a lot of trees through development regulations and community action, but never realize that they are not growing a healthy urban forest.

The single most important requirement for growing large, healthy, and long-lived trees in the urban forest is the quality and quantity of the soil. It is estimated that up to 80% of all tree problems are soil related. This includes many disease and insect infestations. In undisturbed native soils, where the soil mass is not broken into small areas by buildings, paving, or excessive grading, there is normally sufficient volume to grow continuous tree canopies of species that are adapted to the soil type in question. As sites become increasingly urbanized or disturbed, problems related to soil quality and then to soil volume, further restrict the ability of trees to grow and mature. Problems with the soil caused by development activity must be resolved to achieve most of the benefits that result from the creation of a large canopied urban forest.

Even if the soil is of sufficient quantity and reasonable quality, further barriers to the creation of large, healthy tree canopies can result from restricted growth space at the ground level and in the area of the tree canopy itself. Issues that range from constrictions imposed at or near the base of the tree, to competition with buildings, above-ground utility lines, and even other tree canopies can restrict or disfigure tree canopies. The results may be early tree decline, onset of disease and insect infestation, or structural instability.

Unfortunately it takes a long time, 10-20 years, for this process of decline to result in the loss of the tree. In the meantime, the person who planted the tree may be gone. A community may assume it is planting a lot of trees through development regulations and community action, but never realize that they are not growing a healthy urban forest. There may be lots of small trees but few that grow to maturity. Trees less than 15 to 20 years old provide few of the environmental, economic, and social benefits that are considered important factors in the justification for more trees in the urban environment. The need to understand the critical components of tree health applies as equally to the preservation of existing trees at construction sites as it does to determining the success potential of newly planted trees.

Changing the way land is developed and redeveloped affects

individual land parcels at the time of development, but does not address larger stewardship issues. Successful long-term stewardship of the urban forest canopy must include good principles of tree protection and planting to the way space is allocated and trees are planted and protected on all land parcels in the community. In addition, community tree maintenance and management policies must be established. The model urban forest must address all of these issues.

A Model Urban Forest

The model urban forest makes space for tree and forests by developing three policy models that encourage preserving and planting more tree canopy. They are:

- Public Education Model
- Ownership Model
- Regulation Model

These three models organize policy tools that communities can use to maintain and expand their tree canopy at different levels of the community structure and at different times in the development cycle. To develop a successful urban forest, all three policy models must be pursued.

The three policy models can be considered a continuum from less formal to more formal approaches in the implementation of the urban forest model, although the models and their associated tools are not mutually exclusive. Each associated policy tool is summarized and rated (high, medium, and low) according to implementation time, cost, and overall effectiveness. Cost refers to the relative expense to implement the tool versus the other tools, not the overall cost-benefit of implementation.

Public Education Model

The public education model involves the organization and education of citizens and groups who will set the community vision for the future of the urban forest and support the planning, implementation and maintenance of trees and forests. It attempts to change attitudes towards trees and foster wider acceptance of a larger tree canopy.

PUBLIC EDUCATION MODEL

Policies that serve to educate landowners on how to be responsible for protecting, planting, and maintaining trees in lands under their ownership and policies that organize and support citizen actions that improve the urban forest.

OWNERSHIP MODEL

Policies designed to secure and maintain the future of canopy by securing some of the land needed for tree canopy requirements under public ownership. In addition to outright purchase these policies include easements held in the public trust. These policies preserve, plant, manage and maintain these public trees and set the community standard for urban forest practices.

REGULATION MODEL

Policies that impose a higher community value on preserving and planting trees in lands under public and private ownership. These policies regulate the amount of tree canopy to be preserved and planted at the time land is being developed or modified.

Tools within this model include developing programs to convince private owners of tree planting benefits, programs to stimulate and fund tree planting on private property, and organization and support of citizen action groups. These are groups who will become involved in or support tree planting and other urban forest issues such as increased spending on planting and maintenance and stronger tree ordinances.

IMPLEMENTATION TIME Moderate

COST Low

EFFECTIVENESS Moderate to High

1. Develop programs to convince private landowners and other citizens of the benefits of tree preservation and tree planting.

Programs to convince private owners of the benefits of tree planting are generally educational workshops, videos, pamphlets, or newsletters providing information about the planting, care, and maintenance of trees. These programs are voluntary and usually sought by those who already have an interest in the benefits of tree planting, but should be directed at citizens of all ages and interest. Programs should be expanded to include outreach beyond those already inspired. A surprisingly large number of citizens do not like trees on their property and need to be convinced of the benefits of living near large trees. The Georgia Forestry Commission is working on creating new partnerships to disseminate educational material to wider audiences. The University of Georgia Warnell School of Forest Resources can assist communities with these efforts.

2. Develop programs to fund tree planting on private property.

Programs to fund tree planting on private property usually involve tree seedling giveaways coupled with educational components on tree planting, tree care, and tree benefits. These programs can occur regularly throughout the year, or can be focused on nationally recognized days such as Arbor Day or Earth Day. More ambitious programs, such as NeighborWoods, fund larger trees and require the landowner to agree to care for the trees. Private lands can also be the recipients of tree banking by developers provided that reasonable easement restrictions are in place to protect the trees.

IMPLEMENTATION TIME Rapid to Moderate

COST Moderate

EFFECTIVENESS Moderate to High

3. Organize and support citizen action groups supporting tree preservation, tree planting and urban forest programs.

Citizen action groups that support tree planting are usually private, non-profit organizations that raise awareness and funds for tree planting. They can be drawn from school PTA's, garden clubs or environmental groups. American Forests' Global Releaf program has started many such groups. A citizen tree group can become the nucleus of a town volunteer tree board when a professional urban forester is not available. Citizen action groups are vital to political acceptance of new regulations that improve the urban forest.

Trees Atlanta is a citizen action group supporting tree planting in the Atlanta metropolitan area. Trees Atlanta's mission is to "protect, beautify, and preserve our metropolitan environment by planting and conserving our trees." The organization serves as an educational resource for the public, providing information about the value of trees. Trees Atlanta works closely with all city departments in coordinating tree planting projects.

Ownership Model

The ownership model involves the purchase of land or easements by public entities or private non-profit organizations for the establishment of trees and forests. Tools within the ownership model include public purchases of land, private land trust purchases of land, modification of existing public lands for tree planting, and design or redesign of transportation and utility rights-of-way to incorporate tree planting.

1. Purchase land with public funds for tree preservation, tree planting and reforestation.

Public purchases of land can include land dedicated as parks, open space, easements, preservation areas, or wildlife areas where the preservation or creation of urban forest canopy is a compatible use. Land is purchased with public money generally for a public use. This tool may include working to purchase additional land related to another project or reconfiguring a land purchase where the land in question may provide good opportunities to preserve or enlarge the tree canopy. The Georgia Department of Natural

IMPLEMENTATION TIME Moderate

COST Low

EFFECTIVENESS High



Volunteers planting trees.

IMPLEMENTATION TIME Moderate

COST High

EFFECTIVENESS High

IMPLEMENTATION TIME High

COST Moderate to High

EFFECTIVENESS High



24 Large live oak preserved at a commercial site by using a land easement.

IMPLEMENTATION TIME Low to Moderate

COST Low to Moderate

EFFECTIVENESS High

Resources RiverCare 2000 program purchases land to protect, promote, or provide access to certain river sections in Georgia, based on studies of the fisheries, economic, and scenic values of the rivers.

2. **Support the purchase of land by or dedication of land to nonprofit land trust for the purpose of tree preservation or tree planting.**

Private land trust purchase or dedication of land involves land dedicated as parks, open space, easements, preservation areas, or wildlife areas which may or may not be for public use but which preserve or enlarge the tree canopy. The land purchase is usually an agreement between a private landowner and the land trust, although the land trust often works as a liaison among landowners, government agencies, and community groups. Private land trusts are able to function in the marketplace in ways and with timing that public agencies cannot. Land trusts may option important properties before lawmakers or voters can approve funding. The land may be transferred to a public agency after financing is secured. Land acquired by a land trust may be supported with public funds for maintenance or development cost if the land is made available for public use.

Most conservation easements in Georgia are donated by a landowner to a land trust. If the easement is purchased, the price is usually considerably lower than the market value of the land. In either case, a landowner may be eligible for the tax benefits that reflect the donation or the loss of potential income. The Nature Conservancy and The Trust for Public Land (TPL) are examples of national land trusts involved in the purchase and management of land resources.

3. **Modify existing public land to preserve existing trees or plant new trees and forest.**

Existing public lands that could be modified for tree planting or forested areas include government-owned land and government development projects. Sites include open space around schools, housing, military bases, brownfields or redevelopment areas. Projects can be as simple as allowing the PTA to plant new trees at

Space for the Urban Forest

their school to redesigning a large public works project such as a sewer treatment plant to include significant areas of tree planting. Tree planting costs are often low as the land is already available and soil improvement can be made a part of the construction package.

4. Use space in transportation, utility, or other infrastructure right-of-ways to preserve and plant trees.

Transportation, utility, or other infrastructure right-of-way designs can be modified to accommodate tree planting. Transportation corridors include many spaces where tree planting could be incorporated, such as medians, tree lawns, residual spaces, and interchange areas. These areas often need significant soil improvement. Minor adjustments in road and sidewalk alignments and widths can often make the difference in providing adequate space for trees. Interstate interchanges often receive a decorative landscape treatment of mowed lawn with decorative annual or perennial plantings, small shrubs, and small trees. These areas have sufficient room to accommodate safety features such as guardrails or sufficient setbacks and allow reforestation of large canopied trees as a good alternative to the decorative approach. Tree planting along highways provides very high levels of environmental, social and economic benefits.

The Transportation Equity Act for the 21st Century (TEA-21), formerly known as the Intermodal Surface Transportation Efficiency Act (ISTEA), is the newly authorized federal transportation bill written to provide more flexibility in promoting alternative transportation, rather than just highway projects. Projects that "protect and enhance the environment, promote energy conservation, and improve quality of life" are eligible for TEA-21 funding. These projects can include significant tree planting. Baton Rouge Green, a non-profit organization in Louisiana, helped plant 3,000 trees at six major interchanges throughout the city of Baton Rouge using ISTEA funds.

Utility rights-of-way, especially underground pipelines are often places where a significant increase in tree preservation can occur with slight modifications in construction practices. Prohibitions against planting

IMPLEMENTATION TIME Low to Moderate

COST Low to Moderate

EFFECTIVENESS High



Before tree planting on public lands.



After tree planting on public lands.

trees over pipes such as gas, electric, communication and water should be re-evaluated in light of research that shows that tree roots stay in the upper levels of the soil column. The space near and under overhead utility lines is one place where smaller trees should be considered.



Tree preservation in urban areas is a complex process requiring the cooperation of every member of the construction team.

