CONGRATULATIONS!

This Is Your Group's
Adopt-A-Pond Notebook

Let this notebook help your pond group take care of your pond environment, and improve water quality through stormwater pollution prevention.
Use it to organize and record your Adopt-A-Pond activities.

Have a pond question? Look in your notebook for the answer!

Adopt-A-Pond Notebook

Table of Contents:

"Adopt-A-Pond" is a volunteer-based program sponsored by Hillsborough County and The Southwest Florida Water Management District.

2420 N Falkenburg Rd. Tampa, Florida 33619
Phone (813) 744-5671 FAX (813) 744-5674

Chapter 1
Program Information

- ✓ Statement of Adopt-A-Pond Goals
- ✓ Adopt-A-Pond Committee Member List
- ✓ Adopt-A-Pond Plant Species List
- ✓ Keep Adopt-A-Pond Agreement Here
- ✓ Recommended Book List

The Adopt-A-Pond Notebook: *Use it to learn more about your pond environment*.

Adopt-A-Pond Program Goals

- Stormwater Pollution Prevention
- Cleaner Water & Better Pond Environments
- Beautiful Ponds
- Increased Wildlife Habitat
- Fewer Nuisance Plants
- Participate in Adopt-A-Pond Activities
- Receive "On Our Pond" Newsletter

Adopt-A-Pond Program Activities

- Neighborhood Education Meeting
- Neighborhood Pond Planting
- Storm Drain Marking
- Neighborhood Pond Work Days
- Pond Work Day Reports
- Pond Walks (March through October)
- Best Maintained Pond Contest
- Annual Pond Seminar
- Water Quality Testing Kits

The Adopt-A-Pond Notebook: *Use it to learn more about your pond environment*.

ADOPT-A-POND COMMITTEE MEMBERS

HILLSBOROUGH COUNTY ADOPT-A-POND
John McGee
2420 N Falkenburg Rd
Tampa, FL 33619
744-5671

HILLSBOROUGH COUNTY TRANSPORTATION MAINTENANCE DIVISION
Customer Service Call Center
635-5400

HILLSBOROUGH COUNTY MOSQUITO & AQUATIC WEED CONTROL
Carlos Fernandes
4220 Tampa Bay Blvd
Tampa, FL 33607
554-5025

HILLSBOROUGH COUNTY SPECIALIZED SERVICES
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2420 N Falkenburg Road
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Tampa, FL 33637
985-7481

Bill Copeland
7601 US Highway 301 North
Tampa, FL 33637
985-7481

CITY OF PLANT CITY
Shawna Himelright
1802 W Spooner Drive
Plant City, FL 33566
757-9289

Adopt-A-Pond Plant List

Quantity	Description	Common Name
_____	1. *Saururus cernuus*	lizards tail
_____	2. *Iris virginica*	blue flag iris
_____	3. *Canna flaccida*	golden canna
_____	4. *Sagittaria lancifolia*	duck potato
_____	5. *Pontederia cordata*	pickerelweed
_____	6. *Spartina bakeri*	sand cordgrass
_____	7. *Juncus effusus*	soft rush
_____	8. *Scirpus validus*	soft-stem bulrush
_____	9. *Bacopa caroliniana*	lemon bacopa
_____	10. *Myrica cerifera*	wax myrtle
_____	11. *Cephalanthus occidentalis*	buttonbush
_____	12. *Quercus laurifolia*	laurel oak
_____	13. *Acer rubrum*	red maple
_____	14. *Taxodium distichum*	bald cypress
_____	15. *Celtis laevigata*	sugarberry
_____	16. *Ulmus floridana*	florida elm
_____	17. *Liquidambar styraciflua*	sweetgum
_____	18. Fraxinus caroliniana	popash

Saururus cernuus
lizards tail

Iris virginica
blue flag iris

Canna flacci
golden canna

Sagittaria lancifolia
duck potato

Pontederia cordata
pickerelweed

Spartina bakeri
sand cordgrass

Juncus effuses
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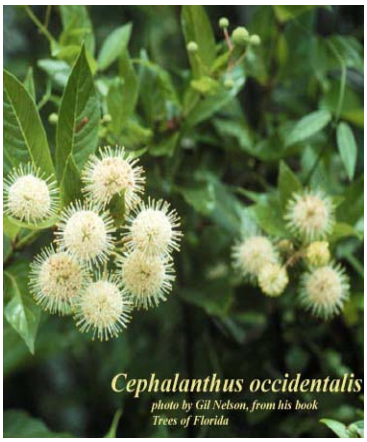
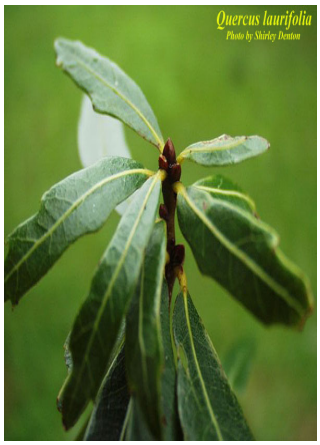
Scirpus validus
soft-stem bulrush

Bacopa caroliniana
lemon bacopa

Myrica cerifera
wax myrtle



Cephalanthus occidentalis
buttonbush



Quercus laurifolia
laurel oak

Acer rubrum
Red maple

Taxodium distichum
bald cypress

Celtis laevigata
sugarberry

Ulmus floridana
florida elm

Liquidambar styraciflua
sweetgum

Fraxinus caroliniana
popash

Suggested Book List

Any Audobon Society Field Guide to North American Mammals, Birds, Amphibians.

Florida Wild Flowers and Roadside Plants
C. Ritchie Bell and Bryan Taylor. 1982

Good Morning, Pond
Alyssa Satin Capucilli
Hypersion Books for Children. 1994

Identification Manual of Wetland Plant Species of Florida
Robert L. Dressler, David W. Hall, Kent D. Perkins, Norris H. Williams
Florida Cooperative Extension Service. University of Florida

Pond Life
Barbara Taylor
A Dorling Kindersley book. 1992

The Guide to Florida Wildflowers
Walter Kingsley Taylor

Weeds of Southern Turfgrass
Tim R. Murphy, Coordinating Author
Florida Cooperative Extension Service. University of Florida

Wetlands
William A. Niering
National Audobon Society Nature Guides. 1994

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Chapter 2
Forms

- ✓ Report Reminder
- ✓ Adopt-A-Pond Activity Announcement
- ✓ Adopt-A-Pond Maintenance Calendars
- ✓ Pond Inspection Checklist
- ✓ Pond Sketch
- ✓ Wildlife Inspection Checklist
- ✓ Work Day Report Form
- ✓ Storm Drain Marking Report Form

Adopt-A-Pond Reports

An important part of your pond group's participation in our program is sending us regular reports of your activities and the success of your pond.

We need these reports from your pond group for two simple reasons:

1. The reports provide evidence that the program has active & successful participants. Your commitment means continued funding as well as continued access to program benefits and a healthier pond for you.

2. The reports maintain communication with you, our pond groups, and keep us informed of problems or special needs you have. We want to continue improving the program, and you can help bring new ideas to Adopt-A-Pond.

And we just enjoy hearing from you!

Remember that to be eligible for continual program benefits, your group MUST submit at least 4 reports per year (details in AAP Policies & Procedures Document).

Reports are also available online at www.hillsborough.wateratlas.org

Adopt-A-Pond Activity

Please join your neighbors for an Adopt-A-Pond activity.

WHAT:

WHEN:

WHERE:

For more info, contact:

Adopt-A-Pond is a public-private partnership for stormwater pollution prevention and the improvement of neighborhood ponds. The program is sponsored by Hillsborough County & the Southwest Florida Water Management District, & YOU!

Adopt-A-Pond Activity

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(Copy this page to distribute activity announcements to your pond group)

Adopt-A-Pond Maintenance Calendar

Spring (March – May)

Review winter damage. Clean up old leaves and growth from last year. Uncover and make way for the new spring growth. This is a good time to transplant from established clumps of old aquatics to start new planting areas. Everyone will think about fertilizing! So, spread the word… SLOW IS BEST! Be sure to keep fertilizer free zones around the pond and storm drains. Brush up on plant identification so that you and your group don't pull up good plants as they emerge from winter's rest. Plan at least one work day per month.

Summer (June - August)

Pond weeds can easily get out of hand during the summer months, so don't turn your back on your pond this summer! Your pond is especially vulnerable if you are in the first two years of adopting your pond. You'll have to have several short work days because of the heat. DON'T risk heat stroke or sunburn trying to do it all in one day. Concentrate on the "high-profile" weeds like cattails, torpedo grass and primrose willow.

Fall (September – November)

It's starting to cool off, so tackle the last few patches of trouble before the holidays take over your life. If you just planted in the last 6 to 8 months, make sure you are able to identify all of the new aquatics you planted. Don't mistake them for weeds! They'll be laying in roots to grow like crazy in the spring. Remember to turn in your report and take this time to schedule a pond walk. Show off all of your groups' hard work.

Winter (December – February)

You don't have to worry too much about new weedy growth (unless you did not maintain your pond during the summer and fall months). Now is a good time to "fine tune" your pond plantings. Prune trees and shrubs, plan new planting areas, plan new recreation areas, and install bird houses and feeders. Have a pond walk with your neighborhood group. Talk to your neighbors and your homeowner association about stormwater pollution prevention.

Remember send in your report each quarter!

Pond Inspection Checklist

Date:_____ Pond:_____ Inspected By:_____

Water Level: ☐normal ☐high ☐low

Water condition: ☐good ☐fair ☐bad ☐duck weed ☐algae ☐trash

Comments on water condition:_____

Wildlife observed:_____

Problem plants (check those observed):
(refer to Chapter 3 for pictures of plants)

☐Air potato (vine)
☐Alligator Weed (floating)
☐Brazilian Pepper (shrub)
☐Carolina Willow
☐Cattails (emergent)
☐Ceasarweed
☐Dog Fennel
☐Elephant Ear
☐Grape Vine
☐Hydrilla (submerged)
☐Kogon grass
☐Mikania (vine)
☐Paragrass
☐Parrot Feather (submerged)
☐Peppervine
☐Primrose Willow (emergent)
☐Ragweed
☐Skunk Vine
☐Torpedo Grass
☐Water Hyacinth (floating)
☐Water Lettuce (floating)

