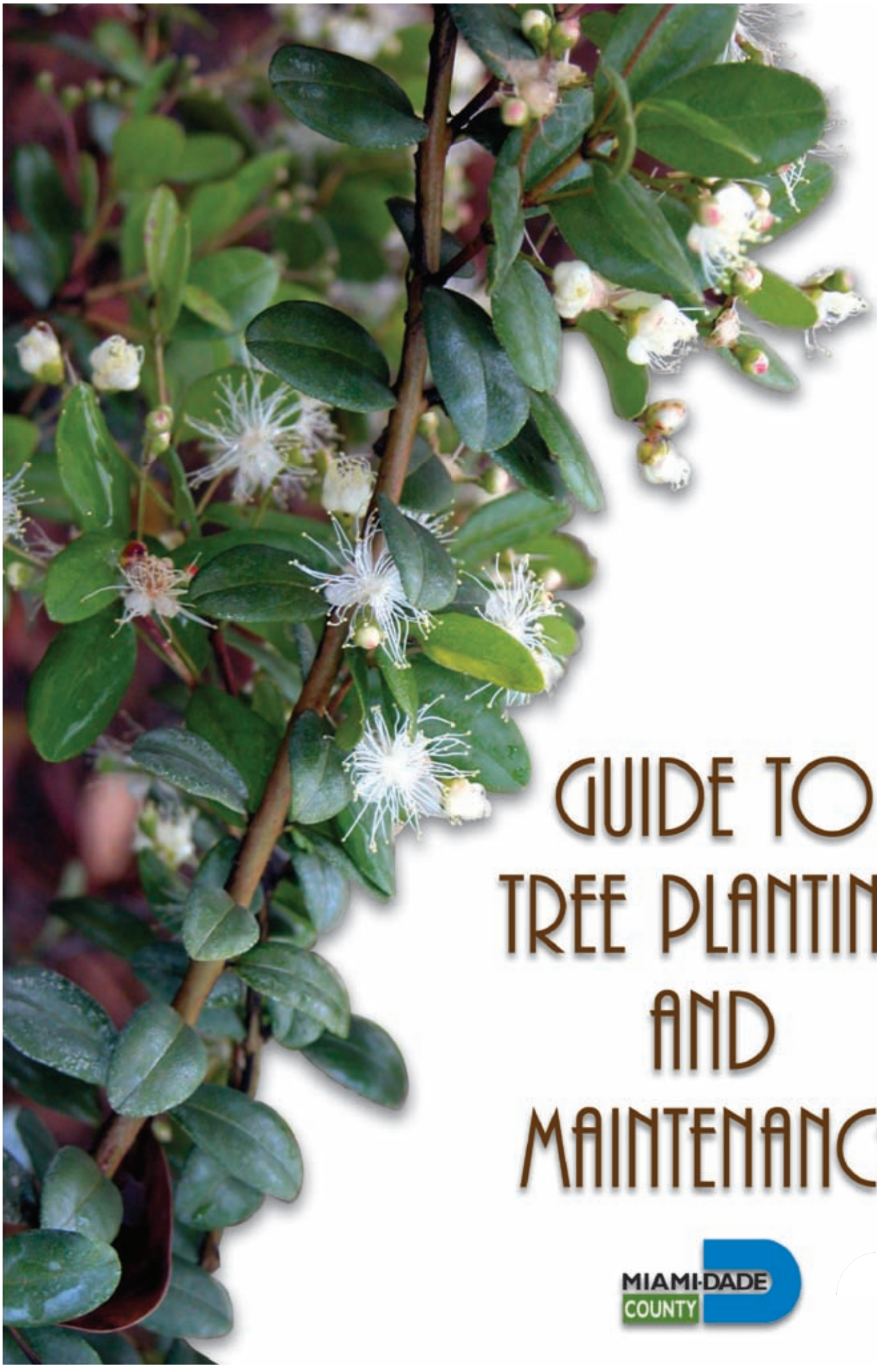


GUIDE TO TREE PLANTING AND MAINTENANCE

MIAMI-DADE COUNTY

No shade tree? Blame not the sun but yourself. ~Chinese proverb

ACKNOWLEDGEMENTS AND PERMISSIONS

This document was written collaboratively work by the Community Image Advisory Board (CIAB) and its member agencies, the Street Tree Working Group and Committee of the CIAB. Special thanks go to James Urban, Landscape Architect and Author; Dr. Edward Gilman, Professor, Environmental Horticulture Department, University of Florida; and Dr. Kathleen Wolf, Assistant Professor, College of Forest Resources, University of Washington, for their influential works and dedication to the creation and preservation of healthy urban forests.

Special thanks to the following people that have contributed photos for this Guide to Tree Planting and Maintenance:

Dr. Ed Gilman, University of Florida
http://orb.at.ufl.edu/FloridaTrees/index.html

Christina M. Casado
Miami-Dade County
http://www.miamidade.gov

Alyce M. Robertson
Downtown Development Authority

Henry Mayer, Donald Pybas
Institute for Food and Agricultural Sciences
(IFAS) http://www.ifas.ufl.edu

Chris Latt, John Oldenburg
City of Miami Beach

Special thanks to the members of the CIAB Street Tree Working Group and Committee:

John Oldenberg,
City of Miami Beach, Chairman

Christina M. Casado,
Miami-Dade County Office of Community Image

Chris Latt,
City of Miami Beach

Jim McMaster,
Grove Tree-Man Trust

Tsahai Codner,
City of Miami Gardens

Joy Klein,
Miami-Dade County DERM

Alyce Robertson,
Miami Downtown Development Authority

Gianni Lodi,
Miami-Dade Planning & Zoning Department

Juan Suarez,
Miami-Dade Planning & Zoning Department

Steve Duncan,
Miami-Dade Public Works Department

David Cardenas,
Miami-Dade Public Works Department

Don Pybas,
Miami-Dade Agricultural Extension

Henry Mayer,
Miami-Dade Agricultural Extension

Penny Lambeth,
Town of Miami Lakes/Treemendous Miami

Terry Lytle,
City of North Miami

Dan Keys,
City of Coral Gables

Rick Vasquez,
FPL

Jesse Stubbs,
Miami-Dade County Commission District 1

Regina Hagger,
City of Miami Public Works

Steven Craig James,
Florida Department of Transportation District 6

Dr. Anna Ward,
Community Image Advisory Board Member

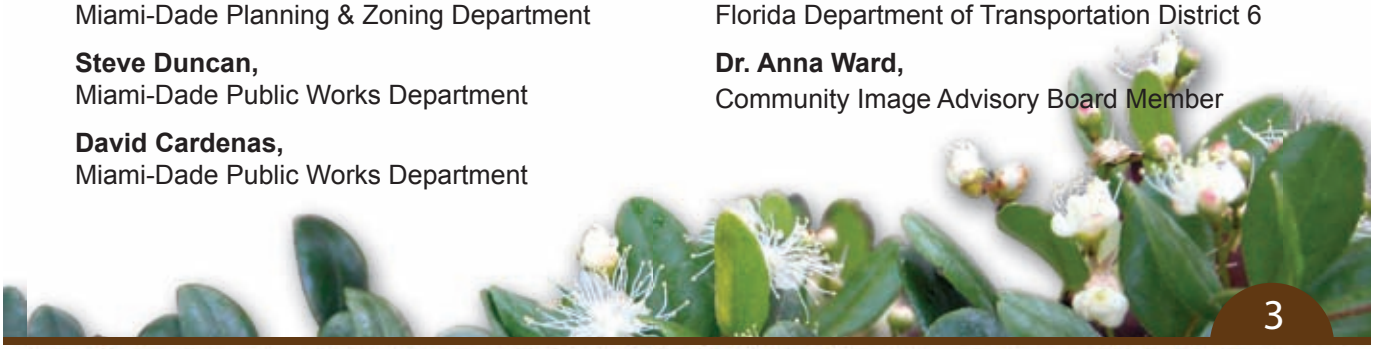


Table of Contents

This guide is one of a two part collection of documents that work together to drive the restoration and enhancement of Miami-Dade County's tree canopy into a thriving urban forest that provides multiple aesthetic and environmental benefits. These documents: 1) Miami-Dade County Street Tree Master Plan, and 2) the Guide to Tree Planting and Maintenance, are designed to support the "greenprint" for the appropriate planning, implementation, and management of our existing and planned tree resources.

This Guide to Tree Planting and Maintenance is a compendium of literature written by government agencies and academic institutions that has been assembled to provide you with an easy to read and ready reference to selecting, placing, protecting, and maintaining trees.

A healthy, functional, and attractive tree growing in any urban location provides benefits not only to the property owner, but to the surrounding community as well. The goal of this guide is to provide you with basic and practical information on how to best accomplish the most important tree management activities.

Who Should Use This Guide?

If you are a…

- Miami-Dade County Homeowner
- Government Official
- General Contractor
- Heavy Equipment Operator
- Landscape Maintenance Service Provider
- Neighborhood Association officer or member
- Tree Care Service Provider (Contractor or Employee)
- Urban Planner
- Engineer
- Landscape Architect
- Property Owner / Developer

--then this Guide is for you!

Your implementation of the practices in this guide is an important component of our overall community tree management program.

This Guide supports the Miami-Dade County Landscape Code (Chapter 18 of the Code of Miami-Dade County, Florida), and should be used as a community education tool, and as a standard for community tree care. For specific planting requirements and project planning guidance, refer to the Miami-Dade County Landscape Manual published by the Miami-Dade Planning and Zoning Department (http://www.miamidade.gov/planzone/lands.asp).

This guide also supports the Miami-Dade Street Tree Master Plan adopted in 2007 with a mission to provide the framework to design and implement tree plantings that complement the purpose and intent of the Landscape and Tree Ordinances and enhance the County tree canopy to a minimum of 30 percent coverage, countywide by 2020.1

For more information on the Street Tree Master Plan

go to (http://www.miamidade.gov/image/)

THE BENEFITS OF TREES

Trees are your best antiques. ~Alexander Smith

The Benefits of Trees

Trees provide you, and our community, with many environmental, social, and economic benefits. Many of these benefits are tangible and measurable. Studies indicate that trees increase property values, protect property as a wind break, reduce erosion, provide sociological benefits, increase and improve wildlife habitat, reduce noise levels, improve economic sustainability and enhance community aesthetics and appeal, contributing to community pride. In addition to what we traditionally think of as the benefits of trees, recent studies show a positive correlation between trees, social benefits, and quality of life indicators. For example, in one study, planting trees along neighborhood streets improved traffic flow.[2] In another study, there were reducted reports of physical violence in public housing that had trees outside the buildings, and significantly better relations and stronger ties between neighbors.[3] A U.S. Department of Energy study reports that trees reduce noise pollution by acting as buffers and absorbing 50% of urban noise. And, recent research shows that consumers are willing to shop longer and spend more in retail areas that have trees because trees provide a "human habitat."[4]

Urban forests improve air quality

Trees reduce air pollution by absorbing or intercepting pollutants such as carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone and particulates. A single mature tree can absorb carbon dioxide at a rate of 48 pounds per year, and release enough oxygen into the atmosphere to support two human beings. Three hundred trees can counterbalance the amount of pollution one person produces in a lifetime. One study from the U.S. Forest Service estimated that over a 50 year lifetime, a tree generates $31,250 worth of oxygen, provides $62,000 worth of air pollution control, recycles $37,500 worth of water, and controls $31,250 worth of soil erosion.[5]

Urban forests save energy

A tree can be a natural air conditioner. The evaporation from a single large tree can produce the cooling effect of ten room-size air conditioners operating 24 hours per day. Shading of homes and office buildings may reduce air conditioning needs by up to 30%, thereby reducing the amount of fossil fuels burned to produce electricity.[6] A recent study by American Forests found that the maximum potential annual savings from energy-conserving landscapes around a typical home ranged from a low of 13% in Madison, Wisconson to a high of 38% in Miami. Projections suggest that 100 million additional mature trees in U.S. cities (3 trees for every unshaded single family home) could save over $2 billion in energy costs per year.[7]

Urban forests reduce storm water runoff and act as natural pollution filters

Tree leaves and branches intercept rainfall, hold it and then release it slowly, thereby reducing runoff, increasing infiltration into the soil, and helping to maintain water quality. This translates to savings in avoided cost for infrastructure that does not need to be constructed to accommodate excess water.[8]

Urban Forests Can Extend the Life of Paved Surfaces

The asphalt paving on streets contains stone aggregate in an oil binder. Exposure to sun heats and volatilizes the oil, leaving the aggregate unprotected. Vehicles then loosen the aggregate and, much like sandpaper, the loose aggregate grinds down the pavement. Typically, streets need to be overlaid or slurry sealed every 7 to 10 years over a 30 to 40 year period, after which reconstruction is required. A slurry seal costs approximately $50,000/linear mile.[9] Shade slows the volatilization of the oil, so pavement on shaded streets requires less frequent maintenance than does pavement on sunny streets. On older streets with an extensive tree canopy, the slurry seal can be deferred from every 10 years to every 20-25 years, resulting in a large savings in maintenance costs.

Urban Forests Can Increase Traffic Safety

Trees can enhance the effect of traffic-calming measures, such as narrower streets, extended curbs, and roundabouts. Tall trees make streets "feel" narrower, and closely spaced trees give the perception of speed (they go by very quickly), resulting in slower driving speeds. A street without trees may be perceived as wide and free of hazards, thereby increasing speeds leading to more accidents.[10]

Trees serve as a buffer between moving vehicles and pedestrians.

Urban Forests Can Improve Economic Sustainability

Are the benefits that trees provide to our communities greater than the costs? The answer is yes. In most cases, the long-term benefits far outweigh the costs. A study of future benefits and costs of a tree planting program in Chicago found that the projected value of trees, when measured by such things as increased property values and decreased energy use, is nearly three times greater than the projected costs.[11] In Modesto, California, a cost/benefit analysis found that for each dollar spent on tree programs, the city received almost two dollars in benefits in terms of air pollution reduction, energy use reduction, and storm water runoff reduction.[12] It is also worth noting that unlike hard infrastructure, which depreciates over time, a tree's value increases as the tree becomes older and larger.