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IMPLEMENTATION TIME Moderate to High

COST Low

EFFECTIVENESS Moderate to High

IMPLEMENTATION TIME Moderate to High

COST Low

EFFECTIVENESS Moderate to High

Regulation Model

The regulation model consists of developing legal tools for preserving and planting trees and forests on public and private lands. Tools within the regulation model include tree preservation and planting ordinances, modifications to development guidelines or regulations for the purpose of preserving and planting more trees, and use of environmental regulations that acknowledge the benefits of trees. The regulation model must begin by establishing a consensus within the community at large, on core issues of the importance of improving the urban forest canopy. The use of this model will have to overcome great political difficulty to write changes to existing law acceptable to the public and the development community. While the effort will be challenging, the effectiveness of strong laws can be enormous. It will be impossible to achieve significant improvements in the urban forest canopy without finding successful ways to use this model.

1. Create and or strengthen tree preservation, planting, or re-planting ordinances.

Tree preservation, planting, or replanting ordinances include planting requirements as part of the building permit process. Community canopy coverage goals must be established and post-construction canopy coverage should be based on acceptable future canopy expectations. Any tree planting requirements must be accompanied by soil improvement requirements that support the required canopy designs. A tree removal permit process must be put into effect to counter the removal of trees prior to applying for a building permit. DeKalb County's (Georgia) tree ordinance recently passed in response to continuing loss of tree cover in that metro Atlanta county.

2. Modify and strengthen development regulations to increase the opportunities to improve the tree canopy.

Regulations that improve the tree canopy can be put into subdivision ordinances, zoning ordinances and PUD provisions.

These include increasing allowable density if accompanied by tree preservation dedications, reduction in required set backs, reduction in road and parking standards and requirements, tree banking, transfer of development rights, or mitigation measures. Existing subdivision and zoning ordinances usually contain set regulations that all development must follow and are generally inflexible, unless a variance is obtained. Often these ordinances are insufficient for protecting land and water resources. State and local planners can be a good resource to improve these laws.

One solution to the inflexibility of subdivision and zoning ordinances is the Planned Unit Development (PUD). PUDs usually allow for more flexibility in project design, particularly for setbacks and density allowances. PUD allowances are generally in exchange for other project amenities like public open space or space for trees and forest. These amenities are located within the PUD. PUDs allow for mixed-use developments, which can reduce driving and parking requirements.

Road and parking design requirements and regulations that set required parking space numbers need extensive re-examination. Reductions in size and numbers would not only make more space for trees but would reduce run off and development costs. Tree banking, transfer of development rights, and mitigation measures also allow for more design flexibility generally in exchange for public amenities. These public amenities (open space, forests, recreational areas, etc.) are not usually located within the project site, but transferred to other locations.

3. Incorporate environmental regulations into the overall development regulations where they improve the urban forest canopy.

Environmental regulations are independent of a specific building permit, often with overlapping jurisdictions. Fulton County, GA, for example, requires a 75-foot pervious surface stream buffer to protect water quality in south Fulton County. At the state level, the Metropolitan River Protection Act (MRPA), written to protect the Chattahoochee River, as it flows through Georgia, requires a 150-foot pervious surface stream buffer and buffers for tributary

IMPLEMENTATION TIME Moderate

COST Low

EFFECTIVENESS Moderate

streams. The higher state standard can be used to create more area devoted to tree planting. In some cases, environmental regulations can be imposed without the trigger of a building permit application such as the prohibition of removing trees in wetlands.

Application Illustration

We have illustrated the feasibility of using these three policy models in Savannah, Georgia and at four different levels of development. These different levels are:

Urban Core

Characterized by higher density development with a commercial and institutional leaning but includes multi-family and single family residential areas. Physically, the urban core has building frontage in proximity to sidewalks and streets. Trees exist as street trees or within parks. The urban core generally has higher story buildings on average than the three other development types. Parking exists as street parking, in decks, or scattered surface lots. Soils are highly variable but usually of poor quality for tree growth.

Older Suburb

Characterized by lower density development with an open character, wider residential streets, houses with larger setbacks on all sides, larger parking lots located between buildings and streets and one-story buildings. In the older suburb, sidewalks are less prevalent due to the emergence of design to accommodate the automobile. Soils are generally good for tree growth but the existing tree canopy is that which the owners have planted absent any regulation.

Recent Suburb

Characterized by medium density development, distinct divisions between land use types especially a separation of residential areas from other use areas, buildings separated from streets, longer blocks, wider arterial streets, more cul-de-sacs, larger parking lots, increased walking distances, and less public space. Soils are generally fair to poor quality for tree growth due to likelihood of grading and topsoil removal.



Urban core – Old existing trees and opportunities for new ones



Older suburb commercial district – A challenging environment to retrofit new trees.



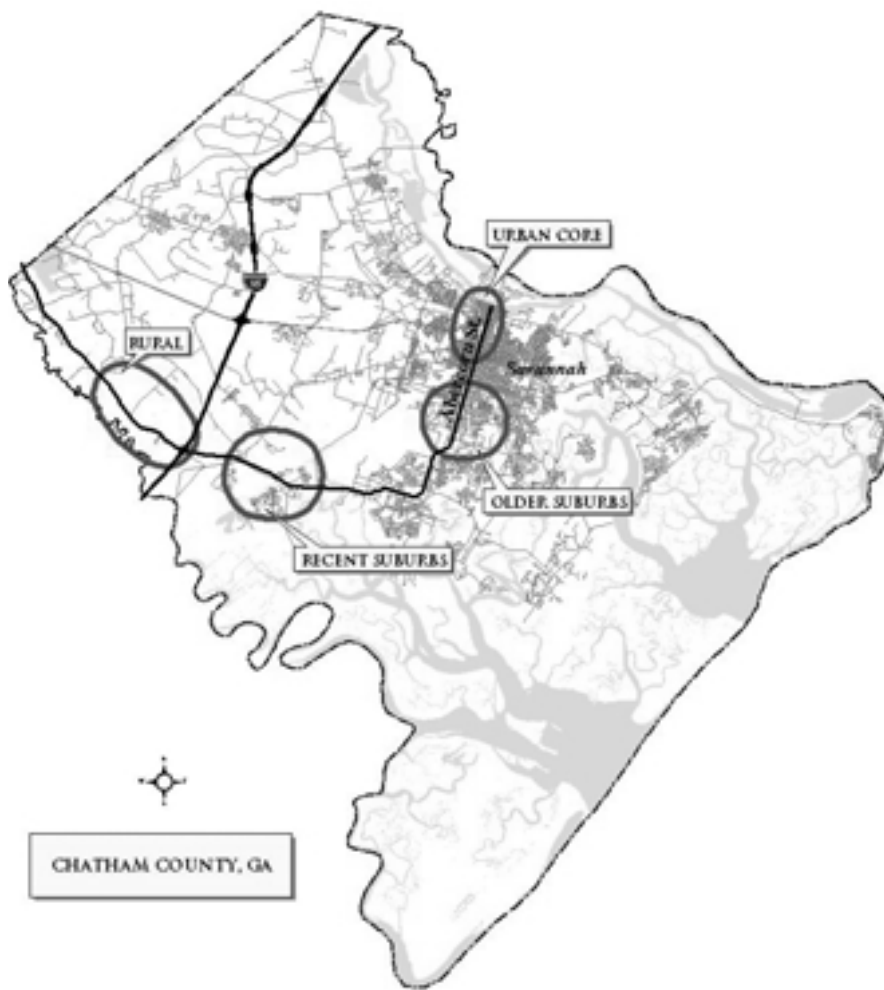
Older suburb residential district – Space to easily add new trees while preserving old ones

Space for the Urban Forest

Rural Area

Characterized by forested areas, occasional fields and scattered housing and commercial buildings associated with farming or forestry land uses. Soils are generally good for tree growth except where disturbed by erosion or grading.

Each development type represents general land uses found in American cities as they have evolved throughout the twentieth century. Each type can include a wide range of land uses - commercial, industrial, institutional, residential, recreational, etc. The areas between these general development types are transitional areas. Examples of these development types are shown along Abercorn Street/State Route 204 in the city of Savannah-Chatham County (see map).



Location of development types in Savannah-Chatham County



Recent suburb commercial district – Opportunities to change development regulations to incorporate new trees into parking lot designs.



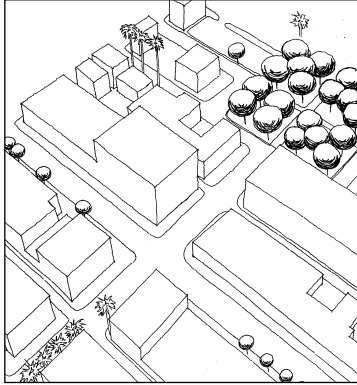
Recent suburb residential district – Opportunities to enhance tree planting and save more trees by cluster development



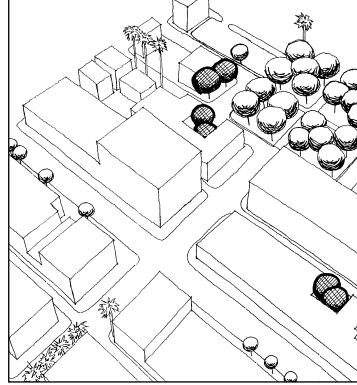
Rural areas – Save existing trees by transferring development to areas without trees including land closer to the urban core and brownfield sites.

Space for the Urban Forest

Next we illustrate examples of the three planning policy models in the four landscape development types: urban core, older suburbs, recent suburbs, and rural areas. Different policy models will be applied to development situations where they are most practical. As each model is applied, the growth in the urban forest becomes apparent.



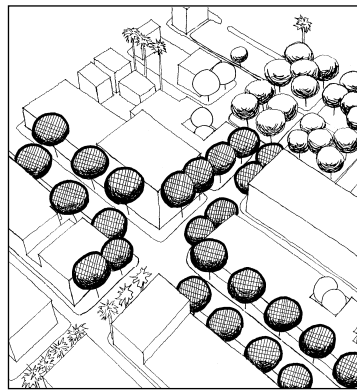
Existing Urban Core



Urban Core Applications

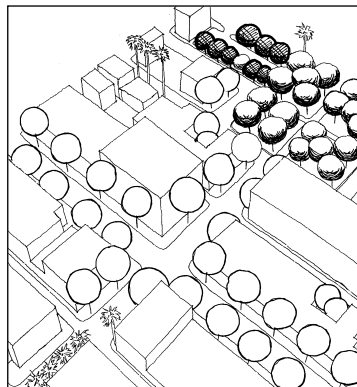
Public Education Model

Street trees planted by adjacent landowners; new trees planted on private land.



Ownership Model

New city purchased street trees in existing locations or enlargement of street side planting locations; new street trees in improved soil conditions as part of public sidewalk improvements.