Survival of planted species: ☐> 85% ☐> 50% ☐< 50%

Comments:_____

Activities for next work day:_____

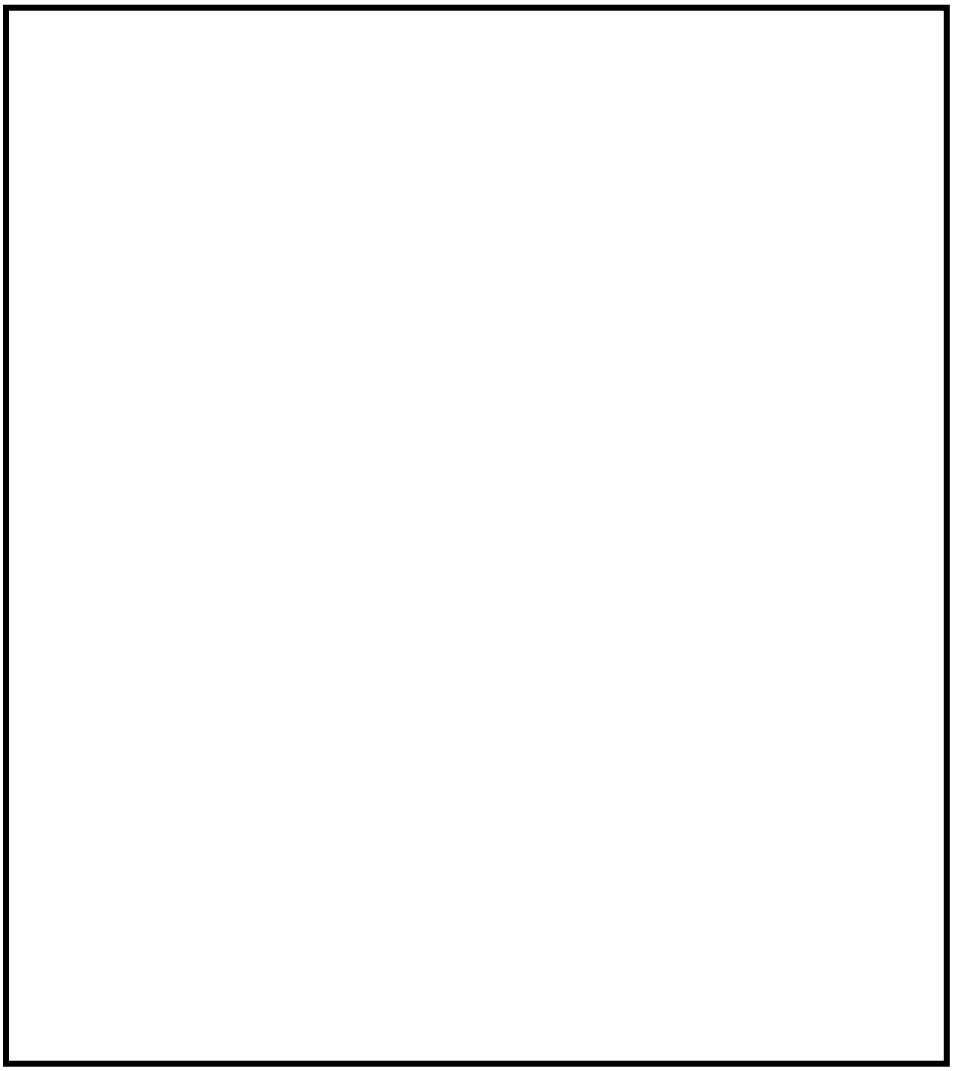
Special problems, i.e. erosion, broken storm drains: _____

Overall condition of your pond: ☐A ☐B ☐C ☐D ☐F

(Copy this page for quarterly pond inspections to document conditions)

POND SKETCH

Make a sketch of your pond. Indicate problem areas or other features your group needs to address on your next work day.



Key

X= nuisance plants to remove
O= areas needing plants
?= identify plants
\\\= erosion problem

Wildlife Inspection Checklist

Birds observed:

- ☐ Anhinga
- ☐ Common Moorhen
- ☐ Great Blue Heron
- ☐ Limpkin
- ☐ Mallard Duck
- ☐ Muscovy Duck
- ☐ Osprey
- ☐ Pied-billed Grebe
- ☐ Sandhill Crane
- ☐ White Ibis
- ☐ Wood Duck
- ☐ Wood Stork

Insects observed:

- ☐ American Bumble Bee
- ☐ Dragonfly_____
- ☐ Praying Mantis
- ☐ Butterfly_____
- ☐ Southeastern Lubber Grasshopper
- ☐ Water strider
- ☐ Whirlygig Beetle

Reptiles/ Amphibians:

- ☐ Alligator
- ☐ Banded Water Snake
- ☐ Green Anole
- ☐ Eastern Glass Lizard
- ☐ Pond Slider
- ☐ Cuban Tree Frog
- ☐ Southern Leopard Frog
- ☐ Soft-shelled Turtle

Mammals:

- ☐ Bobcat
- ☐ Cotton Mouse
- ☐ Gray Squirrel
- ☐ Marsh Rabbit
- ☐ Opossum
- ☐ Raccoon
- ☐ River Otter
- ☐ White-tailed deer

Fish:

- ☐Large-mouthed Bass
- ☐ Bream
- ☐ Nile Perch
- ☐ Mosquito Fish

Other Species Observed:_____

_____

_____

Adopt-A-Pond Work Day Reports

Pond Group Name: _____
Pong Group Representative: _____
Phone #: _____ Work Day Held On: _____
Number of Participants:_____ Total Work Hours: _____
Pond Work Day Activities & Goals:

- ☐ Take Adopt-A-Pond Program information to neighbors
- ☐ Remove nuisance plants
- ☐ Pick up trash
- ☐ Rake algae & duck weed
- ☐ Plant native plants
- ☐ Remind neighbors to fertilize wisely, no more than 2 times a year
- ☐ Clean around "good" plants
- ☐ Storm Drain Marking Event, including door hangers
- ☐ Establish "fertilizer-free" zones
- ☐ Schedule a Pond Walk with an Adopt-A-Pond representative
- ☐ Complete a pond inspection
- ☐ Share your Adopt-A-Pond Notebook with neighbors

Please describe your biggest concern for your pond at this time, and what kind of help you expect from Adopt-A-Pond:

_____

_____

_____

We welcome your pond photos for our newsletter!
Please mail them to: Adopt-A-Pond Program, 23rd Floor
Public Works Dept.
P.O. Box 1110
Tampa, FL 33601-1110

(Copy this page and mail in regular reports to Adopt-A-Pond)

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Storm Drain Tracking Form

Name of Group: _____

Number of Participants: _____ Date of Event: _____

Streets where markers were applied (continue on back if more space is needed):

_____

_____

Number of storm drain markers applied: _____

What ages were your participants?
☐ Adults only ☐ Adults with children or teenagers

Was the equipment easy to use? ☐ Yes ☐ No

Would you recommend storm drain marking to others? ☐ Yes ☐ No

Additional comments or suggestions:

_____

_____

_____

Please mail form to: Adopt-A-Pond Program, 23rd Floor
Public Works Dept.
P.O. Box 1110
Tampa, FL 33601-1110

(Copy this form and use to report marking events)

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Chapter 3
Management

- ✓ Native/Exotic Definitions and Information
- ✓ Adopt-A-Pond Management Guidelines
- ✓ Nuisance Plant ID
- ✓ Planted Species ID
- ✓ Transitional Plant ID
- ✓ Resources and further information

Native, exotic… what's the difference!
What exactly are we talking about here, and why should we care?
The pages that follow will help you get a handle on the purposes and importance of native plants and exotic management.

The following information was taken from the Weeds Gone Wild website of the National Park Service at www.nps.gov/plants/alien/bkgd.htm
For more information log on and check them out.

Definitions

Native Range. Every species of plant, animal, fungi, bacteria and other organism has a home in some part of the world, where it has existed for thousands of years as a result of natural forces and influences like climate, storms, moisture, fire, soils and species interactions. Over long periods of time, these and other physical and biological factors direct the distributions of organisms in nature. A ***native*** (indigenous) species is one that occurs in a particular region, ecosystem, and habitat without direct or indirect human actions (Kartesz and Morse, 1997). Species native to North America are generally recognized as those occurring on the continent prior to European settlement. *Endemic* is used to describe populations of native animals, plants or other organisms, that are have relatively restricted distributions and are confined to certain environments.

Organisms are considered ***non-native*** (alien, exotic, foreign, introduced, non-indigenous) when they occur artificially in locations beyond their known historical natural ranges. Non-native can refer to species brought in from other continents, regions, ecosystems and even other habitats. Species exotic to the U.S. include those transported from Europe, Asia, Africa, South America, Australia and other parts of the world. It also includes any species moved by people from one locality in the U.S. to a new one. For example, black locust (*Robinia pseudoacacia*) is native to the southern Appalachian region of the eastern U.S. Because of its rapid growth and hardiness, it was planted all around the U.S. during this century for living fences, erosion control, wind breaks and other purposes. Even though it is native to the U.S., black locust is considered exotic anywhere it occurs outside its known historical natural range of southern Appalachia.

Once an Exotic, Always an Exotic! European settlers brought hundreds of plants to North America from their home lands, for food, medicinal, ornamental, and other purposes. Introductions of exotic plants continue today, and are increasing due to an exploding human population, increased international travel, and the intentional and accidental movement of large numbers of species between continents as a result of expanded international trade. Many introduced plants have become *naturalized* across the continent and some are replacing North American native plant species. These naturalized plants, how ever much a part of our current landscapes and ecosystems, are nonetheless exotic, since they were moved here by people rather than by natural means. Because the historical distributions of some species are unknown or unclear, research continues to attempt to unravel the tangle of human and natural influences responsible for their current ranges.

Growth Habit - Invasiveness. The most important aspect of an alien plant is how it responds to a new environment. An ***invasive*** species is one that displays rapid growth and spread, allowing it to establish over large areas. Free from the vast and complex array of natural controls present in their native lands, including herbivores, parasites, and diseases, exotic plants may experience rapid and unrestricted growth in new environments. Invasiveness is enhanced by features such as strong vegetative growth, abundant seed production, high seed germination rate, long-lived seeds, and rapid maturation to a sexually reproductive (seed-producing) stage. Invasive plants reproduce rapidly, either vegetatively or by seed. Their phenomenal growth allows them to overwhelm and displace existing vegetation and form dense one-species stands.

Not all exotic species are considered harmful. For example, a small number of non-invasive alien plants (e.g., corn, wheat, oats) form the basis of our agricultural industry and pose little to no threat to our natural ecosystems. However, each alien plant is one less native host plant for our native insects, vertebrates and other organisms that are dependent upon them.

Weeds, Wildlands and Natural Areas. The term **weed** is a subjective word used to describe any plant considered to be "out of place." In other words, weeds can include native and non-native plants alike, growing wherever someone wishes they weren't. Invasive exotic plants of natural ecosystems are often referred to as natural areas weeds. A ***natural area*** is generally an area of land or water with predominantly native vegetation or natural geological features that is allowed to respond to the forces of nature with little to no direct human interference. The term ***wildlands*** is also used to describe these areas.

Biodiversity. *Biodiversity* is, simply put, all life on earth, even that which has yet to be discovered. More specifically, it includes the millions* of diverse species, from bacteria to whales, that share the earth's lands and waters with us. Each year, many thousands of species are being extinguished as a result of human activities, such as habitat destruction and exotic species introductions.

**The actual number of species in existence is unknown and can only be estimated because we really only know about the species that botanists, entomologists and other scientists have been able to collect, process and identify to date.*.

Noxious Weeds. The term ***noxious*** is a legal designation used specifically for plant species that have been determined to be major pests of agricultural ecosystems and are subject, by law, to certain restrictions. The U.S. Department of Agriculture regulates noxious weeds. For a list of these weeds click here. Plants can also be designated as "noxious weeds" by states and counties, usually through "noxious weed boards". Many noxious weeds designated for their impacts to agriculture also threaten natural areas. Melaleuca (*Melaleuca quinquenervia*), a tree from Australia, aggressively invades seasonal wetlands in the Everglades National Park in Florida and has been designated a federal noxious weed. Additional listings of exotic pest plants affecting natural ecosystems are expected, as their ecological and economic impacts continue to grow.