Urban Forests Can Increase Real Estate Values

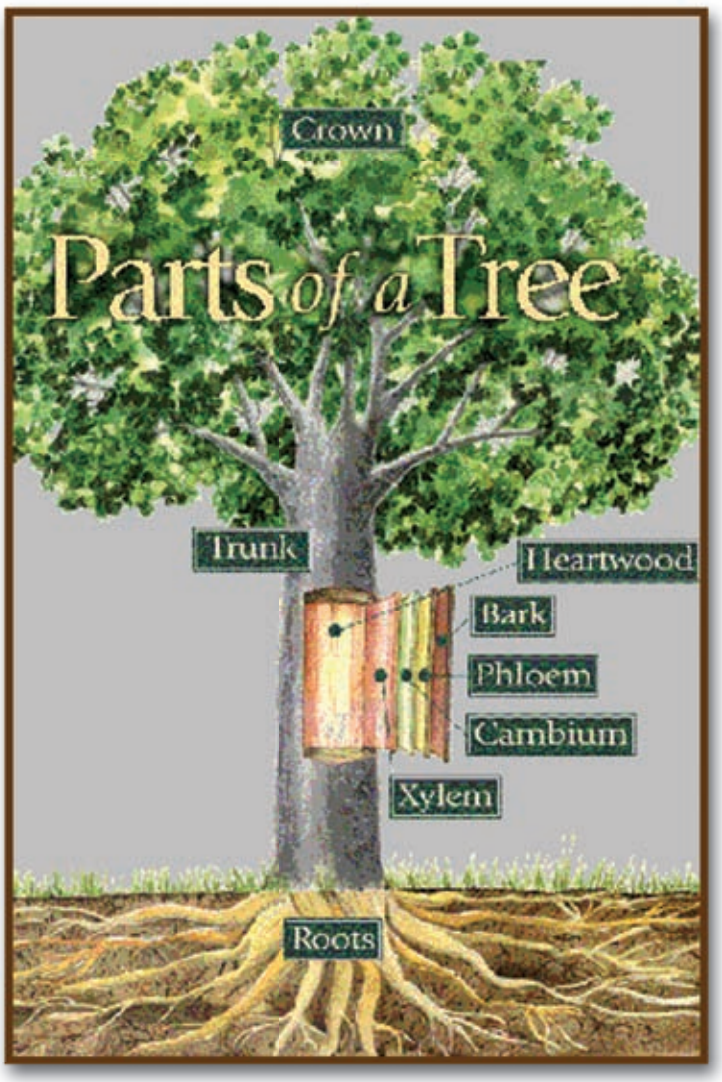
A community's urban forest is an expression of its pride and spirit and gives visitors a positive first impression of the community. Apartments and offices in wooded areas rent more quickly and have higher occupancy rates than similar facilities in areas without trees. Rental rates of commercial office properties were approximately 7% higher on sites having quality landscape including trees, and businesses that lease office space in developments with trees find their workers are more productive and absenteeism is reduced. Shoppers are willing to pay 9-12 percent more for products purchased in shops along tree-lined streets than they would pay for the same item in a barren setting.[13]

Research on the aesthetic quality of residential streets shows that trees are the single strongest positive influence on scenic quality. Well-maintained trees increase the "curb appeal" of properties. The studies on the effect trees have on residential property values finds that each large front-yard tree raised the sale price by 1%.[14] Various studies report that trees can increase property values from 5% to 15%, as compared to properties without trees (depending on species, maturity, quantity and location). In addition, appraised property values of homes that are adjacent to parks and open spaces are typically 8-20% higher than those of comparable properties elsewhere.[15]

Urban Forests Can Provide Sociological Benefits

Two University of Illinois researchers studied the effect of trees and greenery on the daily lives of residents of Chicago's Robert Taylor Housing Project (the largest public housing development in the world). They found that residents living in "greener" surroundings reported lower levels of fear, fewer incivilities, and less aggressive and violent behavior and had significantly better relations with and stronger ties to their neighbors. One positive correlation is that vegetation deters crime in poor urban neighborhoods by increasing residents' use of outside spaces, thereby increasing informal surveillance, and by mitigating residents' mental fatigue, thereby reducing the potential for violence.[16]

TREE BASICS



There are rich counsels in the trees. ~Herbert P. Horne

Tree Structure

A tree is defined as a woody plant that grows to 12 or more feet in height, usually with a single trunk, growing to more than 3 inches in diameter at maturity, and possessing an upright arrangement of branches and leaves. Trees are commonly referred to by their size, specifically their mature height.

In this Guide, tree heights are divided into small, medium, or large height classes and are defined as follows:

Small = Less than 20 feet tall at maturity
Medium = 20 to 30 feet tall at maturity
Large = 30 feet or taller at maturity

Figure 1. Small tree, i.e. Pigeon Plum (Coccoloba Diversifolia)

Figure 2. Medium tree, i.e. Lysiloma (Lysiloma Sabicu)

Figure 3. Large tree, i.e. Live Oak (Quercus Virgiana)

The Parts of a Tree

The three main parts of a tree are its crown, trunk, and roots.

Crown

The crown is the woody and leafy component of the tree that is supported by the trunk. It is composed of large, scaffold limbs that support smaller branches, twigs, leaves, and buds. The leaves absorb carbon dioxide and in the presence of sunlight produce food—carbohydrates—in a process called photosynthesis. As a by-product, the tree's leaves produce and release oxygen. Growth occurring at the tips of branches can increase the length of branches by a few inches to several feet per year, depending upon the species and growing conditions. **Tree crown size is measured as diameter in feet of the width of the branches at their greatest extent.**

Tree canopy cover is roughly calculated by multiplying the width of the crown in the north-south direction by the width of the crown in the east-west direction, or the longest spread multiplied by the shortest spread, (Fig. 4).

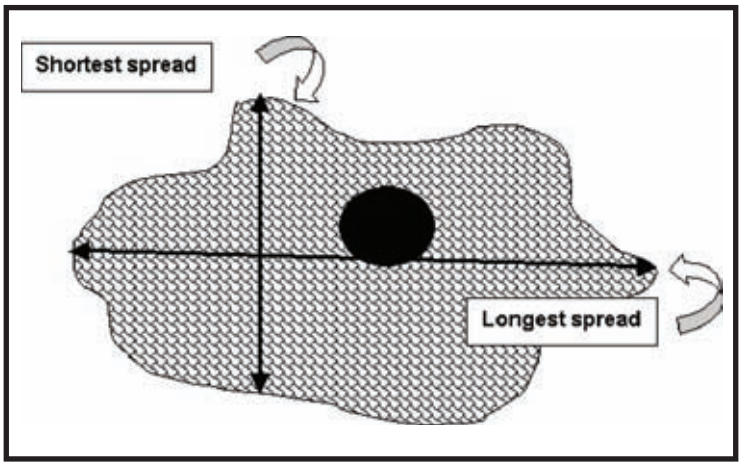


Figure 4. Source: Institute of Florida and Agricultural Sciences (IFAS/UF), University of Florida. For example, a tree with a crown width of 40 feet in the N-S direction and a width of 30 feet in the E-W direction has an approximate canopy cover area of 1200 square feet.

Size categories of mature crown canopy size for trees growing in urban areas are as follows:

Very Small Canopy = 150 square feet (approximately 12 x 12 feet)
Small Canopy = 400 square feet (20 x 20 feet)
Medium Canopy = 900 square feet (30 x 30 feet)
Large Canopy = 1600 square feet (40 x 40 feet)

Trunk

The trunk is the main woody stem of the tree and supports the crown. While most trees normally have one stem or trunk, other trees are characteristically multi-stemmed. Tree size is often measured as dbh or "diameter at breast height" which is the diameter of the trunk at 4.5 feet above ground (Fig. 5). For a tree forked at or below 4.5 feet, diameter is the sum of all the trunks at 4.5 feet above the ground.

Figure 5. You can calculate trunk diameter by measuring trunk circumference at 4.5 feet above the ground with a standard tape measure and dividing by 3.14.

The trunk stores carbohydrates and other substances necessary for tree growth and also transports water and nutrients to other parts of the tree. Beneath the bark—the outer protective layer that covers the trunk, limbs, branches, and roots—there is a very thin layer of specialized cells known as the cambium layer. The cambium layer is where growth in trunk and root diameter takes place each year when both a layer of wood (xylem) is produced to the inside, and a layer of tissue (phloem) and bark are produced to the outside.

Roots

The roots are the underground structures that anchor the tree and absorb water and nutrients essential for tree survival and growth. The anchoring roots are large, ropelike, and woody. Trees generate 4 to 11 large anchoring lateral roots within 7 years of seed germination. The largest lateral roots typically comprise about 75% of a tree's total root system (Fig. 6). Tree roots grow out from the trunk for a distance of at least 2 to 3 times the radius of the tree's crown, or at least 2 times the height of the tree.

However, they taper rapidly as they move away from the tree trunk. The large woody lateral roots grow out from the tree trunk and produce many small, fibrous, absorbing roots (fine roots) that generally grow up and into the top layers of soil and leaf litter—layers rich in organic material and nutrients. Beneficial fungi often infect the fine roots, forming mycorrhizae, structures that increase the surface area that absorbs water and nutrients.

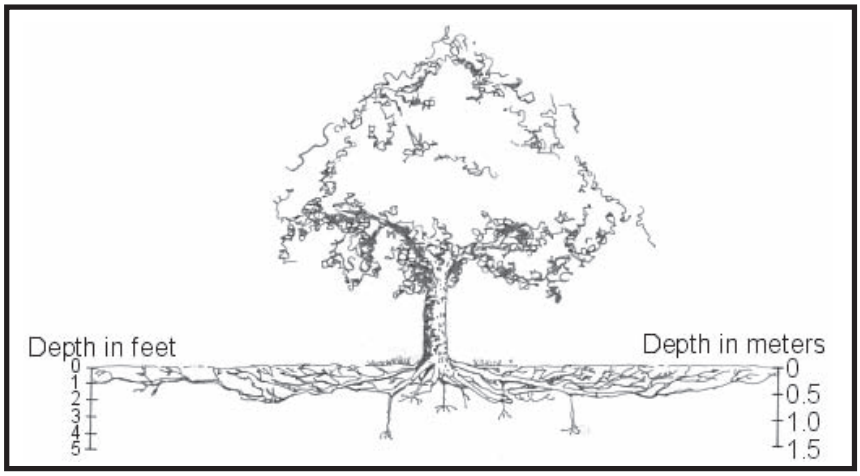


Figure 6. Source: IFAS/UF. 85% of a tree's roots are located in the top 18 inches of soil.

Tree Growth and Protection

Trees require a certain amount of basic substances and a specific combination of environmental conditions to function, survive and grow. Each individual tree species, like all plant species, has a range of soil moisture, soil volume, soil nutrient and acidity levels, air temperature, humidity, and sunlight in which it will grow. Under optimal conditions, trees will achieve their genetic potential for size, age, and characteristic form of their species. Under less than optimal conditions, trees will grow slower, be smaller at maturity, become easily stressed, have more dead wood, and be more vulnerable to attacks by insects and disease organisms.

Because trees contribute so much to our quality of life, they must be actively conserved, wisely selected, well placed, well planted, routinely maintained, and constantly protected.

Figure 7. Damage caused by weed eater

Figure 8. Damage to trees is permanent

One of the most critical steps in planning for trees and cost effective ways of managing trees is to maintain adequate growing space for each tree's roots, trunk, and crown throughout the tree's life.

Remember that as a tree gets older it gets larger and the growing space it requires increases accordingly. Because trees can only "seal" their wounds and cannot "heal" their wounds, any physical damage done to a tree's roots, trunk, or crown affects it for the rest of its life (Fig. 7, Fig. 8).

This is important to understand before we cut or damage a tree's roots, wound its trunk, providing an entry point for disease or decaying fungus, break its limbs, or prune it incorrectly. The amount of energy mostly carbohydrates, that a tree is able to store in the trunk, roots and branches affects its ability to withstand unfavorable conditions, hurricanes, stress, and resist attacks by insects, fungi, bacteria, and other harmful organisms. The amount of energy storage capacity that will be lost when trees are trimmed or root pruned is an important factor to consider when working around trees (Fig. 9). Trees most affected by injury or stresses are those that have lost significant amounts of energy-storing tissue, have inadequate soil volume (Soil Volume Chart Fig. 21, Page 21) and growing space, have been adversely affected by weather conditions, have been repeatedly wounded, or are at a critical point in their seasonal or life stage development.

Figure 9. Trees such as this banyan, have massive aerial roots that store energy and anchor the tree.

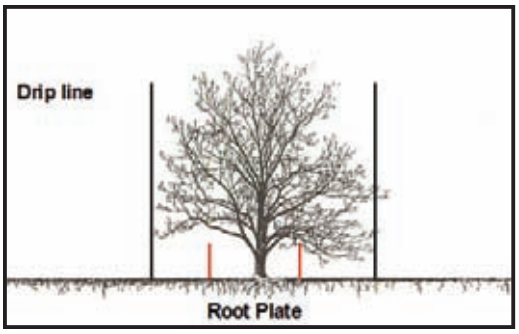


Figure 10. Source: IFAS/UF. A tree's dripline as illustrated above, is used to define the critical root zone (CRZ) or tree protection zone (TPZ).

In order to grow well and remain healthy, trees require a certain minimum amount of aboveground space to accommodate the trunk and crown, and a certain amount of soil and below ground space to accommodate root growth. The minimum volume of soil required to support trees of various sizes is shown in Figure 21. To preserve tree health, especially during construction or development activities, these areas, which are frequently identified as the critical root zone (CRZ) or tree protection zone (TPZ), must be protected. A commonly used means of defining the CRZ or TPZ is the tree's dripline, or the imaginary vertical line extending from the edge of the crown to the ground (Fig. 10). Using this measure, all area under the crown of the tree is protected. However, for small trees, newly planted trees, trees with narrow crowns, and leaning trees with crowns that are not centered over the trunk, the dripline may define an area that is too small for proper protection. Therefore, it may be better to define the CRZ or TPZ as a circular area, centered on the trunk of the tree, with a radius equivalent to the greater of 6 feet, or 1.5 feet for each inch of trunk diameter measured at 4.5 feet above the ground.

Avoid these common mistakes within (and as far as possible beyond) the tree's critical root zone (CRZ):

- ***Compacting soil with foot, vehicle, and equipment traffic and materials storage***
- ***Cutting roots by trenching for utility line installation or repair***
- ***Grade changes, including cuts and fills***
- ***Change in water drainage patterns and water levels***
- ***Soil contamination from equipment washouts, vehicle and lawn maintenance chemicals***
- ***Lack of adequate soil volume within and around hardscapes such as tree wells, plazas, and parking lots***
- ***Weed eating to close to trunk and surface roots***
- ***Mower damage to surface roots***
- ***Inappropriate applications of weed and feed products to turf within the root zones of trees***

Soil Health

Preserving soil health is essential to preserving tree root health, which in turn promotes whole tree health. While it seems that some trees will grow anywhere, most trees are particular about the soil conditions under which they will thrive.

Soil consists of basic components-mineral matter, organic matter, soil organisms, and pore spaces that hold water and oxygen. Both the texture of the soil and the structure of the soil are important factors in determining how much water and oxygen a soil can hold.