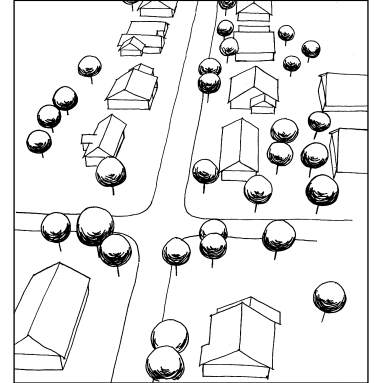
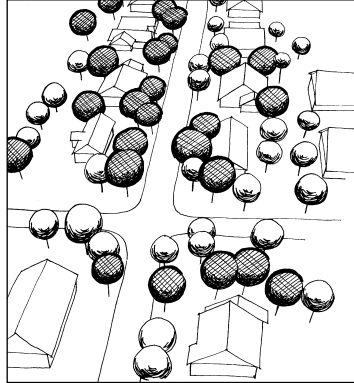
Regulation Model

Improved parking lot planting standards.

Older Suburb Residential Applications

Public Education Model

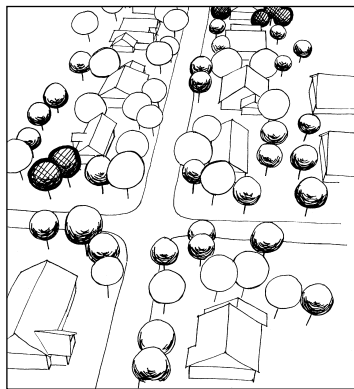
New trees planted by private landowners; trees planted on private land using public funds.



Existing Older Suburb Residential

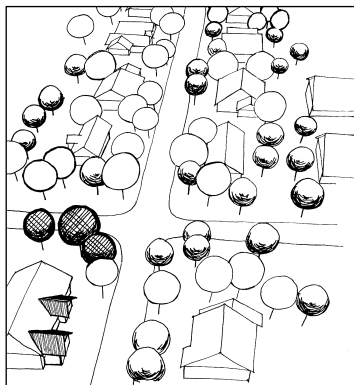
Regulation Model

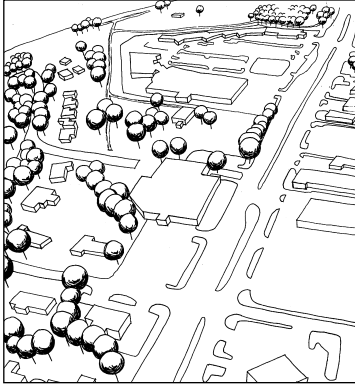
New trees planted as part of home remodeling.



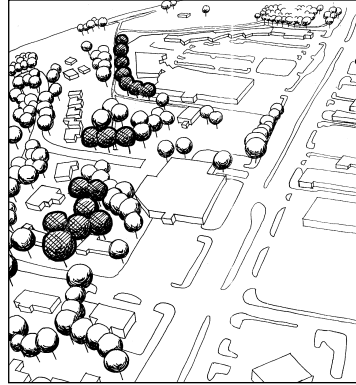
Regulation Model

Existing trees preserved as a result of flexibility of set backs for home remodeling and construction.





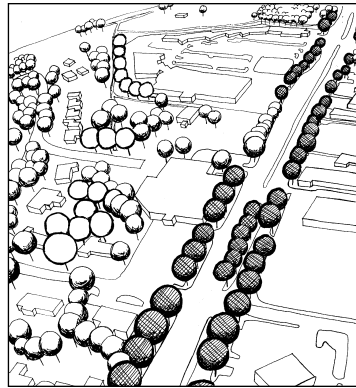
Existing Older Suburb Commercial District



Older Suburb Commercial Applications

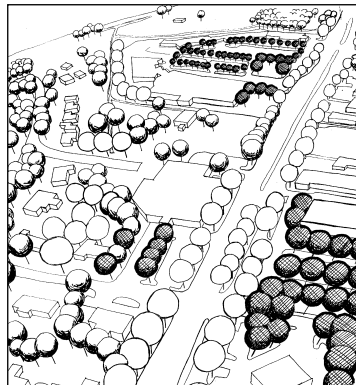
Public Education Model

Trees planted in available space on private land by commercial landowners.



Ownership Model

New street trees planted in right-of-way as part of district revitalization effort.



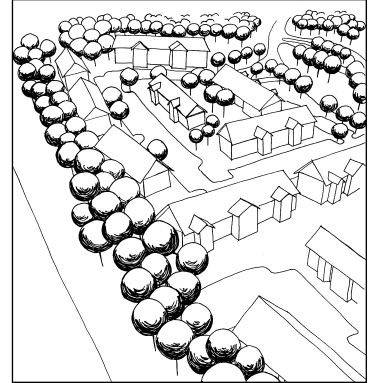
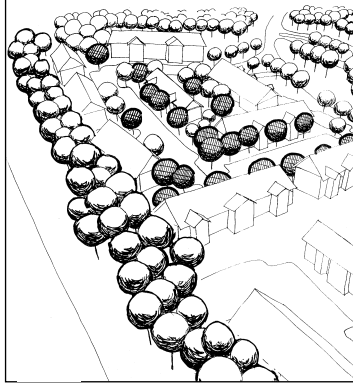
Regulation Model

Increased tree canopy in parking lot standards, retrofit during building improvements.

Recent Suburb Residential Applications

Public Education Model

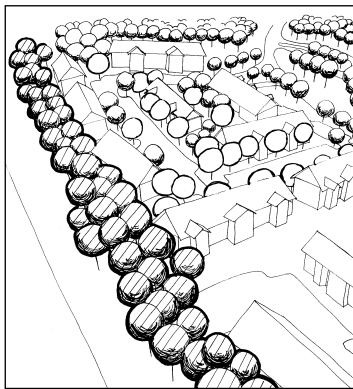
Community tree planting program at existing apartments/townhomes.



Existing Recent Suburb Residential

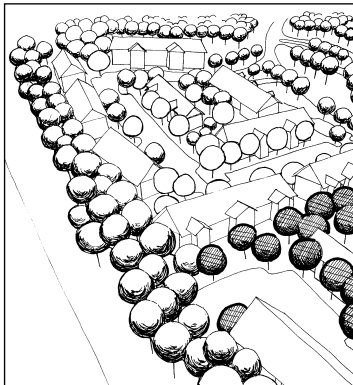
Ownership Model

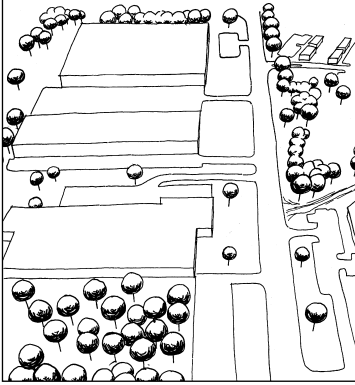
Tree buffer and wildlife corridor preserved by easement to land trust.



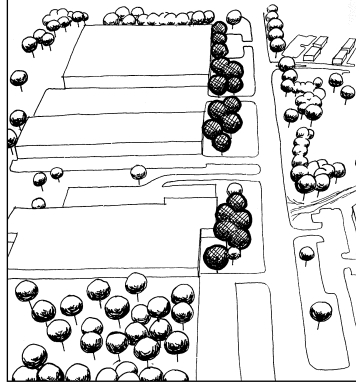
Regulation Model

Increased tree canopy requirement for new development.





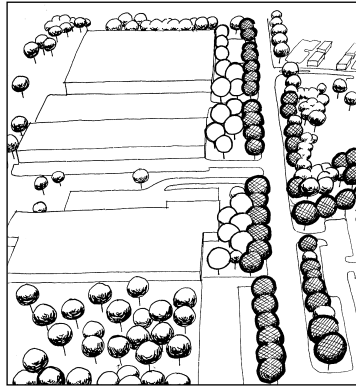
Existing Recent Suburb Industrial



Recent Suburb Industrial Applications

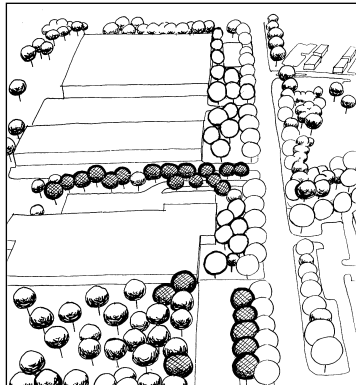
Public Education Model

Land owners uses existing setbacks for tree planting. Business replants adjacent stream banks.



Ownership Model

New street trees planted by city in industrial district. Stream bank buffer trees protected by easement to land trust.



Regulation Model

Increased tree canopy requirements in parking lots and entry roads during plant expansion projects.

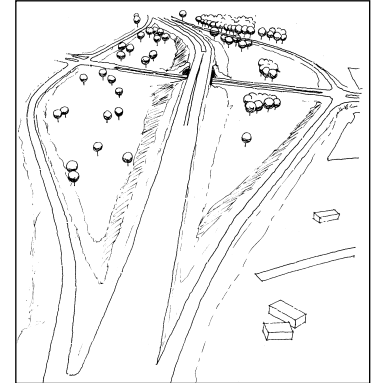
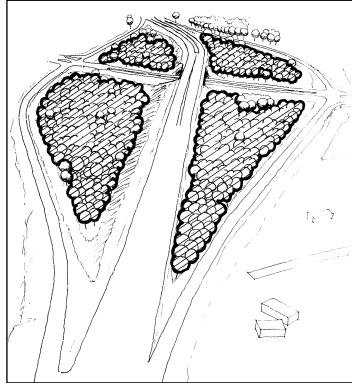
Recent Suburb Highway Interchange Applications

Public Education Model

Public/private volunteer partnership to plant trees.

Ownership Model

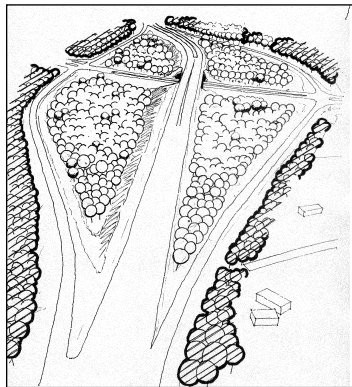
Reforestation of interchange interior, interchange right-of-way tree buffer protected by easement.

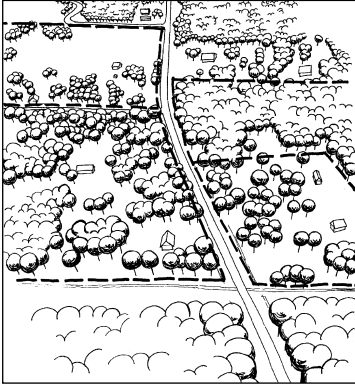


Existing Suburb Highway Interchange

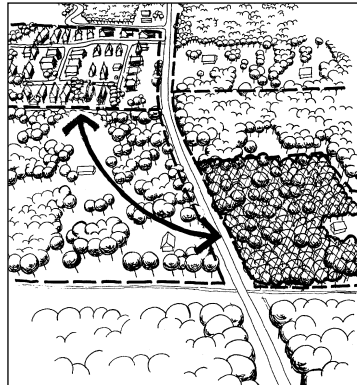
Regulation Model

Increased use of guard rail in critical places to permit planting closer to highway edge. Required planting on highway edge as buffer.