The Invasive Problem

Impacts of Invasive Alien Plants. Invasive non-native organisms are one of the greatest threats to the natural ecosystems of the U.S. and are destroying America's natural history and identity. These unwelcome plants, insects and other organisms are disrupting the ecology of natural ecosystems, displacing native plant and animal species, and degrading our nation's unique and diverse biological resources. Aggressive invaders reduce the amount of light, water, nutrients and space available to native species, alter hydrological patterns, soil chemistry, moisture-holding capacity, and erodibility, and change fire regimes (Randall 1996). Some exotics are capable of hybridizing with native plant relatives, resulting in unnatural changes to a plant's genetic makeup; others have been found to harbor plant

pathogens, such as bacterial leaf scorch (*Xylella fastidiosa*) that can affect both native and non-native plants, including ornamentals (McElrone, et al., 1999). Still others contain toxins that may be lethal to certain animals. For example, garlic mustard has been found to contain compounds that are lethal to a native butterfly species.

Exotic organisms have been referred to as biological pollution (Westbrooks 1991). In some cases, exotic plant invaders are driving our rarest species closer to extinction. According to the U.S. Fish and Wildlife Service, an estimated 42% of the nation's endangered and threatened species have declined as a result of encroaching exotic plants and animals. And management of these species is expensive. Each year, the National Park Service and the Fish and Wildlife Service spend an estimated 2 and 10 million dollars, respectively, on controlling exotic plants (Westbrooks, 1998). Invasive plants also cause great economic losses and expenditures each year, measured in billions of dollars, for agriculture, forestry, range lands and roadways management (Westbrooks 1998).

Impacts to Native Fauna. Our native fauna, including insects, birds, mammals, reptiles, fish and other animals, is dependent on native plants for food and shelter. While some animals have a varied diet and can feed on a wide number of plant species, others are highly specialized and may be restricted to feeding on several or a single plant species. For example, caterpillars of the monarch butterfly have evolved to feed primarily on plants in the genus *Asclepias* (milkweeds) that contain special chemicals. The term *host plant* is generally used to describe a plant species that is required food for at least one stage of an insect or other animal. As exotic plants replace our native flora, fewer host plants are available to provide the necessary nutrition for our native wildlife.

Approximately 4,000 species of exotic plants (Kartesz and Morse 1997) and 500 exotic animals (Office of Technology Assessment 1993) have established free-living populations in the United States. Nearly seven hundred are known to cause severe harm to agriculture at a cost of billions of dollars annually. Over 1,000 exotic plant species have been identified as a threat to our native flora and fauna as a result of their aggressive, invasive characteristics.

Some of the known ecological impacts of invasive plants are summarized below, and include:

- reduction of biodiversity
- loss of and encroachment upon endangered and threatened species and their habitat
- loss of habitat for native insects, birds, and other wildlife
- loss of food sources for wildlife
- changes to natural ecological processes such as plant community succession
- alterations to the frequency and intensity of natural fires
- disruption of native plant-animal associations such as pollination, seed dispersal and host-plant relationships

Invasive alien plants:

- compete with and replace rare and endangered species
- encroach upon limited habitat of rare and endangered species
- reduce or eliminate localized or specialized native plant communities, such as spring ephemeral plant communities
- disrupt insect-plant associations necessary for seed dispersal of native plants
- disrupt native plant-pollinator relationships
- reduce and eliminate host plants for native insects and other wildlife
- hybridize with native plant species, altering their genetic makeup
- serve as host reservoirs for plant pathogens and other organisms that can infect and damage desirable native and ornamental plants;
- replace nutritious native plant foods with lower quality sources
- kill trees and shrubs through girdling
- increase the incidence of plant disease and stress in forested areas
- prevent seedling establishment of native trees and shrubs
- reduce vigor of mature trees through shading
- reduce the amount of space, water, sunlight and nutrients that would be available to native species
- increase erosion along stream banks, shorelines and roadsides
- change characteristics of the soil structure and chemistry
- alter hydrological flows and conditions

Disturbance Effects. Invasive species are especially problematic in areas that have been disturbed by human activities such as road building, residential development, forest clearing, logging operations, grazing, mining, ditching of marshes for mosquito control, mowing, erosion control and fire prevention and control activities. Natural disturbances, such as fires, floods, tornadoes, landslides, and tree falls also provide avenues for invasive species to get started. The enormity of change wrought upon the American landscape over the past few hundred years has thrown things out of balance. Lacking exotic species, native species and ecosystems benefit from natural disturbances that provide opportunities for genetic mixing and nutrient recycling, and reduced fuel loadings.

Some native plants display invasive growth tendencies in their native ranges, often as a response to natural or human-caused disturbances. For example, native grape vines in forests may grow vigorously in response to a tree fall or selective timber cut that opens the canopy

and brings abundant sunlight into previously shaded areas. This "invasive" growth spurt is usually temporary though, and slows down again as trees and other plants fill in and the forest canopy is recovered.

The best way to reduce plant invasions is to focus on preventing non-native species introductions, managing existing infestations, minimizing disturbance to forests, wetlands, barrens and other natural communities, and learning to work with, rather than against, "Mother Nature."

Importance of Native Plants. Approximately 18,000 plants are native to the ecosystems of North America. Our native flora (i.e., all U.S. native plants) provides the foundation of the historic American landscape and defines the various ecosystems and regions of the country. These plants also provide natural sources of food and fiber, and were the essential sources of nutrition and other materials for Native American Indians.

The populations of many native plants have been greatly reduced as a result of human encroachment which has destroyed many millions of acres of natural habitat. In the U.S. alone, about 200 native plant species have become extinct since the 1800's and 5,000 species are considered to be at risk. Invasions of non-native plants are the second greatest threat to native species after direct habitat destruction.

Selected References

Kartesz, John, North Carolina Botanical Garden, and Larry Morse, The Nature Conservancy, 1997, Personal communication.

McElrone, A., Sherald, J. L. and Pooler, M. R. 1999. Identification of alternative hosts of *Xylella fastidiosa* in the Washington, DC area using nested polymerase chain reaction (PCR). J. Arboric. (IN press)

Office of Technology Assessment. 1993. Harmful non-indigenous species in the United States. OTA-F-565. Government Printing Office, Washington, D.C.

Randall, J. and J. Marinelli. 1996. Invasive plants: weeds of the global garden. Brooklyn Botanic Garden Club, Inc. Handbook No. 149. 111 pp.

Sherald, J. L. and Kostka, S. J. 1992. Bacterial leaf scorch of landscape trees caused by Xylella fastidiosa. J. Arboric. 18: 57-63.

Stein, B. and S. Flack. 1996. America's least wanted: Alien species invasions of U.S. ecosystems. The Nature Conservancy, Arlington, Virginia.

Westbrooks, R. 1991. Plant protection issues I. A commentary on new weeds in the United States. Weed Technology 5:232-237.

Westbrooks, R. 1998. Invasive plants, changing the landscape of America: Fact book. The Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW), Washington, D.C., p.8

The Nature Conservancy, Arlington, VA.

What You Can Do

In order to prevent the introduction or spread of invasive alien plants into natural areas, and to help restore our native flora and fauna, you can:

- Avoid disturbance to natural areas, including clearing of native vegetation, planting of non-native plants and dumping of yard wastes.
- Do not purchase or use invasive exotic species in your landscaping or for land restoration or erosion control projects.
- For landscaping, use plants that are native to your local region as much as possible or those that are not known to be invasive.
- Know your plants. If you are unsure of the identification of a plant, take a sample to a university, arboretum, department of agriculture office, local nature center, or native plant society for assistance. Find out if it is known or thought to have invasive tendencies. If the exotic plant is closely related to an invasive species, it is likely to have similar tendencies. To be on the safe side, if you don't know it, don't grow it.
- Control exotic invasive plants in your landscape either by removing them entirely or by managing them to prevent their spread outside your property. This may include pruning to prevent flowering and seed dispersal or cutting, mowing or herbicide use to prevent vegetative spread.
- Discuss your concerns about invasive exotic plants with nurseries and garden shops and ask them not to sell these species. Provide them with printed material (such as this) explaining the problem to read later. Ask for non-invading alternatives instead.
- Notify land managers of invasive exotic plant occurrences.
- Offer to assist in exotic plant removal projects.
- Work with your local government to encourage the use of native plants in their urban and suburban landscapes. Provide them with lists of attractive, non-invasive locally native alternatives that are naturally hardier, pest-resistant, and provide more nutritious food for wildlife than cultivated plants.

Adopt-A-Pond Management Guidelines

❶ It is important to remember that your pond is a stormwater pond, designed to collect runoff from streets, yards, and gutters. That fact must affect what you expect your pond to be. Also, it affects who you'll invite to be part of your "pond group". All together your neighborhood contributes pollution to your stormwater pond, and all together you can improve the water quality and beauty of it.

❷ You pond is also a product of geology. This will affect what grows in your pond. If it was dug next to a wetland it's probably sitting in rich soils, and might grow algae and duck weed. If it was dug in a pine area, it probably has sandy, nutrient-poor soils, and cypress trees may have trouble.

❸ Your goal is to *manage* your pond environment so that nuisance plants don't dominate, a healthy balance of plant diversity is achieved, and water quality is improved. You probably will not "eliminate" nuisance plants, duck weed, or algae from your pond.

❹ Although there are many plants that can become a nuisance in ponds, your pond probably has only 2 or 3 that you have to worry about. Concentrate on keeping those under control, especially during the summer months.

❺ When it comes to plants growing in your pond, "If you don't know what it is, don't pull it out!" We have many native plants that will naturally occur in healthy pond systems, so get it identified before you pull it out.

❻ Please remember that Adopt-A-Pond is a pollution prevention program first and foremost. Therefore, use herbicides, fertilizers and other chemicals strategically and sparingly. With proper management you can leave behind use of chemicals after the first year.

❼ The first year of your new pond maintenance program requires the most work and has the most problems, so plan to make monthly inspections and organize work days at least on a quarterly basis.

❽ Pulling up, cutting, and raking out nuisance plants will be easier in the winter and spring when water levels are low and the weather is pleasant for a day at the pond, so plan those activities accordingly.

The Adopt-A-Pond Notebook: Use it to learn more about your pond environment.

Nuisance Plants

The following pages contain pictures and information about plants that may be a nuisance in your pond.
The list is not exhaustive, but it has all the main problem plants.

Use it to help you identify things you need to control or manage.

Take care to identify plants properly, because there are many look-alikes that may not be bad.

Remember as well, that some presence of nuisance or exotic plants is normal and okay. We just want to control them from taking over.