Soil conditions is also important and can be evaluated using standard tests that measure the amount of phosphorous, potassium, calcium, magnesium, zinc, and manganese in the soil. Soil testing in Miami-Dade is usually unnecessary since the soil will likely indicate that the soil is alkaline and nutrient poor. Where planting, soil amendments are not recommended unless absolutely necessary so that plant material can adapt to the native soil conditions as it establishes and grows.

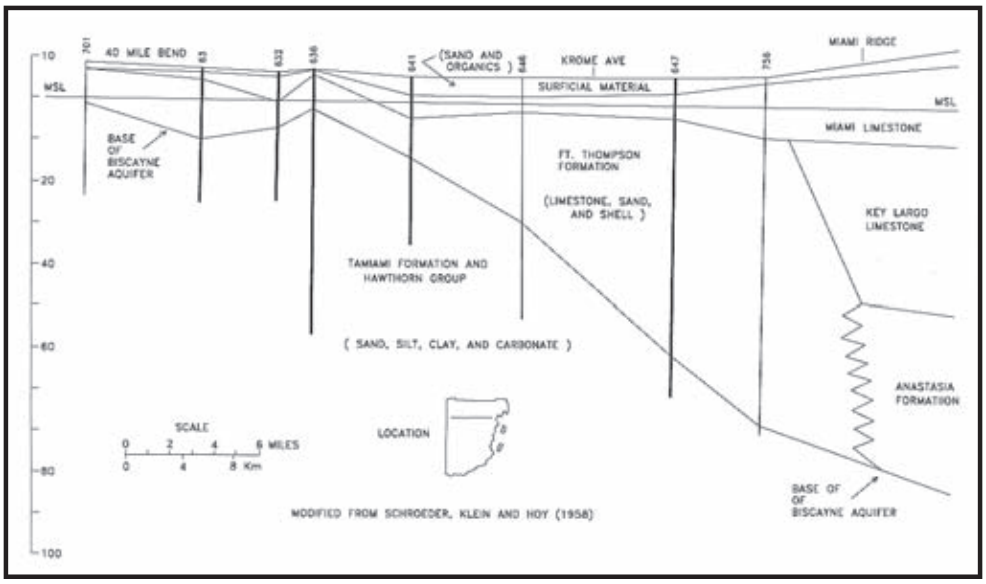


Figure 11. Geologic soils cross section of Miami-Dade County. The Miami Ridge (right) is the coastline and the 40-mile bend (left) is the west part of the County.

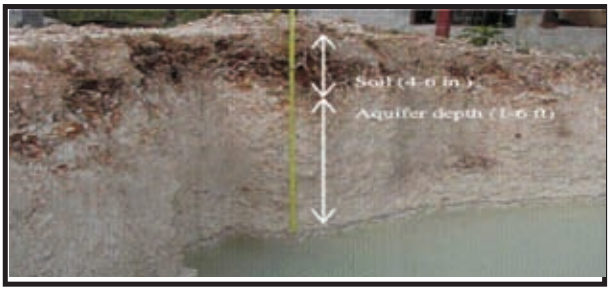


Figure 12. Source: IFAS/UF. Shallow limestone Biscayne Aquifer and thin "rock plowed" soil c/UFommon in south Miami-Dade.

Figure 13. Source: IFAS/UF. Limestone rock outcrop in a South Florida yard.

In Miami-Dade, our natural soils consist of rock, sand, marl and muck. The rock, is soft, oolitic limestone, which is an alkaline calcium carbonate found on the eastern edge of the County. Figure 11 illustrates a geologic cross-section of the County estimating the depth of our various geologic formations.

Oolitic limestone is high in pH (7.8-8.1) and does not retain water or nutrients well which contributes to the poor soil condition found in South Florida. To the west of the Miami Rock Ridge, the soil is a combination of sand, muck and marl.

Sand is found in large quantities around the "Redland" in the Southern part of Miami-Dade County and in pockets within the limestone coastal ridge.

Figure 14. Source: IFAS/UF. Sandy soils are fast-draining, but nutrient poor.

Figure 15. Source: IFAS/UF. This man is walking along a berm of muck that was recently excavated in South Florida. Although the dark organic matter is nutrient rich, muck is a slow draining, soggy soil.

Muck is half-decomposed organic matter and is often sold as potting-soil or top-soil, but has very poor aeration and drainage. It is very difficult to dry once it is wet and very hard to wet once it is dry. When exposed to the air, it oxidizes and disappears.

Figure 16. Source: IFAS/UM. Marl soils tend to crumble when dry.

Figure 17. Source: IFAS/UF. Limestone mining.

Marl is weathered limestone with a high in pH. It has the consistency of clay and has good water holding capability. Marl appears grey and will dry to a chalky substance.
Most newly developed building sites are in urban areas. This material is brought in and compacted to raise the grade of the building site. This is mostly crushed limestone and therefore has all the qualities of limestone such as a high pH, good drainage, and poor nutrient holding capacity. Rock, sand, muck, marl, and builder's fill are not a recipe for good soil and yet looking around South Florida one sees a lush tropical paradise. The key to growing plants in South Florida is the right plant in the right location. One must choose plants that are adapted to growing in our soil.

Soil moisture levels also affect the health of a tree (see section on "Irrigation"). Refer to the Recommended Street Trees for Right-of-Way Plantings list for specific information.

Design Considerations

A fool sees not the same tree that a wise man sees. ~William Blake

Trees typically grow poorly in densely developed urban areas where open soil space is limited unless the soil beneath and adjacent to hard surfaces supports root growth (Fig.18). Root growth is THE critical factor for successful design execution! The system has to be specially designed to accommodate tree root growth. This does not happen without careful planning, and execution.

Root paths are narrow channels of loose soil that provide a small path for air that encourages root growth under pavement (Fig. 19). A trenching machine is used to cut a trench through the compacted soil. Aeration mats are then placed in the trenches, which are backfilled with loose soil once the mat is in place. Roots tend to follow the paths because they provide a channel for airflow adjacent to the mat; roots follow the air. Encouraging roots to spread under the pavement can help to prevent roots from circling around in the small cutout in the sidewalk, which is a common cause for trees blowing over during hurricanes. This method is preferred over just providing a cutout or box of soil, though it does not significantly increase the amount of soil space.

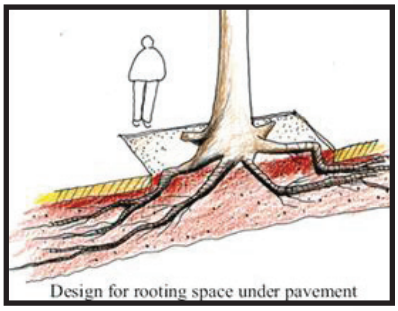


Figure 18. Source: IFAS/UF. Trees in urban environment need space for roots to grow underneath the pavement.

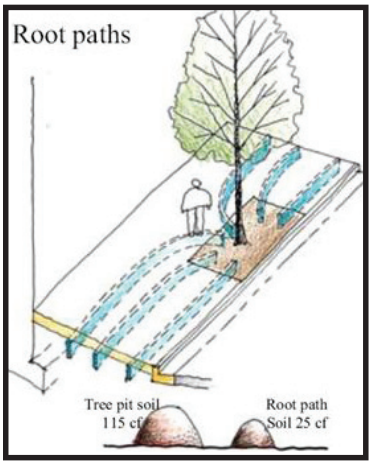


Figure 19. Source: IFAS/UF. Root paths

Structural soil is designed to support the weight of walks, roads, pedestrians and vehicles as well as provide a well-aerated soil substrate for tree root growth. In structural soil, weight is transferred from one aggregate (rock) to another, with enough soil to almost fill the space between the aggregates. The aggregates are angular rocks that are typically about 1 inch in diameter. Roots grow well in the soil between the aggregates, which is not compacted because load is transferred to the rocks.

Selecting a well-structured, healthy tree as defined in the Landscape Code, as “Florida Fancy” or “Florida #1” (Chapter 18 of the Code of Miami-Dade County, Florida, will contribute to the tree’s establishment and prolonged health. It is equally important to select a species well suited to the specific site conditions at the planting locations. For example, trees that thrive in wet conditions will not do well if planted on arid sites. Trees that are well selected and placed will provide recognizable, tangible benefits to the property owner and community.

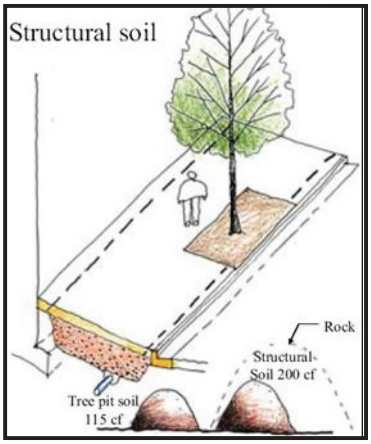


Figure 20. Source: IFAS/UF. Structural soils replace the filled areas underneath pavement in urban settings.

Soil Volume

Trees require adequate volumes of soil in which their roots can expand, allowing for tree growth. If adequate soil volumes are not available throughout a tree's life, then much more intensive management is required, and the tree will be reduced in size, condition, and useful life span.

It is very important to recognize that a tree's requirement for growing space and soil rooting volume increases as the tree ages and size increases. At the time they are planted, trees should be provided with enough growing space for their future, mature size.

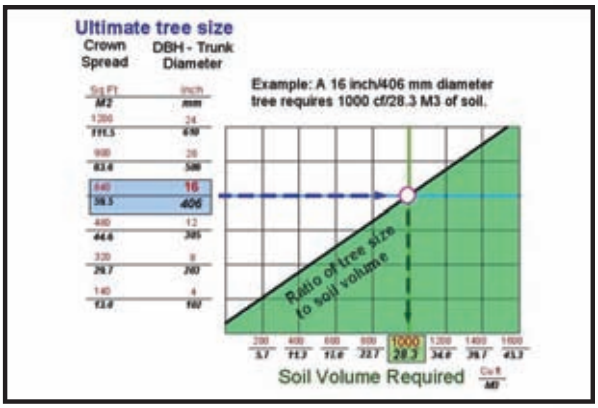


Figure 21. Source: James Urban. Note: The ultimate tree size is determined by the project size of the crown and the diameter of the tree at breast height.

The minimum requirements for the amount of soil area are listed below, by tree canopy size:

Very Small Canopy = 25 square feet (5 x 5 feet)
Small Canopy = 100 square feet (10 x 10 feet)
Medium Canopy = 225 square feet (15 x 15 feet)
Large Canopy = 400 square feet (20 x 20 feet)

Larger areas are recommended wherever possible. The use of soil volume enhancers (such as structural soils or silva cells) will reduce required soil surface accordingly.

Species Selection

Tree selection is an important part of tree conservation and planting. Native species, together with a few proven Florida-friendly species, are listed in the Tree Species List located in the Street Tree Master Plan, also provided as Appendix A of this guide. The recommended trees included in the list are the choices of local and regional experts and comply with the latest adopted version of the Miami-Dade Landscape Code. These species form a broad palette of trees for use in our landscapes. Some of the important species characteristics and growth requirements that should be considered when making tree management decisions are also indicated in the attached Tree List.

Outside resources available for assistance in selecting trees for planting are provided below.

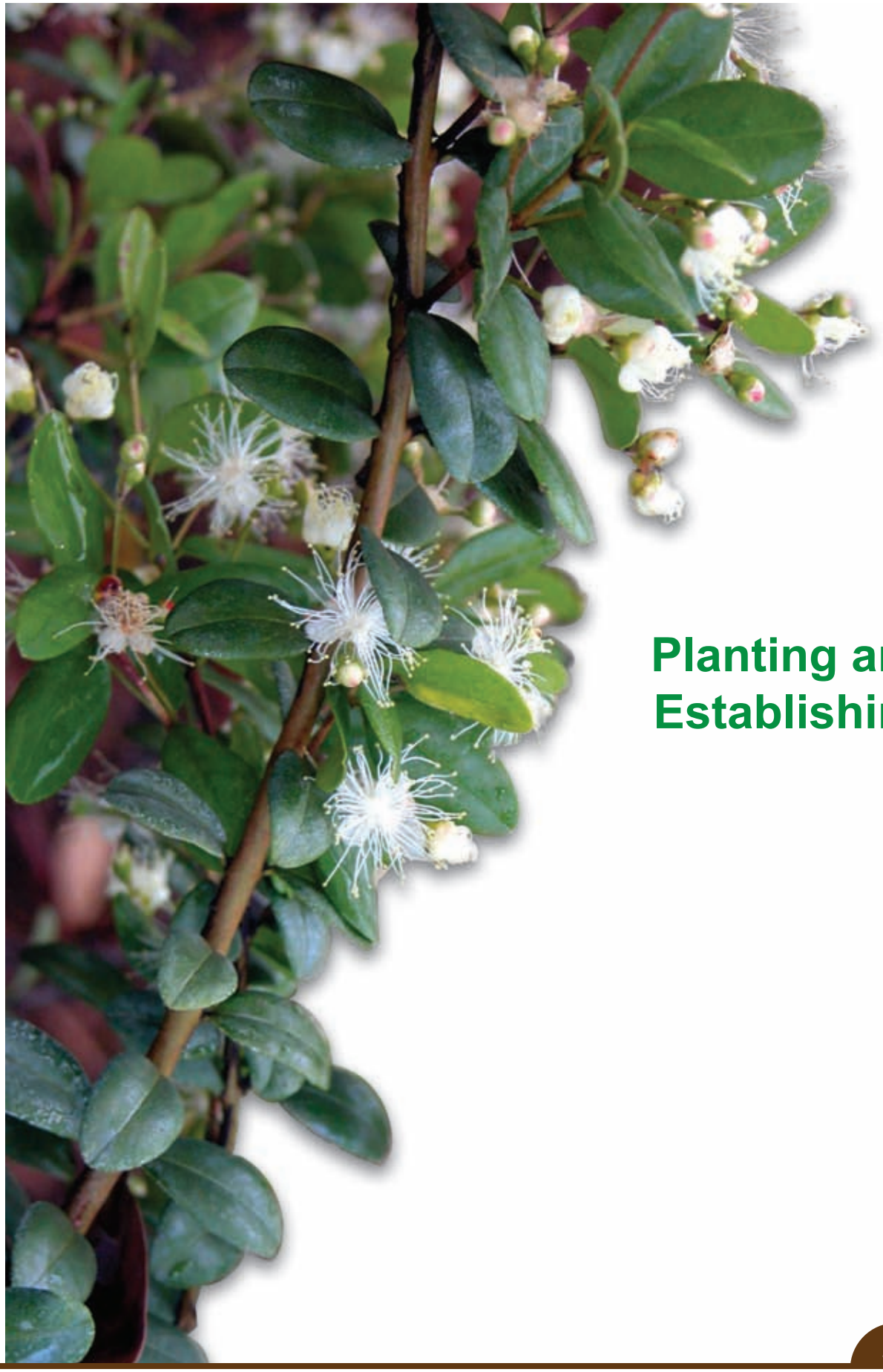
Tree Selector software (University of Florida) can be accessed at:
http://hort.ifas.ufl.edu/woody/species.shtml
Florida Friendly/Florida Yards and Neighborhoods: ***http://fyn.ifas.ufl.edu/***

Best Management Practices for Species Selection

- Plant trees that are native or appropriate.
- Plant Florida #1 Grade trees or better. For more information on Florida Grades and Standard, visit the Florida Department of Agriculture & Consumer Services Division of Plant Industry website: ***http://www.doacs.state.fl.us/pi/pubs.html***
- Plant large canopy trees wherever adequate space exists.
- Maintain species diversity by conserving and planting a variety of tree species.
- Evaluate site conditions sunlight, soil pH, nutrient availability, soil moisture, and growing space and select species for planting whose requirements match those conditions.
- Select species that will best provide the function desired on the site (e.g. use non-deciduous trees for buffering and screening).
- Select a tree from the recommended species in the Street Tree Master Plan palette.
- Select a tree of appropriate size (at maturity) for the site
- Provide adequate room for tree to grow to maturity without infrastructure conflicts that compromise health or form.
- Provide adequate usable soil volume for tree growth and stability.
- Ensure there will be adequate clearance, now and at maturity, between the tree and over head and underground utility lines, pedestrian and vehicular traffic, buildings, signs and street lights.