Existing Rural



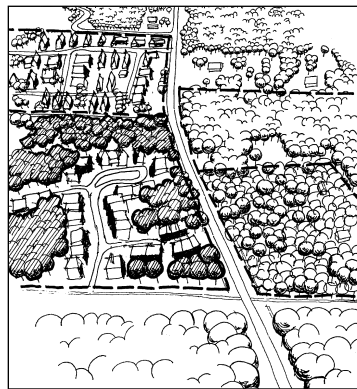
Rural Applications

Public Education Model

Promote preservation or reforestation of forest resources.

Regulation Model

Transfer of tree canopy requirement and building density allowance from land with poor tree planting resources to land with good resources or which can be reforested.



Regulation Model

Preservation of existing forest resources using compact Planned Unit Development (PUD) with smaller lot sizes or clustered homes.

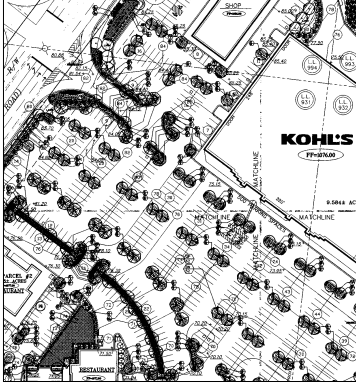
Planning and Community Standards

Determining a regional community standard for an acceptable amount of tree cover is difficult. Conditions vary considerably from community to community. Topography, history, soils and geology and economics all play a role in the amount of tree canopy that exist and how challenging it is to protect existing coverage or increase future coverage.

While the amount of tree canopy coverage is important, the location of the tree cover is even more important and can dramatically improve its effectiveness. The closer the canopy coverage is to areas of human activity, the more valuable it becomes. Buildings low enough to be shaded by tree canopy, parking lots, and other large paved surfaces (such as streets, sidewalks, commercial and industrial sites) are prime areas that should be addressed when improving canopy coverage. This canopy will cool buildings and pavement, reducing air conditioning cost and runoff water temperature. Cars parked under shade trees will lose significantly less fuel due to evaporation in addition to requiring less air conditioning when first driven. Trees covering paved areas also dramatically reduce stormwater runoff as demonstrated every time you see people huddled under trees during a summer rain. Pavement shaded by trees is cooler and more comfortable to the pedestrian. Water running off this pavement is also cooler which benefits aquatic habitat down stream. Forested areas that buffer waterways or other sensitive environmental areas are very important in protecting these ecological systems from human impact.

Due to human activity, tree canopy in urban areas is worth significantly more than an equivalent area of canopy on the rural edge of town. But, urbanized areas are the places where it is most difficult to achieve successful tree growth. It is, however, reasonable to maintain a very high percentage of canopy coverage even in intensely developed areas, provided that the building footprint is removed from the calculation. This high percentage is possible through new tree planting techniques, coupled with a higher regard for the benefits of trees. Acceptance of the benefits of trees translates into acceptance of spending higher amounts per tree, as the planting site becomes

Due to human activity, tree canopy in urban areas is worth significantly more than an equivalent area of canopy on the rural edge of town.



New tree coverage ordinance for Cobb County, GA applied to a commercial site.

[From Cobb County Arborist]

more difficult. In large parking lots the geometry of car movements and economic pressure to reduce the percentage of green areas, makes it difficult to plant enough trees to completely cover the paved area. However, even in parking lots, canopy coverage standards should be raised above current levels. Cobb County has recently increased their parking lot planting requirements and these are a good model for the rest of the state. The Cobb County ordinance and others can be accessed on the USDA Forest Service — Southern Region web site.

American Forests, a nationally respected organization that collects data on tree cover and monitors the nation's urban forest, suggests that an average tree canopy cover of 40% is a reasonable community standard. This number exceeds the current tree cover of many Georgia communities, but is an attainable level. Savannah has a canopy coverage of over 50%. If measured by environmental standards, however, even 40% canopy coverage falls short of meeting a community's obligation to reduce development-based impacts. Tree planting alone cannot solve the environmental problems being created at our current rate of consumption. But trees can do a lot to mitigate many human impacts and make dramatic improvements in the quality of life. Given that the best Georgia communities are able to function well at a higher level of tree canopy coverage, it is reasonable to set a goal higher than 40% for any community that wants to commit to obtaining the benefits of large areas of tree canopy cover.

Only a few communities in the United States have tree ordinances requiring maintaining future canopy coverage. In 1990, Fairfax County, Virginia, a suburb of Washington, DC, adopted an innovative ordinance that requires the number of trees to be planted to be based on meeting required canopy coverage at ten years after completion of the project. In the Fairfax County ordinance, the percentage of the site that must be covered by tree canopy after ten years varies from 20% in low density residential areas, 15% in high density residential areas (greater than 8 dwelling units per acre), to 10% in commercial and industrial areas. These percentages are calculated after subtracting the building area from the total site area. Existing trees that remain count in the total tree coverage. Fairfax County has published accepted growth rate assumptions for a large number of

tree species that could be planted.

While this may seem like a strong ordinance, this low level of canopy coverage requirement (10-20%) will not sustain an existing community forest. In the ten years since the adoption of its ordinance, Fairfax County reported a loss of approximately 5% of its tree canopy.

Despite the net result of not stabilizing canopy loss, the structure of this ordinance is a good starting point to develop a new generation of canopy coverage based law with higher percentage of requirements. Changes in the public's acceptance of trees should make attaining higher percentage of canopy coverage politically possible.

There is a greater opportunity on single-family housing developments to prevent canopy cover reduction than in commercial or industrial development. Most residential development occurs on the edges of urban areas or on forested sites. Tree preservation at these sites can be very effective provided that other development standards, such as road width, lot size, and setbacks are reduced and clustered development is encouraged. A strong forest preservation law may be the most effective way to stop the decline in tree canopy. Once completed, new residential areas are relatively easy places to establish new tree canopy provided soil resources are protected.

At more urbanized sites, saving old specimen trees is difficult due partly to competition for ground space. Therefore protecting and improving soil resources for new tree planting should be emphasized. Large trees in urban areas should be preserved when it is reasonable and practical, but often too much energy is expended trying to save specimen trees when the likely outcome is long-term decline and eventual removal. Tree preservation laws should account for this difficulty.

A new community canopy coverage standard should be implemented along with development policies that are flexible enough to respond to urban, suburban, and rural conditions. In rural and new suburban areas, policy standards should emphasize existing forest preservation,

**There is a greater opportunity
on single-family housing developments to
prevent canopy cover reduction than
in commercial or industrial development.**

while maintaining the existing percentage of tree canopy cover through cluster development, tree preservation, and replanting of small trees where tree canopy is removed. In older existing suburbs, policy should stress individual tree preservation and in-fill planting to raise the existing canopy percentage. In the urban core, policy should stress soil improvement and new in-fill tree planting. In the urban core, the percent of tree canopy should be raised dramatically to reflect new tree planting techniques that make it possible to plant large trees in difficult sites. Flexible development regulations can be accomplished by distinguishing between forest preservation and tree protection, requiring input from an arborist in determining the feasibility of preserving individual trees and linking the need to provide tree-rooting environments when calculating predicted canopy areas.

A New Community Tree Canopy Standard

The Georgia Forestry Commission is recommending tree canopy standards be developed based on the following principles:

1. The new tree canopy standard should be designed for individual properties and not on a regional basis. Regional coverage standards are difficult to apply in multi-jurisdictional areas, especially areas with widely differing development densities, areas of rapid growth, and areas where large portions of the existing tree canopy in a jurisdiction may not be available for development such as military bases or forested wetlands. Trees are removed or planted as a result of individual actions at individual properties and tree canopy coverage standards should be directed at the source of tree removal or tree planting.
2. Tree canopy percentage standards should be calculated for the portion of the property where tree canopy can be expected to grow. The following items should be subtracted from the gross site area:
 - Building footprint
 - Land in active agricultural use, other than forestry
 - Areas of the site where tree canopies would be in conflict with the proposed use, such as industrial storage areas, large truck parking, fueling facilities, overhead utility line right-of-ways

(ROWs), sport fields, or non-forested wetlands.

Tree canopy calculations should be made for the resulting net site area. Land in active commercial forestry use should be counted as tree canopy provided trees are replanted after each harvest.

Surface parking lots and roads would remain part of the net site area since they can be covered to a great extent by tree canopy. By subtracting these elements, the playing field is leveled between urban and rural areas. Agricultural uses can be preserved without penalty, while urban areas can develop at higher densities. Low-density development on forested sites is penalized when compared to urban sites. These policies have the added advantage of encouraging more compact development and less sprawl.

3. Tree canopy standards should attempt to use existing trees as the primary source for required canopy area and then allow the future growth of newly planted trees to make up the remainder of the required area.
4. Canopy coverage for newly planted trees should be estimated at a point in the future (approximately 10 years after planting) to accommodate growth and allow for adequate tree spacing.
5. While tree canopy standards are property based, they should be formulated to support no net loss in regional tree canopy when factored for the growth of newly planted trees as a near-term minimum standard and increased regional canopy as a long-term community goal. Both of these goals can be met without decreasing the rate of regional economic development. What must change, however, is the pattern of economic development from sprawling to a more connected and compact form of urban growth.

The Georgia Urban Forest Roundtable

In order to raise community standards for tree preservation and planning, a consensus will have to be built among the various stakeholders in the community to determine acceptable levels of changes to development law. An excellent way to achieve this consensus is to hold round table discussion groups that would

In order to raise community standards for tree preservation and planning, a consensus will have to be built among the various stakeholders in the community to determine acceptable levels of changes to development law.

recommend policy directions. This round table discussion group may be state wide or restricted to smaller regions of the state like the Atlanta metropolitan area. Roundtable must include citizens groups, urban foresters, landscape architects, civil engineers, developers, lawyers, planners, and politicians who represent a broad constituency of interest. These roundtable groups should convene to set new parameters in each area of development regulations. Since issues are likely to be contentious, a group facilitator would be critical to the success of the process.

A CHECK LIST FOR CHANGE

Review and adaptation of local zoning and subdivision ordinances to allow for these changes is important to protect land and water resources. The following checklist provides a means for evaluation and comparison of policy models and tools mentioned above or of those tools already in place in a community.

Evaluating Existing Policy Tools for Tree Planning and Planting

Adapted From **Managing Scenic Beauty Along the Lower Wisconsin River**, University of Wisconsin-Madison Department of Landscape Architecture.

1. Does the tool clearly address urban forest planning as an objective?
2. Does the tool require new legislation or ordinances to deal with urban forest planning?
3. Does the tool have the flexibility or adaptability to extend protection to the urban forest?
4. What is the political feasibility of adopting the proposed tool for urban forest protection?
5. Is the tool uniform and comprehensive?
6. Does the tool specifically and accurately describe or delineate affected property or parcels for urban forest planning?
7. Is the proposed tool established on a case by case basis or a priori basis (logically assumed without investigation)?
8. Does the tool afford permanent protection?
9. Who pays for the tool and how much will it cost?
10. What level(s) of government administer the tools?

