SP 191

A Guide to Environmentally Friendly Landscaping

Florida Yards and Neighborhoods Handbook

Second Edition

Florida Yards & Neighborhoods

UNIVERSITY OF FLORIDA

IFAS EXTENSION

Acknowledgements

Editors:
Christine Kelly-Begazo and Rebecca McNair
P.O. Box 110675 Gainesville, FL 32611-0675
(352) 392-1831 ext. 330

Contributors and Reviewers
Amy Alexander, Dale Armstrong, Carol Keiper-Bennett, Ben Bolusky, Eileen Buss, Chris Claus, Patty Connolly, Dan Culbert, Edward Gilman, Hugh Gramling, Mike Holsinger, Adrian Hunsberger, William H. Kern, Jr., Gary Knox, Mickey MacDonald, David Marshall, Russ Mizell, Terril Nell, Sydney Park-Brown, Marina Pryce, Gale Robinson, Kathleen Ruppert, Fred Santana, Mark Shelby, Mike Scheinkman, Bart Schutzman, Mike Thomas, Laurie Trenholm, Brian Unruh, Theresa Watkins, Celeste White, Tom Wichman, Ray Zerba

Past Contributors:
Allen Garner, John Stevely, Heidi Smith, Mary Hoppe, Tracy Floyd and Paul Hinchcliff

Design and layout by:
Rebecca McNair

Published Fall 2003
Portions of this text may be reproduced for non-commercial use only.

Special thanks to Dr. Stoer for permission to use front and rear cover images taken at Serenola Plantation, Gainesville, FL.

This project and the preparation of this report was funded in part by a Section 319 Nonpoint Source Management Program grant from the U.S. Environmental Protection Agency (US EPA) through a contract with the Nonpoint Source Management Section of the Florida Department of Environmental Protection.

Cooperative Extension Service, University of Florida, Institute of Food and Agriculture Sciences, Christine Taylor Waddill, Director, in cooperation with the United States Department of Agriculture, publishes this information to further the purpose of the May 8 and June 30, 1914 Acts of Congress; and is authorized to provide research, educational information and other services only to individuals and institutions that function without regard to race, color, age, sex, disability or national origin. The information in this publication is available in alternate formats. Information on copies for purchase is available from IFAS-Extension Bookstore, University of Florida, PO Box 110011, Gainesville, FL 32611-0011 or visit our Web site at: ifasbooks.ufl.edu. Information about alternate formats is available from IFAS Communication Services, University of Florida, PO Box 110810, Gainesville, FL 32611-0810. This information was published November 1994 as SP 191, Florida Cooperative Extension Service. Revised November 2003.

Table of Contents

Page

Introduction to Florida Yards and Neighborhoods 2
- About the Florida Yards and Neighborhoods Program 5
- Nonpoint Source Pollution 6
- Stormwater Runoff and Leaching 6
- Natural Areas of Florida 8
- Literature Cited 9

Creating Your Florida Yard 10
- Site Analysis 14
- Soil 15
- Vegetation to Keep 17
- Landscape Design 19
- Right Plant, Right Place 20
- Plant Selection 22
- If You Prefer Natives 25
- Proper Tree Planting 27
- Attracting Wildlife 31
- Reducing Stormwater Runoff 35
- Literature Cited 38

Maintaining Your Florida Yard 40
- Recycle Yard Waste 41
- Mowing, Pruning and Raking 42
- Mulch 45
- Composting 49
- Fertilizing Appropriately 52
- Watering Efficiently 59
- Control Yard Pests Responsibly 64
- Avoiding Pest Problems 65
- Identifying Pest Problems 65
- Protect the Waterfront 73
- When You Don't Do the Work Yourself 78
- Literature Cited 79

Helpful Literature 82

Glossary 92

Appendix 98

Florida Neighborhoods: Connecting Florida Yards to Waterways

Our yards and neighborhoods are channels to our waterways. The decisions we make, from developing a home site to improving and maintaining our property, will determine the future of our treasured water resources. Nature knows no property lines. A rainstorm can wash bare soil, landscape debris, gas, oil, fertilizers or pesticides from one yard to another. A butterfly attracted to one person's wildflowers can flit across a property line into another landscape. Landscapes don't just connect people to the outdoors; they also connect one person's property to the next, forming neighborhoods. Ultimately, yards and neighborhoods are connected to water resources. This final connection may be immediate in a waterfront community, or gradual through the flow of storm drains, ditches, streams, rivers and groundwater.

Introduction

The First Line of Defense

It may surprise you to know that your yard is the first line of defense for Florida's fragile environment. The health of Florida's estuaries, rivers, lakes and aquifers depends partly on how you landscape and maintain your yard. You don't even have to live on the water to make a big difference. Rain falls on yards, roads and parking lots. It can wash into waterways or leach into groundwater carrying pollutants, including fertilizers, pesticides, soil and petroleum products [1]. Improperly applied fertilizers and pesticides from residential areas are serious threats to the health of Florida's waters [2].

When fertilization and other cultural techniques are correctly implemented, they will help the lawn absorb stormwater runoff and reduce impairment of Florida's natural waters. If runoff contains nitrogen and phosphorus from fertilizers, algal blooms can become so abundant that natural vegetation is smothered, oxygen is depleted and fish kills may result. The same nutrients responsible for lush growth and colorful blooms can, if applied improperly, cause invasive weeds to flourish, changing Florida's natural plant communities. Perhaps most alarming, potentially harmful substances, such as common household pesticides and fertilizers are leaching into our water supply [3]. Not only do these materials damage aquatic life, they are harmful to humans as well.

A mat of algae covers the surface of the stagnant water in this pond.

A new mindset is emerging among concerned Floridians who seek to redefine the image of home and landscape. The idea is to cooperate with pre-existing natural conditions rather than battle the elements. More people are conserving water and energy inside and outside the home [4,5]. Interest is growing in landscaping with native and suitable non-native trees, shrubs and groundcovers. Homeowners are choosing plants that blend beauty with environmental benefits. People are selecting safer alternatives to traditional chemicals used indoors and out. Best of all, many of these benefits to the environment also save time and money, while enhancing our unique Florida lifestyle.

This handbook about the Florida Yards and Neighborhoods program (FYN) provides helpful concepts, tools and techniques for creating your own Florida Yard. You will learn the basics of designing a landscape that features carefully selected plants suited to our climate, soil and wildlife. Tips on cost-saving, energy-efficient landscape maintenance also are included to help you reduce water, fertilizer and pesticide use. Waterfront property owners can find helpful information about shoreline management. Whether starting from scratch with a new landscape or considering changes in an existing one, the information provided will help you get started on your Florida Yard.

Sandhill cranes search for food in a Micanopy resident's backyard.

Remember, the information contained within these pages describes a low-input approach to landscaping, but individual preferences may vary. Refer to updated versions of the University of Florida's Institute of Food and Agricultural Sciences' (UF/IFAS) publications such as the Florida Lawn Handbook to obtain a broader range of recommendations specific to each region of Florida. This book can be purchased from the IFAS Bookstore (800) 226-1764, or viewed online at the following URL: http://edis.ifas.ufl.edu [6]. Other relevant publications listed in the "Helpful Literature" section of this manual are available online or in printed form. Visit extension's Electronic Data Information Source (EDIS) online at http://edis.ifas.ufl.edu. You can search for authors, titles, keywords or publication numbers. Go directly to specific EDIS publications by typing the Digital Library Number (DLN) at the end of the Uniform Resource Locator (URL). The URL is the address of a resource or file available on the Internet. So, for the publication located at http://edis.ifas.ufl.edu/MG028, the DLN is MG028. Publications in PDF format print best. For printed copies or further assistance, contact the extension service in your county and ask about the FYN program.

About the Florida Yards and Neighborhoods Program

The FYN Program addresses the serious problems of pollution, water shortages and disappearing habitats by enlisting Floridians in the battle to save our natural resources. The program provides special education and outreach activities in the community to help residents reduce pollution, conserve water and enhance their environment by improving home and landscape management. In this integrated approach to landscaping, nine interrelated principles are emphasized.

The nine principles of FYN:

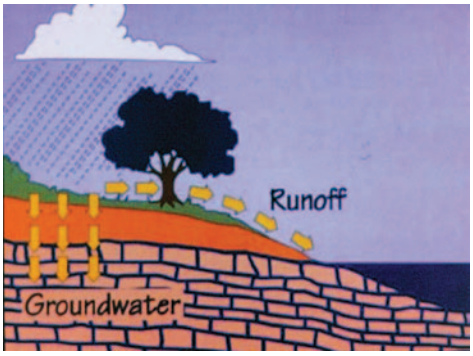
1) right plant, right place
2) water efficiently
3) mulch
4) recycle yard waste
5) fertilize appropriately
6) control yard pests responsibly
7) reduce stormwater runoff
8) attract wildlife
9) protect the waterfront

Swallowtail butterfly feeding on the nectar of lantana (Lantana camara).

FYN is a partnership of concerned citizens, members of private industry, the UF/IFAS' Extension Service, the National Estuary Program, Florida Sea Grant College Program, Florida's Water Management Districts, Florida Department of Environmental Protection (FDEP) and numerous other non-governmental agencies. FYN is an educational program and not a regulatory agency; however, the FDEP, the Environmental Protection Agency (EPA), the Department of Agriculture (USDA) and local governments strongly support the program.

Nonpoint Source Pollution

Since the formation of the EPA and the passage of the Clean Water Act, great strides have been made towards maintaining and restoring water quality throughout the United States. This has been accomplished through regulation of "point sources" of pollution, such as smokestacks and sewage discharge. However, a more diffuse source of pollution, nonpoint source (NPS) pollution, threatens the health of Florida's ecosystems. NPS pollution cannot be pinpointed to a single source. Over time, pollutants from our everyday activities accumulate on the land. Examples of NPS pollutants include: gasoline, fertilizer, pesticides and even soil. NPS pollution is a problem when rainfall or heavy irrigation carries sediments and dissolved chemicals to our waterways in stormwater runoff and by leaching through the soil.



Stormwater Runoff and Leaching

Many of Florida's water resources are particularly susceptible to pollution because of the state's unique geology and climate. Floridians obtain most of their drinking water from the ground. Groundwater supplies often lie near the surface and are covered by porous limestone and sandy soils that allow water to infiltrate rapidly. Dissolved pollutants reach groundwater through a process called leaching. These impurities affect the quality of our drinking water [7,8]. Heavy rainfall, typical during Florida's rainy season, is a major cause of leaching and stormwater runoff. Stormwater runoff is water that runs off impervious or water-saturated surfaces, transporting sediments and dissolved chemicals into nearby waters. Surface waters in Florida such as lakes, streams, rivers and estuaries are very sensitive to even small amounts of pollution.

You can help to reduce nonpoint sources of pollution. The following pages will help you to design appropriate landscapes and develop a maintenance plan to conserve water and reduce impacts on the environment. A properly designed and managed landscape can help to slow down and filter stormwater runoff, using adapted plant material and appropriate rates and methods of fertilization and irrigation. We urge you to follow these recommendations for an environmental approach to landscaping. New research and technologies are being developed constantly. Stay informed by reading the most recent versions of UF/IFAS publications and check with us for the latest developments of the FYN program.

A bird's eye view of the Hillsborough River.

Natural Areas of Florida

For decades, Florida landscaping has been portrayed as picture postcards of lavish resorts, tourist destinations and tropical gardens. However, the picture of natural Florida is quite different. The Florida Natural Areas Inventory identifies 82 different natural ecological communities in Florida, from wetlands to xeric uplands [9]. Unfortunately, the state's original rich diversity is being replaced with impervious surfaces and housing developments with standardized yards that bear little resemblance to native Florida [10,11]. Expanses of manicured lawns are the dominant landscape in most of our communities [12,13,14]. Look around your neighborhood or nearby parks to see if any of these natural landscapes remain. Can your own landscape be modified to replace a piece of what's been lost?

The practices discussed in this book can help you do your part to protect our natural resources while maintaining a healthy and attractive landscape, even if you prefer a classically manicured lawn.

Literature Cited

[1] U.S. Geological Survey. 1999. "The Quality of Our Nations Waters - Nutrients and Pesticides." Cir 1225. URL: http://water.usgs.gov/pubs/circ/circ1225.

[2] Florida Department of Environmental Protection et al. 2002. "Florida Green Industries: Best Management Practices for Protection of Water Resources in Florida." Available at county extension service offices and online: http://www.dep.state.fl.us/water/nonpoint/pubs.htm.

[3] United States Environmental Protection Agency. 2000. "Atlas of America's Polluted Waters." EPA 840-B-00-002. Office of Water (4503F), Wash, D.C., p.10.

[4] G. Israel, G. Knox, and S. Park-Brown. 1993. "Using Environmental Landscape Management Practices: An Exploratory Program Assessment." UF/IFAS Bul287.

[5] G. Israel, J. Easton, and Knox, G. 1999. "Adoption of Landscape Management Practices by Florida Citizens." HortTechnology. 9(2):262-266.

[6] Ruppert, K.C. and R.J. Black (editors). 1997. Florida Lawn Handbook. 2nd edition. UF/IFAS, Gainesville, FL. URL: http://edis.ifas.ufl.edu/.

[7] P.S.C. Rao. 1997. "Criteria for Monitoring Organic Pollutants in Groundwater." UF/IFAS Fact Sheet SL 56 (Revised). URL: http://edis.ifas.ufl.edu/SS175.

[8] J.C. Stewart, A.T. Lemley, S. I. Hogan, R.A. Weismiller, and A.G. Hornsby. 2001. "Health Effects of Drinking Water Contaminants." UF/IFAS Fact Sheet SL161. URL: http://edis.ifas.ufl.edu/SS299.

[9] Florida Natural Areas Inventory. 2003. "Florida Natural Areas Inventory." URL: http://www.fnai.org/descriptions.cfm [Accessed 6/1/03] Florida Resources and Environmental Analysis Center, Florida State University, Tallahassee, FL.

[10] K.A. Langeland and R.K. Stocker. 2000. "Control of Non-Native Plants in Natural Areas of Florida." UF/IFAS Fact Sheet SP 242 (Revised). URL: http://edis.ifas.ufl.edu/WG209.

[11] P. Sprott and F. J. Mazzotti. 2001. "Habitat Loss, Florida's Changing Landscapes: Upland Forests." UF/IFAS Fact Sheet WEC 151 (Revised). URL: http://edis.ifas.ufl.edu/UW160.

[12] A. Wasowski and S. Wasowski. 2000. "The Landscaping Revolution: Garden With Mother Nature, Not Against Her." Contemporary Publishing Group, Chicago, IL.

[13] F.H. Bormann, D. Balmori and G.T. Geballe. 2001. "Redesigning the American Lawn." 2nd edition, Yale University Press, London.

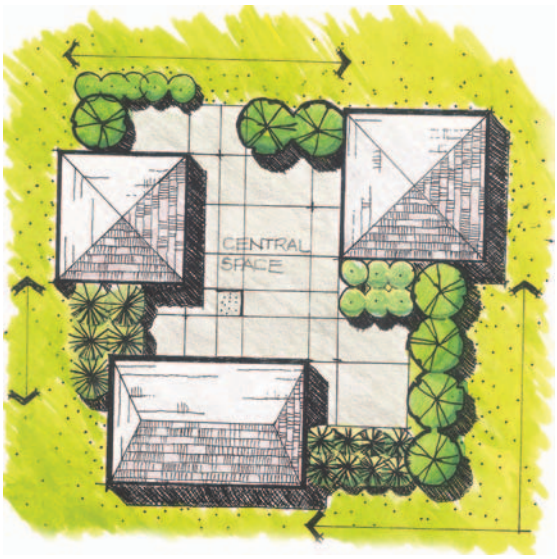
[14] B. Hipp, S. Alexander, and T. Knowles. 1993. "Use of Resource-Efficient Plants to Reduce Nitrogen, Phosphorous, and Pesticide Runoff in Residential and Commercial Landscapes." Water Science Technology 28: (3-5), pp.205-213.

Creating Your Florida Yard

What is a Florida Yard? A Florida Yard is an approach that recognizes the home landscape is part of a larger natural system. Creating a Florida Yard does not necessarily mean creating a "wild-looking" yard, but it does mean creating a landscape that is more of an environmental asset than a liability. If designed, installed and maintained properly, a Florida Yard will be attractive, environmentally sustainable and protect natural resources. An aesthetically pleasing Florida-friendly yard begins with good landscape design decisions based on your needs and desires, and a healthy environment. Whether you are designing on a shoestring budget or hiring a professional landscape architect, understanding a few basic concepts can help you make environmentally appropriate decisions and avoid trouble later.

Plan First, Plant Last

The secret to being satisfied with your landscape design is to follow a logical planning process. Read this section "Creating Your Florida Yard" in conjunction with the Florida Yardstick Workbook [15] and follow the steps outlined below to develop your own landscape plan.



Drawing by Carol Keiper-Bennett

1 Decide why you want to landscape.
In a Florida Yard, appropriate landscaping protects the environment by stabilizing the soil, preventing erosion, filtering pollutants and reducing harmful runoff. Environmental protection should be considered during each step of the landscaping process. Other considerations include aesthetics, improving the resale value of a home, noise reduction, climate control and wildlife habitat.

2 Determine how you will use your property.
Perhaps you need a play area for children or like to give outdoor parties. Maybe you want to have a vegetable garden or enjoy a waterfront view. Maybe you don't want to spend much time in your yard; you just want to enjoy looking at it without time-consuming or costly maintenance.

3 Analyze the existing site.
Take a walk around your property and make note of any special conditions that make your yard unique. Does your site require plants that are tolerant of cold, wind, full sun, shade, drought, occasional flooding, or salt spray? Do you know your soil's pH and nutrient content? Take a soil sample to your local extension office for testing.
Look at your existing vegetation and decide which plants you want to keep. Can you identify some plants that always seem to have one problem or another throughout the year? These plants should be removed. Observe landscaping features of surrounding properties, like shade trees that cast a shadow on your yard. This is a good time to find out if a neighbor will share property lines to enhance plantings for privacy or wildlife. Please read the "Site Analysis" section of this manual for more information.

Lacebug damage on an azalea (Rhododendron simsii) planted in full sun.

4 Prepare a land-use plan.
A pencil, ruler and graph paper are handy tools for this step. A photocopy of the survey completed for your mortgage is also helpful. Draw your house, and the location of existing trees and shrubs you want to keep. If your yard includes a septic tank, underground utilities or overhead power lines, draw these. If you have a sprinkler system, note the spray coverage.

Now sketch where various activities will take place. Is there a view you want to enhance with plants that attract birds or butterflies? If you live on the water, consider placing *intensively* maintained turfgrass and vegetable gardens away from the water's edge. This will reduce the potential for polluted runoff to reach surface waters. In many circumstances, a 10'-25' buffer strip of turfgrass or low maintenance groundcover along the water's edge, maintained with minimal fertilizer and spot treated for pests, can significantly reduce pollution from upland areas. Never allow fertilizers or pesticides to directly enter the water.

5 Add the landscape plan to the sketch.

Determine the types of plants you want in different locations. Don't worry about specific plant identification yet. Indicate where you want trees, shrubs, groundcovers, or flowering plants. Remember to keep plants away from buildings to allow for growth and ease of building maintenance. Note the ultimate plant height you desire in each area. Group plants according to their water needs so irrigation can be applied more efficiently and plants will be healthier.

6 Incorporate the irrigation plan.

In-ground irrigation systems are not necessary in every landscape, particularly if drought resistant plants are used. However, while plants are becoming established in the yard, a temporary watering system is convenient and usually warrants the effort. Research your irrigation needs and determine which type of system, if any, will be installed. Irrigation techniques and water conservation strategies are discussed on page 59. Add any new irrigation plans to your drawing.