In order to avoid damaging underground utilities such as gas lines, water lines always call the Sunshine State One at 811 for utility locations before you dig to install trees 48 hours prior to planting.

He who plants a tree, plants a hope. ~Lucy Larcom



Planting and Establishing

"The best time to plant a tree is twenty years ago. The second best time is now." ~Anonymous

Before You Plant

The information in the following section is based on the work of Dr. Edward Gilman, Professor of the University of Florida. More detailed information can be found at: http:/hort.fl. edu/woody/

Step 1: Look up

A) Look up to see if anything is overhead: wires, security light, or building nearby that could interfere with proper development of the tree canopy as it grows.

Although small trees remain below the wires, they often have a short life span. If large trees are planted too close to wires, it increases costs of providing electrical service and reduces reliability

If your planting location is too close to overheard wires, plant elsewhere or plant a tree that has a small canopy or a narrow canopy at maturity or consider moving wires or lights so a larger tree can be planted.

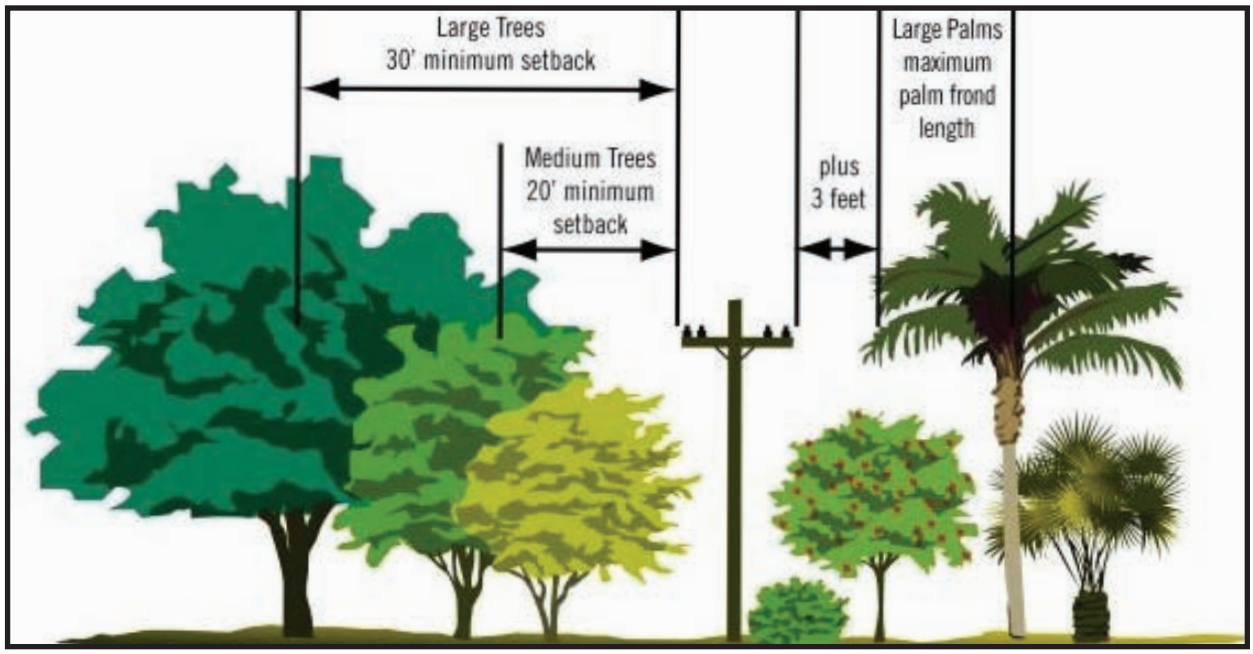


Figure 22. Source: Florida Power and Light (FPL). FPL recommended distances for trees to power lines.

Step 2: Dig shallow and wide planting hole

A) To estimate the depth of the planting hole, measure the distance between the point where the topmost root emerges from the trunk and the bottom of the root ball **(Fig. 23)**.

B) Then dig a hole slightly shallower than this distance **(Fig. 24)**. No more than about 2 or 3 inches of the root ball needs to be above the soil unless the site is poorly drained.

- If the soil is poorly drained, plant even higher.
- If the hole was inadvertently dug too deep, add soil to the bottom of the hole and compact it with your foot.
- If the hole fills with water as you dig it, position the bottom of the root ball above the water and mound soil to cover the sides of the ball.

C) Make the hole at least 1.5 times the diameter of the root ball **(Fig. 25)**. Wider holes should be used for compacted soil and wet sites. This helps roots from becoming deformed by the edge of the hole in compacted or clayey soils.

Figure 23. Source: IFAS/UF. Estimate size of planting hole.

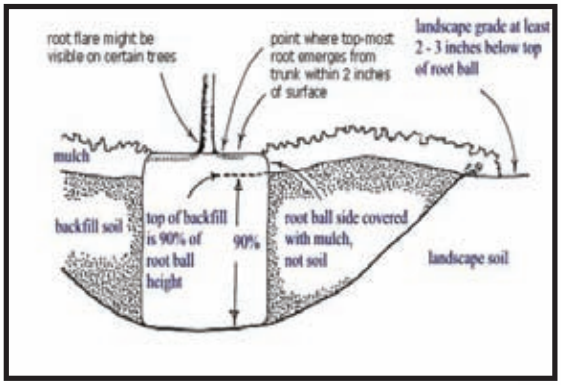


Figure 24. Source: IFAS/UF. Root ball should fit into the the hole with only 2-3 inches above the soil (with exceptions).

Figure 25. Source: IFAS/UF. Dig a hole at least 1.5 times the diameter of the root ball.

Step 3 Find the topmost root and treat defects

A) Choose a tree whose topmost root emerges from the trunk visibly, at or slightly above the surface:

- The point where the topmost root merges from the trunk should be within 2 inches of the surface (Fig. 26).
- Trees whose topmost roots are too deep in their root balls have less of a root system than trees whose topmost roots emerge near the surface.

B) To check for root defects such as circling and kinked roots in containers or field-grown trees, you might have to displace or remove soil and media from the top of the root ball, especially near the trunk. Be sure to look for roots that circled when trees were in a smaller container.

C) **If Yes:**

- Cut the circling root at the point before it begins to circle. This will prevent new roots that emerge from the cut from circling the trunk again (Fig. 27).
- Cut or spread out any circling or kinked roots growing up above the topmost root or by slicing the edge of a root ball from top to bottom with a balling spade after trees are in the hole.
- This will prevent these roots from strangling the trunk in the future, or trees may develop a severe lean after a wind storm due to an issue with circling roots (Fig. 28, Fig. 29) as branch roots develop on the outside of a circling root so there may be no support on that side of the tree.
- If these cut roots are large (larger than about 1/3 trunk diameter), the tree might shock and could die.

Figure 26. Source: IFAS/UF. Search for topmost root within 2 inches of surface.

Figure 27. Source: IFAS/UF. Cut circling roots of the point it begins to circle.

Figure 28. Source: IFAS/UF. Circling roots.

Figure 29. Source: IFAS/UF. Circling roots may cause to lean.

Step 4 Carefully place tree in planting hole

A) Lift the tree with straps or rope around the root ball. Do not lift it by the trunk. Special strapping mechanisms need to be constructed to carefully lift trees out of large containers and to handle large field grown balled and burlaped trees to prevent bark damage on the trunk and branches. Balled and burlaped trees should be handled by the root ball.

- Remove any plastic wrapped around the root ball before planting.

B) Position the rootball in the hole.

- Trees planted from containers may settle more than balled and burlped trees, so you may want to plant these an inch or two higher.
- Larger containers appear to settle more than smaller containers.

Step 5 Position the top most root 1 to 3 inches above the landscape soil

A) Position the topmost root about even with or slightly above (about 2 inches above) the top of the landscape soil in well-drained soil.

- Plant even higher in soil that drains poorly as that it is better to plant the tree too high than to plant it too deep.

B) Lay a shovel across the top of the planting hole to check root ball depth.

- If the tree is too deep in the hole, remove it from the hole and firmly pack soil in the bottom of the hole to raise the root ball.
- If it is only a little bit too deep, tip the ball to one side and slide some soil under it; then tip it back the other way and slide some more soil under the ball. Continue this until it is set at the appropriate depth.
- Once it is at the appropriate depth, place a small amount of soil around the root ball to stabilize it.
- Soil amendments are usually of no benefit. The soil removed from the hole makes the best backfill unless the soil is poor or contaminated.

Step 6 Straighten the tree in the hole

A) Before you begin backfilling have someone view the tree from two directions to confirm the tree is straight.

B) Fill in with some more backfill soil to secure the tree in the upright position.

- Once you add large amounts of backfill, it is difficult to reposition the tree.

Step 7 Remove synthetic materials

String, rope, synthetic burlap, strapping, plastic, and other materials that will not decompose in the soil must be removed at planting.

A) Treated Burlap

- Many contractors leave the treated burlap commonly used by field growers pinned in place. This seems to be all right as long as the topmost root is not too deep and there are no root defects to treat. However, removing burlap from the top of the ball allows you to check for root defects including deep planting in the root ball and circling roots.

B) Synthetic burlap

- If burlap is synthetic, be sure to remove all of it with a pruner, knife or other sharp blade. Roots grow through artificial burlap with little difficulty, but as the roots attempt to expand in diameter, they become girdled or strangled (Fig. 30). Synthetic burlap melts into plastic goo, while real burlap flames and turns to ash when lit.

C) Wire Baskets

- Baskets made from wire are typically used to help keep a root ball intact during shipping and handling and there is no research documenting any detrimental effects of wire baskets on trees.
- Do not attempt to remove some or all of the wire from wire baskets before backfilling unless this voids any guarantee that came with the tree. If you decide to remove wire, do so after the tree is positioned in the hole.
- Stake the tree to stabilize it.

Figure 30. Source: IFAS/UF. Roots growing through synthetic burlap can strangle roots over time.

Step 8 Add backfill and firm the backfill soil

A) Slice a shovel down into the backfill 20 to 30 times all around the tree as you add backfill soil.

B) Attempt to break up large soil clumps as much as possible. Do not pack the backfill, instead step firmly on the backfill soil, not the rootball, to help stabilize the root ball.

C) When the planting hole is filled with soil, the root ball should remain 1 inch (small trees) to 3 inches (larger trees) above the backfill soil. --Do not over-pack the loosened soil, especially when the soil is wet.

D) Add 10 to 20 gallons of water to the root ball and backfill.

E) Fill in any holes or depressions with additional backfill soil. Do not firmly pack backfill soil in an attempt to eliminate air pockets because this could cause too much soil compaction.

- The water infiltrating the backfill soil will eliminate many of the large air pockets.

The presence of small air pockets could even be of benefit because they could allow more air to reach the roots.

Step 9 Cover sides of the root ball with mulch

Mulch reduces soil temperature fluctuations, prevents packing and crusting, conserves moisture, helps control weeds, adds organic matter to the soil, and improves the appearance of the landscape. Common mulch materials include leaves, pine needles, compost, bark, and wood chips. Peat and cypress chips should not be used since once dry they are very difficult to wet and may restrict water movement into the soil. Inorganic materials such as gravel and crushed stone have been used, but do not provide any organic matter, are difficult to keep tidy and clean, and often work their way into the soil.

A) Provide a 3-inch-deep layer of mulch around the tree (Fig.31).

- Generally, a 2 to 3 foot diameter circle of mulch per inch of tree trunk caliper will give adequate mulch area for newly planted trees.
- A thin (1 inch) layer of mulch can be placed over the root ball for aesthetic reasons, but deep layers on the root ball can prevent adequate irrigation and rain from reaching roots.

B) Keep turf as far away from the trunk as possible with mulch or herbicides to aid tree establishment, **and to prevent mower damage to the trunk**, and to prevent soil compaction (Fig. 32).

Keep turf away from the bark, about eight inches from the trunk, make a large doughnut around the tree. This can rot the trunk, cut off oxygen to roots, keep vital irrigation and rain water out, and can keep roots too wet in poorly drained soils.

C) Build a berm to hold water from a high volume delivery system such as a hose or water truck, or if soil is sandy or very well drained. The berm will ensure that water penetrates to where it is needed most, i.e. in the root ball. Use mulch, not soil, from the rootball or backfill (Fig. 33).

- If mulch is used to construct the berm, it can wash over the root ball and bury the roots too deeply. Plastic edging can be used to keep water in so it all percolates through the root ball.
- The berm should be removed when the tree is established. Do not push the berm onto the root ball and trunk since this can cause root defects.

Figure 31. Mulching a newly planted tree.

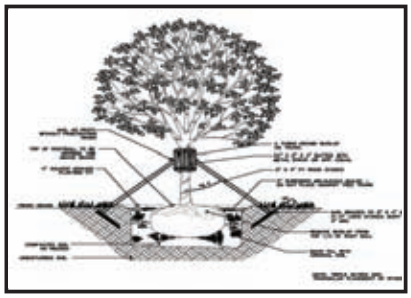


Figure 32. Keep turf grass away from trunk.