Alligator Weed

Alternanthera philoxeroides

-small sprawling plant
-forms dense mats
-green with white flowers
-reproduces by propagation
-target of successful biological control (release of insects that eat it)
-grows fast
-difficult to control

Australian Pine

Casuarina equisetifolia

-evergreen tree similar to pine trees
-leaves are drooping and needle-like with segments
-very invasive
-leaves drop to form dense mats on the ground that choke out other growth
-will take over wetland or coastal areas forming stands of only Australian pine
-reproduces by seeds in small cones
-fairly easy to control

Brazilian Pepper-tree

Schinus terebinthifolius

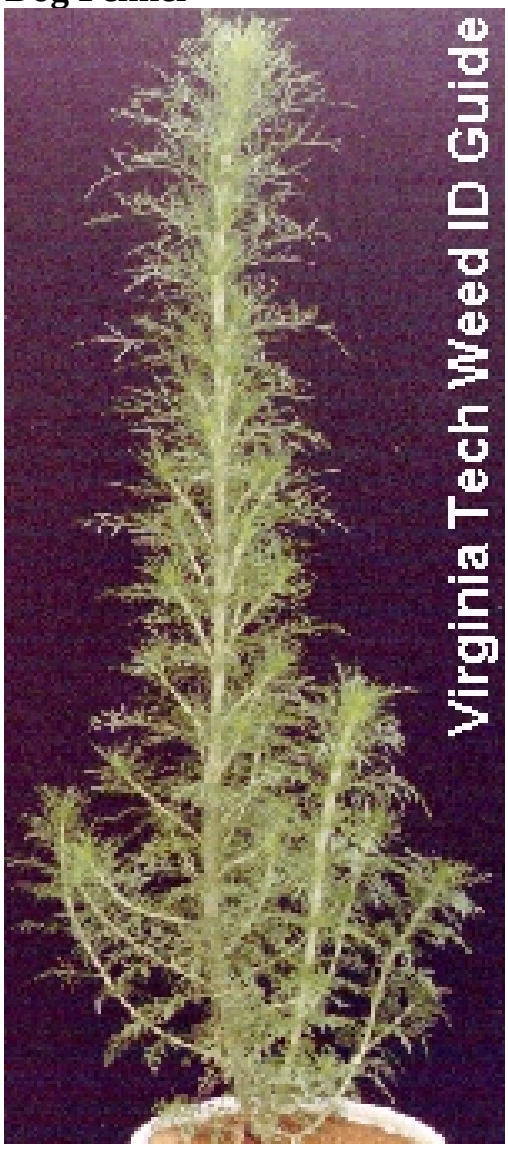
-medium-sized shrubby tree
-bright green leaves with serrated edges
-produces bright red berries in season
-can be identified by distinct spicy smell when leaves are crushed
-extremely invasive
-reproduces by seeds & propagation
-dropped berries will sprout as will twigs, branches, and roots

Cattails

Typha spp.

-actually a native, but often invasive in ponds
-can reach nine feet tall
-flowers in long brown cylinders that bloom into soft, fine hair-like seeds
-leaves twist half-way up length
-reproduces mainly by rhizome
-very invasive
-hard to control
-can be confused with iris when small, distinguished by round base (iris is flat and curved)

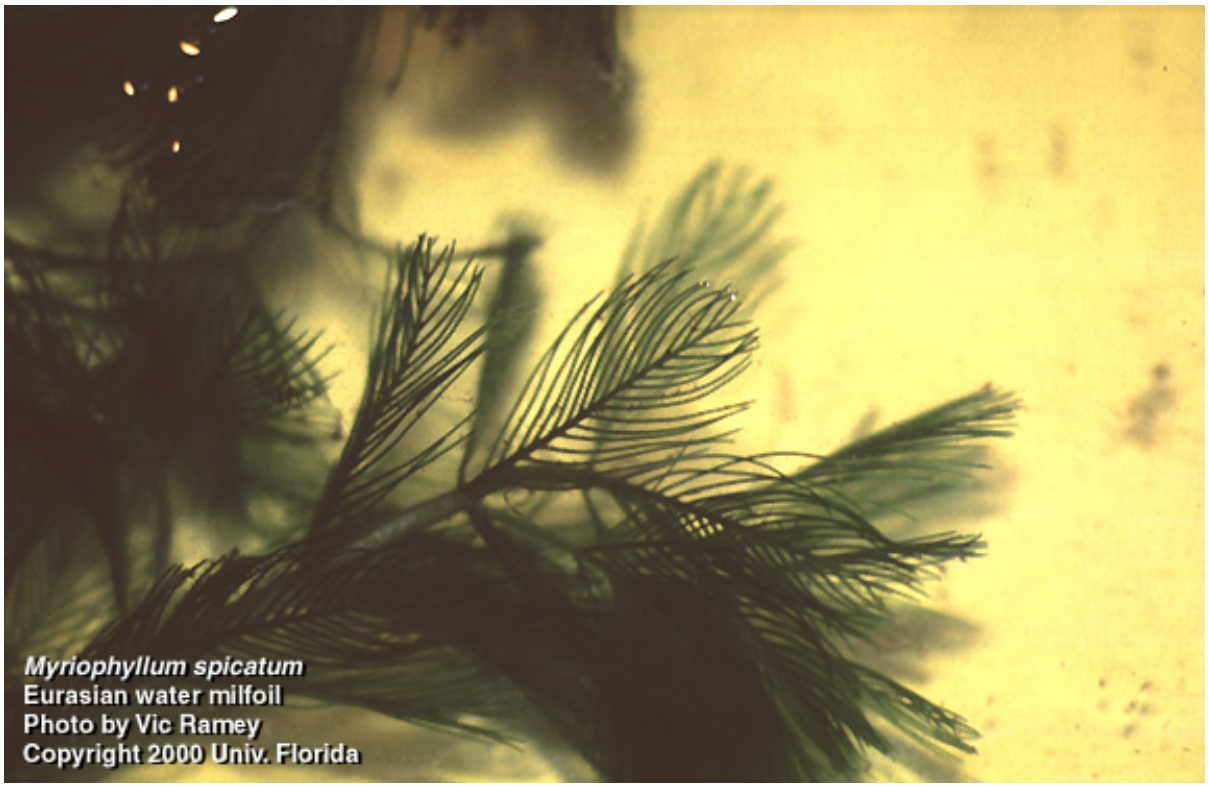
Dog Fennel



Eupatorium capillifolium

-native plant, invasive in ponds
-green, early on then brown to white with wispy seeds
-can reach six feet tall
-very common in fields and disturbed areas
-reproduces by seeds and propagation
-fairly easy to control

Eurasian Watermilfoil



Myriophyllum spicatum

-submerged aquatic plant that can reach 10 feet long
-leaves form thin whorls around the stem giving it a wispy appearance
-grows into mats that can block waterways and shade out vegetation
-reproduces by propagation mainly
-not a serious problem in most cases

Hydrilla

Hydrilla verticillata

-submersed plant
-grows in long stalks from bottom of water but can form floating mats
-numerous small serrated leaves ringing the stalk
-tiny flowers grow at water surface on very long, thin stalks
-can block waterways
-very invasive
-can be confused with Brazilian elodea, another exotic, distinguished by smaller flowers than elodea

Hygrophila

Hygrophila polysperma

-mostly submerged creeping plant
-brownish green in color
-small bluish white flowers at uppermost leaves
-clogs canals and waterways
-competes with hydrilla
-fast growing
-very invasive

Melaleuca

Melaleuca quinquenervia

-large evergreen tree
-flowers look like bottlebrush
-bark is spongy and peels off in layers
-reproduces by propagation
-extremely invasive
-moves into wet areas and out-competes other vegetation
-can have drying effect on land
-also called ‘punk tree’, ‘bottlebrush tree’

Mikania

Mikania scandens

-climbing vine with nearly heart-shaped leaves
-small white flowers in clusters
-forms tangled mats over other plants
-reproduces by propagation and by seeds
-very invasive
-difficult to control

Primrose

Ludwigia peruviana

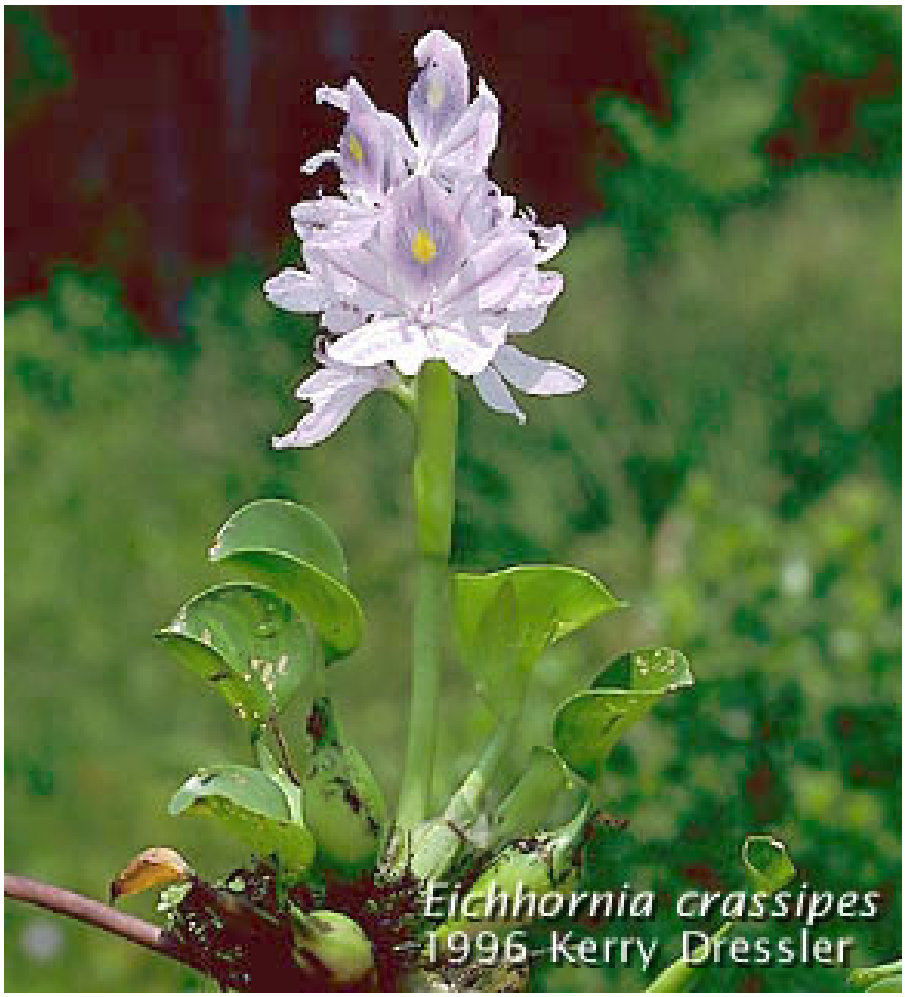
-actually a native, but nonetheless a nuisance
-many species varying in size
-range from 1 foot to 6 feet in height
-woody stalks and yellow to white four-petal flowers
-reproduce by propagation or seeds
-extremely invasive
-trunks, roots, or branches will sprout if wet

Torpedo Grass

Panicum repens

-grass that forms thick mats on ground and over water
-alternating light green blades with hairs on top
-thin spikelet seed heads
-reproduces by rhizomes and seeds
-extremely invasive
-long rhizomes may sprout several feet from main mat
-easily confused with maidencane, a native, distinguished by the leaf hairs

Water Hyacinth



Eichhornia spp.