7 Select landscape materials.

Remember to consider maintenance requirements, the limitations of your site and wildlife value when selecting plants. Consult gardening books and plant lists specific to Florida; a list of reference material is provided at the end of the "Plant Selection" section of this manual. Try to write the common and scientific name (genus and specific epithet) into your plan; common names may cause confusion when it is time buy plants.

Also note other landscaping materials that will be used for walkways, mulch or borders.

8 Implement.
Buy quality plants. Keep in mind that proper planting techniques are important in establishing healthy plants. Remember to allow enough space for each plant to grow to maturity.

9 Maintain.
Maintenance includes proper irrigating, fertilizing, composting, pruning, mowing, mulching and integrated pest management. The more thorough you are with steps 1-8, the less you will have to worry about maintenance. It is possible to maintain an established landscape with minimal amounts of pesticide, fertilizers and supplemental water [14,16]. Remember, watering *efficiently*, fertilizing *appropriately* and controlling yard pests *responsibly* are all a part of proper landscape maintenance.

10 Enjoy!
Photograph the evolution of your Florida Yard and share pictures with the horticulture agent in your county. Let us learn from your experience and share your knowledge with others. "Before" and "after" shots with captions are particularly useful when illustrating your success.

Elementary students select plants for their butterfly garden.

Site Analysis

In order to match plants to your yard, it is very important to first determine the site characteristics. Remember that these may differ at various sites throughout your yard. Here is a list of site characteristics that will need to be considered before you begin the transformation of your yard. This list is not complete, but it will give you a place to begin.

SOIL

- Sand
- Loam
- Clay
- pH
- Nutrients present
- Compacted

DRAINAGE

- Well-drained
- Poorly drained

Tree pruned excessively to make room for overhead power lines.

LIGHT

- Full sun
- Partial sun
- Shade

TEMPERATURE

- Exposure to freezing temperatures
- Exposure to extreme heat

STRUCTURAL LIMITATIONS

- Power lines
- Underground utilities
- Septic tank
- Roof overhangs
- Paved surfaces
- Security lights

OTHER

- Exposure to salt spray or salty well water
- Exposure to strong wind
- Exposure to wet/dry seasonal extremes

FLORIDA YARD TIP: Do you know where your underground utilities are?

Digging without knowing where it's safe to dig can cause tremendous damage, interrupting your electric, telephone, cable television, water, sewer and gas service, even causing injury or loss of life! If you're doing any digging within the state of Florida, state law requires you to notify Sunshine State One Call of Florida (SSOCOF) two full business days before you dig. The toll free number is (800) 432-4770. Underground facility owners will locate any underground utilities in the area you wish to dig. The service is free. If you don't follow this procedure and underground lines are damaged, you could be fined. This can be a substantial amount if a fiber optics cable is cut. For more information, visit their website: www.callsunshine.com.

Soil

In much of Florida*, "soil" and "sand" are almost synonymous. Sand allows rapid, downward movement of water and many nutrients. Thus, sandy Florida soils typically dry out quickly and are usually not compatible with plants that have high water and nutritional requirements. Sandy soils are more likely to allow pollutants to leach into groundwater and waterways as well.

---

*In Miami-Dade county the marls are clays and drainage is slow; in the Keys there is really no soil at all-it's rock; in parts of the panhandle the soil is reddish clay.

The simplest way to avoid problems in the landscape is to use only plants that are compatible with the site. If you want a vegetable or rose garden, be prepared to modify or amend the soil. If this is the case, you should frequently add organic matter such as compost to the planting bed. This will retain moisture, provide nutrients and attract beneficial organisms like earthworms.

It is helpful to have your soil's pH (acidity/alkalinity) tested. In general, sandy coastal areas are usually alkaline (high pH), and inland areas are usually acidic (low pH). However, different areas on the same property may have vastly different soils, so site-specific pH testing is a good idea. Moreover, concrete slab foundations, brick, mortar, plaster and other building materials are strongly alkaline. These materials leach into the surrounding soil, drastically changing the pH over time. For this reason, azaleas (*Rhododendron*), flowering dogwoods (*Cornus*), flame-of-the-woods (*Ixora coccinea*) and other acid loving plants should not be planted near the concrete foundation of a home. Knowing your soil's pH will help you make better use of plant reference guides, which often provide this information along with other requirements of the plants listed. Although many plants will tolerate a wide pH range, they do best when planted in the right soil. Modifying the soil's pH is not recommended, as this is only a temporary solution. Contact your county extension service for information on soil testing services in your area.

Roses (Rosa spp.) *planted in a bed.*

Many new homes are built on a raised platform of compacted "fill dirt" imported by the construction companies.

Compacted soils may resist water infiltration and restrict the healthy growth of plants. Minimizing soil compaction in landscapes will greatly reduce further maintenance problems [17]. Another variable factor in your soils may be the presence of a sub-layer of hardpan, rock or shell. This is one reason to examine your soil to a depth of about 18" before making final plant selections. Deeper examination may be needed if larger trees are to be planted.

Vegetation to Keep

When making changes to an existing landscape, retaining some trees and shrubs reduces cost and leaves valuable wildlife habitat undisturbed. For those building a new home, retaining existing plants also reduces erosion by limiting the amount of cleared area. Be sure to retain healthy plants with good form growing in the appropriate locations. Retain individual trees that live the longest, such as live oak (*Quercus virginiana*). Mature laurel oaks (*Q. laurifolia*), water oaks (*Q. nigra*), silver maples (*Acer saccharinum*), cherry laurels (*Prunus caroliniana*) and wild black cherry (*P. serotina*) are less desirable because of their relatively short lives [18,19,20]. Trees growing in groups or shady forests often grow very tall and narrow. If the site is cleared, an isolated tree will be vulnerable to wind damage, and could snap in half during a windstorm. For this reason, trees are best preserved in clusters (trees with ground cover and native shrubs intact) to buffer the wind [21].

To ensure roots are not damaged by soil compaction and construction activities, avoid disturbing the root zone of these plants or driving over them with heavy vehicles, as soil compaction retards growth. Species particularly sensitive to soil compaction and root disturbance include beech (*Fagus* spp.), dogwood

Soil mounded against the base of this tree could result in slow decline and eventual death, even years after the problem is corrected.

(*Cornus* spp.), sassafras (*Sassafras* spp.), tupelo (*Nyssa* spp.), pine (*Pinus* spp.), white oak (*Quercus alba*), black oak (*Q. velutina*) and most nut trees, such as black walnut (*Juglans nigra*), hickory and pecan (*Carya* spp.) [21]. Construct barricades at the edge of the canopy (dripline) to prevent construction equipment from driving on the roots. Even though this does not protect the entire root system, many trees can be saved by preventing equipment from driving under the canopy.

Consider removing plants that are unhealthy, invasive, or ill-suited for the site. Foundation plants too close to the home block air currents and prevent access for home maintenance. Plants spaced too closely can create moisture problems. Plants under eaves are also problematic; they may not receive adequate rainfall, or may be damaged by the force of rainwater dripping from a gutter. Plant removal should be considered in all of these cases.

FLORIDA YARD TIP:
Where are tree roots?

A tree resembles a wine glass placed on a dinner plate: the base of the wine glass is the part of the trunk where major roots flare outward. The dinner plate represents the rest of the root system, which extends far beyond the drip line: up to five times the canopy's diameter depending on the species [21]. Vertically speaking, most tree roots are located in the top 2' of soil, where oxygen is available through exchange between the soil surface and atmosphere [22].

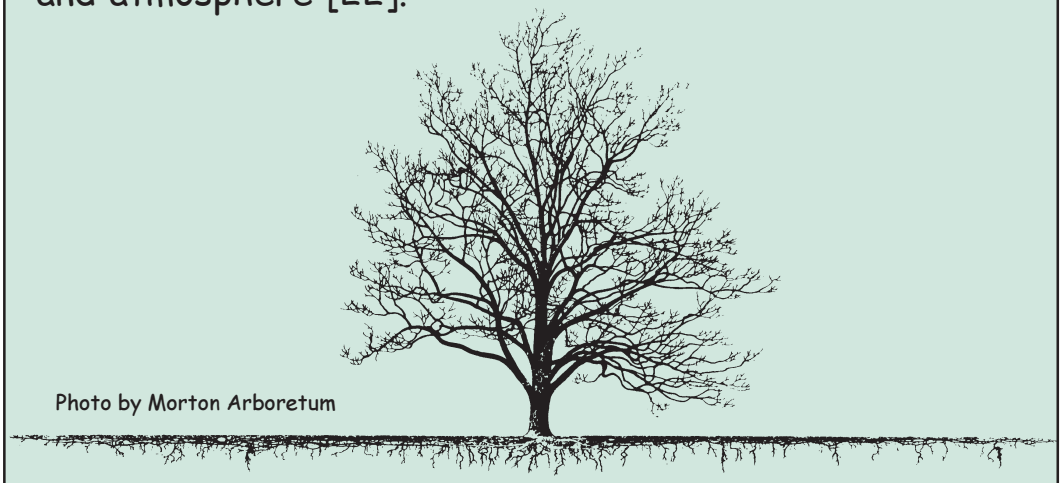


Photo by Morton Arboretum

Landscape Design

Landscape design combines art and science to create functional, aesthetically pleasing, and ecologically sound surroundings that complement the home or building structure. Many elements of art, including color, form, line and texture, interact within a landscape to produce the design principles of unity, balance, simplicity and focalization. Not only are plants the tools used to create attractive landscapes, but they are also the key to reducing energy use and to protecting our natural resources. For example, landscape designers often recommend grouping plants into masses to unify the design of plant beds. Groups of three, five or seven plants are usually pleasing to the eye. This design technique provides environmental benefits as well. Trees planted in groups provide more atmospheric cooling than the same number of evenly spaced, isolated trees [21]. For a more thorough overview of the artistic elements of landscape design, please check out the references listed in the "Helpful Literature" section of this manual, or consult a professional landscape architect.

FLORIDA YARD TIP:

Color in the landscape

Choose two or three colors that complement each other and repeat this color combination throughout the landscaped area.

Right Plant, Right Place

Have you ever purchased a plant that looked great at the nursery or garden center, only to have it die once you planted it? Normally, you can avoid this heartbreaking scenario by putting the right plant in the right place; that is, by matching the plant to the site conditions. Drought tolerant plants should be used on elevated dry spots, windy areas, exposed areas, plantings on berms, and along the unshaded southern or western walls of buildings. Don't waste time, energy and resources caring for a plant not adapted to the microclimatic features of your yard. For example, turfgrass makes an excellent choice for sunny recreational areas, but most types available don't grow well in dense shade. In addition, turf is difficult to mow on sloped or extremely wet areas. Plants adapted to wet soils should be used in low spots, waterways and areas with poor drainage [23].

Often we see woody plants scattered throughout the lawn, with no clear design pattern. Turfgrass and woody ornamentals have differing water, fertilizer and maintenance needs. Furthermore, mowing and irrigation patterns can be disrupted by a misplaced shrub. To reduce maintenance and

Plant in groups according to water, fertilizer and maintenance needs. Place shrubs and woody ornamentals in beds separate from turf areas, to avoid competition.

conserve water in the landscape, group plants in beds according to water requirements and maintenance needs [24].

The location of a tree or shrub in relation to the home affects shade patterns and movement of air currents. Wisely placed trees and shrubs can greatly improve your home's heating/cooling capacity. It is estimated that tree shade can reduce air conditioning costs by 50% [25]. Deciduous shade trees planted on the south, east and west sides of the house will shade in summer and let warming light enter your windows in the winter. The outdoor compressor/condenser unit of the air conditioning system uses less energy when it is shaded from direct sun during the entire day. However, care must be taken not to block the conditioner's air flow. If the warm discharge air is prevented from escaping, the intake air temperature rises, causing the unit to operate less efficiently.

In Florida, winter's prevailing winds are from the north or northwest. A solid fence or a row of evergreens planted on the north side of a house can provide a barrier against cold winter winds and reduce evaporative water loss. Winds from the south, southeast and southwest predominate during the summer months, when air circulation is desired [26].

Live oak (Quercus virginiana) provides shade on the western side of this home.

Plant Selection

Plant selection is undoubtedly the fun part of landscaping. Florida's climate supports countless varieties of plants, and many are grown by local plant nurseries. Remember, the plants you select determine the level of maintenance required and also how long your landscape will last. For example, fast growing trees often have a shorter life span than slower growing trees [18]. If you follow the site analysis provided earlier in this section, you'll be well prepared to make the best plant choices.

Selecting plants for your Florida Yard:

- Select from a plant palette that includes low maintenance plants suitable to the site. Once these plants are established in the right location, most require little, if any, supplemental water, fertilizers or pesticides [14,27,28].

Bromeliads are remarkably drought tolerant.

- If you don't want to continue irrigating after plants become established, select drought tolerant plants that are suited to your soil.

- Consider wildlife. Providing flowering and fruiting plants can bring birds and butterflies into your yard and your view. Florida is a stopover for many migrating and wintering butterflies and birds.

- Limit the number of plants that have high water and maintenance requirements. Place them where they will have the most visual impact.

- Don't plant noxious, invasive species. The State of Florida prohibits planting of Brazilian pepper (*Schinus terebinthifolius*) Australian pine (*Casuarina equisetifolia*), melaleuca (*Melaleuca quinquenervia*), carrotwood (*Cupaniopsis anacardioides*), Chinese tallow (*Sapium*

sebiferum), and many others. If present, these plants should be removed from your yard. They crowd out native plants and seriously threaten Florida's ecosystems and wildlife [29]. Several other common landscape plants can become invasive in parts of Florida and should be avoided. The UF/IFAS Center for Aquatic and Invasive Plants maintains a list of invasive species on their website: http://aquat1.ifas.ufl.edu.

- Aim for diversity. Strive to create a mosaic of trees, shrubs, groundcovers, native grasses and wildflowers. Monocultures, which are large expanses of the same plant species, are prone to disease and insect infestation and are not as sustainable as a diverse plant community [30].

- Turf areas should be functional and designed for easy maintenance.

- Groundcovers can be especially useful in shady or sloped areas where turf may not thrive but the potential for runoff exists.

- Don't be fooled by the quick-fix appeal of fast growing plants. Such plants require more pruning, resulting in more clippings and yard waste. Lush, green shoots attract certain pests. Slower growing plants may take longer to fill in your landscape, but they will last longer and create less work.

- Consult the USDA's revised 2003 Plant Hardiness Zone Map to determine your zone numbers for cold and heat. If you find the map difficult to read, you may search the American Horticulture Society website (www.ahs.org) by zip code. Each plant species is assigned four codes: the first two numbers represent the cold hardiness range, or the coldest and "least cold" zones in which the plant will thrive. The second set of numbers represent the hottest zone in which plants will thrive, followed by the "least heat" zone in which the plant will thrive [31].

Consider plant characteristics that will...

reduce maintenance and prevent pollution:

- Drought resistance
- Pest resistance
- Non-invasiveness
- Slow growth
- Wind resistance
- Low nutritional requirement

affect wildlife:

- Cover and habitat
- Seeds and nuts
- Fleshy fruits and berries
- Nectar and larval food for butterflies
- Red tubular flowers for hummingbirds

affect humans:

- Shade
- Scent
- Allergies
- Thorns
- Screen for privacy
- Attractive flowers or foliage
- Human food source
- Deciduous or evergreen

Native trumpet vine (Campsis radicans) attracts hummingbirds.

Consult with these experts:

- Extension Service
- Florida Master Gardeners
- Florida Certified Horticultural Professional
- Forida Certified Landscape Contractor
- Florida Native Plant Society
- Division of Forestry
- Water Management District
- USDA Natural Resources Conservation Service
- Libraries

Blue jay photo by Sandra Granson, Broward County Extension.

If You Prefer Natives

A plant is considered native to Florida if it was present at the time of first European contact (about the year 1500 A.D.). Some Florida native plants are widely available at your local garden center, and others are becoming more available as the commercial demand for them grows. Here are some tips on learning more about native plants that may be suited to your yard:

- Visit parks, wildlife preserves, botanical gardens, FYN demonstration landscapes, and nurseries to view native plants. Some plant nurseries specialize in Florida native plants.
- Visit the library or bookstores (particularly those at botanical gardens) to find good reference books on Florida native plants.
- Search the web for information on native plants. Some examples can be found in the "Helpful Literature" section of this manual.
- Consider consulting a landscape architect, contractor or designer who is knowledgeable about native plants to survey your yard and make suggestions.
- Remember, just because a plant is native does not ensure its success in your landscape. Always put the right plant in the right place.

Native plants in this beachfront landscape were selected for salt tolerance.
Photo by Mat O'Malley, SJRWMD

FLORIDA YARD TIP: Trees can help

Don't know where to start? Plant trees. Reestablishing a tree canopy is a great way to begin your Florida Yard. Trees not only provide shade and wildlife habitat, but they also help to reduce stormwater runoff. If those reasons don't suffice, consider that trees significantly increase the value of a home and lot. According to the American Forestry Association, trees have other significant monetary benefits. They found that a single tree provides $73 worth of air conditioning, $75 worth of erosion control, $75 worth of wildlife shelter, and $50 worth of air pollution reduction a year. Compounding this total of $273 for fifty years at 5% interest results in a tree value of $57,151. The overall benefits far outweigh the initial cost of the trees [25].

Members of a 4-H club planting a tulip tree (Liriodendron tulipifera) on Arbor Day.

Proper Tree Planting

Trees are a more permanent attribute to the landscape. They cannot be swapped out as easily as annuals. Therefore, site selection and proper planting techniques are essential (This section was adapted from Dr. Gilman's website, reprinted with permission) [32].

1 Look up.
If there is a wire, security light or building nearby that could interfere with proper development of the tree canopy as it grows, plant elsewhere.

2 Dig a shallow hole as wide as possible.
Shallow is better than deep! Many people plant trees too deep. A hole one-and-one-half to three times the width of the root ball is recommended. Wider holes should be used for compacted soil and wet sites. The depth of the hole should be slightly LESS than the height of the root ball, especially in compacted or wet soil. If the hole was inadvertently dug too deep, add soil to the bottom of the hole. Breaking up compacted soil around the tree provides the newly emerging roots room to expand into loose soil. This will hasten root growth and encourage establishment.

3 Find the point where the top-most root emerges from the trunk.
The point where the top-most roots emerge from the trunk (called trunk flare, root flare or root crown) should be within 2"of the soil surface. If the top-most root is buried in the root ball then remove enough soil from the top so the point where the top-most root emerges from the trunk is within the top 2". Check for and loosen circling roots especially in the top half of the root ball. Selectively

Root-bound (or "pot-bound") plant-thick roots encircle the root ball.
Photo by Ed Gilman, University of Florida

remove small roots that are kinked or circling. If many roots circle the bottom or sides of the rootball, slice the root ball about 1" deep in four places from top to bottom before planting. This will reduce the likelihood of these roots causing problems later. If these cut roots are large, the tree or shrub might go into shock and die. To avoid all this root slicing, buy plants that are not root-bound.

4 Slide tree carefully into the planting hole.
To avoid damage when setting the tree in the hole, lift the tree with straps or rope around the root ball, not by the trunk. Special strapping mechanisms need to be constructed to carefully lift trees out of large containers.

5 Position the point where the top-most root emerges from the trunk slightly above the surface of the landscape soil.
Most horticulturists agree it is better to plant the tree a little high than to plant it too deep. If the tree is a little deep, tip it to one side and slide some soil under it; then tip it back the other way and slide some more soil under the ball. 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 in this case [33]. The soil removed from the hole usually makes the best backfill unless that soil is substandard or contaminated.

6 Straighten the tree in the hole.
Before you begin backfilling have someone view the tree from two directions perpendicular to each other to confirm the tree is straight. 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.