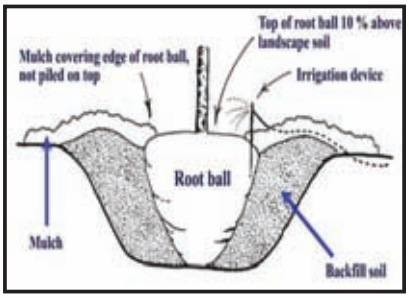
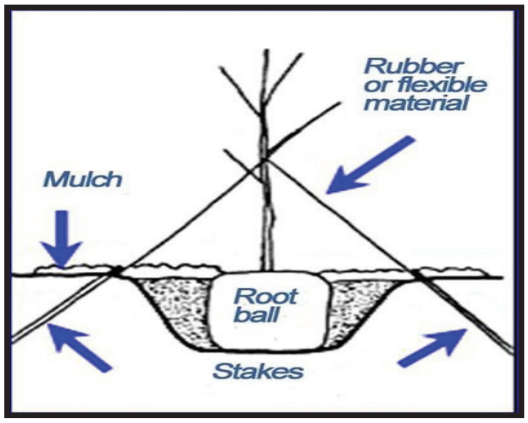


Figure 33. Source: IFAS/UF. Build a berm using mulch covering the edge of the rootball (not on top) to hold in water.

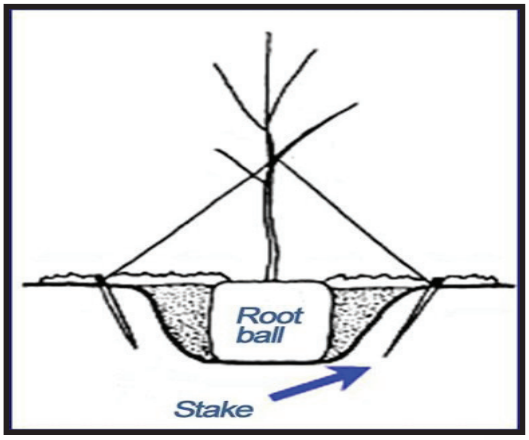
Step 10 Stake and prune if needed

Figure 34. Source: IFAS/UF. Staking a newly planted tree.



A) **Stake the tree only if necessary to hold the root ball firmly in the soil.**

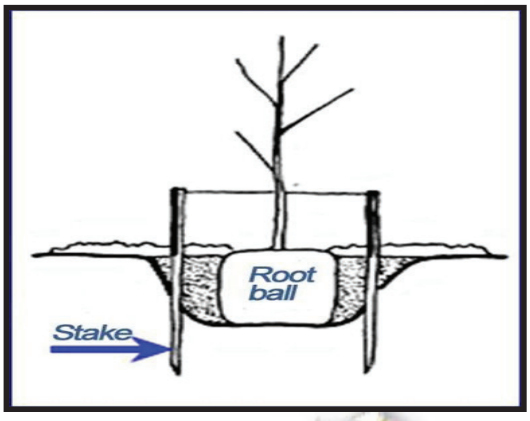
- If the root ball moves in the wind, emerging roots could break and trees will establish slowly.
- Staking to hold a thin, weak trunk upright should not be necessary on trees with a trunk diameter more than about 1.5 inches.
- If large trees require staking to prevent the trunk from bending, it probably indicates a lesser quality tree.
- Smaller trees might require staking until enough trunk strength develops.



B) **Traditional staking systems**
Figure 34 shows traditional staking systems
The system shown on top consists of three short stakes (2 shown) attached to the trunk with straps.

- The center system consists of three short stakes (2 shown) driven into soil in a traditional manner attached to the trunk with stretchable material.

The system shown on bottom consists of two or three two-inch by two-inch wood stakes driven straight through the backfill soil. Recent research shows that stakes driven straight into the ground are most secure in the soil. Tree stakes require removal within about one year after planting.



C) Prune to remove or reduce stems that compete with the main leader if no pruning is planned in the next couple years. Wait until later if there is pruning planned in the next two years. Broken branches should also be pruned, but do not over-prune to compensate for root loss.

Establishing Trees

Once planted, care must continue until such time that the new trees are established in the landscape. This establishment period is the time it takes for a tree to regenerate enough roots to stay alive without irrigation. During this period, shoots and the trunk grow slower than they did before transplanting. A tree may appear to be established after a period of favorable growing conditions; however true establishment may take several years as growing conditions will vary with the season and from year to year. Only when the growth rates of the shoots and trunks become more or less consistent from one year to the next is the tree considered to be established.

At the end of the establishment period in those landscapes where roots can expand without obstructions a tree has generally regenerated enough roots to stay alive without supplemental irrigation. However, urban structures such as curbing, sidewalks, buildings or roadways often provide physical barriers to the growth of new roots into new soil spaces and may therefore limit the quantity of water available for use by the tree. In cases like these and in any situation where new soil is not available for exploitation by roots, the tree's establishment status may change over time and a tree site may revert and require supplemental watering once again.

On sites uninhibited by urban structures, rainfall in Florida is usually sufficient to maintain trees once established, however, in severe drought periods even mature trees can benefit from watering by turf and landscape irrigation systems or hand watering.

Tree Care and Maintenance

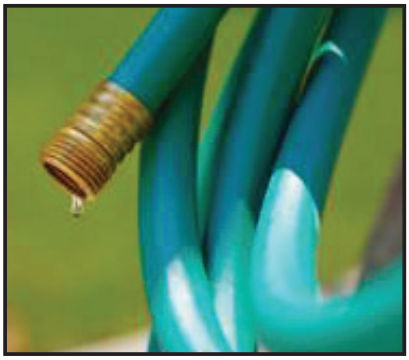
A tree falls the way it leans. ~Bulgarian Proverb

The routine care given to a tree through its life will preserve or improve its health, function, and safety. The amount of maintenance a tree requires depends on the species, the tree's location in the landscape, its age, and the care (or abuse) it receives. Basic tree maintenance begins with regular inspections to determine a tree's needs, which may include mulching, irrigation, pruning, fertilization, and pest management. Each of these maintenance activities is discussed separately below.

Three of the most common causes of poor plant establishment or tree death are:

Planting too deep

Under watering



Over watering

Source: IFAS/UF

If appropriate trees are planted at the right depth and they are irrigated properly, the planting has a good chance of success. As simple as this appears to be, problems often arise that lead to poor establishment or plant failure.

Mulching

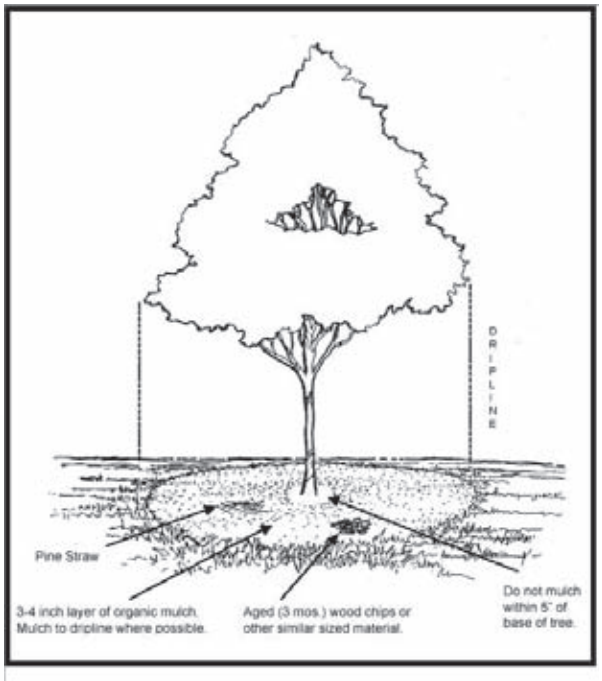
Mulching is the application of organic material on top of the ground over a tree's root system to improve soil moisture, temperature and fertility and to enhance root and tree growth. The objective in mulching is to recreate the conditions found in undisturbed, natural areas.

During establishment mulch should be maintained to control weeds and protect the trunk. Weeds can also be controlled with herbicide. Increase mulch diameter over time to keep pace with root growth for best establishment. Roots normally grow 3 to 10 feet in length the first year after planting. Soil compaction should also be minimized during establishment to allow adequate root expansion. This is best accomplished with wide mulch areas. If staking systems have not been removed, remove them about one year after planting to prevent trunk girdling but keep mulch off the root ball (Fig. 35).

Best Management Practices for Tree Mulching

- Use organic materials such as pine straw, leaves, aged wood chips, and compost when possible.
- For newly planted trees, mulch an area at least six feet around the tree, or 1½ DBH.
- For established trees, mulch out to the dripline or as far out as practical.
- Spread mulch in an even layer, 3 to 4 inches deep and avoid mounding the mulch around the tree trunk.
- Keep mulch at least 5 inches from the tree trunk to avoid bark decay and the creation of favorable conditions for pests and pathogens.
- Mulch twice per year, in the late spring and in fall during leaf fall.
- Use a tree's own leaves for mulch.
- Avoid using string weed trimmers around the base of trees to remove weeds within mulch beds. Hand pull weeds or use a contact herbicide to kill weeds.

As simple as mulching can be, if done improperly it can cause problems for the tree such as insect, disease, and rodent damage, or a decrease in soil aeration or moisture.



Use Figure 35 as a guide for recommended mulching methods. Source: IFAS/UF.

Tree Pruning

Pruning is the removal or shortening of tree branches to achieve a specific objective, for example, reduced tree size or spread, development of structural strength, improved tree health and appearance, and better clearance. Regularly inspect your trees to determine pruning needs, and be sure to specify your objective before starting to prune.

The benefits of correct tree pruning are:

- Better tree form, health, and structural strength
- Reduced risk of limb or stem breakage
- Improved clearance for pedestrians and vehicles
- Improved appearance
- Removal of dead, damaged and diseased branches

Some of the common mistakes made in tree pruning include:

- Using improper techniques which can harm the tree, for example, topping, stub cuts, flush cuts, and tearing the bark beneath the pruning cuts
- Removing more than 25% of the tree's crown during a single growing season
- Excessive raising of the crown
- Using spikes to climb trees during pruning
- Delaying pruning until limbs get so large that pruning will result in major wounds
- Pruning trees on a crisis-only basis, for example, a hurricane warning
- Pruning to reduce tree size as a substitute for proper tree selection and placement
- Hiring untrained or unqualified crews to trim trees

Best Management Practices for Tree Pruning

- Put safety first! Carefully consider the hazards and personal risk before deciding to prune your own tree.
- Hire only experienced professionals to prune trees; arborists certified by the International Society of Arboriculture (i.e. certified arborists) are required to pass a written test of basic arboricultural knowledge and to attend continuing education courses to maintain their certification.
- Remove no more than 25% of a healthy tree's crown during a single growing season. For mature or stressed trees, removal of even 25% of the crown may be harmful, so pruning should be kept to the minimum necessary to achieve your objective.
- Maintain a live crown ratio of greater than 60%. Live crown ratio is the percent of total tree height occupied by functional branches, so a 100-foot-tall tree with branches growing along 60 feet of the trunk has a live crown ration of 60%.
- Remove girdling or circling roots growing around the trunk.
- NEVER "top" or "hatrack" trees. Topping, in which major branches are reduced to stubs, is an unacceptable practice that greatly decreases tree health, safety, and longevity.
- ALWAYS use proper pruning cuts and techniques.
- Tree trimmers should:
    - ***a.*** Evaluate trees for hazards before climbing or pruning, and notify the tree owner of potentially hazardous or harmful conditions.
    - ***b.*** NEVER use climbing spikes or spurs while pruning trees, except during an emergency rescue.
    - ***c.*** Keep pruning tools and equipment sharp, clean, and in good operating condition.
    - ***d.*** Sterilize pruning equipment after pruning limbs or trees that show evidence of disease, and before moving to another tree.
    - ***e.*** Always wear personal protective safety equipment while pruning, including safety glasses.
    - ***f.*** NEVER prune (or remove) trees under powerlines, or located near other utility lines, unless you are trained and certified to trim trees near utility lines.

Young Trees – Pruning Objectives:

The main goal of pruning young trees is to create a strong branch structure that will reduce the future risk of tree or branch failures.

1. Develop or maintain a single dominant leader, which is the shoot that will form the tree's trunk.
2. Identify the lowest branches to be retained in the permanent canopy. This will be determined by the amount of clearance required under the tree.
3. Prevent branches below the permanent canopy from growing too large, so that major wounds will not be created when the branches are removed.
4. Prevent branches from growing larger than one-half the trunk diameter.
5. Space main branches along the trunk, to avoid closely spaced branches growing from the same general location.
6. Remove crossing or rubbing branches.
7. Suppress growth on branches with included bark, or remove the branches. Included bark is the bark trapped between branches growing at tight angles, forming a weak branch connection.

Mature Trees – Pruning Objectives

The main goals of pruning mature trees are to reduce risks associated with branch or tree failure, maintain tree health, and provide required clearance.

1. Reduce the risk of failure by proper pruning, based on the specific situation:
   a. Remove dead, damaged or diseased branches, while retaining small-diameter interior branches.
   b. Reduce mass and weight of foliage especially at branch ends. Pruning should focus on smaller branches and, if possible, should exclude larger branches that are more than one-third the diameter of the trunk or older than fifteen years.
   c. Correct structural problems
   d. Raise the crown if necessary
2. Maintain tree health, especially by cleaning crowns of dead, diseased, or structurally defective branches.
3. Provide clearance under the tree, and near buildings, powerlines and lights.
4. Improve tree appearance.

Pruning Cuts

As illustrated below, trees present you with three possible situations when removing branches:

a. ***Visible branch collar. Cut to the edge of, but outside of, the collar. Do not damage the branch collar.***

b. ***No visible collar. Begin the cut where the top of the branch makes an abrupt turn toward the trunk and cut outside an imaginary line drawn parallel to the trunk.***

c. ***No visible collar and included bark. Make the final pruning cut at the base of the actual connection between the branch and trunk.***

There is no need to apply paints, wound dressings, or chemical formulations of any type to the surface of the cut because none of these helps prevent decay. Only appropriate pruning, properly executed, helps prevent decay. Refer to http://hort.ufl.edu/woody/pruningcuts.shtml for more on pruning methods.

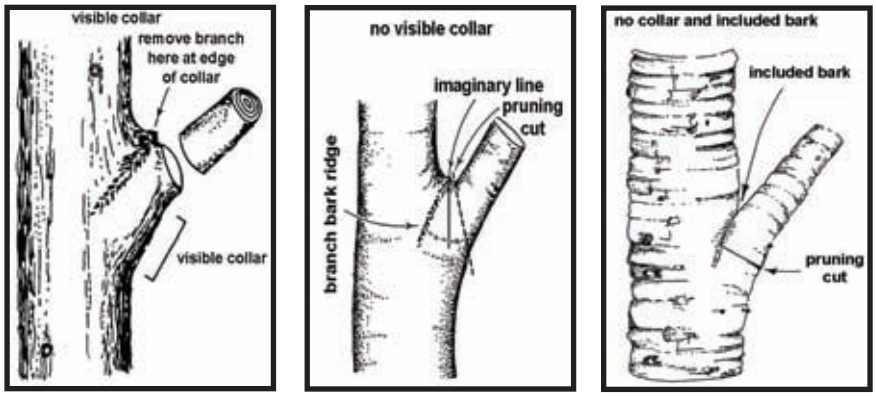
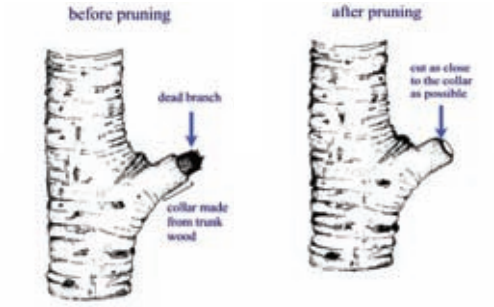


Figure 36. Source: IFAS/UF. Three situations and recommended pruning cuts.