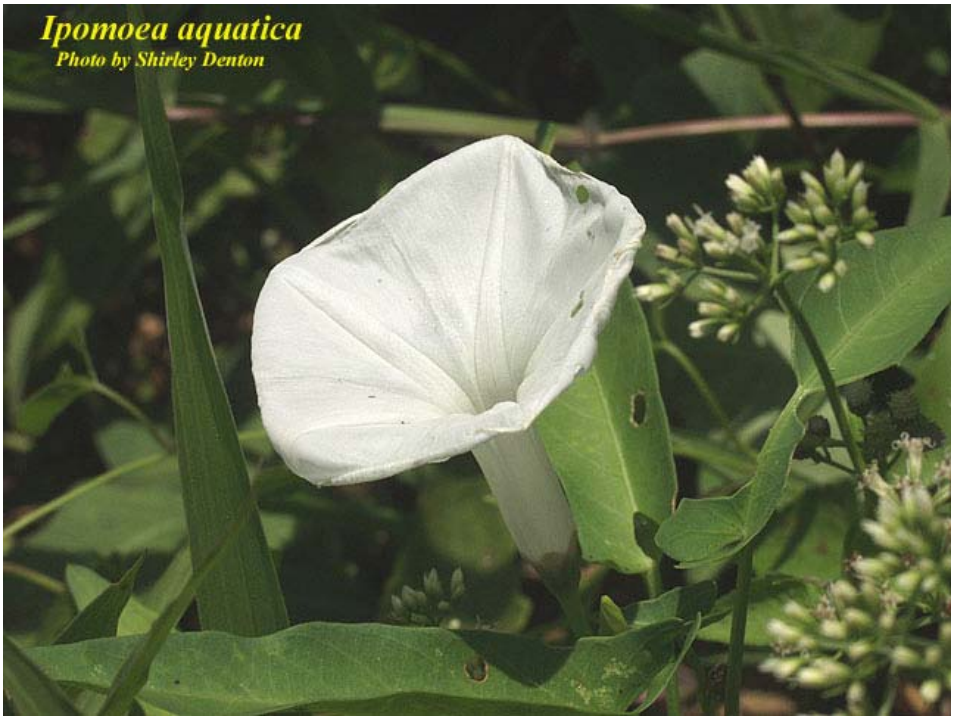
-shiny green floating plant
-forms white to purple flowers in clusters on top of short stalk
-flesh is hollow with air-filled cells that keep it afloat
-reproduces by propagation mainly, and by seeds
-grows fast and can block waterways and pond surfaces
-very invasive
-fairly easy to control

Water Lettuce

Pistia stratiotes

-light green floating plant that grows in large colonies
-resembles lettuce head
-reproduces by budding
-can block waterways and cover large surface area
-very invasive
-fairly easy to control

Water Spinach



Ipomoea aquatica

-bright green or red-purple vine with arrowhead shaped leaves
-stems hollow
-white to pink-lilac flowers are funnel shaped, similar to morning glory
-forms tangled mats that float over shallows
-very invasive
-hard to control

Planted Species

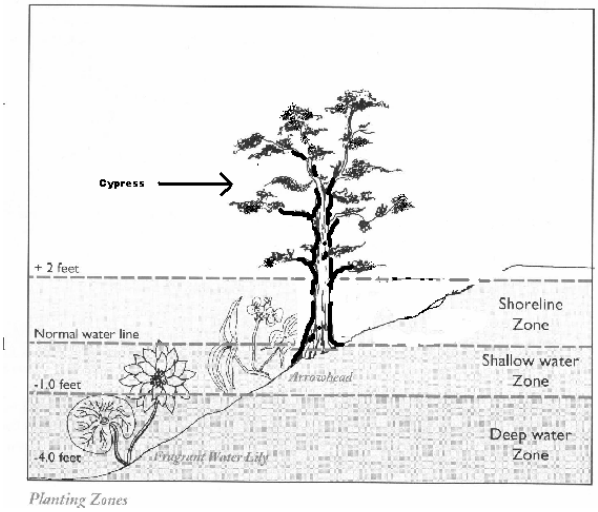
These pages contain pictures and information on the planted species available through Adopt-A-Pond. Every plant on the list in Chapter 1 is included here to make it easy for your group to identify them.

Remember that there are plants that will come into your pond naturally and that is good. Just because it isn't planted doesn't mean you need to remove it.

Bald Cypress

Taxodium distichum.

-deciduous wetland tree
-grows tall and narrow
-needle-like leaves
-might grow “knees”, especially in areas with a sprinkler system
-plant at or above normal water level



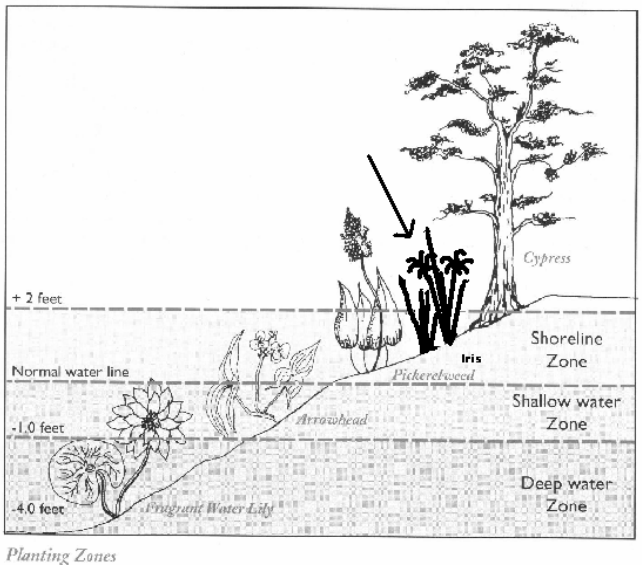
Planting Zones

The Adopt-A-Pond Notebook: Use it to learn more about your pond environment.

Blue Flag Iris

Iris virginica

-narrow and sword-like leaves
-unique large, light purple to blue flowers
-plant above normal water level



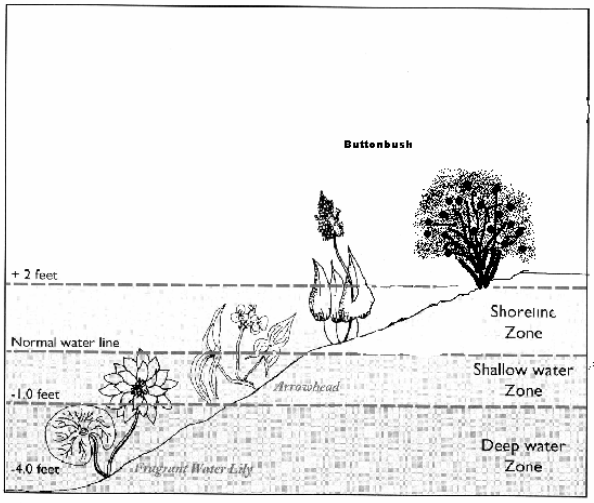
Planting Zones

The Adopt-A-Pond Note ment.

Buttonbush

Cephalanthus occidentalis

-wetland shrub or small tree
-opposite leaves
-small white flowers form a dense ball
-brownish ball-shaped fruits
-plant just above the normal water level
-good butterfly bush

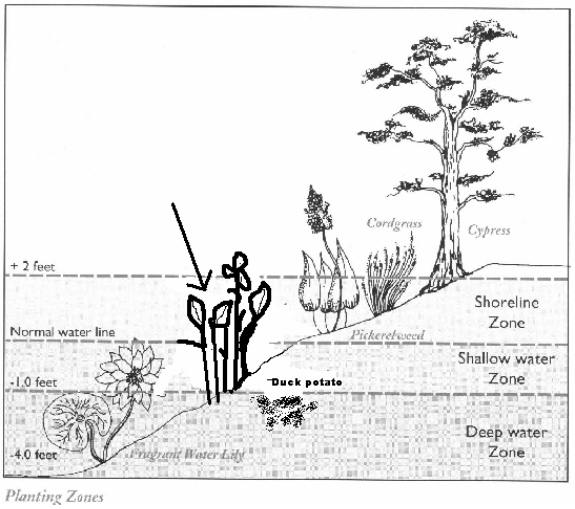


Planting Zones

Duck Potato

Sagittaria lancifolia

-shallow water plant
-large lance-shaped leaves
-leaf bases taper to the stem
-produces large, white, 3 pedal flowers
-plant duck potato at and below the normal water level



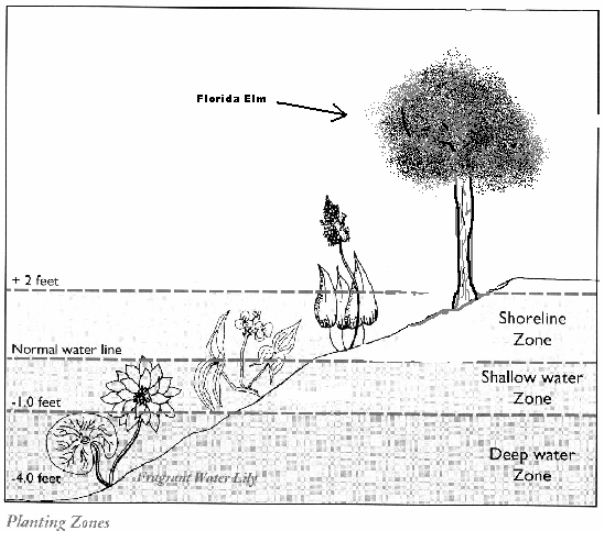
Planting Zones

The Adopt-A-Pond Notebook: Use it to learn more about your pond environment.

Florida Elm

Ulmus floridana

-large deciduous wetland tree
-dark green leaves that turn in fall
-reproduces by seed
-plant above normal water level



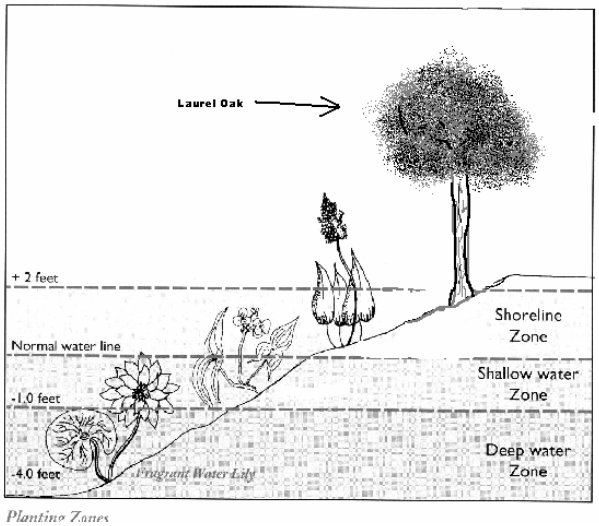
Planting Zones

The Adopt-A-Pond Notebook: Use it to learn more about your pond environment.