7 Remove all synthetic materials from around the trunk and root ball.
String, rope, synthetic burlap, strapping, plastic and other materials that will not decompose in the soil must be removed at planting.

8 Fill the planting hole with backfill soil.
Slice a shovel down into the backfill 20 to 30 times all around the tree as you add backfill soil. Attempt to break up clay soil clumps as much as possible. Do NOT step firmly on the backfill soil because this could compact it, restricting root growth, especially in clay soil. When the planting hole is filled with soil the root ball should remain 1" (small trees) to 3" (larger trees) above the backfill soil.

9 Add 10-20 gallons water to the root ball.
Fill any air pockets with soil.

10 Cover the backfill soil with mulch.
Apply mulch to at least an eight-foot diameter circle around the tree, if possible. Do not construct a berm from soil since this soil could end up over the root ball several months later. Water the mulch well after it is spread.

11 Stake the tree, if necessary.
Staking holds the root ball firmly in the soil. If the root ball moves in the wind, emerging roots could break or the plant could fall over. Young trees might require staking until enough trunk strength develops. Remember to remove staking materials after the tree becomes established. Ties and stakes can girdle a tree if not removed.

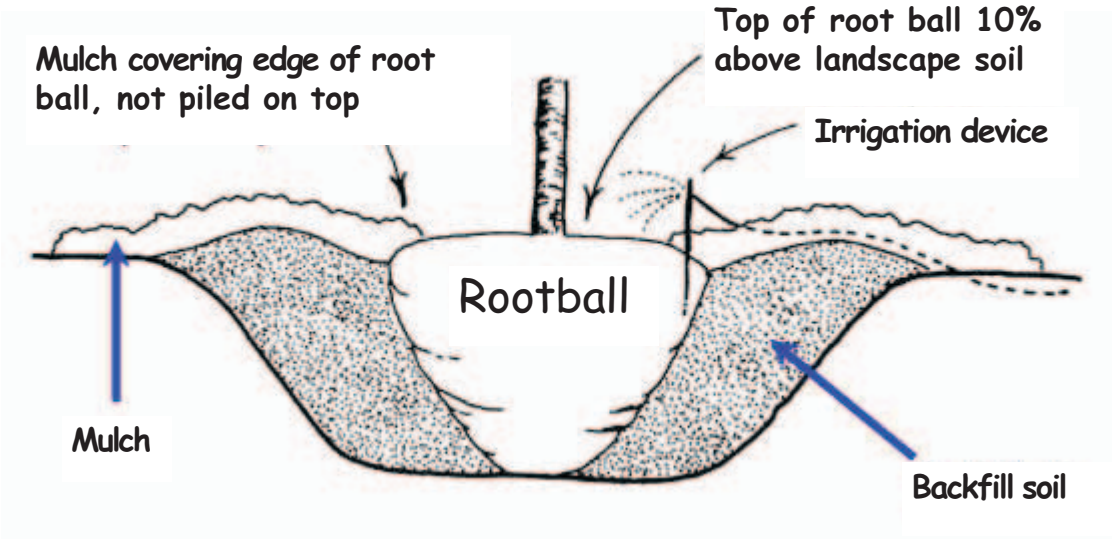


Photo by Ed Gilman, University of Florida

12 Irrigate trees frequently to fully establish roots in the landscape soil.

Light, frequent irrigation provides the quickest establishment [34]. Following the initial few months of frequent irrigation, provide weekly irrigation until plants are fully established. In cooler climates, irrigation frequency can be reduced slightly. At each irrigation, apply about one to two gallons of water per inch of trunk diameter (i.e. two to four gallons for a 2" tree) over the root ball. Never add irrigation water if the root ball is saturated. Establishment in Florida can take about three months per inch of trunk diameter, but could take longer depending upon climate, irrigation schedule and species. Fertilizing during the establishment period does not improve survival rates [35,36].

Sample watering schedule

To establish a one-gallon size plant with average water requirements:

- Week 1: Water daily.
- Week 2-3: Every two days.
- Week 4-6: Twice per week.
- Week 7-12: Once per week.

FLORIDA YARD TIP: Micro-irrigation hoses

There is an inexpensive product which may help you establish new plantings. Several manufacturers make micro-irrigation hoses that allow water to seep through them. The hose can lie on top of the ground or can be slightly buried in the soil or mulch. Place the hose near the plant's root zone. When the plant is established and no longer needs frequent watering, store the hose for later use and discontinue scheduled watering.

Attracting Wildlife

Florida has the third most diverse wildlife population of any state in the nation. But the rapid growth of human populations, particularly in coastal communities, is replacing native wildlife habitat with urban development. As our communities expand, we lament the loss of birds and other wildlife, yet our own yards are partly to blame. A Florida Yard provides a habitat for wildlife by increasing biodiversity and creating landscaped islands and natural vegetative corridors that connect bordering properties. Animals use these corridors to travel from one natural area to another, thus benefiting wildlife on a larger neighborhood scale. As you consider objectives for your new or existing landscape, add a few features for wildlife to bring your yard alive with birds, butterflies and beneficial insects. Wildlife will be attracted by food, water and cover; however, providing habitat is not enough. One should manage the yard or neighborhood so maintenance impacts are minimal.

Yards can be managed both for wildlife and humans.

Consider these suggestions for attracting wildlife:

- **Food**
  Food should be provided in the form of plants that bear seed, fruit, foliage or flowers you are willing to have consumed by birds, larval butterflies (caterpillars) or adult butterflies. Berries, fleshy fruits, nuts and acorns are treats for wildlife.

- **The sound of running water**
  The sound of running water will attract wildlife to your yard. This may be a natural feature such as a pond, creek or other body of fresh water. A manufactured water feature (i.e. birdbath) that captures rainwater can suffice. Dump and clean the container every few days and refill it to prevent mosquito breeding and bacterial contamination.

The trickling sound of flowing water attracts many different kinds of wildlife to your yard.

- **Increase Vertical Layering**
  Planting a variety of vegetation in different sizes and heights provides more cover and feeding opportunities for wildlife species.

A cardinal nest in a shrub.

- **Birds**
  Birds are attracted to planted areas that include a tree canopy, smaller understory trees and shrubs and grasses or flowers, particularly those that are allowed to go to seed on occasion. Meadow grasses can be especially attractive to wildlife, adding a graceful feature to your landscape.

- **Butterflies**
  A combination of both larval and nectar plants will attract a variety of butterflies to your yard.

- **Caterpillars**
  Caterpillars are the larval form of butterflies and moths. Each species of butterfly lays its eggs on a preferred species of plant, which may differ from the adults preferred nectar source. Caterpillars often strip larval plants of leaves. If you want to attract butterflies to your yard, a certain level of damage should be tolerated.

This snag is home to an osprey and her young.

- **Snags**
  Dead trees can be left in place if they don't create a hazard. Birds use snags for perching, nesting and feeding.

- **Manage Pets**
  Pets allowed to harass wildlife will frustrate any efforts you make toward attracting wildlife. This is especially true for house cats allowed to roam in the backyard. If this is the case, it is better not to try to attract birds and other animals whose lives could be in danger.

- **Reduce Pesticide Use**
  Pesticides used in the landscape will reduce insect populations, an important food source for birds. Some chemicals also may poison mammals and birds that feed on affected insects [37].

- **Limit the Amount of Lawn**
  Reducing the amount of mowed lawn area around your house, especially in areas of low traffic such as corners of the yard, and adding diversity of plant species will create shelter and food for many animal species. Over time, unmowed areas contain more plant species than mowed areas. This plant diversity attracts more wildlife species [37].

- **Extension's Urban Wildlife Program**
  Extension's Urban Wildlife program can aid in your plans. Visit their website: http://www.wec.ufl.edu/extension/landscaping.htm. Your yard could be certified as a Florida Wildlife Habitat or a Certified Florida Yard through FYN.

Domestic felines are skilled hunters.

Reducing Stormwater Runoff

One of the basic concepts of a Florida Yard is that rain that falls in your yard should soak into your yard. After all, rainfall is an excellent source of water for your landscape, and reducing runoff will help protect waterways. Retaining rainfall long enough for it to percolate through the soil is particularly challenging in neighborhoods built on compacted fill soils. Please consider a few practical tips for reducing the amount of rainfall that runs off your yard.

Downspouts

If the roof of your home has rain gutters, make sure the downspouts are aimed at a porous surface so the water can soak into the soil. Be sure water does not pool next to buildings. If you decide to landscape this area, choose plants adapted to wet/dry extremes.

This swale captures and filters stormwater from nearby parking lot.

Earth Shaping

Earth shaping can be an attractive and functional design element in your landscape. Swales (small dips in the ground) and berms (raised earthen areas) can help divert runoff rushing from your yard. A densely growing turfgrass or groundcover can be especially useful to capture rainwater, filter nutrients, recharge groundwater and reduce soil erosion. A berm and swale combination might be especially appropriate if your waterfront yard has a seawall. Earth shaping in combination with a maintenance-free zone of native wetland plants can make your yard more waterfront-friendly. Minor alterations to the lay of the land won't require permits or engineers, but any major earth work should have the professional touch and will require regulatory review.

Rain Barrels and Cisterns

These ancient "technologies" are making a comeback as water shortages prompt homeowners to use rain that falls on their property. Large plastic rain barrels are now available at home and garden stores. The barrel looks much like a garbage can, but has a hole in the top where a roof downspout can fit snugly. A valve near the bottom allows you to fill a watering can or connect a hose. Barrels are great for hand watering, and they aren't mosquito attracters as long as the downspout fits tightly. The barrel is not unsightly, but a 4' shrub could easily shield it from view.

Rainbarrel connected to a swimming pool.
Photo by Chris Claus, Pinellas County Extension

"Cistern" is really just a fancy word for rain barrel, but it implies a bit more engineering and greater storage capacity. Water is collected from the roof, filtered and stored in a container made of concrete, metal, wood, fiberglass or plastic. Water travels from the cistern upon demand by either gravity feed or pump action. Currently in Florida, water obtained from a cistern can only be applied to non-potable uses, such as irrigating the landscape. In other words, do not drink it! Before building a cistern, check with local authorities to make sure that it is not against the law in your area.

Cistern collects rain for nonpotable uses.
Photo by Mark Shelby, Sarasota County Extension

Porous Surfaces

Whenever possible, use bricks, gravel, turf block, mulch, pervious concrete or other porous materials for walkways, driveways or patios. These materials allow rainwater to seep into the ground, helping to filter pollutants and reducing the amount of runoff from your yard. In some cases they may even cost less to install than typical paving materials. A cost comparison of some pervious surfaces can be found in Table 1 in the Appendix of this book.

Recycled railroad ties, bricks and gravel make a unique footpath capable of absorbing rainwater.

The combination of turf growing between flagstone withstands foot traffic and absorbs rainwater.

Literature Cited

[15] C.H. Best et al. 1997. "Florida Yardstick Workbook." UF/IFAS Bulletin 325, URL: http://hort.ifas.ufl.edu/fyn/Florida-Yardstick-Workbook.htm.

[16] R. Black and K.C. Ruppert. 1998. Your Florida Landscape: A Complete Guide to Planting and Maintenance. University Press of Florida, Gainesville, FL. This book can be purchased from the IFAS Bookstore: http://ifasbooks.ufl.edu.

[17] M. Duryea and M. Malavasi. 1995. "How Trees Grow in the Urban Environment." UF/IFAS Circular 1093, (Revised). URL: http://edis.ifas.ufl.edu/FR002.

[18] M. Flinchum. 1990. "A Guide to Selecting Existing Vegetation for Low-energy Landscapes." UF/IFAS Circular 489. URL: http://edis.ifas.ufl.edu/MG013.

[19] E. Gilman and D. Watson. 1993. "*Quercus laurifolia*: Diamond Leaf Oak." UF/IFAS Circular ENH-707. URL: http://edis.ifas.ufl.edu/ST549.

[20] E. Gilman and D. Watson. 1993. "*Quercus nigra*: Water Oak." UF/IFAS Circular ENH-711. URL: http://edis.ifas.ufl.edu/ST553.

[21] J. Petit, D.L. Bassert, and C. Kollin. 1995. "Building Greener Neighborhoods: Trees as Part of the Plan." Published by American Forests and Home Builder Press, National Association of Home Builders, Washington, DC.

[22] G.W. Watson and E.B. Himelick. 1982. "Root distribution of nursery trees and its relationship to transplanting success." Journal of Arboriculture 8(9): 225-229.

[23] D. Wilson. 2000. "Wild Things." Golf Course Management: May 2000 issue; pp.107-116.

[24] G. Knox. 1991. "Landscape Design for Water Conservation." UF/IFAS Fact Sheet ENH-72. URL: http://edis.ifas.ufl.edu/MG027.

[25] American Forestry Association. 2003. "From Grey To Green." (Video) URL: http://www.americanforest.org.

[26] A.W. Meerow and R.J. Black. 1993. "Enviroscaping to Conserve Energy: A Guide to Microclimate Modification." UF/IFAS Circular EES-43. URL: http://edis.ifas.ufl.edu/EH143.

[27] R.J. Black. 1997. "Native Florida Plants for Home Landscapes." UF/IFAS Publication ENH-25. URL: http://edis.ifas.ufl.edu/EP011.

[28] J.H. Parker. 1982. "An Energy and Ecological Analysis of Alternate Residential Landscapes." Journal of Environmental Systems 11(3) pp271-288.

[29] K.A. Langeland and K. Craddock Burks, Editors. 1998. "Identification and Biology of Non-native Plants in Florida's Natural Areas." UF/IFAS Publication SP 257, Gainesville, FL.

[30] B. Ellis and F.M. Bradley (editors). 1996. The Organic Gardener's Handbook of Natural Insect and Disease Control. Rodale Press, Emmaus, PA p.7.

[31] D. Ellis. 2003. "The USDA Plant Hardiness Map." The American Gardener, Magazine of the American Horticulture Society: May/June 2003 issue; pp.30-33.

[32] E.F. Gilman. 2003. "Planting trees in landscapes." [Website accessed July 9, 2003] http://hort.ifas.ufl.edu/woody/planting/ *Adapted from E.F. Gilman 1997. "Trees for urban and suburban landscapes." Delmar Publishers, Albany, NY, 662 pgs.*

[33] J.R.Schulte and C.E. Whitcomb. 1975. "Effects of soil amendments and fertilizer levels on the establishment of silver maple." Journal of Arboriculture 1: 192-195.

[34] E.F. Gilman, R.J. Black and B. Dehgan. 1998. "Irrigation volume and frequency and tree size affect establishment rate." Journal of Arboriculture 24(1): 1-9.

[35] E.F. Gilman, T.H. Yeager and D. Kent. 2000. "Fertilizer rate and type impacts magnolia and oak growth in sandy landscape soil." Journal of Arboriculture 26(3): 177-182.

[36] E. Perry and G. Hickman. 1992. "Growth Response of Newly Planted Valley Oak Trees to Supplemental Fertilizers." Journal of Environmental Horticulture 10 (4):242-244.

[37] M. Hostetler, G. Klowden, S. Webb Miller, and K. N. Youngentob. 2003. "Landscaping Backyards for Wildlife: Top Ten Tips for Success." UF/IFAS Circular 1429. URL: http://edis.ifas.ufl.edu/UW175.

Maintaining Your Florida Yard

A good landscape design incorporating the right plants in the right places can reduce maintenance requirements and costs. For most yards it will be necessary to perform some maintenance, including:

- Mowing, pruning and raking
- Recycling yard waste
- Mulching
- Fertilizing
- Watering
- Managing pests

The following pages discuss some of the basics of nurturing your landscape without damaging the environment. You will find pollution-free maintenance is easiest when plants are selected with that goal in mind. If your existing landscape is too much work or requires maintenance practices that could damage the environment, you may want to consider changing some plants in your yard. If so, please review the "Landscape Design" section in this handbook.

Seashore paspalum (Paspalum vaginatum) is a choice for lawns near the ocean. Once established, it is both drought resistant and salt tolerant.

Photo by Jeff Thomas, Turfgrass America

Recycle Yard Waste

Trimming some plants can help enhance the beauty of your Florida Yard. This also is an area of maintenance where you can reduce the workload by doing things the environmentally friendly way. For example, if you've selected slow-growing plants, the amount of pruning necessary will be reduced. Also, less pruning is required if plants are placed far enough from walkways, driveways or buildings to allow them to reach maturity without interfering. If your yard isn't turf intensive, less mowing is an obvious work and time saver. In addition, a beautiful landscape need not have a clipped, formal look. Soft, flowing, natural lines can be attractive and easy to maintain.

Yard waste generated by landscape maintenance activities such as mowing, pruning, and raking can be returned to the soil, recycling valuable nutrients. Composting or mulching with yard wastes helps reduce the amount of solid waste to be hauled away. Did you know that Florida Statute prohibits disposal of yard trash in landfills [38]? Leaves and pine needles provide a source of mulch that is a real asset in the landscape, and it's virtually free! If your yard generates more leaf mulch than you can use, compost the material or share some with a neighbor. When pruning trees and shrubs, toss small cuttings into a compost pile or behind a shrub. Never dump grass clippings or other yard waste into storm drains or waterways. Such activities are illegal and can pollute water systems and clog drains. Remember, grass clippings are a significant source of nitrogen, so keep them on the lawn and out of the water.

Palm Coast artist Paul Baliker sculpts with recycled driftwood.

Mowing

If there are turf areas to be mowed, keep in mind, except for dwarf varieties, most St. Augustinegrass (*Stenotaphrum secundatum*) and Bahiagrass (*Paspalum notatum*) should be kept at a minimum height of 3-4". Centipedegrass (*Eremochloa ophiuroides*) that is actively growing should be mowed every seven to fourteen days at $1\frac{1}{2}$ to 2". Bermudagrass (*Cynodon dactylon*) should be cut at a height of $\frac{3}{4}$ to $1\frac{1}{2}$", which may require mowing one to three times per week [39]. Seashore paspalum (*Paspalum vaginatum*) should be cut at a height of 1-2". If cut shorter than recommended height, the turf will be stressed. Do not remove more than one-third of the leaf blade at one time. Sharpen mower blades monthly to protect against pathogen invasion. Clippings should remain on the lawn to decompose and return nitrogen to the soil. Research indicates this practice improves soil fertility over time, gradually reducing the need for N fertilization up to 50% without a decrease in turfgrass quality [40,41,42]. For procrastinators who don't mow regularly, mulching mowers will cut grass into smaller pieces, speeding the rate of decomposition. If the grass has gotten too tall, spread clippings behind shrubs or add them to a compost pile to avoid unsightly build-up.

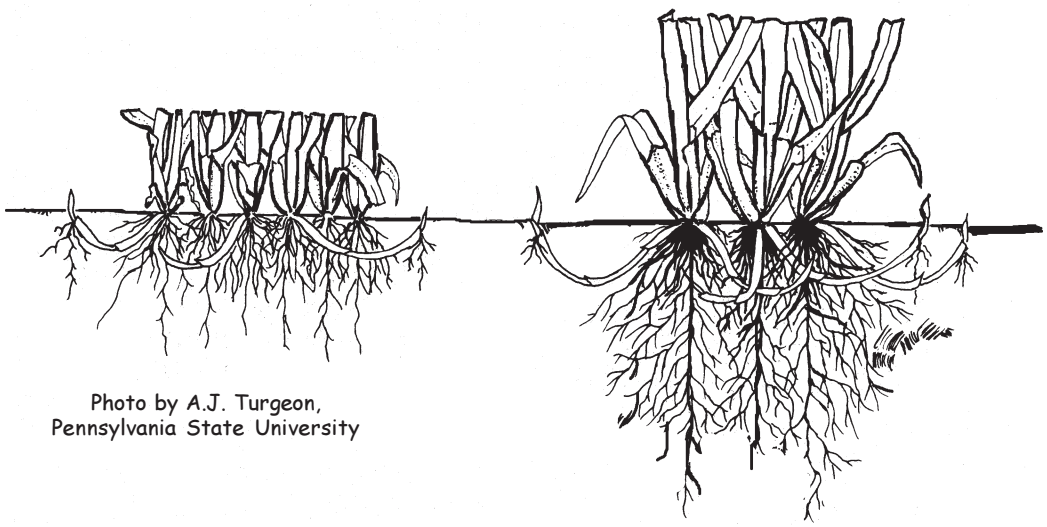


Photo by A.J. Turgeon, Pennsylvania State University

Closer mowed turfgrass (left) is finer textured and denser, but has less underground growth of roots and rhizomes. A deeper root system develops in response to taller mowing heights (pictured right).