Dead Branch Removal

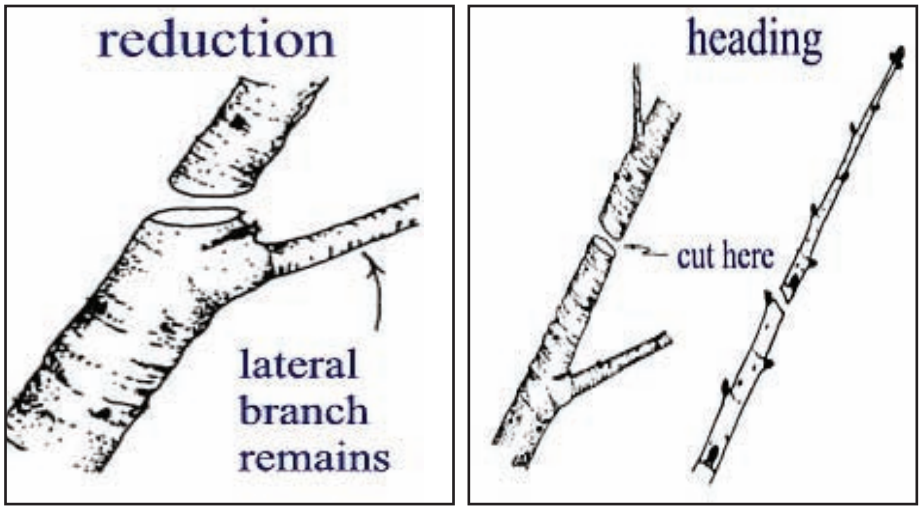


Before pruning: A collar of trunk wood begins to grow out onto a dead branch that remains on the tree. Be sure not to cut into this collar. Cutting into the collar amounts to cutting into the trunk. Removing dead branches is good for the health of trees.

After pruning: Cut all dead branch tissue from the tree, but do not injure the collar. If the branch is small or severely decayed, you might be able to simply break the dead branch from the tree. This often allows you to remove more of the dead tissue inside the edge of the collar. Do not break the dead branch if this could injure the collar.

Figure 37. Source: IFAS/UF. Removing dead branches is good for the health of the tree. Do not injure the branch collar.

Stem Reduction



A reduction cut (also referred to as a drop-crotch cut) removes a stem back to a lateral branch that is at least one-third the diameter of the cut stem. Sprouts commonly follow a reduction cut, especially if a large portion (greater than about one-quarter) of the live foliage was removed with the cut. If the branch that remains is less than about one-third the diameter of the cut stem, the cut is considered a heading cut. Reduction cuts are used to reduce the length of a stem or branch. Heading cuts are not considered appropriate in most instances in the landscape. Heading cuts are sometimes necessary when attempting to restore trees following storm damage.

Figure 38. Source: IFAS/UF. Stem reduction is best accomplished using reduction cuts. This method frequently creates sprouts.

Large branch removal

The recommended method to safely remove large tree limbs without causing unnecessary harm to the tree is illustrated in Figure 39 (see following page). Begin with an undercut (Cut 1), and then make a second cut on the top side of the limb, farther towards the end of the limb (Cut 2). With cut 2, the branch begins to fall, and cut 1 prevents bark from stripping away on the underside of the branch. After the branch has been removed, the final cut (Cut 3) removes the branch stub. Cut 3 is made just outside the collar and branch bark ridge if present. If not present, the final cut should be made through the limb at a point that results in the smallest wound size.

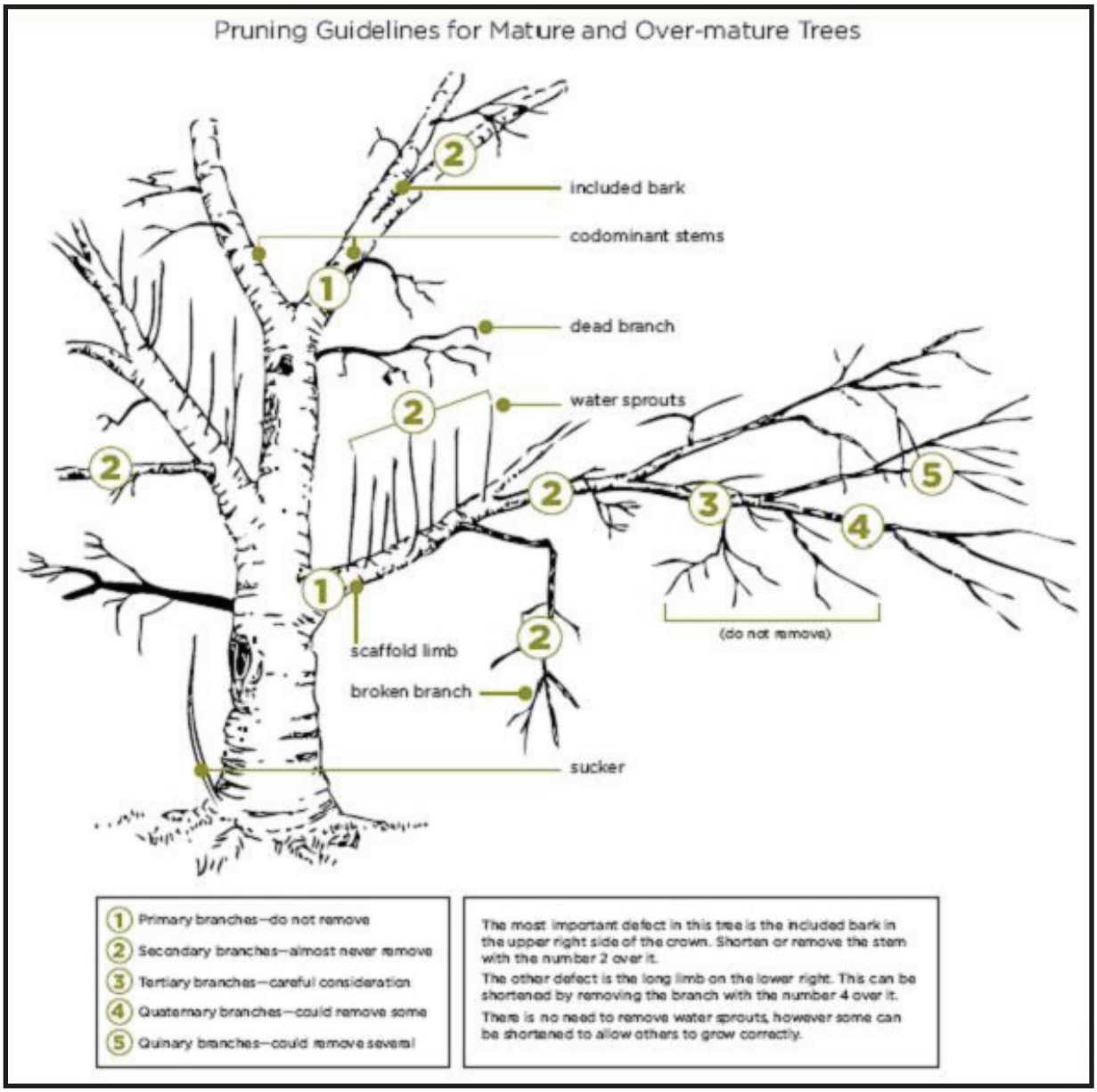


Figure 39. Source: IFAS/UF. Large branch removal.

Tree Fertilization

Fertilization is the application of nutrients to the soil or plant leaves to enhance growth. It should only be done only for a specific purpose or to correct a specific deficiency identified through soil testing or foliar analysis. The Cooperative Extension Service (305-248-3311) may provide fertilization advice and soil sample analysis, as do private laboratories.

Best Management Practices for Tree Fertilization

1. Apply fertilizer based upon recommendations resulting from a soil test to address known deficiencies.
2. Do not apply fertilizer to newly planted, drought stressed, or severely wounded or injured trees.
3. Use an NPK fertilizer ratio of 3:1:1 or 3:1:2 in the absence of a recent soil test. Mature trees in lawns that are regularly fertilized do not require additional fertilization.
4. Use slow release organic fertilizers with a salt index of less than 50.
5. Apply slow release fertilizers to trees at a rate between 2 and 4 pounds of nitrogen per 1000 ft 2 of root area.
6. Apply fertilizer to the CRZ of trees, from the trunk to the dripline, but only once to overlapping root zones.
7. Do not use fertilizer injections and implants into the trunk for routine fertilization.
8. For palms, use 8-2-12-4 Mg plus micronutrients, with 100% of N, K, and Mg in controlled release form. Apply 15 pounds of fertilizer (not N) per 1000 square feet every 3 months.
9. Do not use turf fertilizers with high N and water-soluble K within 50 feet of any palm.
10. Palm fertilization information can be accessed at the website of University of Florida-IFAS Ft. Lauderdale Research and Education Center at **http://flrec.ifas.ufl.edu/palm_prod/palm_nutrition.shtml** and at University of Florida IFAS Extension please visit: **http://edis.ifas.ufl.edu/pdffiles/EP/EP26100.pdf**

Tree Irrigation

All landscape shrubs and trees grown in a nursery and planted in a landscape require water to become established. Water is essential to tree growth, the absorption of nutrients, and the tree survival. Irrigation may be done simply using a hose, sprinkler, or bucket, or may be accomplished with a large capacity water tank, or installed low volume irrigation system. Irrigation is most crucial to newly planted trees. Well-established trees that are well matched to site conditions should not require irrigation except during extended dry periods.

The amount of water required for a tree depends upon its age, trunk diameter, soil type, environmental conditions, and the size of its root zone. Research shows that frequency of irrigation has a greater affect than irrigation volume. This means that you can not make up for lack of frequency by adding large volumes less frequently. Never apply irrigation if the soil is saturated.

Under most circumstances, rainfall occurs irregularly, so irrigation is required, at least until plants are established. When the tree growth rates become more or less consistent from one year to the next, the tree is considered established. Trees require about three to four months per inch caliper to become established. Shrubs require about 20 to 28 weeks to become established. Once drought-tolerant plants like live oak, are established, they can withstand extended dry periods with little or no irrigation.

Irrigation events should be 2 to 3 gallons of water per inch trunk diameter. For example, a 2 inch tree should be watered 4 to 6 gallons at each irrigation event. In the case of newly planted trees and shrubs, water should be applied directly to the root ball. It is important to keep the mulch away of the rootball in order to avoid water interception. When water reaches the rootball, new roots can grow and develop quicker. Regular irrigation after planting encourages rapid root growth that is essential for tree establishment. Irrigation helps maintain and encourage the desirable dominant leader in the tree canopy on large-maturing trees. Instead of a dominant leader, trees that are under irrigated during the establishment period often develop undesirable, low, codominant stems and double leaders that can split from the tree later. Since most root growth occurs in the summer months, irrigation during this time is crucial. You could lose almost an entire year's root growth if you under irrigate the first summer.

In order to save water and provide and fulfill tree requirements it is recommended to use drip irrigation and other low volume irrigation devices. When designing irrigation systems, keep trees, and shrubs in different irrigation zones than lawn, and ground covers. Irrigation recommendations for trees can be found at http://hort.ufl.edu/woody/irrigation.shtml

Figure 40. Source: IFAS/UF. Irrigation schedule for recently planted trees.

Size of nursery stock	Irrigation schedule for vigor 1,3	Irrigation schedule for survival 2,3,4
< 2 inch caliper	Daily for 2 weeks; every other day for 2 months; weekly until established.	Twice weekly for 2-3 months
2-4 inch caliper	Daily for 1 month; every other day for 3 months; weekly until established.	Twice weekly for 3-4 months
> 4 inch caliper	Daily for 6 weeks; every other day for 5 months; weekly until established.	Twice weekly for 4-5 months

1.) Delete daily irrigation when planting in winter or when planting in cool climates. Irrigation frequency can be reduced slightly (e.g. 2-3 times each week instead of every other day) when planting hardened-off, field-grown trees that were root-pruned during production. Establishment takes 3 (hardiness zones 10-11) to 4 (hardiness zones 8-9) to 8 (hardiness zones 6-8) to 12 (hardiness zones 2-5) months per inch trunk caliper. Never apply irrigation if the soil is saturated.

2.) Irrigation frequency can be reduced slightly (e.g. to once or twice each week) when planting hardened-off, field-grown trees that were root-pruned during production.

3.) At each irrigation, apply 1-2 gallons (cool climates) or 2-3 gallons (warmest climates) per inch trunk caliper to the root ball. Apply it in a manner so all water soaks into the root ball. Do not water if root ball is wet/saturated on the irrigation day.

4.) Trees take much longer to establish than regularly irrigated trees. Irrigate in drought the following summer.




Irrigation provides benefits such as:

- Better tree growth with fewer periods of stress and less susceptibility to insect and disease infestation
- Quicker establishment of newly planted trees
- Better tree survival, less replanting, more economical tree establishment costs
- Regular visits to the tree which can also serve as a time for tree inspections

Avoid these common mistakes:

- Failure to regularly water newly planted or damaged trees especially during hot and dry periods
- Application of too little water during each irrigation period, or water runs off and does not penetrate the soil
- Small amounts of water are applied too often, encouraging shallow rooting
- Trees that are watered too much and too frequently, keeping roots and soil "waterlogged" for prolonged periods of time

Best Management Practices for Tree Irrigation

1. Plant trees with the top of the root ball at or slightly above ground surface level to avoid creating a place where excessive water may accumulate.
2. Match tree species to soil moisture conditions, utilizing upland and drought tolerant trees where soil moisture is typically low, and water tolerant species where soil moisture is typically high or where the site is frequently flooded.
3. Plants with the same water requirements should be planted together.
4. Mulch trees before they show signs of water stress.
5. Water trees before they show signs of water stress.
6. Follow the South Florida Water Management District recommendations at: **http//www.sfwmd.gov**
7. To ensure newly planted trees are receiving adequate water, apply irrigation directly to the root ball where most of the roots are located.
8. To determine if newly planted trees are receiving the proper amount of water, check the root ball. If dry, increase watering; if saturated decrease watering.
9. Irrigation systems use low water volume devices for trees, and shrubs.
10. Design different irrigation zones for trees and shrubs compare with lawn and ground cover plants.