Laurel Oak

Quercus laurifolia

-large semi-deciduous wetland tree
-dark green, leathery leaves
-produces egg-shaped acorns with deep caps
-plant at top of bank

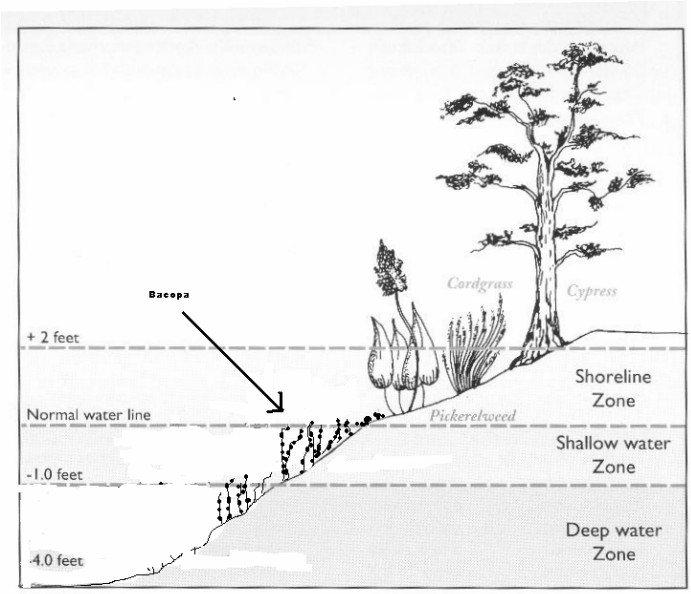


Planting Zones

Lemon Bacopa or Water hyssop

Lemon Bacopa

-small, sprawling, emersed herb
-leaves are small, round and relatively thick
-small blue or white flowers
with 4-5 pedals
-plant in shallow water

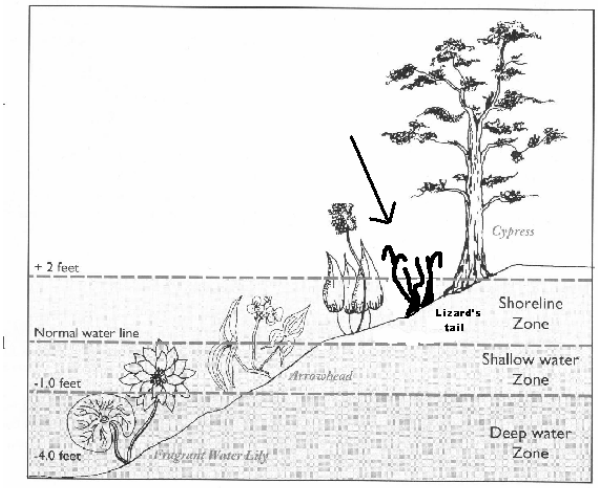


Planting Zones

Lizard's-tail

Saururus cernuus

-shallow water shoreline plant
-grows into small colonies
-one to two feet tall
-has a brush-like arrangement of flowers that arch above the leaves
-leaves can be arrow or heart shaped
-plant in a slightly shaded area

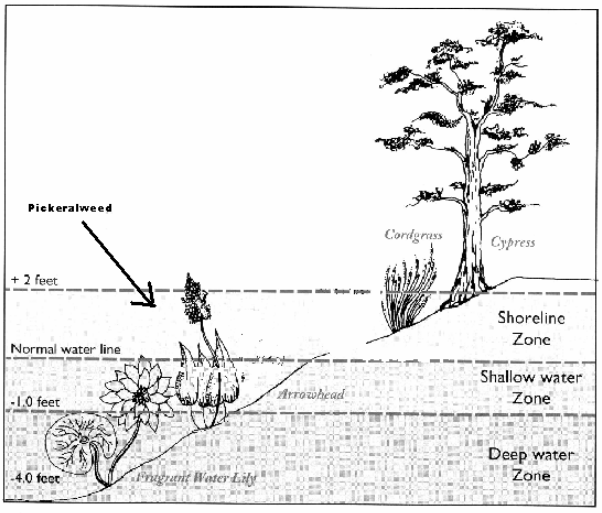


Planting Zones

Pickerelweed

Pontederia cordata

-common shallow water plant
-purple flower spikes most of the year
-covers shoreline areas and grows quickly
-large lance-shaped leaves
-plant at and slightly below the normal water level



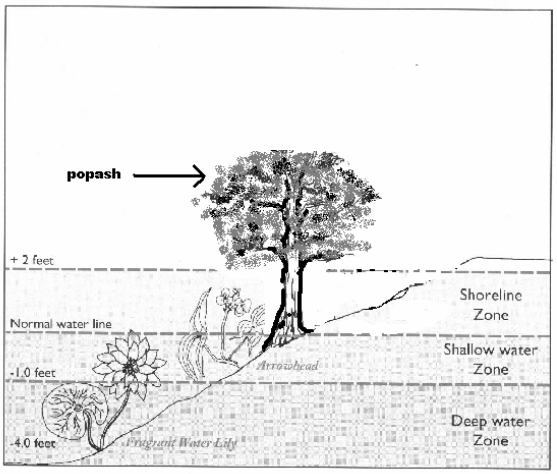
Planting Zones

The Adopt-A-Pond Notebook: *Use it to learn more about your pond environment*.

Popash

Fraxinus caroliniana

-small tree to 30 ft-light green leaves-white to pinkish flowers in spring
-grows in similar location to cypress
-plant at or above normal water level

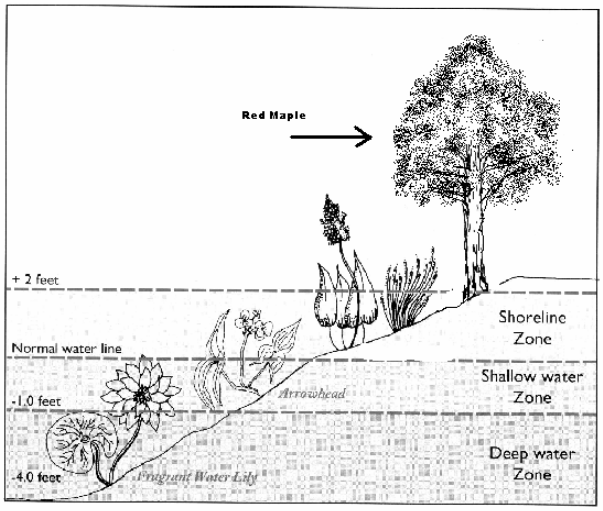


Planting Zones

Red Maple

Acer rubrum

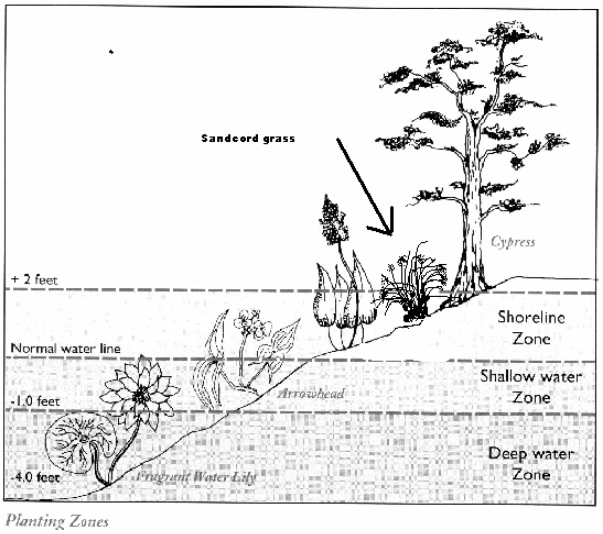
-fast-growing wetland tree
-leaf stems are often reddish
-bright red fruit in spring
-plant at or above the normal water level



Planting Zones

Sand Cordgrass

Spartina bakeri
-shoreline plant
-grows in thick clumps (does not spread by runners)
-helps reduce erosion
-cylindrical, pointed leaves
-gray-green or silver color
-plant along shoreline



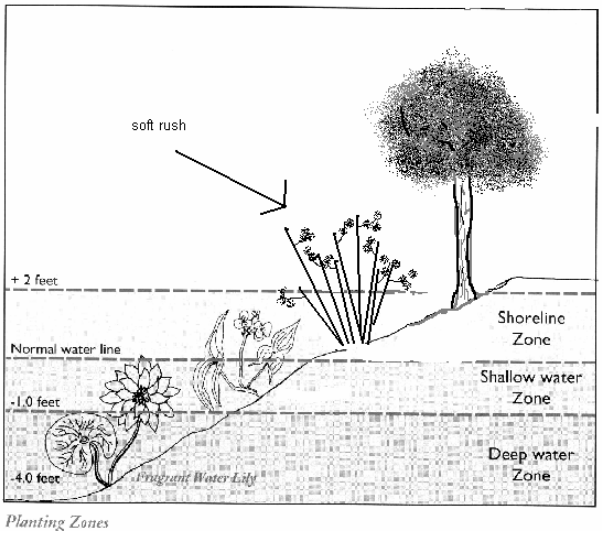
Planting Zones

The Adopt-A-Pond Notebook: *Use it to learn more about your pond environment*.

Soft Rush

Juncus effuses

-most common species of rush
-provides food and nesting to birds and other wildlife
-round stems, pale green, hollow
-grows to 4 feet tall
-flowers and seeds at tops of pointed stems

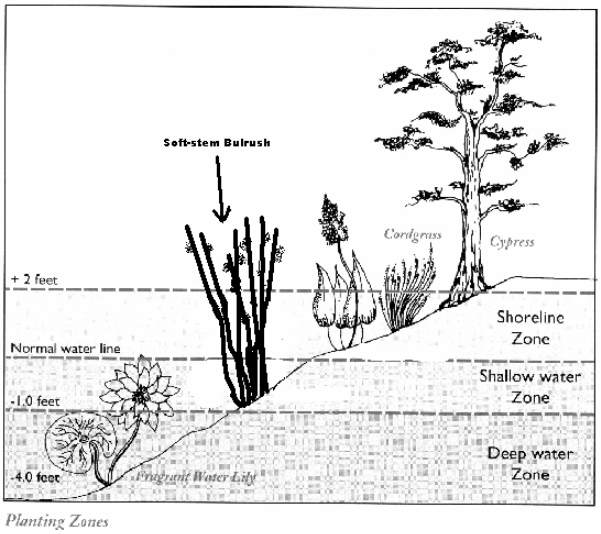


Planting Zones

Soft-stem Bulrush

Scirpus validus

-birds feed on the tall seed heads
-grows along underground runners
-can grow in several feet of water
-stems are larger at the base and taper off at the top
-good game fish habitat



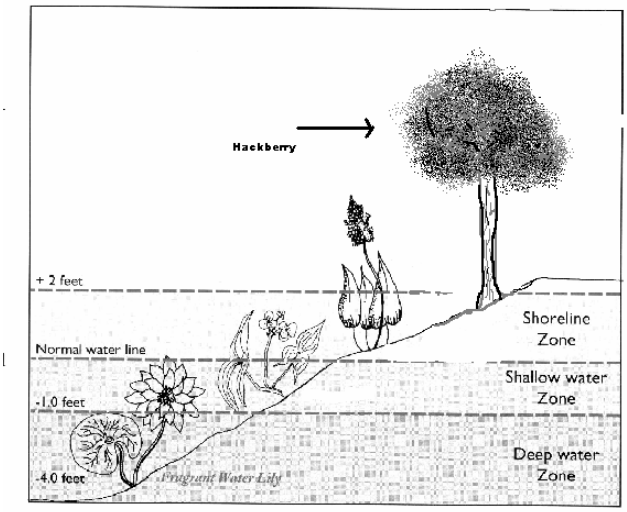
Planting Zones

The Adopt-A-Pond Notebook: *Use it to learn more about your pond environment*.