Pruning

Pruning is the selective removal of plant parts, typically shoots and branches, to improve health, control growth or enhance fruiting, flowering or appearance. Shrubs are pruned by either hedging, heading back or thinning. Thinning is the complete removal of branches back to lateral branches, the main trunk, or in shrubs, to the ground. Thinning gives a plant an open appearance and can encourage new growth inside the crown, increase light penetration, and resist wind damage. Heading back is the selective cutting of terminal ends of twigs or young branches back to an axillary bud or node. This technique produces a denser tree or shrub because it usually increases the number of shoots and leaves. Pruning cuts should not be visible, but located inside the plant, covered up by remaining foliage.

The first step in pruning is to remove all dead, diseased, or injured branches. Pruning shears and saws can be dipped in a weak alcohol solution (one part alcohol to nine parts water) to prevent spread of disease between plants. Remove branches that cross or touch each other and those which look out of place. If the shrub is too tall, heading and thinning may be desirable. Do not use hedge shears, but cut each branch separately to different lengths with hand pruners. This will maintain a neat informal shrub with a natural shape [43].

Proper pruning can prevent property damage.
Photo by Ed Gilman, University of Florida

If you are unsure about proper pruning techniques, you may want to hire a certified arborist to prune your trees. An arborist is a specialist in the care of individual trees. Certified Arborists are knowledgeable about the needs of trees, and are trained and equipped to provide proper care. To find a certified arborist in your area, check out the International Society of Arboriculture's website, http://www.floridaisa.org and search by zipcode [44]. Pruning trees is a detailed, dangerous and technical process. Tree pruning is beyond the scope of this document. The website http://hort.ufl.edu/woody/pruning is an excellent resource to learn more about tree pruning [32].

Raking

Deciduous trees help reduce energy costs by shading the house in summer and allowing sunshine to heat the house in winter when their leaves fall. Many new Floridians avoid having deciduous trees in their yards because they believe that fallen leaves require raking. If high quality turf is desired under trees, raking will improve light penetration to the turf. When turf is not desired, leaves are best left under trees for a self-mulching area. Leaves add nutrients to the soil as they decompose. If aesthetics are an issue, plant shrubs under the trees to avoid raking. They will benefit from the decomposition of plant litter and help to hold leaves in place so they won't clutter the landscape.

Liriope groundcover (Liriope muscari) growing underneath a shade tree. Notice the self-mulching area along the footpath.

Mulch

A layer of mulch around trees, shrubs, planted beds and covering bare ground can provide many benefits. Mulches can replace turf or groundcovers in areas that are difficult to mow, irrigate or otherwise maintain. Mulches can also be used in shady areas where plants may not grow well. In addition, mulch gives planting beds a neat and uniform appearance, adding a contrast of color and texture that compliments plantings.

Here are a few simple facts about mulch:

- Organic materials applied as mulch can improve soil fertility as they decompose.
- Mulch buffers soil temperature; it keeps soils warmer in the winter and cooler in the summer.
- Mulch helps maintain soil moisture. Evaporation is reduced, and the need for watering established plants can be minimized.
- Fresh mulch inhibits germination and growth of weeds.
- Many types of mulch can improve soil aeration, structure, and drainage over time.
- A layer of mulch can inhibit certain plant diseases.
- Mulch around trees and shrubs (not against the trunk) eases maintenance and can reduce the likelihood of damage from string trimmers or "weed whackers."

The type of mulch chosen and the method of application are important to the health of landscape plants.

The following are some guidelines to use when applying mulch:

- For well-drained sites, apply a 2-3" layer (after settling) of mulch around trees, shrubs, and bedding plants. If there are drainage problems, a thinner layer should be used.

Mulch that is too deep or touching the trunk is applied improperly. This is commonly referred to as "volcano mulch."
Photo by Ed Gilman, University of Florida.

- Coarse materials such as pine nuggets may be applied to a depth of 4", but do not allow mulch to accumulate to a greater depth. "Volcano mulching," or mulch applied too deeply, hinders oxygen exchange to the roots, which can stress the plant and cause root rot [44,45]. More than about an inch of mulch on the root ball of newly planted trees and shrubs can also stress plants because mulch can intercept water meant for the roots.

Occasional hand weeding may be necessary.

- Mulch out to the tree's drip line or beyond, at least an eight foot diameter around the plant. Remember: if in a forest environment, the tree's entire root system (which usually extends well beyond the drip-line) would be mulched.
- Do not place mulch on top of a tree's root ball or against the trunk. If mulch is piled against the trunk, pull it back

several inches so the base of the trunk and the root flare is exposed. Stems and trunks that remain constantly wet are prone to diseases like root rot.

- Mulch piled high against the trunks of young trees may create habitats for rodents that chew the bark and can girdle the trees.
- If mulch is already present, check the depth. Do not add mulch if there is a sufficient layer in place (2-3"). Rake the old mulch to break up any matted layers and to refresh the appearance.
- Thick blankets of fine mulch can become matted, and may prevent the penetration of water and air. In addition, a thick layer of fine mulch can become like potting soil and may support weed growth.
- Organic mulches may require occasional additions and weeding. Replenish mulch once or twice a year as needed to maintain a total depth of 2-3".
- Cypress mulch is not recommended because harvesting from the wild depletes the wetlands.
- Shell, crushed stone or pebbles can be used as mulch but they will not contribute to the nutrient, organic content or water holding capacity of the soil.

FLORIDA YARD TIP: How much mulch?

Bulk quantities of mulch are sold in cubic yard volumes. To calculate the amount of mulch needed, first measure the area to be mulched, in square feet. Next convert the desired depth to a fraction of a foot. For example, 3" divided by 12" equals $\frac{1}{4}$', or 0.25'. Multiply this fraction by the square foot measurement of the area to be covered: (.25 feet x 100 square feet = 25 cubic feet). Convert cubic feet to cubic yards by dividing cubic feet by 27 (25/27 = .926). To cover a 100 square foot area to a depth of 3", you will need .926 cubic yards of mulch [46].

- Limestone and shell raise the soil's pH. They also reflect heat, increasing the water needs of plants.

Recycled Mulch

There are many sources of recycled mulch. You may even be able to acquire mulch for free! Here are some tips on obtaining recycled mulch products:

- Use mulch that originates in your own landscape such as leaves, pine needles, grass and shrub clippings.
- Local power companies, municipal solid waste departments and tree services may supply free or low cost utility mulch and sometimes deliver bulk quantities. Try to get only mulch from trimming as it is generally more disease-free than mulch from other sources, such as roots.
- Team up with other homeowners and have bulk quantities delivered to the same neighborhood.
- Check the phonebook for commercial suppliers of mulch made from recycled materials.
- If you need lots of mulch for a new landscape, place an ad in the local newspaper so suppliers come to you.

Recycled mulch products made from the invasive plant, melalueca, are an excellent alternative to cypress mulch. Melalueca mulch should be made entirely of bark and wood (pictured above) and heat composted to kill any stray seeds (pictured left).

Composting

A common misconception about plant care is that plants require fertilizer for proper nutrition. Plants need nutrients, but they may not need added fertilizer. As organic matter decomposes, nutrients are released into the soil in a form available for plant uptake [47,48]. Nutrients in the soil are essential for plant functions such as regulating plant metabolism, growth and reproduction. Plants use water, carbon dioxide and chlorophyll to convert light energy of the sun into chemical energy (sugars), a process called photosynthesis. Some key nutrients for plants include nitrogen, phosphorus, potassium, magnesium, calcium, zinc, iron and manganese [49].

A great way to supply essential nutrients to your plants while recycling yard waste is by adding compost, which can be made from partially decomposed yard or kitchen waste. Generous amounts of composted material frequently added to the soil will release essential nutrients as it decomposes. When added to your soil, it can create the perfect medium for sustained plant health [47].

Compost pile (above) and manufactured bin (below).

Composted organic matter is dark in color.

Adding compost can:

- Improve soil structure, texture and aeration
- Increase the water holding capacity of soil
- Help loosen compacted soils
- Promote soil fertility and stimulate root development
- Create a favorable environment for microorganisms, earthworms and insects that are nature's "soil builders."

Composting can be as simple as placing leaves, grass clippings and small cuttings behind shrubs or in a hidden corner of the yard and letting nature take its course. Homemade or manufactured compost bins are another option to consider and will allow you to easily incorporate kitchen waste such as vegetable and fruit scraps, egg shells and coffee grounds. Numerous types of compost bins are commercially available, and many are designed to be attractive. Gardening magazines, catalogs and garden centers are good sources for such products. For more information visit Florida's Online Composting Center at http://compostinfo.com.

FLORIDA YARD TIP: The Squeeze Test

To find out if your compost pile is getting too much water, try this test. Squeeze some compost from the bottom of the pile. You should not be able to squeeze drops of water from the composted material.

The squeeze test illustrating adequate moisture (above) and excessive moisture (left).

A compost pile needs adequate moisture, oxygen, nitrogen and carbon sources to generate the right conditions for decomposition. The more closely these factors are monitored and manipulated, the faster decomposition can occur and the sooner you'll have rich compost for fertilizing plants and amending soil.

Here are some tips on composting:

- Bins aren't necessary but they help keep piles neat, retain heat and moisture and prevent complaints from neighbors. The minimum recommended size is one cubic yard (three feet square by three feet high).
- Composting can take as little as four to six weeks or as long as one to two years depending on the size and type of material in the pile and the amount of attention you give it.
- Proper moisture is necessary for microorganisms to compost the material. Covering the pile helps retain moisture and prevents the pile from getting too soggy when it rains. You should not be able to squeeze water from the material produced at the bottom of the pile.
- Heat is important in composting, so a sunny location is better than a shady one.
- Combining different materials, such as grass clippings and leaves, in the pile can help achieve the right proportions of carbon and nitrogen for effective composting. Always bury kitchen waste in the pile to discourage pests and to prevent odor from rotting fruit and vegetables.
- Generally, for fastest composting, the pile should be turned with a pitchfork or stirred on a weekly basis in warm weather. Stabbing the pile with a length of pipe or rake handle can help with aeration and mixing.
- Never place meat, animal fat or dairy products in the compost pile.

Fertilizing Appropriately

Fertilizers are generally used to achieve a specific goal: more or larger blooms, faster growth, greener leaves or more fruit. If one of these is your goal, you basically have three choices: using composted organic material, applying packaged fertilizer or applying a specific mineral, such as iron. We will discuss fertilizing lawns, woody landscape plants and palms in separate sections.

Fertilizing Lawns

It is often assumed lawn fertilization contributes to pollution of our ground and surface water, but research has shown this is not necessarily the case [50]. Turfgrass that receives the appropriate levels of fertilizer, neither too little nor too much, will produce a dense root and shoot system capable of filtering out impurities or other components of leachate or runoff [51,52,53]. Overfertilizing or underfertilizing can be harmful to your lawn, while the proper amount of fertilizer produces a strong, healthy lawn. A lawn fertilized in the proper manner will not only absorb nonpoint source pollutants, it will aid in soil stabilization, reduce ambient air temperatures and promote a healthy ecosystem of its own. It might also require fewer cultural or chemical controls for weeds, insects, or diseases, because it will be growing more vigorously.

The practices followed when you fertilize your lawn influence how much of the fertilizer is taken up by grass or how much might be lost to leaching or runoff [53,54,55]. There are several factors that can determine the potential for pollution from fertilizer application. Among these are:

- Type of fertilizer you use
- How much you apply
- How you apply it
- When you fertilize
- How much irrigation is applied after fertilization
- Overall health of the lawn

As with any product, it is very important that you read and understand the label before you apply fertilizer. If you do not feel confident in your ability to comprehend and follow label instructions, consider hiring a lawn service professional to do it for you.

Selecting a Fertilizer

When selecting fertilizer, look at the three numbers on the bag. They will read something like 15-0-15 or 16-2-8. The first number represents the percentage of nitrogen in the bag, the second refers to phosphorus, and the third number to the amount of potassium in the bag. For example, a 50 lb. bag of 16-2-8 is 16% nitrogen, or eight pounds of nitrogen, one pound of phosphorus, and four pounds of potassium. Nitrogen and phosphorus are the two elements that cause the most problems with regard to water pollution.

FLORIDA YARD TIP: Turf Fertilizer

Granular turfgrass fertilizer (top left) and slow release fertilizer (top right) can be broadcast with a drop spreader. These forms are recommended for use on turfgrass. Soluble powders (bottom left), such as the kind used on houseplants, are dissolved in solution. This form is not recommended for use on turfgrass.

What Fertilizer is Safest to Buy?

It is generally considered best for homeowners to look for slow-release fertilizers, or fertilizers that have a high percentage of slow-release nitrogen in them [56]. These products have less potential to leach or runoff into our waterways than quick-release sources. How do you know if a fertilizer is slow-release? You will find the fertilizer sources listed on the back of the bag. Look for the amount of nitrogen that is "slow-release." The higher the percentage of slow-release, the less chance of leaching. Since nitrogen promotes shoot growth, you will have less growth surge and thatch accumulation following an application of slow-release nitrogen, resulting in less need for mowing [57]. Thatch is a layer of dead and living plant matter that accumulates between the soil and the turfgrass, often blocking water and nutrient movement into the soil.

How Much Phosphorus and Potassium Should I Look For in a Fertilizer?

Since many Florida soils are naturally high in phosphorus, you may not need to apply this element. A soil test will tell you how much phosphorus, if any, you need to apply. Your local extension office has the information and supplies for collecting and submitting a soil test. If you have ample phosphorus in your soil, look for a fertilizer with no more than 2% phosphorus [56]. As for potassium, look for a fertilizer with at least half as much potassium as nitrogen (16-2-8) or equal amounts of nitrogen and potassium (15-0-15), depending upon the results of your soil test.

How Much Fertilizer Should I Apply to a Lawn?

How much to apply is based on your desired level of maintenance, the amount of nitrogen in the bag, and what percentage of that is slow-release. To get the maximum points towards yard certification based on FYN guidelines outlined in the Florida Yardstick Workbook [15], you will be applying the lowest of the fertilizer ranges recommended by the UF Turfgrass Science program. It is important to note that at

times an underfertilized lawn may not be as pest or disease resistant, nor be able to perform as well in preventing erosion. In addition, some Floridians might not care for a low maintenance lawn. On the other hand, it is important to understand that lawns that receive more fertilizer than recommended by FYN guidelines will generally require more mowing, additional irrigation, and may lead to more pest problems than lower maintenance levels.

Regardless of the level of maintenance you choose to implement, please adhere to the following guidelines. If you are applying a fertilizer with less than 50% of its nitrogen in a slow-release form, only apply ½ lb. of nitrogen per 1000 square feet of lawn per application. If it has more than 50% slow-release, you may apply up to 1 lb. of nitrogen per 1000 square feet of lawn per application [56]. Table 4 in the Appendix of this book is a helpful reference to assist you in calculating the amount of fertilizer to apply to your lawn area.

Remember that regardless of the total nitrogen applied over a year, even at the high maintenance levels, it is the amount of nitrogen applied at any one time, and the proper application and watering in, that will have the most impact on the potential for creating pollution. Do not exceed ½ - 1 lb. of nitrogen per 1000 square feet within a two week period. For more detailed information on how to properly maintain your lawn, including fertilizer schedules, disease and pest management, please refer to the Florida Lawn Handbook [6].

How Should I Apply Fertilizer to a Lawn?

Determine the annual fertility needs of your grass species (a range of rates are included in Table 3 in the Appendix of this book). Measure the square footage of your lawn area. Do not include landscape plants in this area calculation. Determine how much slow release nitrogen is in the fertilizer product you have chosen. Refer to Table 4 in the Appendix of this book to find out how much fertilizer to apply to your lawn area, based on the percentage of nitrogen in your fertilizer product. These figures are based on ½ lb. of soluble fertilizer per 1,000 square feet. If you are using a product with over 50% of the nitrogen

in slow-release form, double these amounts to apply 1 lb. nitrogen per 1,000 square feet. Broadcast the fertilizer over the lawn with a drop spreader.

One of the main things you can do to prevent pollution is to use caution when applying fertilizers. The following precautions will help reduce environmental impact:

- Be careful not to spill fertilizer granules. If you do have an accident, sweep the granules up rather than rinse them off with a hose, which could send fertilizer particles down the storm drain.
- Be careful not to spread fertilizer onto water bodies or impervious surfaces such as driveways or sidewalks. Again, these particles can wind up in our waterways.
- Use a drop spreader, which puts the particles down directly beneath the spreader, rather than a rotary spreader, which flings the particles a further distance.
- Avoid using "weed and feed" products that contain herbicides and fertilizer together. These products can injure some trees and shrubs. Remember that tree and shrub root systems can extend far beyond the canopy, intermingling with turf and other areas of the yard.
- Do not fertilize if heavy rain is expected. This will increase the potential for fertilizers to run off into storm drains or to leach through the soil with the rainwater.
- In the summer, when turf is actively growing, apply an iron source instead of a nitrogen fertilizer to green the lawn up without increasing growth. Use a chelated iron or iron sulfate.

When Should I Apply Fertilizer to a Lawn?

Some parts of Florida have year-round growing seasons, while other parts will have dormant lawns for parts of the year. Apply fertilizer when your grass is actively growing, not when it is dormant. Be careful not to apply too much nitrogen at one time in the summer months when grass is already growing rapidly. Consult with your local extension office.

How Do I Irrigate-In Fertilizer?

Most fertilizers need to be irrigated-in to move the fertilizer just below the soil surface to the roots. This can be done with approximately $\frac{1}{4}$" of irrigation water applied to the grass [56]. To find out how long it takes your sprinkler system to deliver this much water, please read the Florida Yard Tip, "Calibrating Irrigation Systems," on page 63. Do not over-irrigate or you increase the potential to move fertilizer past the root zone and into groundwater. When fertilizing lawns, follow recommendations in the Florida Lawn Handbook, available for viewing at all local extension offices [6].

Fertilizing Woody Landscape Plants

In the soil, roots of trees, shrubs, turfgrass and bedding plants intermingle and compete for water and nutrients. In fact, the roots of a single mature tree may extend 60' or more out into your lawn or flower beds. Fertilizer applied to one plant will be absorbed by the roots of a nearby plant. Every treatment applied to the lawn (fertilizer and herbicide, for example) can impact the health of trees and shrubs. Conversely, treatments applied to a tree, such as pruning and fertilizing, can influence the appearance and health of the underlying turfgrass. Areas where tree or shrub fertilization zones overlap with lawn fertilization zones should be fertilized for one or the other of the plant types, but not both.

If trees and shrubs are *not* located near fertilized turfgrass, additional nitrogen may be applied to enhance growth of established trees and shrubs. Please refer to Table 2 in the Appendix for specific rate recommendations. Tables 4 and 5 contain helpful information on calculating the amount of fertilizer to apply to a given area. Fertilizer should be broadcast uniformly over the desired areas of the landscape. Water soluble fertilizers should be applied at no more than $\frac{1}{2}$ lb. of actual nitrogen per 1000 square feet per application. Application rates of controlled-release fertilizers depend on release rates of the product [58].