Pest Management

Pest Management is the control of weeds, insects, fungi, bacteria, or other tree pests through a variety of techniques and at a level that meets your management objectives.

The best approach to pest management is an integrated one that utilizes prevention, biological controls, and--when warranted and absolutely necessary--chemical controls.

The benefits of timely pest management include:

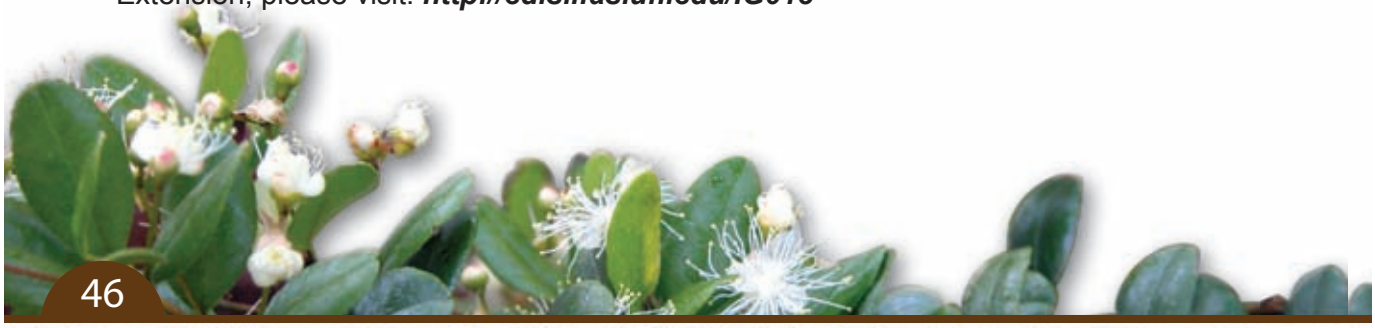
- Increase in knowledge of impact and life cycle of tree pests
- Reduction in the number of trees affected
- Increased tree health with timely pest identification and management

Some common mistakes made in managing tree pests include:

- Trees are planted that are highly susceptible to common pests
- Changes in tree condition and pest symptoms and signs are ignored
- Pest problems are allowed to reach catastrophic proportions before treatment is considered
- Pesticides are over-used or are selected as the first option
- Pesticides are applied at a stage when they are ineffective on or do not reach the pest
- Tree trunks are painted white to defend against insects (this is not effective)

Best Management Practices for Pest Management

1. Plant trees where their needs will match the site conditions to prevent stress and predisposition of trees to pest attacks.
2. Plant a diversity of tree species to reduce the risk of catastrophic species-specific pest or pathogen outbreaks.
3. Mulch to relieve soil moisture stress and to suppress weeds; pull weeds by hand where necessary around the base of trees.
4. Protect tree roots, trunks, and limbs from wounds. Wounds are entry points for insects and diseases.
5. Learn the habits and life cycle of the pests affecting your trees, and know when to apply pesticides for the greatest effect.
6. Hire only experienced and knowledgeable professionals to apply pesticides
7. Do not apply any soil active herbicides or weed-and-feed lawn formulations over the root systems of trees.
8. Contact the Cooperative Extension Service for instructions on collecting insect and disease organisms, or signs for analysis and identification.
9. Pest Management information can be accessed at the website of University of Florida IFAS Extension, please visit: ***http://edis.ifas.ufl.edu/IG013***



Tree Removal and Replacement

The overall goals of tree removal and replacement are to maintain public safety and community forest health while also preserving tree canopy cover.

There are many reasons why trees must be removed. They may be growing in the wrong location, without adequate growing space, and are in conflict with hardscape (driveways, walkways, etc.) or other infrastructure (buildings, roadways, overhead utility lines). They may be old trees that are at the end of their normal life span. They may be dead or in poor or hazardous condition, and may require removal to protect the safety of the owner or the public in general. Whatever the reason for removal, the site should be evaluated to determine if another tree can be planted in the same or a nearby location to maintain tree canopy cover in the area.

The benefits of timely tree removal and replacement include:

- Reduced risk of failure with the prudent removal of trees
- Reduced risk of pest infestations and damage to other trees
- Additional space for new, vigorously growing trees

Common mistakes made in tree management that cause tree removals include:

- Trees are not provided with adequate space to grow to maturity
- Large maturing trees are planted beneath utility lines
- Trees are neglected and not routinely maintained
- Tree preservation activities are undertaken only when a tree is in poor condition
- Trees in poor condition without reasonable chances for improvement or repair are left to fall apart instead of being removed
- Trees are planted that have a characteristic unsuitable for their location
- Trees are not protected during construction activities

Source: IFAS/UF.

Best Management Practices for Tree Removal and Replacement

1. Have an experienced arborist (ISA certified) evaluate tree health and risk for failure before removing old, large, landmark, or historic trees, or trees damaged in a storm to avoid unnecessary tree removal. Some species are able to be righted after a storm and survive for many more years.

2. Check with the Miami-Dade County Department of Environmental Resources Management (DERM at the following link http://www.miamidade.gov/derm/permits tree_removal.asp) or your municipality regarding tree removal permitting requirements.

3. Hire only experienced professionals to remove trees.

4. Reduce the number and frequency of necessary tree removals through proper tree selection, placement, protection, and maintenance.

Putting It All Together

There is Chinese proverb that says, “The best time to plant a tree was 20 years ago. The next best time is now.” A healthy and sustainable urban forest provides significant social, economic, and environmental benefits that fosters a high-quality, livable, vibrant, and beautiful community. Trees are the “keystone” of our green infrastructure, providing us with countless environmental and aesthetic benefits. We hope that this guide inspires you to plant more trees, select good quality “Florida Friendly” species, install them properly, care for them, and enjoy them for generations to come. It is important to remember that proper tree care starts when you select a tree and that what you do with your tree in its first few years of life will affect its shape, strength, and even its life span. This guide was written by our local tree care experts wishing to share their knowledge with you. Miami-Dade County has set a goal to achieve 30% tree canopy coverage by the year 2020. In order to reach our goal EVERYONE needs to participate. Planting a tree may seem like a small act, but each tree planted helps us, and the planet, breathe a little easier.

Literature Cited

1 Miami-Dade County, Community Image Advisory Board, Street Tree Master Plan (Miami-Dade County, Florida: Community Image Advisory Board, 2007) 3.

2 Nicholas Bratton and Kathleen Wolf. Urban Trees and Traffic Study :Considering US Roadside Policy and Crash Data (International Society of Arboriculture, 2006) 172.

3 F.E. Kuo and W.C. Sullivan, "Do Trees Strengthen Urban Communities," Forestry Report, R8-FR 56, January 1996.

4 Kathleen L. Wolf, "The Environmental Psychology of Shopping," Green Design, Research Review, Vol. 14, No. 3, 2007.

5 Kathleen Alexander, "Urban Forest Improve our Air," 1 Mar. 2010 <http:/www.coloradotrees.org/benefits.htm

6 E. G. McPherson and J.R. Simpson, 1996, "Potential of Tree Shade for Reducing Residential Energy Use in California," Journal of Arboriculture (22) 1.

7 Kathleen Alexander, "Urban Forest Saves Energy," 3, 1 Mar. 2010 <http:/www.coloradotrees.org/benefits.htm

8 Q.F. Xiao, E. G. McPherson, J. R. Simpson, and S.L. Ustin, 1998. "Rainfall Interception by Sacramento's Urban Forest," Journal cf Arboculture (24) 235:244.

9 Kathleen Alexander, "Urban Forest Can Extend the Life of Paved Surfaces," 3, 1 Mar. 10 <http:/www.coloradotrees.org/benefits.htm

10 Liz Dunn, "The Benefits of Street Trees," 8 Sept. 2008 <http:/www.frinkpark.org/trees.htm

11 McPherson, E.G. Nowak D.J., Heister, G., Grimmand, S., Souch, c., Grant, R. and Rowntree., R., 1995. Results of the Chicago Urban Forest Climate Project, in Kollin, C. and Barratt, M. (eds), Proceedings of the 7th National Urban Forest Conference., New York, Sept. 12-16.

12 Linda McIntyre, "Treeconomics," American Society of Landscape Architects February 2008

13 Kathleen I. Wolf, "Business District Streetscapes Trees and Consumer Response," Journal of Forestry. 2005

14 Anderson and Cordell, "Influence of Trees on Residential Property Values," 1988

15 Georgia Urban Forest Council, Shade-Healthy Trees, Healthy Cities, Healthy People (Decatur, Georgia, 2004)

16 W.C. Sullivan, F.E. Kuo, "Do Trees Strengthen Urban Communities," Forestry Report, R8-FR 56, January 1996.

Additional References:

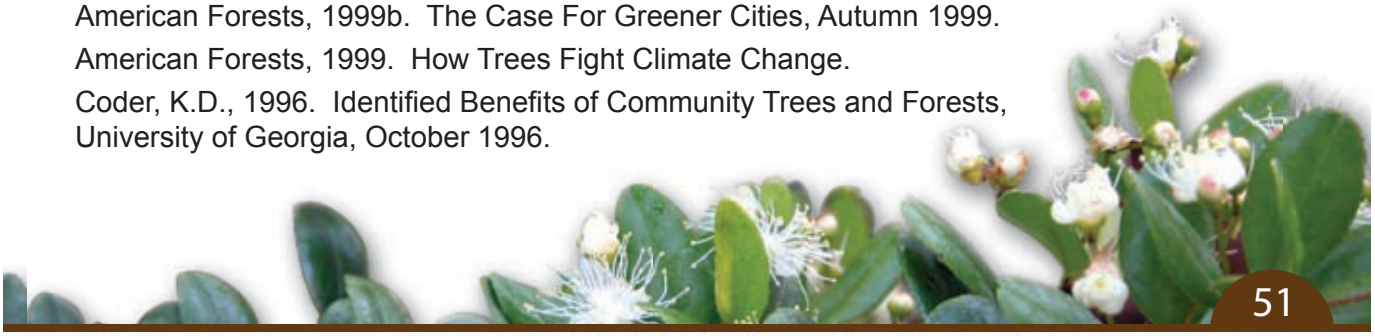
Portions of this material have been used with permission from Athens, Clark County, Georgia and amended for use in Miami-Dade County.

American Forestry Association. 1992. Tree Facts: Growing Greener Cities.

American Forests, 1999b. The Case For Greener Cities, Autumn 1999.

American Forests, 1999. How Trees Fight Climate Change.

Coder, K.D., 1996. Identified Benefits of Community Trees and Forests, University of Georgia, October 1996.



Dr. Gilman, Edward, University of Florida, Urban Design Guidelines http://hort.ifas.ufl.edu/woody/documents/ch_6_mw06.pdf

International Society of Arboriculture Tree Care Bulletin, Benefits of Trees

Kuo, F.E. 2001, “Environment and Crime in the Inner City: Does Vegetation Reduce Crime?” Environment and Behavior, Volume 33

Limestone, http://southfloridahorticulture.com/v2/soils/Marl, http://www.fas.org/irp/imint/docs/rst/Sect3/Sect3_8.html Martin, Paul, The Value of Trees

McAliney, Mike. 1993. Arguments for Land Conservation: Documentation and Information Sources for Land Resources Protection, Trust for Public Land, Sacramento, CA, December 1993

Miami-Dade County Department of Environmental Resource Management (DERM) http://www.miamidade.gov/derm/trees.asp

Michigan State University Extension, Urban Forestry #07269501, Benefits of Urban Trees

National Arbor Day Foundation pamphlet #90980005

Nowak, D. J., Benefits of Community Trees, (USDA Forest Service General Technical Report)

Nowak, D. J., Urban Trees and Air Quality, November 1995

Prow, Tina. The Power of Trees, Human Environmental Research Laboratory at University of Illinois.

Pruning Mature Shade Trees, http://hort.ifas.ufl.edu/woody/documents/ch_13_mw06.pdf

Pruning Young Trees, http://hort.ifas.ufl.edu/woody/documents/ch_12_mw04.pdf

Urban, James. Up by Roots: Healthy Soils and Trees in the Built Environment. 2008. ISA

Appendix

Recommended Street Tree Species *

Common Name	Scientific Name	Height Range	Tree Size	Tree Type	Growth Rate	Blooming Season	Special Needs/ Comments
Allspice	*Pimenta dioica*	15' - 30'	Medium	Shade	Slow	N/A	Leaves are leathery, aromatic and quite attractive. Has whitish gray bark peels in thin sheets. The leaves and fruit smell like a combination of cloves, black pepper, nutmeg, and cinnamon, hence the common name. Small white flowers. Wind tolerant.
Bahama Lysiloma	*Lysiloma sabicu*	20' - 30'	Medium	Shade	Slow	N/A	Slow growing shade tree with small leaves and red-dish new growth. Can be invasive, so do not plant next to a natural area
Bald Cypress	*Taxodium distichum*	30' - 60'	Large	Native	Moderate	N/A	Thrives in wet sites. Native deciduous tree. Loses all its leaves in winter. Wind tolerant.
Bitterbush	*Picramnia pentandra*	12' - 18'	Small	Native	Moderate	N/A	Can be planted adjacent to power lines.
Black Ironwood	*Krugiodendron ferreum*	20' - 30'	Small	Native	Slow	N/A	Wind tolerant.
Black torch	*Erithalis fruticosa*	10' - 20'	Small	Native	Fast	N/A	Can be planted adjacent to power lines.
Blolly	*Guapira discolor*	25' - 35'	Medium	Native	Moderate	N/A	Hardy shade tree. Needs minimal care. Very salt tolerant.