Sugarberry or Hackberry

Celtis laevigata

-medium-sized tree with
slender branches
-gray, smooth bark
usually becoming “warty”
-red fleshy fruits
-plant above the normal
water level



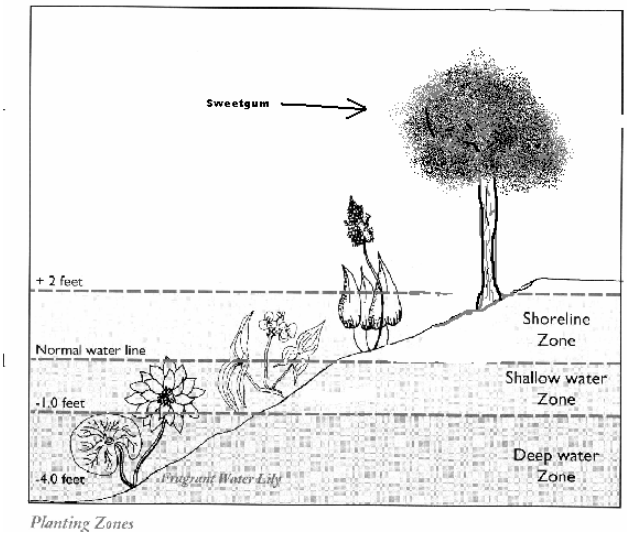
Planting Zones

The Adopt-A-Pond Notebook: *Use it to learn more about your pond environment*.

Sweetgum

Liquidambar styraciflua

-large wetland tree
-brilliant green foliage turns purple shade in fall
-produces seedpods
-plant above normal water level

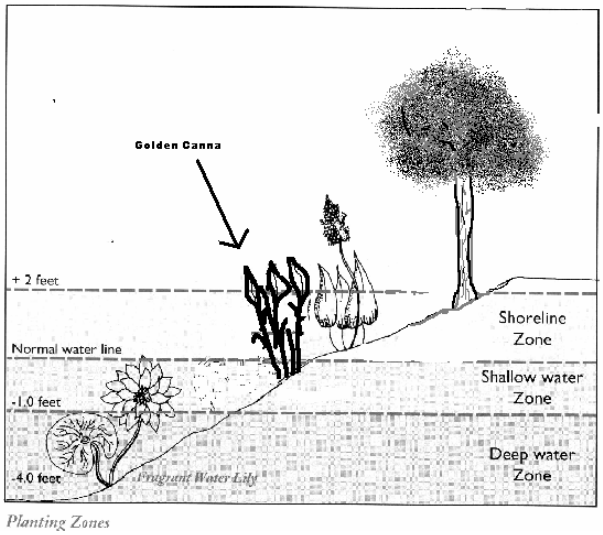


Planting Zones

Yellow or Golden Canna

Canna flacida

-shallow water plants
-can grow to four feet
-leaf shape is oblong or elliptic, with tapered bases and pointed tips
-leaves can be six inches wide and 2 feet long
-three part capsule fruit, rough to touch
-bright yellow-golden blooms in summer



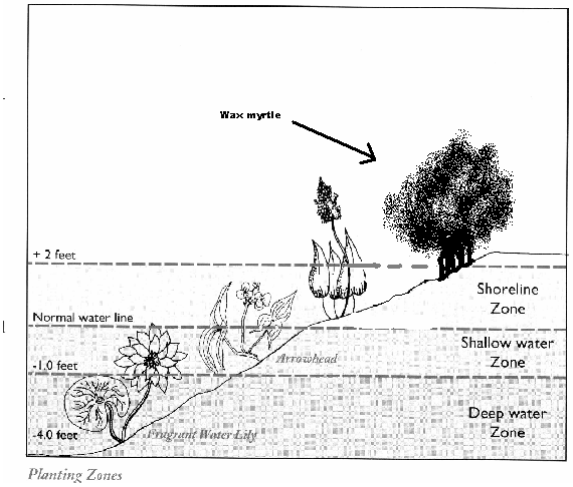
Planting Zones

The Adopt-A-Pond Notebook: *Use it to learn more about your pond environment*.

Wax myrtle

Myrica cerifera

-shrub or small wetland tree
-waxy-gray fruits that are hard and
fleshy, clustered on branches
-thin alternating leaves
-leaves have a characteristic odor
when crushed
-plant at the top of the bank



Planting Zones

The Adopt-A-Pond Notebook: *Use it to learn more about your pond environment*.

Transitional Species

These pages contain pictures and information on transitional species available through Adopt-A-Pond. These plants are useful in situations where ponds go dry through portions of the year. In addition, these plants may occur naturally around the upper banks of the pond.

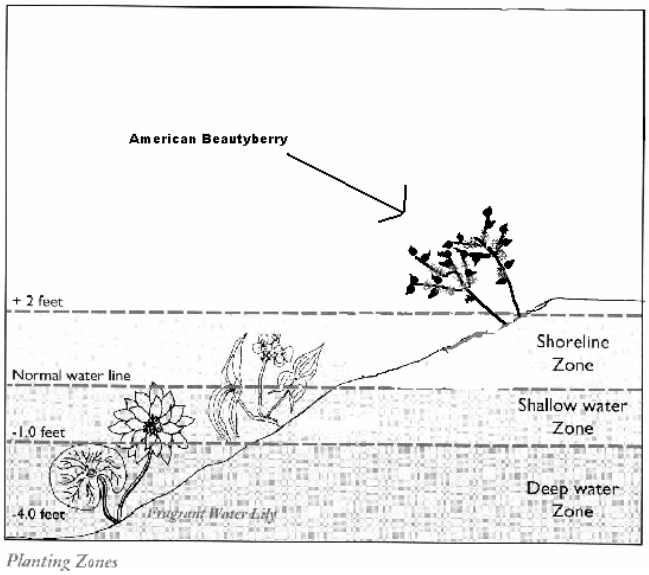
Remember that these plants aren't good in every situation, and they can be hard to establish, but we want you to be aware of what's out there.

Adopt-A-Pond will help you determine if you need any of these plants.

American Beautyberry

Callicarpa americana

- Shrub, 8ft tall
- Small pink flowers
- Pink to purple berry clusters in late summer
- Grows in pinelands and clearings

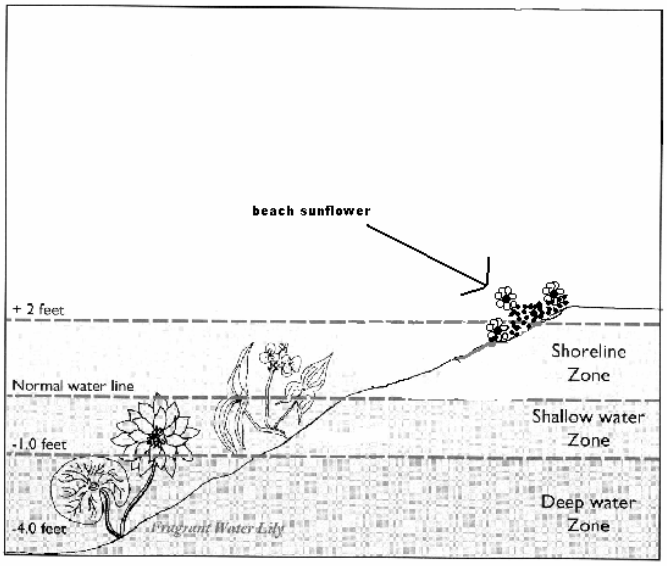


Planting Zones

Beach Sunflower

Helianthus debilis

- Annual, spreading
- Yellow flowers in spring summer and fall
- Grows in disturbed soils and dunes.

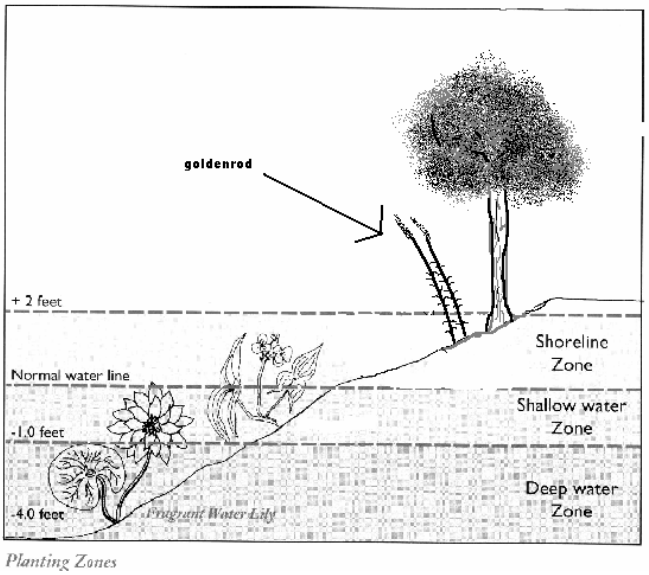


Planting Zones

Goldenrod

Solidago fistulosa

- Perennial, 6ft. tall
- Grows in individual stalks
- Yellow Flower spikes in fall
- Grows in dry to moist open areas

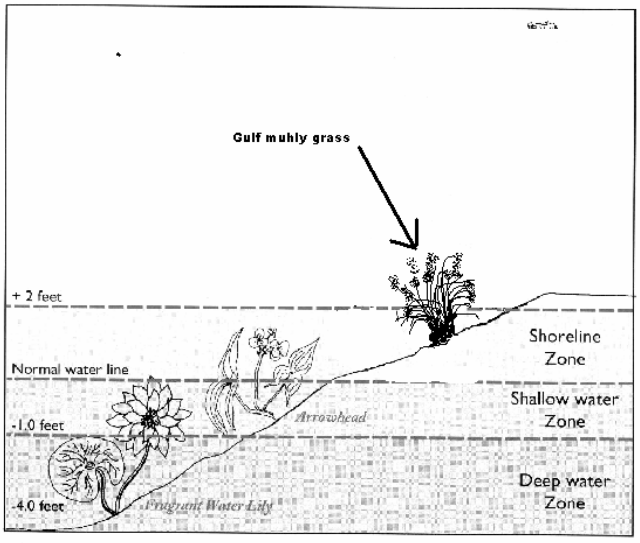


Planting Zones

Gulf Muhly Grass

Muhlenbergia capillaris

- Perennial, 4 ½ ft tall
- Grass grows in clumps
- Feathery purple plumes in fall and winter
- Similar to cordgrass