11. Will the tool be enforced on a voluntary or mandatory basis?
12. Does the proposed level of administration have the willingness or capacity to enforce the tool?
13. Are there specific penalties for noncompliance or violations?
14. Does the tool allow the public to gain physical access to the property or parcels?
15. Does the tool affect property values?
16. Does the tool affect property rights?
17. Does the tool provide for income or property tax credits?
18. Does the public perceive use of the tool as a "taking" of the land?
19. Does opportunity exist for citizen involvement in the decision-making process?
20. Does the individual landowner play a direct role in implementing the tool?
21. How rapid is the implementation process of this tool, relative to other tools?
22. Are provisions made for grandfathering nonconforming uses?
23. Are development or structures allowable?
24. What loopholes or exceptions remain?

RESOURCES

Useful Web Sites

American Forest Foundation
www.affoundation.org

American Forests
www.americanforests.org

American Planning Association
<http://www.planning.org/plnginfo/GROWSMAR/>

Center for Watershed Protection
www.cwp.org

Georgia Environmental Protection Division – Department of Natural Resources
www.state.ga.us/dnr/enviro

Georgia Greenspace Program
www.ganet.org/dnr/greenspace

Nature Conservancy
www.tnc.org

Transportation Equity Act for the 21st Century
www.tea21.org

Treelink
www.treelink.org

Trees Atlanta
www.treesatlanta.org
(Additional links to tree research, tree care, and community action web sites).

Trust for Public Land
www.tpl.org

USDA Forest Service – Southern Urban Forestry Technical Service Center
www.urbanforestrysouth.org

University of Georgia – Warnell School of Forest Resources
www.forestry.uga.edu

Urban Land Institute
www.uli.org
(Information on smart growth).

Books and Research on Planning for Trees

Arendt, Randall. **Growing Greener**. Washington, DC: Island Press. 1999.

Burban, Lisa L. and John W. Andersen. **Storms Over the Urban Forest. Planning, Responding, and Regreening – A Community Guide to Natural Disaster Relief**. 1994.

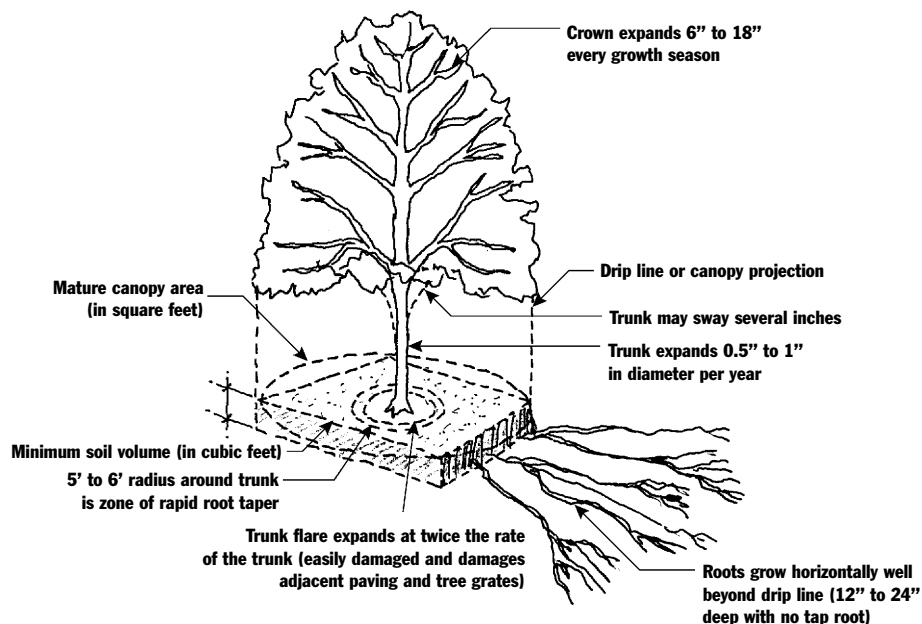
County of Fairfax, Virginia. **Public Facilities Manual Metric of the County of Fairfax, Virginia**. Fairfax, VA, 1997. 12-0000 "Vegetation Preservation and Planting."

CHAPTER 3

Building the Urban Forest

Making space for trees and forests, as described in the previous chapter, is a long-term process of education, land purchase, policy, and regulation development. At some point, however, the actual work of preserving, planting, and managing trees must begin. This chapter is a resource guide to assist in better implementation of urban forest practices. This guide is not intended to serve as a manual, but rather as a starting point for up-to-date practices at the project level using six principles that improve the urban forest.

Prior to starting existing tree protection or new tree planning, it is important for the person responsible for the design to understand the long-term growth patterns and requirements of these large biological systems. Tree biology as it affects design changes in the landscape is now well understood. A review of resource material, particularly "Principles and Practices of Planting Trees and Shrubs" provides an excellent review of the critical points. Basic tree biology is illustrated in the figure.



Tree-soil relationship.

All tree work starts with in-depth planning and analysis of the projects goals and resources as well as the situation on the ground.

PRINCIPLES TO IMPROVE THE URBAN FOREST

1. Preserve existing trees and forests.
2. Increase space for tree planting.
3. Preserve and improve the quality of the tree-growing environment.
4. Select trees for diversity and suitability.
5. Select efficient planting locations.
6. Manage the urban forest as a continuous resource regardless of ownership boundaries.

To build an effective urban forest,
basic principles of sound urban forestry must
be understood and followed.

This analysis should result in a detailed plan of action. Often there are many different interests and individuals involved in a single project, and the construction process may go on for several years. The success of any tree protection or planting effort may require actions by many different individuals, some of whom are not interested in trees. It may only take one mistake to kill a large tree or make it impossible for new trees to grow. A mislaid plumbing line or washing out a concrete truck in the wrong place can kill a tree or dramatically change soil composition. Getting advice from an urban forester, consulting arborist, or landscape architect with urban forestry expertise can dramatically improve the success rate of these complex efforts. These professionals must have the respect of the other project team members and the authority to affect work related to how trees will be protected or planted. As with any consultant, make sure that the individual has experience in the type of problems likely to be encountered.

Make sure the budget and schedule are sufficient to accomplish the project goals. The costs of tree preservation work and soil improvement are often underestimated and project schedules are unrealistic. Many tree practices such as root pruning, fertilization, insect control, and tree planting are very season-specific. These practices may be ineffective if undertaken too close to the onset of construction impacts. In the case of the preservation of large trees, preparation of the tree for construction should begin a year or more before the start of construction. At the end of active construction, additional efforts to help the tree through the recovery process should include supplemental watering, disease and insect control, and pruning. These efforts may last several years.

To build an effective urban forest, basic principles of sound urban forestry must be understood and followed. These principles form the structure of a good community urban forest program. Each principle is accompanied by several action items that the community should follow and apply to each project that impacts any tree, new or old.

Building the Urban Forest

PRINCIPLE ONE: PRESERVE EXISTING TREES AND FOREST

Actions

- Set high community standards for tree canopy coverage requirements.
- Preserve only those trees worthy of preservation.
- Prepare and follow tree preservation plans.
- Prepare trees well in advance of construction.
- Protect the land and soil within the tree or forest critical root zone.
- Increase community awareness of the importance of trees and tree preservation.
- Preserve urban remnant areas of forest that can remain as wildlife habitat or which are important as an environmental resource such as wetlands or riparian buffers.
- Improve urban forest management.

The preservation of existing trees in heavy construction areas often presents the quandary of which trees are best to preserve and whether the resources used to save trees are well spent. Mature trees are more valuable both aesthetically and ecologically than younger trees. On the other hand, younger trees are easier to save than mature trees. More emotion is often attached to larger trees even though the trees may not be good candidates to withstand construction impacts.

All trees within the construction area should be examined by a certified arborist prior to making any design decision about saving any tree. Trees should be evaluated for potential hazards using procedures established by the International Society of Arboriculture (ISA). A qualified consultant must also set work limits around the trees during the design process. All members of the development team must respect these work limits.

An important part of tree preservation is community education about the human impact on trees. Harmful activities such as soil compaction, trunk and branching damage, over or underwatering and chemical spills should be made clear to all members of tree crews. This educational effort can be as simple as a discussion with each



Growing or preserving large mature trees requires making space for roots in an area at least as large as the canopy area.



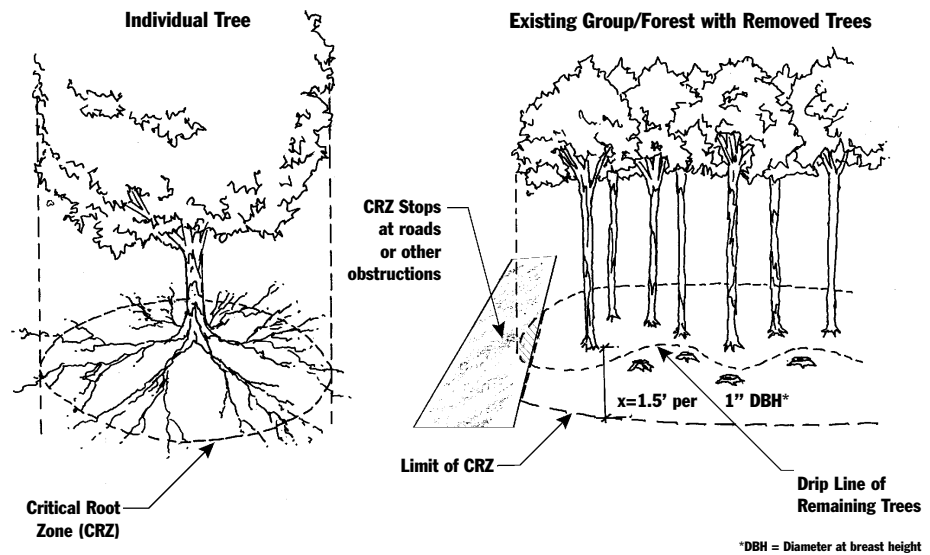
Lack of tree preservation plans can result in an expensive legacy for a new homeowner 4-5 years after their home purchase.

trade crew on a construction site or be directed to citizens in the entire community. Local urban foresters need the support of citizens in the identification of hazardous trees and enforcement of tree removal ordinances.

The actual process of protecting a tree or group of trees during a construction project is complex. Fortunately there are many resources to assist in establishing proper procedures to guide the process. The ISA has an excellent technical guide and several short videos that can be shown to clients, the community, or contractors. After the trees to be saved have been identified the critical root zone (CRZ) should be established and well marked. The CRZ is the area containing the roots that must be protected for tree survival. Any compromise to the CRZ makes it harder for the tree to adapt to its post-construction environment. For each tree or group of trees, a tree protection plan must be developed and made part of the construction documents. All members of the development team should follow this tree protection plan.



Use of a pneumatic excavation tool combined with a vacuum truck removes soil from tree roots prior to excavation of a curb allowing more roots to be saved.



Critical root zone.

Trees do not adapt easily to changes in water table levels, soil compaction, or soil depths. Most tree roots are within the top one foot of soil, so adding or removing even a few inches of topsoil can damage significant roots. Roots need oxygen as well as water, so adding more than a couple of inches of heavy soil on top of tree roots can block air flow and cause root death. Tunneling under the tree

root mat to install utility lines does little damage compared to trenching through the roots. Use of a pneumatic excavating tool for excavation work that must happen inside the CRZ greatly reduces tree damage. This tool can remove soil around the tree's roots without harming them.