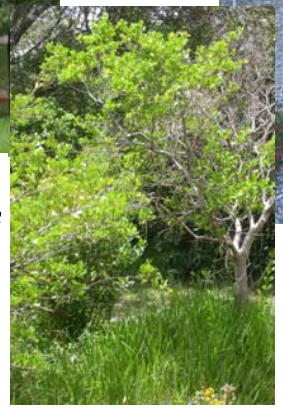
Allspice
Pimenta dioica

Bahama Lysiloma
Lysiloma sabicu

Black torch
Erithalis fruticosa

Black ironwood
Krugiodendron ferrum

Bald cypress
Taxodium distichum



Blolly
Guapira discolor

Bitterbush
Picramnia pentandra

Common Name	Scientific Name	Height Range	Tree Size	Tree Type	Growth Rate	Blooming Season	Special Needs/ Comments
Brown Ebony	*Caesalpinia punctata*	20' - 30'	Medium	Flowering	Moderate	Summer	Beautiful, wide spreading tree up to about 15 m tall (50 ft) and 23 m spread (75 ft); yellowish to tan-colored trunk, dividing into several large branches low on stem; flowers small and light yellow. Ornamental specimen tree.
Colville's Glory	*Colvillea racemosa*	40' - 50'	Large	Flowering	Moderate	Fall (November)	Clusters of vivid scarlet and orange flowers. Like a late season flamboyant.
Copperpod	*Peltophorum pterocarpum*	40' - 50'	Large	Flowering	Fast	Spring/ Summer	Fast-growing evergreen tree. Produces fragrant, showy yellow flowers in the spring and summer. Seedpods turn to an attractive wine-brown color. Subject to wind damage. Needs space to de-velop adequate root system to reduce the likelihood of toppling
Crape Myrtle	*Lagerstromeia indica*	15' - 20'	Small	Flowering	Moderate	Summer (May-September)	Lavender or white flowers. Can be planted adjacent to power lines
Dahoon Holly	*Ilex cassine*	20' - 40'	Large	Native	Moderate	N/A	Wet areas; wind tolerant

Brown ebony
Caesalpinia punctata

Colville's glory
Colvillea racemosa

Copperpod
Peltophorum pterocarpum

Crape myrtle
Lagerstromia indica

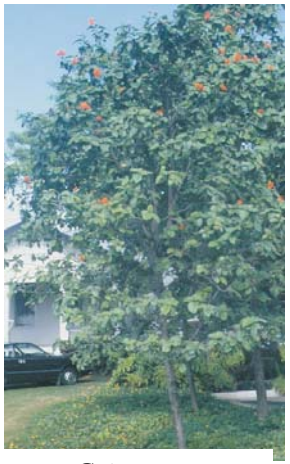
Dahoon holly
Ilex cassine

Common Name	Scientific Name	Height Range	Tree Size	Tree Type	Growth Rate	Blooming Season	Special Needs/ Comments
Desert Senna	*Senna polyphylla*	10'- 15'	Small	Flowering	Slow	Fall	Slow growing evergreen tree with a spreading, cascading crown with tiny leaves. Produces yellow flowers throughout Fall to Spring. Larval plant for Sulfur butterfly. Can be planted under power lines, but planting as a standard can result in a snapped main stem.
Florida Privet	*Forestiera segregata*	10'- 15'	Small	Native	Moderate	N/A	Drought tolerant; OK under power lines
Geiger Tree	*Cordia sebestena*	20' - 25'	Small	Flowering Native	Moderate	Year-round	Moderate-growing with a dense rounded evergreen canopy. Flowers appear throughout the year with small edible white pear-shaped fruit. Salt and wind tolerant.
Green Buttonwood	*Conocarpus erectus*	30' - 50'	Large	Native	Moderate	N/A	Salt and Wind Tolerant
Guinea plum	*Drypetes laterifolia*	20' - 30'	Small	Native	Slow	N/A	
Gumbo limbo	*Bursera simaruba*	40' - 50'	Large	Native	Fast	N/A	Does not have showy flowers, but it is affectionately called the tourist tree because of its shiny red and peeling bark. Wind tolerant.
Inkwood	*Exothea paniculata*	25' - 35'	Medium	Native	Moderate	Summer	Slender dense crown with glossy leaves and tiny fragrant blooms in spring and early summer. Produces red berries that ripen to deep purple. Native

Desert senna
Senna polyphylla

Florida privet
Forestiera segregata

Green buttonwood
Conocarpus erectus



Geiger tree
Cordia sebestana

Guinea plum
Drypetes laterifolia

Gumbo limbo
Bursera simaruba

Inkwood
Exothea paniculata

Common Name	Scientific Name	Height Range	Tree Size	Tree Type	Growth Rate	Blooming Season	Special Needs/ Comments
Jacaranda	*Jacaranda mimosifolia*	40' - 50'	Large	Flowering	Fast	Fall and Winter (if cool enough)	Needs space to develop adequate root system to reduce the likelihood of toppling. Does not flower well in South Florida.
Jamaica Rain	*Brya ebenus*	15' -30'-	Small	Flowering	Slow	Spring and Summer	Blooms spring, summer and in times of high humidity. Tolerates heat and salt but may drop leaves when dry Excellent street tree selection.
Japanese Fern	*Filicium decipiens*	20'- 30'	Medium	Shade	Moderate	N/A	Broad canopy. Decorative leaves.
Krug's Holly	*Ilex krugiana*	25' - 30'	Small	Native	Moderate	N/A	Attractive red berries in winter.
Lancepod	*Lonchocarpus violaceous*	30' - 35'	Medium	Flowering	Fast	Late Summer/Fall	Evergreen with a fast-growing, dense canopy. Produces fragrant, lavender, showy flowers during the late summer/ fall. Produces long, slender, seed pods. Plant at least 30 feet from power lines and 16-22 feet from your house. Full sun.
Lancewood	*Nectandra coriacea*	25' - 35'	Medium	Native	Moderate	N/A	Aromatic leaves and small clustering white flowers. Attract bees. Wind tolerant.

Jacaranda
Jacarana mimosifolia

Jamaica rain
Brya ebenus

Japanese fern
Filicium decipiens

Krug's holly
Ilex krugiana

Lancewood
Nectandra coriacea

Lancepod
Lochocarpus violaceous

Common Name	Scientific Name	Height Range	Tree Size	Tree Type	Growth Rate	Blooming Season	Special Needs/ Comments
Lignum Vitae	*Guaiacum sanctum*	10' - 30'	Small	Flowering Native	Very Slow	Year-round	Purple blooms several times per year. Slow-growing but long-lived, it is adaptable to dry rocky areas in full sun to light shade Can be planted adjacent to Power Lines. Rare, expensive, but worth it in small spaces.
Limber Capper	*Capparis flexuosa*	15' - 20'	Small	Flowering Native	Moderate	Late Spring/ Summer	Pink and white flowers. Can be planted in partial sun adjacent to power lines.
Live Oak	*Quercus virginiana*	40' - 50'	Large	Native	Moderate	N/A	Wind tolerant.
Madagascar Olive	*Noronhia emarginata*	20' - 30'	Small	Shade	Moderate	N/A	Salt tolerant. Can be planted adjacent to power lines.
Mahogany	*Swietenia mahagoni*	35' - 60'	Large	Native	Fast	N/A	Low wind tolerance; needs space to de-velop adequate root system to reduce the likelihood of toppling; brittle in Central and North Dade
Mast Tree	*Polyalthia longifolia*	10' - 25'	Small	Shade	Slow	N/A	Narrow canopy tree with attractive foliage. Good for screening.
Mexican Cassia	*Caesalpinia mexicana*	20' - 25'	Small	Flowering	Moderate	Summer (May-September)	Fragrant, golden flowers. Needs full sun. Can be planted adjacent to power lines.

Lignum vitae
Guaicium sanctum

Limber caper
Capparis flexuosa

Live Oak
Quercus virginiana

Madagascar olive
Noronhia emarginata

Mexican cassia
Caesalpinia mexicana

Mast tree
Polyalthia longifolia

Mahogany
Sweitenia mahogoni

Common Name	Scientific Name	Height Range	Tree Size	Tree Type	Growth Rate	Blooming Season	Special Needs/ Comments
Myrsine	*Myrsine guianensis*	15' - 25'	Small	Native	Slow	N/A	Can be planted adjacent to power lines.
Paradise Tree	*Simarouba glauca*	35' - 50'	Large	Native	Moderate	N/A	Attractive reddish color on new foliage. Fast growing native. Female plant bears black berries that attract birds.
Pigeon Plum	*Coccoloba diversifolia*	25' - 30'	Small	Native	Moderate	Spring	Moderate-growing with a dense, columnar canopy producing small white flowers in the spring. Attractive bark. Native. Fruits ripen in late summer/fall and attract birds. Female plant bears fruit; weevils if near sea grape.
Podocarpus	*Podocarpus sp.*	30' - 50'	Large	Shade	Moderate	N/A	Evergreen conifer. Red "berries" attract birds. Wind tolerant.
Queen's Crepe Myrtle	*Lagerstroemia speciosa*	30' - 45'	Large	Flowering	Moderate	Summer	Moderate-growing with leaves that turn red before falling in the winter. It has large showy pink or purplish flowers during the summer. Drops leaves when during cold spells.
Red Bay	*Persea borbonia*	50' - 60'	Large	Native	Moderate	N/A	Large native evergreen tree. Moderate growing. Thrives in wet areas. Wind tolerant.

Myrsine
Myrsine guianensis

Queen's crepe myrtle
Lagerstromia speciosa

Paradise tree
Simarouba glauca

Pigeon plum
Coccoloba diversifolia

Podocarpus
Podocarpus sp.

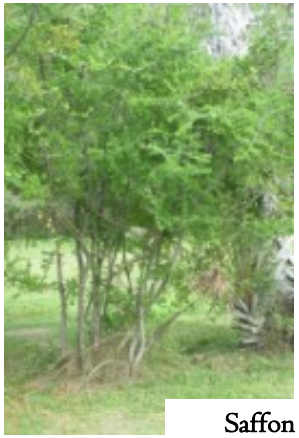
Red bay
Persea borbonia

Common Name	Scientific Name	Height Range	Tree Size	Tree Type	Growth Rate	Blooming Season	Special Needs/ Comments
Red stopper	*Eugenia rhombea*	15' - 20'	Small	Native	Moderate	N/A	Can be planted adjacent to power lines.
Redberry stopper	*Eugenia confusa*	15' - 20'	Small	Native	Moderate	N/A	Can be planted adjacent to power lines.
Rough Strong Bark	*Bourreria ovata*	15' - 20'	Small	Native	Moderate	N/A	Can be planted adjacent to power lines.
Saffron Plum	*Bumelia celastrinum*	20' - 25'	Small	Native	Slow	N/A	Can be planted adjacent to power lines.
Satinleaf	*Chrysophyllum oliviforme*	20' - 30'	Small	Native	Slow	N/A	Wet and/or Shady areas wind tolerant.
Sea Grape	*Coccoloba uvifera*	15' - 35'	Large	Native	Moderate	N/A	Salt tolerant/ needs to have multiple trunks for stability
Shortleaf Fig	*Ficus citrifolia*	40' - 50'	Large	Native	Fast	N/A	Large, fast growing native. Fruit attrac-tive to birds.

Red stopper
Eugenia rhombea

Redberry stopper
Eugenia confusa

Rough strongbark
Bourreria ovata



Saffon plum
Bumelia celastrinum

Satinleaf
Chrysophyllum oliviforme

Shortleaf fig
Ficus citrifolia

Sea grape
Coccoloba uvifera

Common Name	Scientific Name	Height Range	Tree Size	Tree Type	Growth Rate	Blooming Season	Special Needs/ Comments
Silver Buttonwood	*Conocarpus erectus*	10' - 25'	Small	Native	Moderate	N/A	Small native evergreen tree. Moderate growing. Salt Tolerant. Can be planted adjacent to power lines.
Simpson Stopper	*Myricanthes fragrans*	20'- 30'	Small	Native	Slow	N/A	Hardy native; can be planted adjacent to power lines
Soapberry	*Sapindus saponaria*	20' - 30'	Small	Native	Moderate	N/A	Seeds are poisonous.
Spanish Stopper	*Eugenia foetida*	15' - 20'	Small	Native	Moderate	N/A	Small native evergreen tree. Moderate columnar growth; small leaves in tight formation; wildly fragrant flowers; good salt-tolerance. Can be planted adjacent to power lines.
Spicewood	*Callyptranthes pallens*	10' - 15'	Small	Native	Moderate	N/A	Can be planted adjacent to power lines.
Sugarberry	*Celtis laevigata*	40' - 60'	Large	Native	Moderate	N/A	Rated only to zone 10
Torchwood	*Amyris elemifera*	10' - 15'	Small	Native	Slow	N/A	Salt tolerant. Can be planted adjacent to power lines.

Silver buttonwood
Conocarpus erectus

Simpson stopper
Myricanthes fragrans

Soapberry
Sapindus saponaria

Spicewood
Callyptranthes pallens

Sugarberry
Celtis laevigata

Spanish stopper
Eugenia foetida

Torchwood
Amyris elemifera

Common Name	Scientific Name	Height Range	Tree Size	Tree Type	Growth Rate	Blooming Season	Special Needs/ Comments
Vera wood	*Bulneisa arborea*	20'- 30'	Large	Flowering	Moderate	Summer	Large flowering tree (yellow). Tall, slow growing with bright yellow flowers and shiny deep-green compound leaves. This tree is adapted to dry conditions and has very hard wood and flowers throughout the year. Needs space to develop adequate root system to reduce the likelihood of toppling.
Wax myrtle	*Myrica cerifera*	15' - 25'	Small	Native	Moderate	N/A	Salt tolerant. Can be planted adjacent to power lines. Susceptible to lac scale
West Indian Cherry	*Prunus myrtifolia*	30' - 40'	Large	Native	Fast	November-January	Profuse clusters of tiny fragrant white flowers with yellow centers. Fruit attractive to birds. Leaves aromatic.
White Cordia	*Cordia boissieri*	15' - 20'	Small	Flowering	Moderate	Year-round	Salt tolerant. Can be planted adjacent to power lines.
White Mangrove	*Laguncularia racemosa*	15' - 20'	Large	Native	Moderate	N/A	Salt tolerant. Can be planted adjacent to power lines.

Vera wood
Bulnesia arborea

West Indian cherry
Prunus myrtifolia

White cordia
Cordia boissieri

Wax myrtle
Myrica cerifera

White mangrove
Laguncularia racemosa

Common Name	Scientific Name	Height Range	Tree Size	Tree Type	Growth Rate	Blooming Season	Special Needs/ Comments
White stopper	*Eugenia axillaries*	15' - 25	Small	Native	Moderate	N/A	Salt tolerant. Can be planted adjacent to power lines.
Wild Dilly	*Manilkara bahamensis*	15' - 20'	Small	Native	Slow	N/A	Salt tolerant. Can be planted adjacent to power lines.
Wild Tamarind	*Lysiloma latisiliqua*	40' - 50'	Large	Native	Fast	N/A	Salt tolerant. Can be planted adjacent to power lines.
Willow Bustic	*Dipholis salicifolium*	20' - 30'	Medium	Native	Moderate	N/A	Salt tolerant. Can be planted adjacent to power lines.
Winged Sumac	*Rhus copallina*	15' - 20'	Small	Native	Fast	N/A	Salt tolerant. Can be planted adjacent to power lines.
Ylang-Ylang (dwarf)	*Canaga fruiticosa*	10'- 15'	Small	Flowering/ Shade	Slow	Spring and Summer	Slow growing. This plant is attractive to bees, butterflies and/or birds. Flowers are fragrant. Suitable for growing in containers.

White stopper
Eugenia axillaries

Wild dilly
Manilkara bahimensis

Winged sumac
Rhus copallina

Ylang-Ylang
Cananga fruticosa

Willow bustic
Dipholis salicifolium

Wild tamarind
Lysiloma latisiliqua