Fertilizing Palms

Palms have different nutritional requirements than other landscape plants. When palms are important, landscaped areas within 30' of large established palms should be fertilized with a 4-1-6-2 Mg (N - P_2O_5 - K_2O - Mg) ratio fertilizer (an 8-2-12-4 Mg is an example of a fertilizer using this ratio). Nitrogen, potassium and magnesium should have equivalent percentages of each nutrient in controlled-release form. Using a fertilizer with a ratio other than specified may induce or accentuate nutrient deficiencies in palms. Fertilization rates may be based on the rates for nitrogen given in the Appendix for basic, moderate and high levels of maintenance. Because palms are highly prone to several potentially fatal micronutrient deficiencies, any fertilizer applied to them should contain 1-2% iron (Fe) and manganese (Mn), plus trace amounts of zinc (Zn), copper (Cu), and boron (B) to prevent these deficiencies [58].

Magnesium deficiency is quite common on some species of palms in Florida, including this Canary Island Date Palm (Phoenix canariensis). Magnesium deficiency of palms and cycads usually appears as broad yellow bands along the margins of the oldest leaves with a green midrib. Later leaves become completely yellow with tip necrosis.

Watering Efficiently

Homeowners in many parts of Florida are becoming accustomed to restrictions limiting irrigation to certain days and times. Still, many of us are overwatering. Overwatering depletes our water supply, makes plants prone to pests, and adds to stormwater runoff which pollutes our water systems. By choosing and operating a watering system correctly, you can reduce water bills, insect and disease problems and maintenance requirements. For example, the more you water, the faster your lawn grows and the more it needs to be mowed. Even if it is your assigned day to irrigate, this does *not* mean you *must* irrigate. Instead, let the physiology of the plant indicate when you should apply irrigation water. Lawns should be watered when 50% of the lawn shows signs of wilt: leaf blades folded in half, blue-gray color and footprints that remain on the lawn. Established bedding plants and shrubs can be watered "as-needed;" watch for early signs of wilting. Remember, scheduled watering can be a waste of time, money and resources.

FLORIDA YARD TIP: Soil Moisture

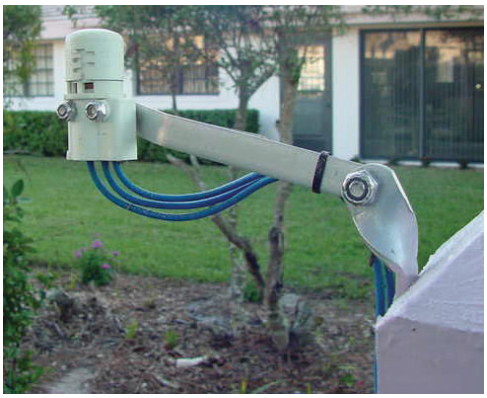
If the soil surface of your yard appears dry, that doesn't mean the root zone is dry. A "soil-coring tool" like the one pictured here can pull up a soil sample from below the soil surface, allowing you to see and feel the moisture below. It can also reveal whether you are watering so much that water is wasted below the root zone. Using this tool can help you judge when to turn off that automatic watering system. Coring tools are available at most irrigation and some garden supply stores.

Photo by Dan Culbert, Okeechobee Extension

Here are some tips on irrigation:

- A sure way to reduce the need for watering is to choose water efficient and drought tolerant plants, including those native to your site, and plant them in the right place. If you group plants according to their water (and light) needs, your irrigation methods and systems can be simplified. For example, turf irrigation zones should be separate from tree and shrub zones.

- If you have an automatic sprinkler system, install a rain shut-off device or sensor that will override the system when adequate rainfall has occurred. Set this device to shut off your system when 0.5" of rain has fallen. Rain shutoff devices are required by Florida law on all automatic sprinkler systems installed since 1991 [59]. Your water management districts, Extension Service, USDA Natural Resources Conservation Service or certified irrigation professional can provide technical assistance.



An automatic rain shut-off device.
Photo by Linda Seashore Larsen, Sarasota County Extension

- For best results, if no water restrictions apply, water in the early morning (4-7 a.m.). This is the most efficient time because temperature and wind speeds are at their lowest and evaporation is reduced. Also, grasses will be less susceptible to fungus if water is applied at the time dew normally forms.

- Avoid watering between 10 a.m. and 4 p.m. Temperature and wind speeds are at their highest during this time so evaporative losses are more likely.

- Here's a simple watering schedule for grass: Apply $\frac{1}{2}$-$\frac{3}{4}$" of water when the grass shows signs of distress (bluish-gray color, folded leaf blades). Don't apply more water until symptoms reappear.
- If rain is predicted within the next 24-hour period, withhold irrigation.
- Use a rain gauge to measure the volume of rainfall.
- Experiment with gradual reductions in irrigation to see if plants can tolerate less water. Some people use no irrigation, yet have healthy plants.
- Water less in cooler months (November-March), and turn off automatic irrigation systems in the summer if rainfall is consistent and, in the winter months when there is little evaporation of water.
- One of the best ways to conserve water in your landscape is to make sure your sprinkler system is applying uniform coverage and operating properly [60].

Students learn to predict weather patterns in an "Agricultural Meteorology" class at UF.

To Sprinkle or Not to Sprinkle

You're probably familiar with sprinklers, the kind that are part of an automated system. In some landscape situations, such as a lawn or bed of flowering annuals, that may be the best method for applying water. For other areas of your landscape, there are systems which allow you to conserve water by using micro-irrigation equipment. Microirrigation systems allow small volumes of water to be applied directly to the root zone through low-flow-rate emitters, such as microspray jets, bubblers or drip tubes. However, micro-irrigation equipment does not prevent over-watering. Leaching of nutrients can occur when the system is operated for excessively long periods of time and the water applied exceeds the water-holding capacity of the soil. Limited lateral distribution of water in sandy soils also is a constraint. Be aware that drip or microspray fittings may clog and require filtration of the source water, regular inspection and possibly cleaning [61]. Drip tape or tubing can be damaged by insects and rodents. Practical advice on state-of-the-art irrigation systems is available from your local extension service.

Sprinkler water misdirected towards the pavement is more likely to run off the impervious surface and be wasted.

If you are in the market for a new irrigation system, find a reputable certified irrigation contractor who has experience with these systems. Free inspection of irrigation system efficiency is available in some areas through the Natural Resources Conservation Service. For more information on who to contact in your area, please visit: http://www.sfwmd.gov/images/pdfs/splash/spl_mobile_irrig.pdf [62].

If you already have an irrigation system your options for retrofitting may be limited. Sometimes low-pressure emitters, such as bubblers, can be adapted to existing sprinkler heads. This may require an attachment at the source to reduce water pressure. If you are changing areas of your landscape from turf to trees or planted beds, consult with the extension service or Natural Resources Conservation Service on irrigation options. The Water Management Districts and Florida Irrigation Society also provide information on irrigation system selection, maintenance and appropriate watering practices.

Drip irrigation lines can be adapted to your existing system.

FLORIDA YARD TIP: Calibrating Irrigation Systems

Use these simple instructions to determine how much water your irrigation system is applying:

- Set several similar, flat-bottomed, straight-sided cans (all must be of equal size) in various places within one watering zone.
- Turn on sprinklers for 15 minutes.
- Pour the water from all containers into one container. Measure the depth of the water to the nearest 1/8".
- Divide the measurement by the number of containers to determine the average amount of water applied in that zone in 15 minutes.
- In the future, irrigate the area only as long as it takes to apply $\frac{1}{2}$-$\frac{3}{4}$" of water.

Control Yard Pests Responsibly

Concerns about health, the environment and pests with increased resistance to traditional pesticides have forced people to reconsider practices they once took for granted. Regular preventive applications of pesticides is one example. Most people don't realize that, in general, nature takes pretty good care of itself. Healthy plants can usually fend off pest attacks, while predatory insects and birds may suppress undesirable insects. Thus, the preventive and indiscriminate use of pesticides is not advised.

There is an environmentally-friendly approach to pest control called Integrated Pest Management (IPM). IPM emphasizes proper identification of the insect or problem. Regular scouting will help to detect problems early. Further observation is made to determine if a problem really exists or if natural enemies like beneficial insects or other natural controls are already present. All control options are considered, including prevention of serious pest outbreaks using pest-resistant plants and proper landscape management. If control is necessary, the safest and most effective pest management techniques are employed. Often the problem can be solved creatively without the use of pesticides. Safe alternatives are always tried first, such as changing cultural practices, or using barriers to block pest entry. If conventional chemical pesticides are required, the least harmful materials are selected to control them. Pesticides are used only to spot-treat affected plants and lawn, not in blanket applications.

This person is scouting for pests by tapping branches over a white sheet of paper.
Photo by J. Castner, Entomology and Nematology, UF.

Avoiding Pest Problems

Think before you plant. It takes a considerable effort to protect plants weakened by unfavorable growing conditions. Know which plants can tolerate the conditions in your yard and plant them. Concentrate on pest-resistant varieties. Go easy on water and fertilizer. Overwatering and overfertilizing cause excessive growth, making the plants vulnerable to insects and disease. Encourage healthy growth and maintain the quality of your landscape by applying fertilizer and water only when needed and in moderate amounts. Mowing grass too short and severely pruning trees and shrubs weakens them, inviting pests. Mow to the proper height and prune selectively.

Identifying Pest Problems

Inspecting plants helps identify pest problems early, before they get out of hand. Common plant pests in Florida include aphids, mealybugs, scales, whiteflies, thrips, plant-feeding mites and caterpillars. Detecting small insects and mites can be difficult; their entire life cycle can be as short as one week.

To detect small pests, strike the leaves of small branches against a sheet of white paper and use a ten-power (10X) magnifying glass to search for movement or evidence of pests. Scales and whitefly larvae attach to the plant. Look for pests on branches and on both the upper and undersides of leaves. Sooty mold on foliage often indicates an infestation of insects that pierce the plant and suck sap. "Piercing-sucking" insects often secrete a sugary substance known as honeydew, which serves as a medium for growth of the black colored fungi. Sooty mold does not injure the plant directly, but it blocks sunlight from the leaves, reducing photosynthesis. Ants also signal the potential

Ants tending plant hoppers.

presence of pest insects. Ants feed on honeydew and often protect the insects that produce it [63].

If you observe plant damage but few pests, beneficial insects may already be at your service. These may include lady beetles (commonly called ladybugs) and their larvae, lacewings and their larvae, preying mantids, assassin bugs, spiders and parasitic wasps. Try to tolerate some insect damage and leaf disease on plants. No one can maintain an insect and disease-free landscape, and a little damage won't hurt your plants. Remember, in order to have the "good guys" (such as ladybugs) there must be some "bad guys" (pests) as a food source. If a pest problem persists, take a sample of the damage and pest to the extension service for identification and suggestions on how to proceed using IPM.

Integrated Pest Management

When pests, their eggs, and debris are heavily concentrated, insect and disease problems can be reduced or eliminated by removing the affected leaves or plant parts. Crush, burn or compost these infested plant parts to prevent further spread of disease or insects [30]. Handpicking and spraying with water also effectively control some large, slow-moving pests. After you handpick, dispose of the captured insects so they do not return to feed again.

The assassin bug feeds upon many different plant pests.
Photo by Clemson University - USDA Cooperative Extension Slide Series, www.insectimages.org

The big eyed bug is a beneficial insect often mistaken for a chinch bug.
Photo by Bradley Higbee, Paramount Farming, www.insectimages.org

Some disposal options include:

- Drop pests into soapy water or isopropyl alcohol
- Place pests in the freezer overnight
- Compost pest in the center of a hot pile
- Crush them and put them in your household trash

Avoid using broad-spectrum pesticides. Remember, broad-spectrum pesticides are not selective; they also kill beneficial insects and insects that are not problematic. Safer alternatives to traditional pesticides include insecticidal soaps and horticultural oils to reduce populations of sucking insects [64]. Products containing an extract of the bacterium *Bacillus thuringiensis* 'Kurstaki' will reduce populations of caterpillars. Treat for specific pests and only treat the affected plant. Read all product labels carefully and follow them accordingly. Do not attempt to mix your own chemicals or apply homemade recipes unless you have been properly trained to do so.

In general, it is best to apply soaps, oils and pesticides during the cooler part of the day to avoid plant injury. Some plants may be sensitive to certain products. Read the label to find out which plants are listed. To test for phytotoxicity, apply the product to a small portion of a leaf first, and check for leaf burn.

Caterpillar killed with Bacillus thuringiensis *'Kurstaki'.*

Common Plant Pests and Controls

Aphids:

Winged or wingless pear-shaped bodies may be green, yellow, black, red or multi-colored. Aphids are typically found on new growth. Damaged leaves appear yellow, twisted or distorted; ants or sooty mold may be present.

Oleander aphid with lady beetle larva predator.
Photo by Anne W. Gideon, www.insectimages.org

Natural controls:
Lady beetle adults and larvae, lacewing larvae, syrphid fly larvae, parasitic wasps.

Other controls:
Prune infected plant parts or flush with water from a hose, apply insecticidal soaps, horticultural oils or drench with product containing imidacloprid [65].

Mealybugs:

Mealybugs are 1/16 - 1/8" long soft bodied insects with well-developed legs. Their bodies and egg masses are covered by powdery white wax. They attack leaves, twigs and roots, leaving behind white, mealy wax deposits. Sooty mold or ants may be observed.

Natural controls:
Lady beetles, lacewing larvae.

Other controls:
Spray with horticultural oil, insecticidal soap, or drench with product containing imidacloprid. If oil spray fails, systemic pesticide may be applied to root system, affecting only pests that feed on plant sap [65].

Longtailed mealybugs feeding on the underside of leaves.
Photo by J. Castner, Entomology and Nematology, UF.

Scales:

Scales vary in size, shape and color; they are approximately 1/16" in diameter. Two body types exist: armored and soft scales. Soft scales produce honeydew (sugary secretion).The armored scale body is hidden under a waxy scale covering. Mature scales are stationary and feed on leaves, twigs, stems and fruit. Yellow spots (feeding damage) may be observed on top of leaves with scale underneath. Ants or sooty mold may be present. "Crawlers" (immature, mobile) are the most vulnerable life stage and are therefore easiest to control [65].

Hemispherical scale immatures (green) and adults (brown).
Photo by Ken Gray, Oregon State University.

Natural controls:
Lady beetles, parasitic wasps.

Other controls:
See methods for mealybugs.

Whiteflies:

Adults look like tiny white moths on plants. They take flight when leaves are disturbed. Whiteflies deposit eggs on the underside of leaves. Oval, flat, transparent-to-greenish colored larvae are found stationary on underside of leaves. Larvae are dull white when dead; pupae have red eyes. Ants or sooty mold may be present.

Natural controls:
Fungi (most effective in humid weather), parasitic wasps, lady beetles.

Other controls:
Spray with insecticidal soap. Follow with horticultural oils, if necessary [65].

Silverleaf whiteflies.
Photo by Scott Bauer, USDA ARS, www.insectimages.org

Caterpillars:

Caterpillars are the larval form of butterflies and moths. They chew on foliage causing skeletonized leaves and notches. Greenish fecal pellets may be observed on foliage.

Natural controls:
Wasps, birds, predatory stinkbugs, big-eyed bugs, lizards.

Other controls:
Remove by hand (use pliers to remove stinging caterpillars), apply *Bacillus thuringiensis* 'Kurstaki' (most effective when caterpillars are small) [65].

Azalea caterpillar.
Photo by Clemson University - USDA Cooperative Extension Slide Series, www.insectimages.org

Plant-feeding mites:

Plant feeding mites are tiny (1/32") red, yellow or greenish in color with oval bodies. They may have spots. Some species spin loose webs on foliage. Mites reproduce rapidly in hot weather. Injuries to plants look like light colored dots, giving leaves a dull, gray-green, stippled appearance.

Natural controls:
Lady beetles, predatory mites.

Other controls:
Flush with water, then alternate with soap and oils if necessary [65].

Spider mites.
Photo by Clemson University - USDA Cooperative Extension Slide Series, www.forestryimages.org

Thrips:

Thrips are tiny (1/32") winged insects that scar leaves, buds and flower petals in order to drink sap from wounds. Injured plant may be dull gray with curling, distorted leaves.

Natural controls: None identified.

Other controls:
Apply horticultural oils, insecticidal soaps, imidacloprid [65].

Cuban laurel thrip and damage to plant leaves.
Photo by J. Castner, Entomology and Nematology, UF.

Mole crickets:

Mole crickets are 1-1½" long, velvety brown insects that feed on turfgrass. Their front legs are flattened and adapted for burrowing. Mole crickets affect all grasses, but prefer bahiagrass and bermudagrass. Injured turf may be spongy and thinning, with ¾" round holes which are signs of tunneling. Infestation is likely to occur in same area each year. Test for infestation by flushing area with soapy water, crickets will surface if present.

Natural controls:
Parasitic wasp (*Larra bicolor*), Red-eyed fly (*Ormia depleta*), insect-parasitic nematodes (*Steinernema scapterisci*) and birds.

Other controls:
For chronic infestation consider replacing turf with trees, shrubs or groundcovers. If necessary, spot-treat infestations in May or June with materials labeled for mole cricket control. Use baits in the summer [66].

Mole cricket.
Photo by Clemson University - USDA Cooperative Extension Slide Series, www.insectimages.org

Chinch bugs:

Adult chinch bugs are 1/5" long, black with white patches on wings. Young nymphs are smaller and reddish. Chinch bugs feed on St. Augustinegrass, often in stressed areas in full sun or near pavement. Injured turf appears yellow.

Chinch bug and damage to turfgrass.
Photo by J. Castner,
Entomology and Nematology, UF.

Natural controls:
Big-eyed bug, earwigs.

Other controls:
Avoid high fertilizer rates. Maintain St. Augustinegrass at height of 3" in sun and 4" in shade. Use chinch bug-resistant grass varieties, when available. Spot-treat infestations with insecticidal soap or other materials labeled for chinch bugs [66].

Ants:

Ants have three body segments. They range in size from 1/16-1/2", depending on species. Most species are not harmful. In the landscape, fire ants and carpenter ants are a problem. When ants are present, you may observe mounds, ants in trails and on plants.

Imported fire ants sting and bite, but only the sting causes the painful white pustule.
Photo by J.F. Butler,
Entomology and Nematology, UF.

Natural predators:
Fire ants decapitated by Phorid flies, *Thelohania* fire ant disease.

Other controls:
Effective fire ant control can be achieved with baits. Be sure material is dry/fresh and apply in late afternoon or evening around edges of mound. Do not apply when the ground or grass is wet. Do not disturb mound. Store baits in a cool environment [67].

On the Waterfront

Waterfront property owners have firsthand knowledge of the special contributions lakes, ponds, rivers, streams and lagoons add to our quality of life. Florida Yards located on the waterfront must address certain challenges and responsibilities. As next door neighbor to these natural resource treasures, it is your mission to practice good environmental stewardship. Landscapes bordering our surface water resources need to be designed and managed with special sensitivity to the environment. Some considerations are highlighted in this section.

Saltwater Considerations

Naturally sloping shorelines, particularly when buffered by a fringe of mangroves or marsh grass, help smooth out waves and reduce turbidity (cloudiness) in the water. Mangroves and other shoreline plants contribute to the food web, attract wildlife, such as wading birds, and help prevent erosion at the water's edge. The area in which these shoreline plants grow is known as the littoral zone, the boundary between land and water. Unfortunately, seawalls have traditionally been placed directly in this intertidal zone. While returning to a naturally vegetated shoreline is ecologically desirable, removing a shore protection structure is likely to be a complex decision. Inquire about your city and county ordinances to determine whether removal is an option.

Container garden along a seawall of the intracoastal waterway.