Pre-construction preparation and post-construction follow-up are essential to tree success, especially for larger trees. Construction is to a tree as major surgery is to a human. The older they get the harder it is to recover. Getting a tree into good physical shape prior to the operation dramatically increases the chances for success. The older the tree the longer the post operation care period.

When developing adjacent to or within existing forest, the shape and size of the resulting forest remnant is important to its success. Long narrow shapes with large perimeters but small interior areas make it harder to develop successful tree preservation schemes but may be successful as buffers or wild life corridors. Rounder shapes make tree preservation easier and serve as better wildlife habitat if large enough.

PRINCIPLE TWO: INCREASE SPACE FOR TREE PLANTING

Actions

- Promote cluster development.
- Smaller setbacks and side yards.
- Shorter, narrower streets.
- Prepare trees well in advance of construction.
- Smaller parking lots and shorter cul-de-sacs.
- Flexible sidewalks standards.
- Eliminate or significantly enlarge tree-restricted lawn and planting holes in pavements
- Cluster utility lines separate from tree planting areas.

In order to facilitate the requirements in Principle Three: 'Preserve and improve the quality of the tree-growing environment,' space above and below the ground must be preserved. While this principle

is primarily accomplished with the three policy models described in the previous chapter, making space for trees is a critical component in the design process, both at the land planning stage and during detailed engineering and design work.

PRINCIPLE THREE: PRESERVE AND IMPROVE THE QUALITY OF THE TREE-GROWING ENVIRONMENT

Actions

- Preserve existing soil resources with less grading and compaction during construction.
- Improve soil drainage.
- Design planting soil volumes for future canopy growth.
- Treat stormwater as a resource not as a waste product.
- Decrease lawn areas and replace with mulch beds.

The successful planting of new trees requires detailed planning that precedes actual planting. This planning process starts with an analysis of the site to develop an understanding of growing conditions. Any proposals for specific planting details must be based on these existing conditions. In no case should a standard planting detail be used or specified in planting guidelines. As soils vary dramatically from location to location, so should the approach to tree planting. Using landscape architects or urban foresters to help analyze growing conditions and prepare planting plans and specifications is a necessary step, especially for larger projects or difficult sites.

Soil and Drainage

Soil-based planting guidelines must reflect the quality, drainage capability, and volume of existing soil. Locating trees and developing details should only be done after a thorough site analysis of soil, topography, and site features. On many sites a single approach to soil preparation may work, but as sites are more intensely developed, a wider range of soil and drainage preparation will be needed. In situations where the site conditions are variable and resources to make soil or drainage modifications are limited, very specific planting site selection changes can dramatically improve the success of the

Locating trees and developing details

should only be done after

a thorough site analysis of soil, topography

and site features.

Building the Urban Forest

planting. In the urban core or dense commercial sites, even a few feet can make a big difference in tree performance.

As soil and drainage conditions decline, at some point extensive soil and drainage modifications are needed to grow large trees. Determining when to make modifications and what modification to make is best left to an expert trained in soil and planting specification preparation. These modifications can be very expensive. For projects where extensive soil modification is required but budgets are insufficient, planting fewer trees correctly is a preferable alternative to planting the desired number of trees poorly. The old arborist saying about planting a \$5 tree in a \$50 hole certainly applies in the urban core. (Move the decimal over one or two places to bring the formula up to the current economy.)

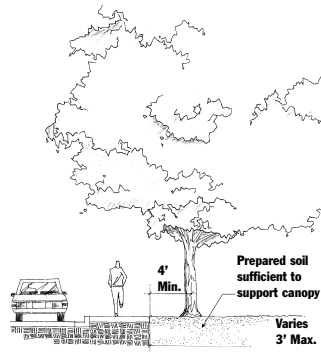
The design of space for planting soil in urban areas must solve the conflict of competition for ground space. When there is no longer enough space for adequate soil volume, the tree must find rooting space underneath adjacent paving. This happens when the planting space is smaller than about 400 square feet. As the planting space becomes less than 100 square feet or the tree trunk is planted less than four feet from the pavement edge, conflicts between root and pavement appear. There are many ways to reduce these conflicts and allow for tree roots to grow underneath pavement. A good selection of alternative details to find rooting space under pavement is available in the tenth edition of **Architectural Graphic Standards**.

Unfortunately, most existing street tree spaces were designed with inadequate room for roots. Retrofitting larger soil areas for tree planting in existing sidewalks is expensive but should be pursued whenever new trees are planted. In downtown areas, aesthetic issues like uniform urban sidewalks and tidy planting hole detailing, make it difficult to achieve long tree life and increased canopy size.

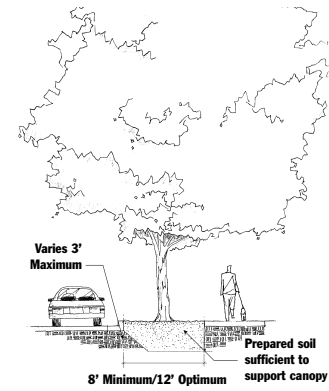
Once the planting site is located, the existing soil may need significant improvement including drainage and organic amendments. When space for tree planting is limited, modify



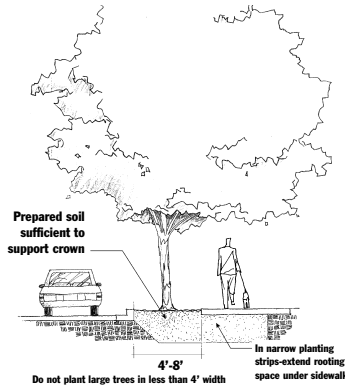
18'x36' tree planting island in a new parking lot provides sufficient prepared soil to establish two trees. However, additional space under the asphalt must be found for long-term tree growth.



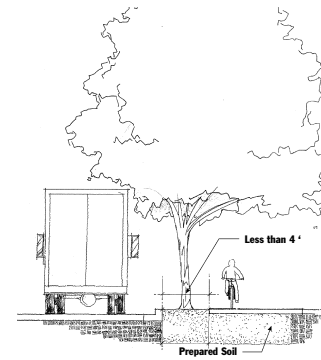
Best practice – tree on property side of sidewalk



Acceptable practice – wider tree lawn



Compromised practice – narrow tree lawn



Not recommended – too narrow tree lawn

designs to use the easiest places to grow trees first to reduce planting cost, while increasing long-term tree health. Tree locations that share rooting space or borrow rooting space from adjacent sites should be selected over sites that locate trees in small isolated rooting spaces. Simply moving the tree from a narrow tree lawn to the sideyard behind the walk will dramatically improve the rooting space.

Understanding a site's previous development history may indicate areas where it is easier to grow trees. Sites, which have had several development cycles of buildings being torn down and rebuilt, will be more difficult to plant, especially if that activity is recent. Construction activity tends to disturb and compact soils. Sites where there has been no significant site disturbance for more than 50 years may be easier to plant since construction techniques prior to the 1940's were less disruptive to the soil and compacted soils may have recovered since that time. Any new construction activity needs to be controlled to protect site soil resources or the soil will need to be refurbished before new planting begins.

Good drainage both on the surface and below ground must be provided to ensure that soil improvement efforts are not wasted. Poor drainage is a significant cause of tree decline. Over-watering of newly planted trees or failing to understand that light surface irrigation does not penetrate root balls of newly planted trees can lead to significant tree loss.

Tree Planting Details and Specifications

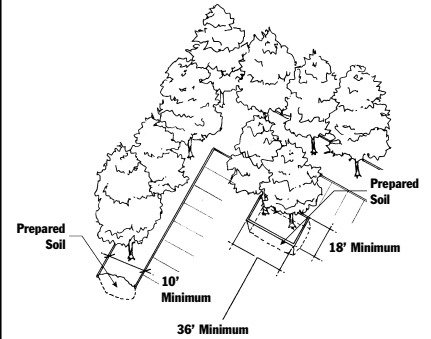
Too much reliance has been placed on a universal planting detail for the installation of almost all trees. This universal planting detail is a warranty-based detail, designed so the tree will survive the warranty period. Design professionals now use a variety of details that reflect different growing conditions, soil types, regional climate differences, plant types, and nursery practices. These soil-based planting details are designed not only to establish the plant correctly, but provide the tree with the environment to develop large crowns over a long and healthy life. The ISA and the American Society of Landscape Architects (ASLA) have recently begun publishing these details on the ASLA web site. Tree planting in good soil is relatively easy, but as soil conditions deteriorate establishing long-lived trees requires greater levels of care that must be reflected in tree planting details and specifications.

PRINCIPLE FOUR: SELECT TREES FOR DIVERSITY AND SUITABILITY

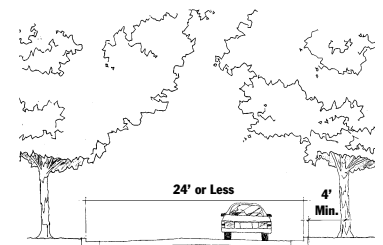
Actions

- Use native species where appropriate.
- Select trees that grow to a size appropriate to the available space.
- Select trees appropriate to the soil and drainage in the planting area.
- Select trees for drought tolerance to reduce irrigation needs.
- Plant quality nursery stock.

The selection of actual tree species is based on many factors. These include the desired size and characteristics of the tree, the ability of the tree to adapt to the growing conditions of the planting site, the time of year of the planting, and the availability of the size and quantity of trees needed for the installation. Rarely can all these criteria be met. Species availability may play a role in the decision-

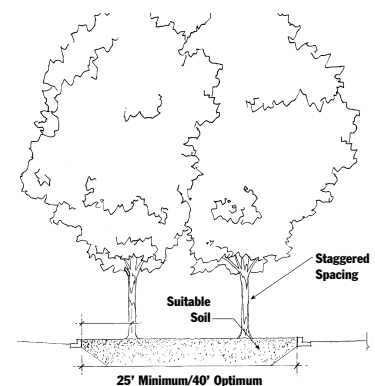


Minimum tree areas on parking lots.



55

Tree-street relationship.



Median Planting Area



Poor nursery practices that produce girdling roots will cause early tree decline and death.

making process. Large canopy trees should make up the majority of the planting. Smaller-sized trees and ornamentals should only be used as accents and understory plantings or in places where there is limited room for crown development. Species diversity and use of native plantings are important, however varied constraints of urban sites can lead tree selection toward less diversity and non-native trees. Professionals with local experience should advise or make tree selections.

The final step in the tree selection process is the purchase of the trees. Obtaining quality nursery stock is critical to long-term success. Bad grafts, girdling roots, or poorly developed root systems and/or co-dominant stem leaders will contribute to future problems and tree failure. Most of these problems do not become apparent until well after the expiration of normal plant guarantees. The American Nursery and Landscape Association publishes standards for nursery stock. However, each tree should be inspected by a trained professional prior to purchase. Purchase specification must require quality assurances, as well as reasonable care in digging, shipping, planting, and initial maintenance.