If a shoreline protection structure has replaced the littoral zone along your property, your options are limited by the depth of your lot, the distance from the waterline to upland structures, the

wave impact against your shore, your budget and the shoreline condition of neighboring properties. Shoreline protection alternatives are very site-specific considerations, and expert advice is essential. The Florida Sea Grant Marine Extension agent in your county, natural resources employees of local governments and the Florida Department of Environmental Protection are good places to obtain help and information. Keep in mind that submerged land is probably not your property, but belongs to the State of Florida.

Those Marvelous Mangroves

The beauty, wildlife value, and erosion protection make mangroves an asset to a Florida Yard. There are four species of mangroves native to Florida: red mangrove, black mangrove, white mangrove and buttonwood. Red mangroves (*Rhizophora mangle*) usually live closest to open water. They have arching red prop roots and their seeds look like green cigars. Black mangroves (*Avicennia germinans*) usually grow further upland than red mangroves. They are taller than red and white mangroves and are the ost cold tolerant of the mangrove species found in Florida. Black mangroves send up nobby projections called pneumatophores, which provide oxygen to the tree's roots. White mangroves (*Laguncularia racemosa*) are usually found at higher elevations, interspersed with black mangroves. Buttonwood (*Conocarpus erectus*) is not considered a true mangrove by some scientists. It grows most landward of the mangrove species. Once established,

Mangrove seedlings
Greg Ira, FDEP

Pneumataphores are sometimes called "knees."
Greg Ira, FDEP

buttonwood is quite drought-resistant. It also can withstand flooding, making it an ideal landscape plant for coastal areas.

If you have mangroves, contact the following organizations for information on properly managing these fascinating plants: Florida Sea Grant Extension Program, FDEP and your local government's natural resources department. Some mangrove pruning requires a permit and the rules are periodically revised. Homeowners, and the individuals they hire to trim their mangroves, are jointly responsible for the appropriate trimming of mangroves. The booklet, Mangrove Trimming Guidelines for Homeowners is available at FDEP's district offices throughout the state. You can read these materials online at http://www.dep.state.fl.us/water/wetlands/mangroves/mangrove.htm [69].

Freshwater Considerations

Lakes, rivers, streams and ponds also have littoral zones, which offer many benefits. For example, littoral zones slow the velocity of runoff, filter nutrients and sediments from runoff, and hold the soil in place. To protect the water resource from nutrient and pesticide runoff, designate a "maintenance-free zone" between your lawn or landscape and the water body. Do not mow, fertilize, or apply pesticides to the littoral zone. Instead, enhance natural wetland vegetation with additional plantings. The FDEP's book, Florida Wetland Plants: An Identification Manual, is an excellent reference source for information on appropriate plant materials [68].

Fragrant white water-lilies (Nymphaea odorata) *growing in a man-made stream.*

Man-made Lakes and Ponds

Selecting a good pond site is a decision involving many factors, including: slope, soil types, water table, septic tank and house foundation setbacks, and utility easements. When planning, try to strike a balance between what your permit allows and what the landscape calls for.

In nature, Florida lakes and ponds are usually located at the lowest elevation in a landscape. Typically, Florida lakes and ponds have a high edge-to-depth ratio; that is, they are wide and shallow. This increases the amount of littoral shelf area — the area receiving maximum sunlight penetration, subsequent rooted plant production and pond life activity. Florida ponds less than 4' deep often exhibit complete plant coverage. It takes 6-10' depths to maintain open water.

Stormwater Control

After a series of swales and channels, a small pond can serve as a final collection point for runoff. Pollutants are filtered by vegetation, filter traps and the settling action in the pond itself. This can significantly improve the quality of water draining into natural water bodies. These systems also have the advantage of extending the "soak time" of stormwater, or increasing the amount of water allowed to percolate, recharging groundwater directly. If you find yourself managing one of these systems, here are some guidelines to assure they continue to function properly:

- DO plant appropriate aquatic, emergent and upland vegetation (they will greatly enhance soil stabilization).
- DO use pondwater for non-potable, local irrigation needs.
- DO fertilize surrounding areas with the least amount possible, using slow-release fertilizer.
- DO use organic compost in lieu of fertilizer.
- DO use mulch around plants to retain moisture.
- DO keep pet and feral waterfowl wastes out of water bodies.

- DON'T allow livestock to graze pond bank sides.
- DON'T swim in or eat fish caught in stormwater ponds.
- DON'T allow invasive plants to clog waterways.
- DON'T direct grass clippings into stormwater ponds.

Ponds and Wildlife Habitat

Whether the pond surface can be measured in square feet or acres, ponds will provide a significant contribution to the wildlife of the area. A common pond type, and perhaps the easiest to imitate as a yard feature, are shallow "seasonal" ponds, typically 2-5' deep and 25-150' across. The wet/dry variations in seasonal rainfall causes fluctuations in water level, appearance and function. Standing water recedes in the Florida winter, often drying down completely, depending on the pond's water depth, soil type and the local water table. Even in this "dry-down" condition, these sites provide moisture sources, the "damp habitats" required by many amphibians, reptiles, birds and small mammals. If you wish to construct a pond to replicate these important habitats, choose an area where:

- their shallow and wide profiles can be accommodated.
- present plant life and soil types are suitable.
- wildlife can get to the pond without disturbance.

Shallow ponds, typical in Florida, allow sunlight to penetrate the bottom.

When You Don't Do The Work Yourself

This handbook will help the "do-it-yourselfers," but what about those lacking the time, desire or ability to do the work? There are thousands of landscaping companies that offer maintenance services. Select companies whose employees have earned a certificate for completion of training in "Florida Green Industries: Best Management Practices for Protection of Water Resources in Florida" from the UF/IFAS Extension Service [2]. Take care to select one that will use sound maintenance practices to produce a Florida Yard that's not only visually pleasing, but friendly to the environment as well.

Your landscape maintenance service should agree to:

- Monitor for pests, rather than apply sprays routinely, and provide evidence of a significant problem before you allow and pay for treatment.
- Use alternative methods of controlling pest problems as described in this handbook.
- Use pesticides only when other methods fail. Post a sign to alert neighbors that pesticides have been applied.
- Properly apply fertilizer, and follow guidelines mentioned in this publication and the "Florida Green Industries: Best Management Practices for Protection of Water Resources in Florida" [2].
- Avoid fertilizers containing weed killer or insecticide. [Note: anyone offering to apply "weed and feed" material must have a pesticide license from the Florida Department of Agriculture and Consumer Services. Unlicensed professional applicators are subject to a $5000 fine per offense.]
- Leave grass clippings on the lawn and use other yard waste as mulch or compost.

Literature Cited

[38] Fla. Stat. §403.708 (13)(c) 2002. URL: http://www.flsenate.gov/Statutes/index.

[39] Trenholm, L.E., J.B. Unruh, and J.L. Cisar. 2001. "Mowing Your Florida Lawn." UF/IFAS Publication ENH 10 (Revised). URL: http://edis.ifas.ufl.edu/LH028.

[40] K.L. Kopp and K. Guillard. 2002. "Clipping Management and Nitrogen Fertilization of Turfgrass: Growth, Nitrogen Utilization, and Quality." Crop Science 42:1225-1231.

[41] Y.L. Qian, W. Bandaranayake, W.J. Parton, B. Mecham, A.M. Harivandi, and A.R. Mosier. 2003. "Long-term effects of clipping and nitrogen management on soil carbon and nitrogen dynamics: the CENTURY model simulation." Journal of Environmental Quality: 32(5), (in press).

[42] J.L.Starr and H.C. DeRoo. 1981. "The Fate of Nitrogen Fertilizer Applied to Turfgrass." Crop Science 21:531-536.

[43] E.F. Gilman and R.J. Black. 1994. "Pruning Landscape Trees and Shrubs." UF/IFAS Circular 853 (Revised). URL: http://edis.ifas.ufl.edu/MG087.

[44] International Society of Arboriculture [website accessed: July 9, 2003.] http://www.floridaisa.org/.

[45] B. Maynard and T. Smiley. 2001. "Over the Top." American Nurseryman, April 2001 issue. pp78-82.

[46] R.J. Black, E.F. Gilman, G.W. Knox and K.C. Ruppert. 1994. "Mulches for the Landscape." UF/IFAS Publication ENH 103 (Revised). URL: http://edis.ifas.ufl.edu/MG251.

[47] M. Buchanan and S.R. Gliessman. 1991. "How Compost Fertilization Affects Soil Nitrogen and Crop Yield." Biocycle Dec. 1991, pp. 72-77.

[48] G. Kidder. 2002. "Plant Nutrients and Fertilizers for The Non-Farmer." UF/IFAS Publication SL-60. URL: http://edis.ifas.ufl.edu/MG090.

[49] K.R. Stern. 1991. Introductory Plant Biology, Seventh Edition. W.C. Brown Publishers, Dubuque, IA.

[50] C.M. Gross, J.S. Angle, and M.S. Welterlen. 1990. "Nutrient and Sediment Losses from Turfgrass." Journal of Environmental Quality 19 (Oct-Dec):663-668.

[51] D.C. Bowman, C.T. Cherney, and T.W. Rufty, Jr. 2002. "Fate and Transport of Nitrogen Applied to Six Warm-Season Turfgrasses." Crop Science 42(3): p833-841.

[52] A.J. Gold, W. R. DeRagon, W.M. Sullivan, and J.L. Lemunyon. 1990. "Nitrate-nitrogen losses to Groundwater from Rural and Suburban Land Uses." Journal of Soil and Water Conservation, March-April 1990, pp 305-310.

[53] Petrovic, A.M. 1990. "The Fate of Nitrogenous Fertilizers Applied to Turfgrass." Journal of Environmental Quality 19 (1):1-14.

[54] L.M. Shuman. 2002. "Phosphorous and Nitrate Nitrogen in Runoff Following Fertilizer Application to Turfgrass." Journal of Environmental Quality 31(Sept/Oct):1710-1715.

[55] G.H. Snyder, B.J. Augustin and J.M. Davidson. 1984. "Moisture Sensor-Controlled Irrigation for Reducing N Leaching in Bermudagrass Turf." Agronomy Journal 76 (6): 964-969.

[56] L.E. Trenholm and J. B. Unruh. 2003. "Figuring out Fertilizer Rates for the Home Lawn." UF/IFAS Publication (currently in press at this time).

[57] J.B.Sartain. 1985. "Effect of Acidity and N Source on the Growth and Thatch Accumulation of Tifgreen Bermudagrass and on Soil Nutrient Retention." Agronomy Journal, 77:33-36.

[58] Trenholm, L.E., E.F. Gilman, G.W. Knox, and R.J. Black. 2002. "Fertilization and Irrigation Needs for Florida Lawns and Landscapes." UF/IFAS Fact Sheet ENH-860. URL: http://edis.ifas.ufl.edu/EP110.

[59] Fla. Stat. § 373.62 (2002) URL: http://www.flsenate.gov/Statutes/index.

[60] A.G. Smajstrla, F.S. Zazueta and D.Z. Haman. 1997. "Lawn Sprinkler Selection and Layout for Uniform Water Application." UF/IFAS Bulletin 320. URL: http://edis.ifas.ufl.edu/AE084.

[61] G.J.Hochmuth, S.J. Locascio, T.E. Crocker, C.D. Stanley, G.A. Clark, and L.R. Parsons. 1993. "Impact of Microirrigation on Florida Horticulture." Hort Technology 3(2) Apri/June: pp. 223-229.

[62] South Florida Water Management District. 2002. "Mobile Irrigation Labs." Splash newsletter October, 2002. URL: http://www.sfwmd.gov/images/pdfs/splash/spl_mobile_irrig.pdf.

[63] A.B. Hamon and M.L.Williams. 1984. Arthropods of Florida and Neighboring Land Areas:The Soft Scale Insects of Florida (Volume 11) Florida Department of Agriculture and Consumer Services, Division of Plant Industry. Gainesville, FL.

[64] E. A. Buss and S. G. Park-Brown. 2002. "Natural Products for Insect Pest Management." UF/IFAS Publication ENY-350. URL: http://edis.ifas.ufl.edu/IN197.

[65] Buss, E.A. and D. E. Short. 2001. "Insect Management on Landscape Plants." UF/IFAS Publication ENY-338 (Revised). URL: http://edis.ifas.ufl.edu/IG013.

[66] Buss, E.A. 2001. "Insect Pest Management on Turfgrass." UF/IFAS Publication ENY-300 (Revised). URL: http://edis.ifas.ufl.edu/IG001.

[67] Oi D.H. and P. G. Koehler. 1994. "Imported Fire Ants on Lawns and Turf." UF/IFAS Fact Sheet ENY-226 (Revised). URL: http://edis.ifas.ufl.edu/LH059.

[68] Tobe, J.D., K. Craddock Burks, R.W. Cantrell, M.A. Garland, M.E. Sweeley, D.W. Hall, P. Wallace, G. Anglin, G. Nelson, J.R. Cooper, D. Bickner, K. Gilbert, N. Aymond, K. Greenwod, and N. Raymond. 1998. Florida Wetland Plants: An Identification Manual; FDEP, Tallahassee, FL.

[69] Florida Department of Environmental Protection. "Mangrove Trimming Guidelines for Homeowners." Available at FDEP district offices throughout the state. http://www.dep.state.fl.us/water/wetlands/mangroves/mangrove.htm.

Helpful Literature

For more Information on Stormwater Runoff and Leaching:

Buttler, T. , W. Martinkovic, and O.N. Nesheim. 1998. "Factors Influencing Pesticide Movement to Groundwater." UF/IFAS Publication PI-2 (Revised). URL: http://edis.ifas.ufl.edu/PI002.

Cook, G.D. 1994. "A Guide to Residential Energy Efficiency in Florida." UF/IFAS Fact Sheet EES-7 (Revised). URL: http://edis.ifas.ufl.edu/EH107.

Cook, G. 1994. "Energy Efficiency & Environmental News: Sustainability: The Concept." November 1993 issue of Energy Efficiency and Environmental News, UF/IFAS. URL: http://edis.ifas.ufl.edu/EH311.

Carriker, RR. 2001. "Florida's Water Resources." UF/IFAS Publication WQ 101 (Revised). URL: http://edis.ifas.ufl.edu/WQ101.

Carriker, RR. 2000. "Florida's Water: Supply, Use, and Public Policy." UF/IFAS Publication FE 207. URL: http://edis.ifas.ufl.edu/FE207.

Carpenter, S., N.F. Caraco, D.L. Correll, R.W. Howarth, A.N. Sharpley, and V.H. Smith. 1998. "Non-point pollution of surface waters with phosphorus and nitrogen." Issues in Ecology 3: 112. URL: http://www.esa.org.

Florida Department of Environmental Protection. 2002. "Florida Green Industries: Best Management Practices for Protection of Water Resources in Florida." Available at county extension service offices and online: http://www.dep.state.fl.us/water/nonpoint/pubs.htm.

Haman, D.Z. and D.B. Bottcher. 1986. "Home Water Quality and Safety." UF/IFAS Circular 703. URL: http://edis.ifas.ufl.edu/AE009.

Hauxwell, J., C. Jacoby, T.K. Frazer, and J. Stevely. 2001. "Nutrients and Florida's Coastal Waters: The Links Between People, Increased Nutrients and Changes to Coastal Aquatic Systems." UF/IFAS Fact Sheet SGEB 55. URL: http://edis.ifas.ufl.edu/SG061.

Hornsby, AG. 1999. "How Contaminants Reach Groundwater." UF/ IFAS Fact Sheet SL143. URL: http://edis.ifas.ufl.edu/SS194.

Olexa , M.T. and A. Leviten. 1999. "Florida Solid and Hazardous Waste Regulation Handbook." UF/IFAS Circular 1139 (Revised). URL: http://www.aglawcenter.ifas.ufl.edu/EDISPubs/EDISPubs.html.

Olexa, M.T., L. Minton, D. Miller, and S. Corbett. 2001. "Handbook of Florida Water Regulations." UF/ IFAS Fact Sheet Series: FE 029- FE 057 (Revised). URL: http://www.aglawcenter.ifas.ufl.edu/EDISPubs/EDISPubs.html.

Rao, P.S.C., R.S. Mansell, L.B. Baldwin, and M.F. Laurent. 1983. "Pesticides and their Behavior in Soils and Water." UF/IFAS Fact Sheet SL-40 (Revised). URL: http://edis.ifas.ufl.edu/SS111.

Rao, M.P., and P.S.C. Rao. 1987. "Organic contaminants in groundwater: 1. Health effects." UF/IFAS Fact Sheet SL-54. URL: http://edis.ifas.ufl.edu/SS173.

Stewart, J.C., A.T. Lemley, S. I. Hogan, R.A. Weismiller, and A.G. Hornsby. 2001. "Health Effects of Drinking Water Contaminants." UF/IFAS Fact Sheet SL161. URL: http://edis.ifas.ufl.edu/SS299.

Vitousek, P.M., J. Aber, R.W. Howarth, G.E. Likens, P.A. Matson, D.W. Schindler, W.H. Schlesinger, and G.D. Tilman. 1997. "Human alteration of the global nitrogen cycle: causes and consequences." Issues in Ecology 1: 115. On-line at: http://www.esa.org.

For More Information on Natural Areas:

Carriker, R. 2002. "Florida Forever: A Program for Conservation Land Acquisition." UF/IFAS Publication FE 331. URL: http://edis.ifas.ufl.edu/FE331.

Demers, C. and A. Long. 2002. "Controlling Invasive Exotic Plants in North Florida Forests." UF/IFAS Publication SS-FOR-19. URL: http://edis.ifas.ufl.edu/FR133.

Florida Exotic Pest Plant Council. 2003. List of Florida's Invasive Species. URL: http://www.fleppc.org/.

Langeland, KA. 2003. "Help Protect Florida's Natural Areas from Non-native Invasive Plants." UF/IFAS Circular 1204 (Revised). URL: http://edis.ifas.ufl.edu/AG108.

Langeland, KA. and R.K. Stocker. 2000. "Control of Non-native Plants in Natural Areas of Florida." UF/ IFAS Document SP 242 Revised). URL: http://edis.ifas.ufl.edu/WG209.

Tanner, G.W., W.R. Marion, and J.J. Mullahey. 1997. "Understanding Fire: Nature's Land Management Tool." UF/IFAS Circular 1018 (Revised). URL: http://edis.ifas.ufl.edu/UW124.

For More Information on Site Analysis:

Kidder, G., R.J. Black and K.C. Ruppert. 1999. "Soil pH and Landscape Plants." UF/ IFAS Fact Sheet SL-113 (Revised). URL: http://edis.ifas.ufl.edu/MG092.

Kidder, G. and R.D.Rhue. 1997. "Soil Testing." UF/IFAS Circular 239, (Revised). URL: http://edis.ifas.ufl.edu/SS156.

Street, J and G. Kidder. 1997. "Soils and Plant Nutrition." UF/IFAS Fact Sheet SL-8, (Revised). URL: http://edis.ifas.ufl.edu/MG091.

For More Information on Landscape Design:

Black, R.J. and A.W. Meerow. 1993. "Landscaping to Conserve Energy: Determining Shade Patterns for North Florida." UF/IFAS Circular EES-49. URL: http://edis.ifas.ufl.edu/EH217.

Bradshaw, J. and L. Tozer. 1993. "Enviroscaping." UF/IFAS Circular EES-101. URL: http://edis.ifas.ufl.edu/EH215.

Florida's Water Management Districts. 2001. "Water Wise Florida Landscapes: Landscaping to Promote Water Conservation Using the Principles of Xeriscape™." St. John's River Water Management District, Palatka, FL.

Ingram, D.L. 1991. "Basic Principles of Landscape Design." UF/IFAS Circular 536. URL: http://edis.ifas.ufl.edu/MG086.

Knox, G. 1991. "Landscape Design for Water Conservation." UF/IFAS Fact Sheet ENH-72. URL: http://edis.ifas.ufl.edu/MG027.

Meerow, A.W. and R.J. Black. 1993. "Enviroscaping to Conserve Energy: A Guide to Microclimate Modification." UF/IFAS Circular EES-43. URL: http://edis.ifas.ufl.edu/EH143.

Meerow, A.W. and R.J. Black. 1993. "Landscaping to Conserve Energy: Determining Shade Patterns for Central Florida." UF/IFAS Circular EES-50. URL: http://edis.ifas.ufl.edu/EH218.

Meerow, A.W. and R.J. Black. . 1993. "Landscaping to Conserve Energy: Determining Shade Patterns for South Florida." UF/IFAS Circular EES-48. URL: http://edis.ifas.ufl.edu/EH216 .

Monroe, M.C. and A. Long. 2001. "Landscaping in Florida with Fire in Mind." UF/IFAS Document FOR 71 (Revised). URL: http://edis.ifas.ufl.edu/FR076.

Olexa , M.T. and M. Armster. 1999. "Handbook of Florida Fence and Property Law." UF/IFAS Circular 1242. URL: http://www.aglawcenter.ifas.ufl.edu/EDISPubs/EDISPubs.html.

Worden, E.C. and C.J. D'Angelo. 2002. "Demonstration Gardens in the UF Cooperative Extension Service." UF/IFAS Document ENH 865. URL: http://edis.ifas.ufl.edu/EP108.

For More Information on Plant Selection:

Association of Florida Native Nurseries (AFNN). January 2, 2003. URL: www.afnn.org.

Barnett, M. R. and D. W. Crewz. 1990. "An introduction to planting and maintaining selected common coastal plants in Florida." Florida Sea Grant Report No. 97. University of Florida, Gainesville, FL. vi, 108 p. Available for purchase: www.ifasbooks.ufl.edu.

Biological Resource Associates. "Plant Library." URL: http://ww.biologicalresearch.com.

Black, R.J. 1997. "Native Florida Plants for Home Landscapes." UF/IFAS Publication ENH-25. URL: http://edis.ifas.ufl.edu/EP011.

Black, R.J. 1994. Bedding Plants: Selection, Establishment and Maintenance. UF/IFAS Circular 1134. URL: http://edis.ifas.ufl.edu/MG319.

Black, R.J. and A.W. Meerow. 1993. "Enviroscaping to Conserve Energy: Trees for North Florida." UF/IFAS Circular EES-40. URL: http://edis.ifas.ufl.edu/EH217.

Black, R.J. and A.W. Meerow. 1993. "Enviroscaping to Conserve Energy: Trees for Central Florida." UF/IFAS Circular EES-41. URL: http://edis.ifas.ufl.edu/EH218.

Broschat, T.K., and A.W. Meerow. 1991. "Betrocks Reference Guide to Florida Landscape Plants." Betrock Information Systems, Inc., Hollywood, FL.

Burks, K.C. 2000. "Non-native Plant Species Restricted by Federal, State, or Local Law in Florida." Florida Department of Environmental Protection, Bureau of Invasive Plant Management, Tallahassee, FL.

Deghan, B. 1998. "Landscape Plants for Subtropical Climates." University Press of Florida, Gainesville, FL.

FLEPPC. 2001. List of Florida's Invasive Species. [06/5/02] Florida Exotic Pest Plant Council. URL: http://www.fleppc.org/.

Florida Native Plant Society [April 15, 2003] URL: www.fnps.org.

Fulghum, L. (ed.) Florida Plants [online] "Florida Garden Finder" URL: http://www.floridaplants.com/flgardens/alpha.htm.

Gilman, E.F., and R.J. Black. 1999. "Your Florida Guide to Shrubs: Selection, Establishment and Maintenance." University of Florida Press, Gainesville. Available for purchase: www.ifasbooks.ufl.edu.

Haynes, J.L. 2001. Virtual Cycad Encyclopedia. Palm & Cycad Societies of Florida, Inc. Internet: http://www.plantapalm.com/vce/vce_index.

Haynes, J., J.McLaughlin, L. Vasquez, and A. Hunsberger. 2001. "Low-Maintenance Landscape Plants for South Florida." UF/IFAS Publication ENH854. URL: http://edis.ifas.ufl.edu/EP107.

Ingram, D.L. R. J. Black and E. F. Gilman. 1991. "Selecting and Planting Trees and Shrubs." UF/IFAS Circular 858. URL: http://edis.ifas.ufl.edu/ MG077.

Knox, G. and R.J. Black 2000. "Salt Tolerance of Landscape Plants for North Florida." UF/IFAS Publication ENH 129 (Revised). URL: http://edis.ifas.ufl.edu/WO014.

Knox, G. and R.J. Black 2000. "Salt Tolerance of Landscape Plants for South Florida." UF/IFAS Publication ENH 145 (Revised). URL: http://edis.ifas.ufl.edu/WO012.

Knox, G. 2001. "Drought Tolerant Plants for North and Central Florida." UF/IFAS Circular 807, (Revised). URL: http://edis.ifas.ufl.edu/EP022.

Meerow, A.W. and R.J. Black. 1993. "Enviroscaping to Conserve Energy: Trees for South Florida." UF/IFAS Circular EES-42. URL: http://edis.ifas.ufl.edu/EH142.

Meerow, A.W. and R.J. Black. 1993. "Enviroscaping to Conserve Energy: Ground Covers for Central Florida." UF/IFAS Circular EES-38. URL: http://edis.ifas.ufl.edu/EH141.

Meerow, A.W. and R.J. Black. 1993. "Enviroscaping to Conserve Energy: Ground Covers for South Florida." UF/IFAS Circular EES-39. URL: http://edis.ifas.ufl.edu/EH139.

Meerow, A.W. 1991. "Native Shrubs for South Florida."UF/IFAS Publication EES-59. URL: http://edis.ifas.ufl.edu/EH159.

Meerow, A.W., H.M. Donselman, and T.K. Broschat. 1996. "Native Trees for South Florida." UF/IFAS Publication EES-57. URL: http://edis.ifas.ufl.edu/EH157.

Meerow, A.W. 1999. "Native Ground Covers for South Florida." UF/IFAS Publication EES-60. URL: http://edis.ifas.ufl.edu/EH402.

Meerow A.W., and R.J. Black. 1993. "Enviroscaping to Conserve Energy: Ground Covers for North Florida." UF/IFAS Publication EES-37. URL: http://edis.ifas.ufl.edu/EH139.

Ramey, V. and A. Murray. 2003. University of Florida's Center for Aquatic and Invasive Plant Website. Online: http://plants.ifas.ufl.edu.

Ramey, V. 2003. Aquatic, Wetland and Invasive Plant Information Retrieval System (APIRS) [Online database] http://plants.ifas.ufl.edu.

Ruppert, K.C. 1999. "Botany Handbook for Florida, Revised Edition." UF/IFAS Publication SS-ENH-901 (Revised). URL: http://edis.ifas.ufl.edu/MG012.

Scheper. J. 2001. Floridata™. [Internet database] http://www.floridata.com.

Simberloff D, Schmitz DC, Brown TC, editors. 1997. Strangers in paradise. Washington, DC: Island Press. 467 p.

Trenholm,L.E., J.B. Unruh, and J.L. Cisar. 2001. "Selecting a Turfgrass for Florida Lawns." UF/IFAS Publication ENH04. URL: http://edis.ifas.ufl.edu/LH005.

Trenholm,L.E., J.L. Cisar, and J. B. Unruh. 2000. "St. Augustinegrass for Florida Lawns." UF/IFAS Publication ENH5. URL: http://edis.ifas.ufl.edu/LH010.

Trenholm,L.E., J.L. Cisar, and J. B. Unruh. 2000. "Bahiagrass for Florida Lawns." UF/IFAS Publication ENH6. URL: http://edis.ifas.ufl.edu/LH006.

Trenholm,L.E., J.L. Cisar, J. Bryan Unruh. 2003. "Bermudagrass for Florida Lawns." UF/IFAS Fact Sheet ENH19 (Revised). URL: http://edis.ifas.ufl.edu/LH007.

Trenholm,L.E., J.L. Cisar, and J. B. Unruh. 2000. "Centipedegrass or Florida Lawns." UF/IFAS Publication ENH8. URL: http://edis.ifas.ufl.edu/LH009.

Trenholm, L.E. and J.B. Unruh. 2002. "Seashore Paspalum for Florida Lawns." UF/IFAS Publication CIR 1244. URL: http://edis.ifas.ufl.edu/EP059.

Trenholm, L.E., J.L. Cisar, and J. B. Unruh. 2000. "Carpetgrass for Florida Lawns." UF/IFAS Fact Sheet ENH7. URL: http://edis.ifas.ufl.edu/LH008.

Unruh, J.B., L.E. Trenholm, and J.L. Cisar. 2000. "Zoysiagrass in Florida." UF/IFAS Fact Sheet ENH11 (Revised). URL: http://edis.ifas.ufl.edu/LH011.

Wunderlin, R. P., and B. F. Hansen. 2003. Atlas of Florida Vascular Plants http://www.plantatlas.usf.edu.

S. M. Landry and K. N. Campbell (application development), Florida Center for Community Design and Research.] Institute for Systematic Botany, University of South Florida, Tampa.

For More Information on Proper Planting:

Gilman, E.F. 2002. "Specifications for Planting Trees and Shrubs in the Southeastern U.S." UF/IFAS Publication ENH856.URL: http://edis.ifas.ufl.edu/EP112.

Ingram, D.L. R. J. Black and E. F. Gilman. 1991. "Selecting and Planting Trees and Shrubs." UF/IFAS Circular 858. URL: http://edis.ifas.ufl.edu/MG077.

Trenholm, L.E. 2001. "Establishing Your Florida Lawn." UF/IFAS Fact Sheet ENH-03 (Revised). URL: http://edis.ifas.ufl.edu/LH013.

Trenholm, L.E. 2001. "Preparing to Plant a Florida Lawn." UF/IFAS Fact Sheet ENH-02 (Revised). URL: http://edis.ifas.ufl.edu/LH012.

For More Information on Attracting Wildlife:

Broschat, T.K. and S. D. Verkade. 1997. "Landscaping to Attract Birds in South Florida." UF/IFAS Fact SHeet ENH-78 (Revised). URL: http://edis.ifas.ufl.edu/EP021.

Demers, C. A. Long and C. Latt. 2001. "Establishing and Maintaining Wildlife Food Sources." UF/IFAS Fact Sheet SS-FOR-12L. URL: http://edis.ifas.ufl.edu/FR062.

Demers, C. L. Hawkins, A. Long, and C. McKelvy. 2001. "Providing Wildlife Cover." UF/IFAS Fact Sheet SS-FOR-15. URL: http://edis.ifas.ufl.edu/FR124.

Hostetler, M. 2003. "A Bird's-Eye View: How Birds Select Habitat." UF/IFAS Fact sheet WEC-163. URL: http://edis.ifas.ufl.edu/UW174.

Hostetler, M., G. Klowden, S. Webb Miller, and K. N. Youngentob. 2003. "Landscaping Backyards for Wildlife: Top Ten Tips for Success." UF/IFAS Circular 1429. URL: http://edis.ifas.ufl.edu/UW175.

Huegel, C. "Native Plants that Attract Wildlife: Central Florida." UF/IFAS Publication SS-WIS-09. URL: http://edis.ifas.ufl.edu/UW062.

Schaefer, J. and J. Tucker. 1999. "Laws that Protect Florida's Wildlife." UF/IFAS Publication WEC-48 (Revised). URL: http://edis.ifas.ufl.edu/UW076.

Schaefer, J. 1999. "Dealing with Unwanted Wildlife in an Urban Environment." UF/IFAS Publication WEC-20 (Revised). URL: http://edis.ifas.ufl.edu/UW070.

Schaefer, J., C.N. Huegel, and F.J. Mazzotti. 1999. "Butterfly Gardening in Florida." UF/IFAS Fact Sheet WEC-22 (Revised). URL: http://edis.ifas.ufl.edu/UW057.

Schaefer, J. 1999. "Impacts of Free-ranging Pets on Wildlife." UF/IFAS Fact Sheet WEC-136 (Revised). URL: http://edis.ifas.ufl.edu/UW090.

For More Information on Mowing, Pruning, and Raking:

Gilman, E.F. 2002. "An Illustrated Guide to Pruning." 2nd edition. Delmar Publishing, Albany, NY.

Gilman, E.F. and R.J. Black. 1994. "Pruning Landscape Trees and Shrubs." UF/IFAS Circular 853 (Revised). URL: http://edis.ifas.ufl.edu/MG087.

Gilman, E.F. 1994. "Dispelling Misperceptions About Trees." UF/IFAS Publication SS-ORH-003(Revised). URL: http://edis.ifas.ufl.edu/MG089.

Ruppert, K.C. and R.J. Black (editors). 1997. Florida Lawn Handbook. 2nd edition. UF/IFAS, Gainesville, FL. URL: http://edis.ifas.ufl.edu.

Worden, E.C., T.K. Broschat, and C. Yurgalevitch. 2002. "Care and Maintenance of Landscape Palms in South Florida." UF/IFAS Fact Sheet ENH 866 (Revised). URL: http://edis.ifas.ufl.edu/EP119.

For More Information on Mulching:

Black, R.J., E.F. Gilman, G.W. Knox and K.C. Ruppert. 1994. "Mulches for the Landscape." UF/IFAS Publication ENH 103 (Revised). URL: http://edis.ifas.ufl.edu/MG251.

Duryea, M.L. 2000 "Landscape Mulches: What Are The Choices in Florida?" UF/IFAS Publication FOR 80. URL: http://edis.ifas.ufl.edu/FR079.

Duryea, M.L. 1999. "Landscape mulches: How quickly do they settle?" UF/IFAS Publication FOR 69. URL: http://edis.ifas.ufl.edu/FR052.

Duryea, M.L. 1999. "Landscape mulches: How long do they retain their color?" UF/IFAS Publication FOR68. URL: http://edis.ifas.ufl.edu/FR051.

Duryea, M.L. 2000. "Landscape mulches: Will subterranean termites consume them?" UF/IFAS Publication FOR79. URL: http://edis.ifas.ufl.edu/FR075.

Koehler, P.G. and J.L. Castner. 1997. "Pests Associated with Mulch and Moisture." UF/IFAS Publication ENH 127. URL: http://edis.ifas.ufl.edu/IN030.

For More Information about Composting:

Black, R.J. and G.L. Miller. 1998. "Benefits of Using Compost and Mulch in Florida Roadside Plantings." UF/IFAS Publication ENH-126. URL: http://edis.ifas.ufl.edu/EP049.

Kidder, G. 1998. "Applying Non-hazardous Wastes to Land: Opportunities and Problems." UF/IFAS Publication SL-137 (Revised). URL: http://edis.ifas.ufl.edu/SS166.

Kidder, G. and G.L. Miller. 2001. "Application Rates and Techniques for Using Composted Materials in Florida DOT Projects." UF/IFAS Publication SL 140 (Revised). URL: http://edis.ifas.ufl.edu/SS193.

Kidder, G. 1989. "Converting Yard Wastes Into Landscape Assets." UF/IFAS Fact Sheet SL-114. URL: http://edis.ifas.ufl.edu/HE005.

Koehler, P.G. and F. M. Oi. 2003. "Pillbugs, Sowbugs, Centipedes, Millipedes and Earwigs." UF/IFAS Publication ENY-221.URL: http://edis.ifas.ufl.edu/IG093.

Martin, J. P., J. H. Black, and R. M. Hawthorne. 1999. "Earthworm Biology and Production." UF/IFAS Circular 455 (Revised). URL: http://edis.ifas.ufl.edu/IN047.

Nordstedt, R.A. and A. W. Barkdoll. 1991. "Construction of Home Compost Units." UF/IFAS Fact Sheet AE-23. URL: http://edis.ifas.ufl.edu/HE026.

Olexa, M.T. and A. Leviten. 2000. "Reglamentación de Desechos y Sólidos Peligrosos en Florida: Compost." UF/IFAS Publication FRE 199-SP. URL: http://edis.ifas.ufl.edu/FE241.

For More Information on Fertilization:

Broschat, T.K. 2000. "Palm Nutrition Guide." UF/IFAS Publication SS-ORH-02 (Revised). URL: http://edis.ifas.ufl.edu/EP052.

Ingram, D.L. and T. H. Yeager. 1999. "Evaluation of Slow-release Fertilizers in Florida." UF/IFAS Publication ENH 136 (Revised). URL: http://edis.ifas.ufl.edu/WO020.

Kidder, G. 2002. "Plant Nutrients and Fertilizers for the Non-Farmer." UF/IFAS Publication SL 60 (Revised). URL: http://edis.ifas.ufl.edu/MG090.

Knox, G., T. Broschat, J. Kidder, E. Gilman, L. Trenholm, R. Black, T. Wichman, D. Palmer, R. Zerba, C. White, A. Hunsberger, G. Israel, J. Cisar, K. Ruppert, D. Culbert, C. Kelly-Begazo, S. Park Brown, E. Buss, E. Worden, and C. Vavrina. 2002. "Fertilizer Recommendations for Landscape Plants." UF/IFAS Publication ENH858. URL: http://edis.ifas.ufl.edu/EP114.

McCarty, L.B. and Jerry B. Sartain. 1995. "How to Calibrate Your Fertilizer Spreader." UF/IFAS Publication ENH-62 (Revised). URL: http://edis.ifas.ufl.edu/LH024.

Ruppert, K.C. and R.J. Black (editors). 1997. Florida Lawn Handbook. 2nd edition. UF/IFAS, Gainesville, FL. URL: http://edis.ifas.ufl.edu.

Sartain, J.B. 2000. "General Recommendations for Fertilization of Turfgrasses on Florida Soils." UF/IFAS Publication SL-21 (Revised). URL: http://edis.ifas.ufl.edu/LH014.

Sartain, J.B. and J. K. Kruse. 2001. "Selected Fertilizers Used in Turfgrass Fertilization." UF/IFAS Fact Sheet CIR 1262. URL: http://edis.ifas.ufl.edu/SS318.

Sartain, J.B 2001. "Soil Testing and Interpretation for Florida Turfgrasses." UF/IFAS Publication SL181. URL: http://edis.ifas.ufl.edu/SS317.

Sartain, J.B. and W.R. Cox. 2002. "The Florida Fertilizer Label." UF/IFAS Publication SL-3 (Revised). URL: http://edis.ifas.ufl.edu/SS170.

Trenholm, L.E., E.F. Gilman, G.W. Knox, and R.J. Black. 2002. "Fertilization and Irrigation Needs for Florida Lawns and Landscapes." UF/IFAS Fact Sheet ENH-860. URL: http://edis.ifas.ufl.edu/EP110.

For More Information on Watering Efficiently:

Black, R.J. 1993. "Conserving Water in the Home Landscape." UF/IFAS Fact Sheet WRC-11. URL: http://edis.ifas.ufl.edu/MG217.

Black, R.J. 2001. "Tips for Maintaining Landscapes During Drought." UF/IFAS Fact Sheet ENH 158. URL: http://edis.ifas.ufl.edu/EP091.

Haman, D.Z., M.D. Dukes, and S.G. Park-Brown. 2002. "Retrofitting a Traditional In-ground Sprinkler Irrigation System for Microirrigation of Landscape Plants." UF/IFAS Fact Sheet ABE324. URL: http://edis.ifas.ufl.edu/AE222.

Haman, D.Z. and F.T. Izuno. 1989. "Principles of Micro Irrigation." UF/IFAS Fact Sheet AE-24. URL: http://edis.ifas.ufl.edu/WI007.