PRINCIPLE FIVE: SELECT EFFICIENT PLANTING LOCATIONS

Actions

- Plant tree buffers to protect streams and increase infiltration of stormwater.
- Plant trees where they offer the most shading for reduced energy use.
- Plant trees where the soil resources are best.
- Avoid planting locations that will conflict with utilities or pavements.
- Plant trees at the most efficient spacing.

The selection of the final location of newly planted trees can dramatically affect both the ability of the tree to develop into a healthy specimen and the tree's effectiveness to provide benefits. Trees that can shade a building or a portion of paving, will provide significant energy savings and heat island reduction, while the same

tree planted away from these locations will have dramatically less effect. The same principle applies when using trees in stream buffers, as windbreaks, and for noise reduction. Trees planted in more remote locations do provide some benefits, such as heat island reduction and particulate matter absorption, but those effects are lower compared to the benefits of trees planted in urban areas.

Tree Spacing

Determining proper tree spacing is an important step in the design process, but is always a compromise between short-term and long-term goals. In a natural forest, tree spacing constantly changes as trees die and are replaced during forest succession. As forest succession slows in the second fifty-year period, large trees are spaced about 20-25 feet on center. But at these spacings, there is constant competition for crown space and trees continue to die only at a slower rate. In the urban forest, there is a low tolerance for the results of competition. Trees need to be able to develop healthy, stable crowns with few tree losses, while providing canopy coverage in a reasonable period of time. A stable landscape spacing is about 35-45 feet on center, moving towards 50-60 feet on center in the second fifty-year period after planting. This wider spacing may be too wide for reasonable canopy coverage in the first several decades, so planting with tighter spacing with planned thinning may be the best choice. Planned thinning is easier when initial planting has a less formal arrangement.

PRINCIPLE SIX: MANAGE THE URBAN FOREST AS A CONTINUOUS RESOURCE REGARDLESS OF OWNERSHIP BOUNDARIES

Actions

- Understand issues of tree ownership.
- Know who has maintenance responsibility.
- Monitor trees for regular maintenance requirements.
- Respond to outside threats to the urban forest.
- Manage activity in the community that may damage trees.
- Establish adequate urban forest budgets.

The maintenance and management of trees in the urban forest is the



Well-spaced trees make for a healthy and long-lived canopy.



Storm damage to trees.

responsibility of a complex network of private and public landowners. Most maintenance is the responsibility of the tree owner, but often tree ownership is not always clear. Trees that straddle property lines have two "owners," while trees in the public domain may be planted by one government department and maintained by another. The level of care and maintenance response may vary dramatically from one maintenance provider to another.

Sometimes problems or threats to trees such as a rapid insect invasion may transcend property lines and require an area-wide response. Other threats to trees may result in laws requiring owners to remove trees, as in the case of Dutch Elm disease, or not to remove trees, as in the case of tree removal permit ordinances that protect trees from the whims of landowners. Finally, utility providers usually have the right to prune trees on private property to maintain utility easements.

Keeping an urban forest healthy requires that some individual or agency take responsibility for its management. Unfortunately, most small towns and cities do not have the resources to have a full-time urban forester and the work may fall to untrained government staff or volunteer tree committees. In the worse case scenario, forest management is simply ignored in these places and maintenance is reduced to tree planting and removal.

There are several good references on the organization of urban forest management programs. These are listed in the resources section at the end of this chapter and should be the starting point for a community that wants to improve tree quality. Individual tree owners should make use of state forestry extension services, private consultants, and tree maintenance companies. Using ISA-certified arborists, consulting arborists, urban foresters or landscape architects with tree care expertise can improve the quality of private and local government tree care.

Landowners or municipalities who ignore critical maintenance tasks not only risk future quality and value of an important resource, but also put themselves at risk. Trees in urban areas become hazardous if not regularly monitored and pruned. The lack of a maintenance program is not a legal defense in the event of a disaster, where falling

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trees injure or kill people or damage property. Sound management is the best defense against storm damage during severe weather. Long-term management will keep the urban forest sustained by continual replanting so the overall area has multiple age classes of trees of diverse species.

A reasonable management program includes regular tree monitoring; a pruning cycle of at least once every five years; pest control; utility wire clearance and pipe/root cleaning; monitoring and repair of root/sidewalk conflicts; and of course tree removal and replanting. Also, forested areas may need occasional thinning and invasive vine control during the early succession period. Trees in reasonable soil conditions should need little water or fertilizer after establishment, compared to those in more restricted rooting environments. Beyond regular maintenance and monitoring, the tree owner must be prepared to mobilize after storms or other occasional events like fire or drought to remove or repair damaged trees. Increasingly, imported pest such as the Asian Long Horned Beetle or the Formosan Termite have invaded the urban forest with devastating results. Communities must be on a constant vigil to understand where these threats are located and how to prepare for them. One community's negligence can impact many adjacent communities.

An important part of the tree management program is having a tree advocate monitor the urban development activity swirling around the urban forest. The ground is constantly being dug up, buildings constructed, soil compacted, and chemicals spilled. Someone must defend the trees and direct development activity in the least harmful direction. In small communities, a volunteer tree board with the authority to approve development actions around trees, can be a big boost to the health of this important community resource. A tree board can activate citizen tree care groups to accomplish some maintenance on young trees in public lands as well as educate and organize landowners so they will take a more responsible role in the care of their own trees.



Both street trees and trees on private land are part of the urban forest. Opportunities exist for new tree planting on either side of the property line.

Putting All the Pieces Together

The above six principles provide a structure to guide building and maintaining the urban forest. Each principle is interdependent on the others and requires a high level of professional expertise and personal commitment for success. To assure tree ready infrastructure, communities must insist on knowledgeable professionals to guide their development and tree maintenance process.

To make all this happen, there must be an adequate urban forest management budget. While several organizations support a \$2-3 per capita budget as a minimum, communities with good forest resources require much larger budgets. Savannah, with its excellent forest coverage of over 50%, spent over \$10 per capita on maintenance in FY2000. The budget needs to include both maintenance and new tree planting. Funding sources in addition to local taxes can include grants and should take into account volunteer hours spent planting and supporting the needs of the urban forest.

RESOURCES

Tree Preservation

Cobb County Soil and Water Conservation District, USDA Natural Resources Conservation Service, Georgia Forestry Commission. **How to Protect Natural Resources on Construction Sites, A Builder's Guide.** 1998.

Matheny, Nelda and James R. Clark. **A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas.** Urbana, IL: International Society of Arboriculture, 1991.

Matheny, Nelda and James R. Clark. **Trees and Development.** Chicago, IL: International Society of Arboriculture, 1998.

Educational Videos on Tree Preservation

The Davey Tree Expert Company. **Tunneling and Trenching: A Video Guide for Excavating Near Trees.** Savoy, IL: International Society of Arboriculture.

International Society of Arboriculture Research Trust. **Effects of Construction Damage to Trees on Wooded Lots.** Savoy, IL: International Society of Arboriculture.

USDA Forest Service. **Tree Health Management: Evaluating Trees for Hazard.** Washington, DC: American Forestry Association and the International Society of Arboriculture.

Watson, Gary W. **Root Injury and Tree Health.** Lisle, IL: Illinois Arborist Association.

Tree Planting

Condon, Patrick and Stacy Moriarty, eds. **Second Nature: Adapting LA's Landscape for Sustainable Living.** Beverly Hills, CA: Metropolitan Water District of Southern California, 1999.

Craul, Phillip J. **Urban Soil in Landscape Design.** New York, NY: John Wiley & Sons, Inc., 1992.

Hoke, John Ray Jr. ed. in chief. **Ramsey Sleeper Architectural Graphic Standards,** 10th ed. New York, NY: John Wiley & Sons, Inc., 2000, pp.177-182.

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CHAPTER 4

Measuring Success

Every urban forest is different as is the quality of a community's urban forest program and their attitude toward trees. What are the best tools to measure the success of your community's urban forest and your urban forest program? A community with a healthy urban forest will meet most of the following benchmarks. Organizations listed at the end of this chapter are available to help communities with urban forest problems or to get started improving their urban forest.

In "Georgia's Urban & Community Forest – An Assessment and Five-Year Strategic Plan 2000-2004", five levels of community programs are defined (see sidebar). Where does your community measure on this scale?

Canopy Coverage

Has the canopy coverage been measured and what is the rate of change in the canopy over time? Canopy coverage can be measured from field data, existing aerial photographs or satellite imagery. This work is best done by a professional urban forester with experience in photographic interpretation. Communities at higher program levels (levels 4 and 5) will know their current canopy coverage and be taking steps to protect, improve and expand.

Urban Forest Budget

The urban forest needs full time care and management. Communities that have healthy urban forests will have an urban forest budget that will allow for maintenance, improvement, and expansion of the urban forest. The budget should be developed based on annual tree care activities. Typical tree care activity budget line items include:

1. Professional Staff
2. Tree Removals
3. Tree Pruning
4. Mulching
5. Fertilization

FIVE LEVELS OF AN URBAN AND COMMUNITY FORESTRY PROGRAM

1. **Non-Participatory** – My community needs to establish an urban and community forestry program.
2. **Project Level** – My community is involved with project activities such as Arbor Day, a tree planting, a one-time community forestry grant, or any other one-time community forestry event or project.
3. **Formative Level** – My community has decided to start a community forestry program. We participate in activities listed in the above Project Level and network, have documented discussions, and coordinate with community leaders about beginning a program. We are establishing a tree board, getting volunteers involved, and conducting a preliminary or basic assessment about the general state of the community forest.
4. **Development Level** – My community is pursuing activities in addition to those in the Project Level and Formative Level to improve overall health of the community forest. We are conducting a tree inventory, writing a community forestry management plan, or pursuing the adoption of new policy and regulations for tree planting, maintenance and protection such as a tree ordinance.
5. **Sustained** – The urban and community forestry program in my community is organized and functional. The program has continuity, planning, awareness, support and a budget. The tree board or tree department is operating on its own with ongoing funding and management for systematic tree planting, removal and replanting, and comprehensive tree maintenance.

6. Community Education
7. Tree Ordinance Enforcement
8. Tree Planting



The majestic tree canopy in historic Savannah demonstrates that significant tree canopy can exist within a high-density urban area and makes Savannah one of the most desirable places to live in the region.

Citizen Tree Boards and Advocacy Groups

Communities with healthy urban forests often have one or more citizen groups that help preserve and plant trees. These groups can be very organized tree boards with authority to make recommendations to government officials or loosely organized groups of citizens who regularly come together to support tree planting days or advocate for stronger tree related ordinances. These citizen groups must be supported and respected by local governing bodies.

Communities with lower level programs (level 1 and 2) will not have an organized tree board, while higher level urban forest programs will have a tree board that has official standing in the local government structure. Activity by the board can be measured in the number of meetings, events, news articles and programs created by or supported by the group.