Jones, H.C., C.S. Lippi, and L.E. Trenholm. 2001. "Managing Your Florida Lawn Under Drought Conditions." UF/IFAS Publication ENH 157. URL: http://edis.ifas.ufl.edu/EP078.

Knox, G.W. 2002. "Coping with Drought in the Landscape." UF/IFAS Fact Sheet ENH-70, (Revised). URL: http://edis.ifas.ufl.edu/MG026.

Knox, G.W. 1991. "Landscape Design for Water Conservation." UF/IFAS Fact Sheet ENH-72 (Revised). URL: http://edis.ifas.ufl.edu/MG027.

Miller, G., S. Park-Brown, C. Stiles, M. Dukes, F. Royce, J. W. Jones, F. S. Zazueta, and D. Zierden. 2001. "Climate-Based Management of Lawns." UF/IFAS Fact Sheet AE 319. URL: http://edis.ifas.ufl.edu/AE201.

Smajstrla, A.G., F.S. Zazueta and D.Z. Haman. 1997. "Lawn Sprinkler Selection and Layout for Uniform Water Application." UF/IFAS Bulletin 320. URL: http://edis.ifas.ufl.edu/AE084.

Trenholm, L.E. 2000. "Improving Drought Tolerance in Your Florida Lawn." UF/IFAS Fact Sheet ENH-57 (Revised). URL: http://edis.ifas.ufl.edu/LH027.

Trenholm, L.E., J. Bryan Unruh, and J.L. Cisar. 2001. "How to Calibrate Your Sprinkler System." UF/IFAS Fact Sheet ENH 61. URL: http://edis.ifas.ufl.edu/LH026.

Trenholm, L.E., J.B. Unruh, and J.L. Cisar. 2003. "Watering Your Florida Lawn." UF/IFAS Fact Sheet ENH-9 (Revised). URL: http://edis.ifas.ufl.edu/LH025.

For More Information on Controlling Yard Pests Responsibly:

Buss, E.A. 2001. "Insect Pest Management on Turfgrass." UF/IFAS Publication ENY-300 (Revised). URL: http://edis.ifas.ufl.edu/IG001.

Buss, E.A. and D. E. Short. 2001. "Insect Management on Landscape Plants." UF/IFAS Publication ENY-338 (Revised). URL: http://edis.ifas.ufl.edu/IG013.

Buss, E.A. and S. G. Park-Brown. 2002. "Natural Products for Insect Pest Management." UF/IFAS Publication ENY-350. URL: http://edis.ifas.ufl.edu/IN197.

Elliott, M. L. and G. W. Simone. 2001. "Turfgrass Disease Management." UF/IFAS Publication SS-PLP-14. URL: http://edis.ifas.ufl.edu/LH040.

McCarty, L.B. 1995. "Integrated Pest Management Strategies." UF/IFAS Circular 1149. URL: http://edis.ifas.ufl.edu/LH080.

Nesheim, O.N. 2002. "Homeowners' Guide to Pesticide Safety." UF/IFAS Publication CIR 642. URL: http://edis.ifas.ufl.edu/PI051.

Oi D.H. and P. G. Koehler. 1994. "Imported Fire Ants on Lawns and Turf." UF/IFAS Fact Sheet ENY-226 (Revised). URL: http://edis.ifas.ufl.edu/LH059.

Valles, S. M. and P. G. Koehler. 1997. "Insecticides Used in the Urban Environment: Mode of Action." UF/FAS Publication ENY-282. URL: http://edis.ifas.ufl.edu/IN077.

Webb, S.E. and F.A. Johnson. 2002. "Insect Management in the Home Garden." UF/IFAS Publication ENY-476 (Revised). URL: http://edis.ifas.ufl.edu/VH036.

Weinzierl, R., T. Henn and P. G. Koehler. 1997. "Microbial Insecticides." UF/IFAS Publication ENY 275. URL: http://edis.ifas.ufl.edu/IN081.

For More Information on Protecting the Waterfront:

Roberts, C. 2002. "Common Wetland Plants of Florida." UF's Center For Wetlands website: http://www.cfw.ufl.edu/Macrophytes.

Debusk, W.F. 1999. "Functional Role of Wetlands in Watersheds." UF/IFAS Publication SL169. URL: http://edis.ifas.ufl.edu/SS301.

Olexa, M.T., L. Minton, D. Miller, and S. Corbett. 2002. "Handbook of Florida Water Regulations: Activities in Wetlands." UF/IFAS Fact Sheet FE 049 (Revised). URL: http://edis.ifas.ufl.edu/FE049.

Duryea, M.L. and L.A. Hermansen. 2003. "Cypress: Florida's Majestic and Beneficial Wetlands Tree." UF/IFAS Publication CIR 1186 (Revised). URL: http://edis.ifas.ufl.edu/FR008.

When You Don't Do the Work Yourself:

Allen, G.M., K.U. Hill, and M.B. Main. 2001. "Finding Natural Resource Information on the Internet." UF/IFAS Publication WEC-148. URL: http://edis.ifas.ufl.edu/UW142.

Bowers A.W. and M.C. Monroe. 2001. "Environmental Education Resources from Federal and State Agencies." UF/IFAS Fact Sheet FOR 100. URL: http://edis.ifas.ufl.edu/FR128.

Park Brown, S. and M. J. Holsinger. 2001. "Considerations for Developing a Lawn and Landscape Maintenance Contract." UF/IFAS Publication SS-ENH-09 (Revised). URL: http://edis.ifas.ufl.edu/LH031.

McCarty, L.B. 1995. "Selecting a Lawn Maintenance Service." UF/IFAS Fact Sheet ENH-69 (Revised). URL: http://edis.ifas.ufl.edu/LH030.

Glossary of Terms

Abiotic- Nonliving factors.
Acclimatization- The forcing of plants to adapt to conditions unlike those under which they were grown.
Anaerobic- Refers to environments without oxygen.
Bare root- A plant, usually woody or herbaceous perennial, that is sold with little or no soil on its roots.
Bedding plant- Herbaceous annual or perennial plants that are sold for use in flower or vegetable gardens.
Best Management Practice- The best available treatment considering the benefits and drawbacks, based on current knowledge.
Branch bark ridge- An area of bark tissue in the union of two branches or two stems or in the union of branch and stem.
Branch collar- a swelling at the base of a branch where it joins the trunk or larger branch resulting from overlapping trunk and branch tissue.
Bud- an undeveloped or compressed stem.
Caliper- The diameter of a tree trunk measured at 15 cm above the ground. If the caliper is larger than 10 cm, the measurement is made 30 cm above the soil surface.
Callus- An unorganized mass of cells that forms on plants in response to wounding.
CAUTION- Pesticide product is slightly toxic if eaten, absorbed through the skin, inhaled or if it causes slight eye or skin irritation. The acute oral LD50 for products with this signal word is from 500 to 5,000 mg/kg.
Certified Arborist- An arborist who has passed an exam and receives, on a regular basis, continuing education administered by the International Society of Arboriculture or another certifying agency.
Central leader- A dominant stem located more or less in the center of the canopy.
Chelate- A complex organic molecule that encloses certain trace elements such as iron and thus keeps them in solution.
Chlorotic, Chlorosis- The absence of chlorophyll, making spots or entire plants appear yellow.

Clay- A small (less than 0.002 mm diameter) flat soil particle.
Compartmentalization- a process that separates injured or decayed tissue from healthy tissue.
Composting- The process of converting plant and animal waste into useful soil additives.
Conifer- A cone-bearing gymnosperm tree or shrub.
Cultivar- A cultivated variety of a species typically propagated by cuttings, tissue culture, grafting or budding. It is a group of plants within a species that is unique.
Damping off- A seed or seedling disease in which decay occurs before emergence through the soil surface or after emergence, when the seedling stem collapses near the soil surface.
DANGER- Pesticide product is highly toxic. It is corrosive or causes severe burning to the eyes or skin that can result in irreversible damage. The acute oral LD50 for products with this signal word is from 0 to 50 mg/kg.
DANGER-POISON- Pesticide product is highly toxic, but only if eaten, absorbed through the skin or inhaled. The acute oral LD50 for products with this signal word is from 0 to 50 mg/kg. These products have a skull and crossbones on the label.
Decay- Breakdown of tissue caused by living organisms; the orderly breakdown of tissue resulting in strength loss.
Deciduous- A plant that sheds all of its leaves at one time each year.
Delineation- Technique of determining the exact boundary of a wetland for legal purposes.
Disease- An interaction between an organism and its environment that results in an abnormal condition; can be biotic or abiotic.
Drip line- The circle that forms at the ends of the branches of a tree, where water drips off the leaves onto the ground.
Drought tolerant- Characteristic of plants that require less water because they are adapted to regions with frequent drought or to soils with low water holding capacity.
Eradication- Removal of branches with pest infestation or disease.

Establishment- Acclimating a new plant to the environmental conditions of the planting site.
Estuary- General location where rivers meet the sea and freshwater mixes with saltwater.
Eutrophic- Nutrient-rich standing water resulting in an overabundance of algae and other aquatic plants that cause a reduction of oxygen levels in the water; generally used in lake classification.
Evapotranspiration- The evaporative loss of water from plants and the soil.
Evergreen- A plant that retains at least some of its leaves year round.
Family- A taxonomic grouping of genera based on their flower characteristics; ends in *"-aceae".*
Frass- The excrement of an insect or mite.
Genus, genera- a group of similar organisms representing a category within a family. A genus consists of one or more species.
Girdling- Constricting or destroying the bark in a ring around the trunk or branch of a plant.
Groundcover- Low-growing plants that are used for control of erosion or for aesthetic reasons.
Healing- A physiological, regenerative process not known to occur in plants.
Herbicide- A chemical that kills plants or inhibits their growth; intended for weed control.
Impervious- Resistant to penetration by fluids or by roots.
Included bark- Bark pinched or embedded between two stems or a branch and trunk, preventing formation of a branch bark ridge; an indication of a weak union; a crack in the union.
Infiltration- The downward entry of water into the soil.
Insecticide- A chemical that kills insects.
Karst- A topography formed over limestone, dolomite or gypsum.
Leaching- The downward movement in water of soluble nutrients in the soil column.
Leggy plant- A tall spindly plant that frequently results when grown under inadequate light.

LC50- Lethal concentration resulting from a single or limited exposure which causes death in 50 percent of treated animals. Expressed in milligrams (mg) of chemical per volume of medium the organism is exposed to (i.e. air or water).
LD50 - Lethal dose resulting from a single or limited exposure which causes death in 50 percent of treated animals. Expressed in milligrams (mg) of chemical per kilogram (kg) of body weight.
Littoral zone-Area between high and low tide in coastal waters, or the shoreline of a freshwater lake.
Macronutrients- Mineral nutrient elements that are required by plants in relatively large quantities such as nitrogen, phosphorus and potassium.
Mature tree- Tree that has reached at least 75% of it's final height and spread.
Micronutrients- Mineral nutrient elements that are required in very small quantities for normal plant growth, such as iron, copper, zinc, boron and molybdenum.
Mulch- A material spread on the soil surface to conserve soil moisture, influence soil temperature and control weeds.
Native- "A species that occurred in Florida at the time of European contact or 1500s." "A native plant species is one that occurs naturally in a particular region, state, ecosystem and habitat without direct or indirect human actions." (Florida Native Plant Society).
Necrotic, necrosis- Dead areas on a plant, usually brown, black or white.
Node- A point on a stem where a leaf and bud emerge. Branches emerge from nodes.
Noxious weed- A weed that is defined by state law to be undesirable, troublesome or difficult to control.
Pesticide- A chemical or other substance used to control pests.
pH, soil-The degree of acidity (or alkalinity) of a soil
Photosynthesis- The process that turns light energy into chemical energy in green plants.
Physiology- The study of internal mechanisms of plant function.
Phytotoxin- A substance that is injurious to plants.
Resistance ratings- Susceptible, tolerant, resistant, immune.

Respiration- A metabolic process in which oxygen is utilized, carbon dioxide is released, and energy is made available for cell metabolism.
Riparian- Pertaining to the bank of a body of flowing water; the land adjacent to a river or stream that is, at least periodically, influenced by flooding.
Root bound- The condition when the roots in a container circle the inside and become dense and matted. Also known as "pot-bound." Pot-bound plants tend to dry out quickly and grow poorly.
Runoff-The portion of precipitation on an area that is discharged through stream channels. That which is lost without entering the soil is called *surface runoff*.
Slow-release fertilizer- A fertilizer that releases its nutrients over a gradual time period.
Species- A taxonomic subdivision of genus represented by plants that resemble each other and interbreed freely.
Specific epithet-in the binomial system for naming plants, the second name of the species.
Spot treated- To limit pesticide treatment to the problem plant or area and a few feet beyond, rather than a blanket application or "wall-to-wall" coverage.
Signal Words- A description of the acute (short-term) toxicity of a formulated pesticide product. (see CAUTION, WARNING, DANGER and DANGER-POISON).
Systemic insecticide- A chemical compound that is absorbed by the host plant making it toxic to sap sucking pests, including: aphids, whiteflies, scales, mealybugs, lace bugs and spider mites.
Tap root- The primary root that develops from the original seedling radicle and penetrates to varying depths.
Thatch- The accumulation of living and dead stems, leaves and roots along the soil surface and beneath the top growth of turfgrass.
Transpiration-evaporation of water vapor from plant foliage.
Tree habit- The form or shape taken on by the tree canopy.
Variegation- A plant organ with two or more colors. The colors may appear as streaks, marks or patches.

Variety- A taxonomic subdivision of species. This botanical term should not be confused or used interchangeably with *cultivar.*
WARNING- Pesticide product is moderately toxic if eaten, absorbed through the skin, inhaled or if it causes slight eye or skin irritation. The acute oral LD50 for products with this signal word is from 50 to 500 mg/kg.
Weed- A plant out of place. Weeds are troublesome because they compete with crop plants for water, minerals, and light.
Wilting- The drooping of plant parts, especially leaves, generally because of a lack of water.
Wind throw- When a tree falls over due to a strong wind.

Appendix

Table 1. Comparison of Surfaces for a 15'x30' Driveway (450 sq. ft)

Material	**Depth**	**Cost** (per sq.ft.)	**Total cost**
Melaleuca Mulch	2"	$0.10-0.40	$45-180
Municipal Waste Mulch	2"	$0.05	$18-$24
Recycled Yard Waste	2"	0	free
Compost	2"	$0.08	$36
Cypress Mulch	2"	$0.11-0.17	$48-76
Washed Shell	2"	$0.20-0.26	$90-120
Gravel	2"	$0.50	$225
Recycled Tire mulch	1.5"	$1	$450
Red Mulch	2"	$0.11	$48
Lime rock	2"	$0.03-0.20	$14-90
River Rock	2"	$0.52-0.93	$232-420
Pine Bark	2"	$0.10-0.12	$45-55
Concrete (plain)	4"	$2.85	$1283
Concrete (stamped)	4"	$8.15	$3668
Asphalt	1.5"	$1.30-5.00	$600-2250

Table 2. Fertilization Guidelines for Established Landscape Plants [58]

Level of Maintenance	**Amount of Nitrogen** (lbs N/1000 ft^2/year)
Basic	0-2 lbs
Moderate	2-4 lbs
High	4-6 lbs

Table 3. Fertilization Guidelines for Established Turfgrass Lawns in Three Regions of Florida [58]

Species	**Nitrogen recommendations (lbs/1000 ft^2/year)[1,2]**		
	North	**Central**	**South**
Bahiagrass	2-3	2-4	2-4
Bermudagrass	3-5	4-6	5-7
Centipedegrass	1-2	2-3	2-3
St. Augustinegrass	2-4	2-5	4-6
Zoysiagrass	3-5	3-6	4-6

[1] Homeowner preferences for lawn quality and maintenance will vary, therefore we recommend a range of fertility rates for each species and location. Additionally, effects within a localized region (i.e. micro-environmental influences such as shade, drought, soil conditions and irrigation) will necessitate a range of fertility rates be used.

[2] These recommendations assume that grass clippings are recycled.

Table 4. Proper Application Rates for Specific Fertilizer Products[1]

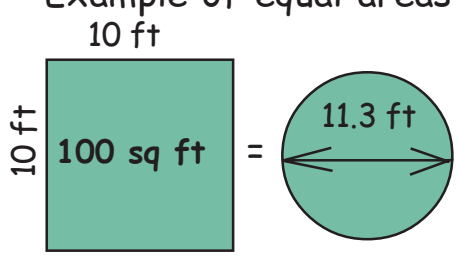
Area (sq ft)	% Nitrogen in Fertilizer Bag						
	6%	10%	12%	15%	16%	23%	27%
10	1.3 oz	0.8 oz	0.7 oz	0.5 oz	0.5 oz	0.4 oz	0.3 oz
	3 TB	1½ TB	1½ TB	3½ tsp	1 TB	2½ tsp	2¼ tsp
50	6.6 oz	4 oz	3.3 oz	2.7 oz	2.5 oz	1.7 oz	1.5 oz
	14 TB	½ cup	7 TB	6 TB	5¼ TB	4½ TB	¼ cup
100	13.3 oz	8 oz	6.7oz	5.3 oz	5 oz	3.5 oz	3 oz
	1¾ cup	1 cup	14 TB	¾ cup	10½ TB	9 TB	½ cup
1000	8.4 lbs	5 lbs	4.2 lbs	3.3 lbs	3.1 lbs	2.2 lbs	1.9 lbs
	17½cups	9½ cups	8¾cups	7¼ cups	6½ cups	5½ cups	4¾ cups
1500	13 lbs	7.5 lbs	6.5 lbs	4.9 lbs	4.8 lbs	3.3 lbs	2.9 lbs
	26¼cups	14¼ cups	13cups	11cups	9¾ cups	8¼ cups	7¼ cups
3000	25.2 lbs	15 lbs	12.6 lbs	9.8 lbs	9.4 lbs	6.6 lbs	5.8 lbs
	52¼cups	28½ cups	26cups	21¾cups	19½cups	16½cups	14½cups
5000	42.0 lbs	25 lbs	21 lbs	16.4 lbs	15.8 lbs	11 lbs	9.8 lbs
	87¼cups	47½cups	43½cups	36½cups	32½cups	27½cups	24½cups

[1] The chart explains the approximate weight of fertilizer to use for a given lawn or landscape area in pounds (first number) and also in cups (second number) to deliver ½ lb N/1000 sq. ft. (the recommended rate for a single application of soluble fertilizer) [56].

Table 5. Equal Plant Bed Areas with Differing Shapes

Bed Area (sq ft)	Circle diameter (ft)
10	3.6
50	8.0
100	11.3
1000	35.7

Example of equal areas



Formulas:
Area= length x width
Area of circle= πr^2

A Guide to Environmentally Friendly Landscaping

Florida Yards and Neighborhoods Handbook

Second Edition

Create a Florida-friendly Yard

Yards and landscapes can be a positive asset to Florida. You can design and maintain your own Florida-friendly yard by following the simple, common sense practices in this book. You will learn the basics of designing a landscape featuring carefully selected plants suited to Florida's unique climate, natural conditions and wildlife.

We offer you cost-saving tips that, if implemented properly, will help you reduce water, fertilizer and pesticide use. There is also a helpful section for waterfront homeowners that addresses the special concerns of shoreline landscape management.

Whether you are starting from scratch with a new landscape or considering changes to an existing yard, the Florida Yards and Neighborhoods Handbook offers helpful concepts, tools and techniques for creating your own Florida-friendly yard. We hope you enjoy the publication and we look forward to assisting you in creating an aesthetically pleasing landscape that will also help to protect Florida's natural resources.

ISBN 0-916287-54-8

9 780916 287542

Florida Yards & Neighborhoods

UNIVERSITY OF FLORIDA

IFAS EXTENSION