Tree Planting Program

A community should fund tree planting on public land at rates at least as fast as the trees are removed, to assure long term forest survival and development of diversity in the age and species of the stand. Yearly citizen tree planting events can get many trees planted with small expenditures of funds. However, each tree planted should include provisions for its care and maintenance. Higher level urban forestry programs will have tree planting programs that increase the number of trees and keep records of all tree removals and new trees planted.

Land Development Laws

A community with a healthy urban forest will examine and modify development laws to improve tree preservation and increase tree planting within the community as development continues.

Communities with lower level urban forestry programs (level 1-3) may not have any tree planting or preservation laws. Communities with higher level programs will have strong current laws and the infrastructure to enforce those laws.

Community Tree Inventory

In addition to actual tree canopy measurements, it is vital to know as much as possible about the health of the urban forest. A tree inventory or statistical sample of urban forest health and condition gives usable information to manage maintenance and develop budgets.

'Tree City' designation

The "Georgia's Urban & Community Forest – An Assessment and Five-Year Strategic Plan 2000-2004" set as a goal to expand and promote the Tree City USA program in the state. Communities should strive to be designated a Tree City USA by the National Arbor Day Foundation. This acknowledges that the programs in your community meet minimum standards to promote a healthy urban forest.

RESOURCES

Moll, Gary and Sara Ebenreck, eds. **Shading Our Cities: A Resource Guide for Urban and Community Forests.** American Forestry Association, 1989.

Tree City USA Bulletin Series, National Arbor Day Foundation, Nebraska City, NE.

Georgia's Urban & Community Forest — An Assessment and Five-Year Strategic Plan 2000-2004. Georgia Forestry Commission, Macon, GA, 2000.

Organizations

American Forests

910 17th Street, Washington, DC 20006
www.americanforests.org

American Society of Landscape Architects

636 Eye Street, Washington, DC 20001
www.asla.org

Georgia Urban Forest Council

Box 961, Macon, GA 31202
www.gufc.org

International Society of Arboriculture

Box 3129, Champaign, IL, 61826.
www.isa-arbor.com.

National Arbor Day Foundation

100 Arbor Avenue, Nebraska City, NE 68410
www.arborday.org

Urban Forest Manual

USDA Forest Service - Urban Forestry Technical Service Center
www.urbanforestrysouth.org

APPENDIX

SIGNIFICANT URBAN AND COMMUNITY FOREST MANAGEMENT PROGRAMS IN GEORGIA

A list of active urban forestry programs. These are communities where the local community and urban forest managers understand the importance of the urban forest.

These urban and community forestry programs exhibit:

- Successful enforcement of tree ordinances.
- Successful efforts with voluntary compliance.
- A city that has drastically rewritten a previous ordinance and accomplished tree planning or planting goals.
- A city that has an excellent general public and/or developer education program as part of their ordinances.

Alpharetta

Jennifer Teates, City Arborist
1790 Hambree Road
Alpharetta, GA 30004
(678) 297-6200

Area of Accomplishment Consistent ordinance enforcement. Specimen tree protection and root zone requirements.

Americus

Carol Quay
Keep Sumter Beautiful
P.O. Box M
Americus, GA
(912) 928-2862

Area of Accomplishment City of Americus, Keep Sumter Beautiful, and Sumter County collaboration to develop National Tree Trust Regional Grow Out Station.

Athens-Clarke County

Roger Cauthen, Manager
Landscape Division
350 Pound Street
Athens, GA 30601
(706) 613-3565

Area of Accomplishment Developed comprehensive urban forestry BMPs.

Barrow County

Connie Head, Consulting Urban Forester
Technical Forestry Services
1055 White Head School Road
Commerce, GA 30529
(706) 335-7070

Area of Accomplishment Initial efforts to impact residential properties alone.

Carroll County

Brian Darr, Southern Urban Forestry Associates
38 Bridge Drive
Douglasville, GA 30134
(888) 433-8733

Area of Accomplishment Countywide development of interest in urban forestry as a result of a local community Urban and Community Forestry grant (Carrollton).

Cobb County

Les Brewer, County Arborist
191 Lawrence Street
Marietta, GA 30060-1661
(770) 528-2124

Area of Accomplishment Implemented a canopy cover requirement in parking lots.

Columbus

Susan B. Kleto, City Arborist
P.O. Box 1340
1152 Cusseta Road
Columbus, GA 31902
(706) 653-4159

Area of Accomplishment Excellent funding; utility ROW tree replacement program; DOT tree planting projects.

Covington

Connie Head, Consulting Urban Forester
Technical Forestry Services
1055 White Head School Rd.
Commerce, GA 30529
(706) 335-7070

Area of Accomplishment Developed and implemented review procedure for developments under the direction/oversight of an urban forester/certified arborist. Training and implementation of the National Arbor Day Foundation utility tree pruning program.

Decatur

Hugh Saxon
P.O. Box 220
Decatur, GA 30031
(404)370-4104

Area of Accomplishment Tree ordinance addressing protection and replacement on single-family properties.

DeKalb County

Steven Strickland
DeKalb County Public Works
1330 Commerce Drive, 3rd Floor
Decatur, GA 30030
(404) 371-2365

Area of Accomplishment Greenspace provision in county tree ordinance.

Fulton County

Gene Callaway
Department of Environment & Community Development, Suite 2085
141 Pryor Street, SW
Atlanta, GA 30303
chcallaway@mindspring.com

Area of Accomplishment Tree preservation for all land uses.

Metter

Elon Flack, Metter Tree Board
P.O. Box 74
Metter, GA 30439

Area of Accomplishment Shared consulting urban forester position with City of Statesboro.

Rockdale County

Rebecca Lamphear
2570 Old Covington Highway
Conyers, GA 30012
(770)785-5919

Area of Accomplishment Tree preservation and landscaping including parking lot requirements and standards.

Savannah

Bill Haws, City of Savannah
Park and Tree Department
P.O. Box 1027
Savannah, GA 31402
(912) 651-6610

Area of Accomplishment Strong Tree Board. Separation of parks and city forester. Historic district management.

Statesboro

Corlyn McCrosky, Statesboro Tree Board
111 Hazelwood Drive
Statesboro, GA 30458-6236
(912) 764-2838
Also see Metter

Area of Accomplishment Training and implementation of the National Arbor Day Foundation utility tree pruning program.

Thomaston

Dudley R. Hartel, Consulting Urban Forester
1339 Madison St.
Comer, GA 30629-4001
(706) 783-3984

Area of Accomplishment Cyclic, but consistent budgeting over the past 10 years for urban forestry support; locally active tree board.

Valdosta

Frank Jenner, City Arborist
P.O. Box 1746
Valdosta, GA 31603-1746
(912) 259-3507

Area of Accomplishment Continuous and excellent community outreach (education) program. Other existing urban and community forestry management programs in Georgia.

OTHER RESOURCES

Ashburn

Connie Head, Consulting Urban Forester
Technical Forestry Services
1055 White Head School Road
Commerce, GA 30529
(706) 335-7070

Chatham County

Ruth Powers
Chatham County Engineering
P.O. Box 8161
Savannah, GA 31412
(912) 652-7805

Dalton

Paul Buchanan, Chairman
Dalton Tree Board
114 North Pentz Street
P.O. Box 1205
Dalton, GA 30722-1205
(706) 226-3959

Gwinnett County

Connie Wiggins, Executive Director
Gwinnett Clean and Beautiful
750 South Perry Avenue, SW
Suite 310
Lawrenceville, GA 30045
(770) 822-5179

Newborn

Connie Head, Consulting Urban Forester
Technical Forestry Services
1055 White Head School Road
Commerce, GA 30529
(706) 335-7070

GENERAL INFORMATION

Georgia Forestry Commission Urban and Community Forestry Program

Susan Reisch, Urban and Community Forestry Coordinator
6835 James B. Rivers/Memorial Drive
Stone Mountain, GA 30083
(404) 298-3935 Telephone
(404) 294-3591 Fax
sreisch@gfc.state.ga.us
1-800-GA-TREES
www.gfc.state.ga.us

USDA Forest Service – Southern Urban Forestry Technical Service Center

www.urbanforestrysouth.org

GLOSSARY OF TERMS

Arborist A professional trained in the care and management of trees.

Brownfield A site of previous industrial or commercial activity that has disturbed soils and actual or perceived contamination. Potential for reuse as tree resource area is dependent on significant soil restoration.

Conservation Easement Certain land rights from a piece of property donated or sold to a public entity or private land trust usually for a broader public objective.

Fee Simple Ownership of all land rights.

Forest A large area of trees at least 1/2-acre in size and a minimum width of approximately 100 feet at its narrowest point. The tree canopy has grown together, with understory growth of new trees, shrubs, and groundcovers, limbs and leaves that fall to the ground are not removed.

Hedgerow A narrow band approximately 20 to 50 feet wide of continuous trees with an understory that forms a divider between two open areas.

Landscape Architect A professional trained in the planning and design of land for human use and enjoyment.

Land Trust Private non-profit organization that works with private landowners to purchase and/or manage land usually for a broader public objective.

Managed Forest Forest that is managed by humans in some manner to control certain properties such as vine control, stand thickness, or drainage. Can be managed for product resource or other use.

Managed Woodland An area of trees with an approximate minimum width of 50 feet at its narrowest point. The tree canopy has grown together but the trees and understory are managed for recreation.

Natural Forest Forest that has not been planted or managed by humans, can include a succession forest that has grown on previously cleared or abandoned land.

Open Grown Trees Trees that are spaced so that their canopies are not growing together.

PDR Purchase of development rights. Direct purchase of the development right on land in order to preserve the existing use or conditions.

Planted Forest A forest where humans have planted the majority of trees for the purpose of product resource or recreation.

PUD Planned urban development. Area in which variance to standard zoning regulations is allowed for design flexibility in return for other benefits as defined by the community planners. PUDs can offer significant opportunities for tree preservation.

Specimen Tree A single tree growing in a managed landscape and planted far enough away from all other trees such that the entire tree can be viewed at maturity.

Street Trees Individual trees growing in rows within or directly adjacent to a street right-of-way.

Suburban Landscape Trees Individual trees or groups of trees growing in managed landscapes where the majority of the ground area is planted or mowed.

TDR Transfer of development rights. Regulation to direct development to a preferred location established by a community. Compensation comes from a private sector exchange, rather than from the public sector.

Tree Banking The planting of trees on land dedicated specifically for that use to allow a different parcel of land to be developed with fewer trees.

Tree Lawn The space between the street curb and the sidewalk reserved for planting trees but also shared with street lights and utilities.

Urban Forester A professional trained in the management of community trees and forest.

Urban Plaza Trees Individual trees or groups of trees growing in areas where a majority of the ground area is paved.

Watershed Area of land from which runoff drains to a stream, lake, or other body of water. Watershed boundaries are located by identifying the highest points of land surrounding the body of water.

Wooded Landscape An area of trees where the tree canopies have grown together but the ground cover is mowed and leaves are removed.

Zoning Basic means of land use regulation by dividing a community into districts or zones, each with different land use controls.