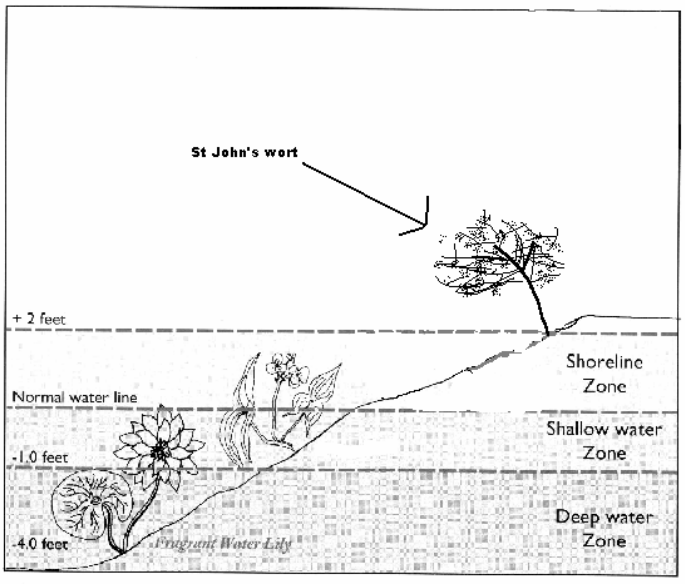


Planting Zones

St John's Wort

Hypericum hypericoides

- Evergreen shrub, 4ft tall
- Yellow flowers in spring
- Grows in depressions, bogs, and pond edges

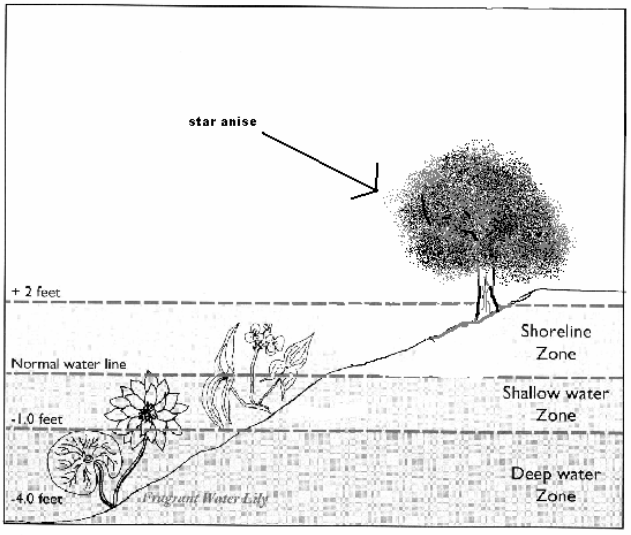


Planting Zones

Star Anise

Illicium parviflorium

- Evergreen shrub, grows to 25ft.
- Yellow star-shaped flowers in spring
- Grows in wet marginal and low areas

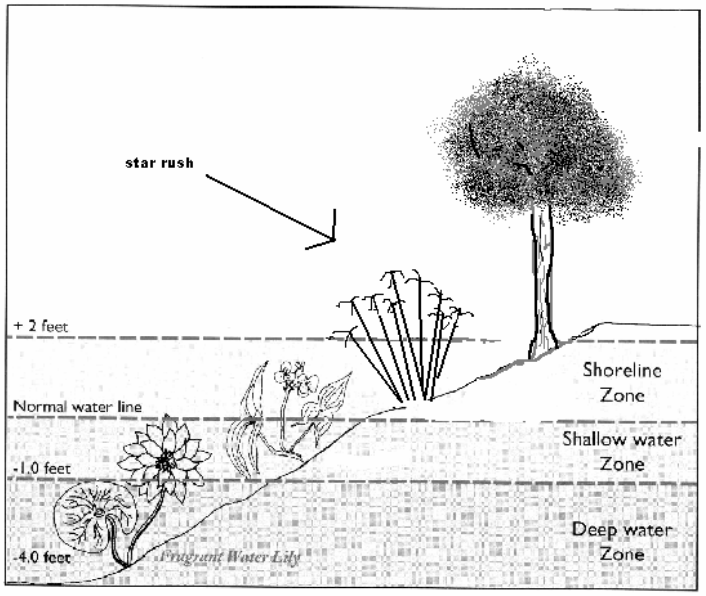


Planting Zones

Star-Rush

Rhynchospora colorata

- Perennial, low growing
- White flower-like leaves
- Spiky, sedge-like
- Flowers year-round
- Grows in wet sandy areas

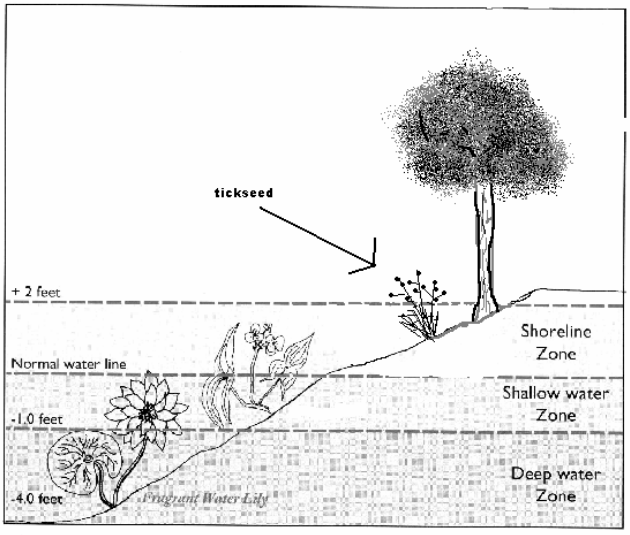


Planting Zones

Tickseed

Coreopsis leavanworthii

- Perennial, 40in. tall
- Yellow flowers with brown centers
- Grows in moist open areas

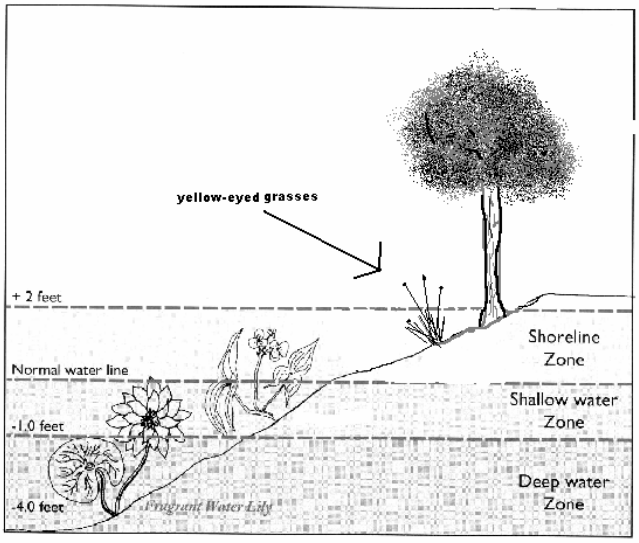


Planting Zones

Yellow-eyed Grasses

Xyris spp.

- Perennial, 40in. tall
- Grows in tufts or solitary
- Yellow flowers in cone-like clusters all year
- Grows in moist sandy ditches and pond shores



Planting Zones

Related Articles

The following section contains some articles that you may find useful in developing a management plan that is specifically suited for your pond.

Remember that no one knows your pond better than your group; any suggestions you read will need to be tailored to meet the needs of your pond and your group.

UNIVERSITY OF FLORIDA
EXTENSION
Institute of Food and Agricultural Sciences

SP 242

Control of Non-native Plants in Natural Areas of Florida[1]

K.A. Langeland and R.K. Stocker[2]

Introduction

Forty-three percent of Florida's land area is currently in agricultural or urban land uses and over one third of its native habitats have been lost (1987 census). While continued urbanization is an inevitable consequence of increasing population, and food production by agriculture is essential, it is also important to preserve and protect Floridas native habitats for historical significance and to protect species, water quality, and water quantity. Setting aside certain lands to be managed for conservation is a method to protect them. According to the Florida Natural Areas Inventory, 6.3 million acres of state and federal public lands are currently managed for conservation. Natural areas are conservation lands that have been set aside for the purpose of preserving (or restoring) native plant and animal communities. Natural areas are also maintained by counties and cities in Florida and by private land owners.

Non-native plants, carried here by humans since Florida's discovery by Columbus, now threaten the state's remaining natural areas. Of the 4,012 plant species now growing on their own without cultivation in Florida, 29% are non-native (Atlas of Florida Flora, R. P Wunderlin). Many of these non-native plants were originally introduced as garden ornamentals or agricultural crops. Other non-native plants were accidentally introduced. Regardless of how they arrived, these 1,200 or so non-native plants grew so well in Florida that they naturalized, that is, spread on their own without cultivation into managed and natural areas. While some of these naturalized non-native plants are not a problem, many became weeds, or undesirable plants, in agricultural, forestry, yards, and roadways. When these naturalized non-native plants spread extensively into natural areas and dominate by displacing native plants and disrupting natural processes such as fire or water flow, they are called invasive. Invasive non-native plants can be thought of as weeds in natural areas.

Familiar examples of invasive non-native plants that have already replaced native Florida plant communities and drastically changed the landscape both visually and ecologically include Brazilian pepper (*Schinus terebinthifolius*), and melaleuca (*Melaleuca quinquenervia*) in south Florida, and cogongrass (*Imperata cylindrica*) and Chinese tallow (*Sapium sebiferum*) in north Florida.

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Currently there is no information source that describes all invasive species for each particular part of Florida, and most invasive species are weed problems in some areas, but not in others. Until more information is developed, the best strategy for land managers is to become familiar with the most invasive species, and be watchful for their appearance. Listing of a species in this publication does not necessarily suggest that it should be regulated. It does indicate that it has warranted control measures in at least one natural area in the state and should be viewed as potentially invasive in other natural areas if it appears. Several invasive plants in Florida are regulated by statutory authority of the Florida Department of Agriculture and Consumer Services (DACS) and the Florida Department of Environmental Protection (DEP). The list of plants regulated by DACS, the Florida Noxious Weed List, includes plants that are federally regulated by the Federal Noxious Weed Act of 1974. The Florida Exotic Pest Plant Council (EPPC) maintains a current list of plants that are considered to be invasive or have invasive potential. While the EPPC list contains some plants that are also regulated by DACS and DEP, the list does not have statutory authority. These lists can be obtained from the University of Florida, Institute of Food and Agricultural Sciences Center for Aquatic Plants at 352/392-9613.

Management of invasive vegetation in natural areas requires methods that will minimize damage to nontarget vegetation and soil. Often this need for caution necessitates more time and effort than weed management in agricultural, industrial, or right-of-way settings. Some particular types of vegetation, for instance woody or sprawling vegetation, may require removal of standing plant material even after it has been killed if its presence increases fire hazard, reduces aesthetic appeal, or could cause harm as it decays and falls. Control methods include manual removal, mechanical removal, physical controls, herbicides, and biological control alone or in combination.

The purpose of this publication is to provide land managers in Florida with current methods being used to manage non-native plants by other land managers in the state.

Regulatory Agencies

Removal of vegetation in certain areas such as public waters and wetlands is regulated by state and local agencies and a permit may be required. For questions regarding permits to control vegetation in public waters, contact one of the following Department of Environmental Protection regional offices:

Bartow (941) 534-7143
Floral City (352) 726-8622
Lake City (904) 758-0464
Orlando (407) 275-4004
Upland Weed Office (904) 487-2600
Tampa (813) 744-6163
West Palm Beach (561) 791-4720

For regulatory questions regarding vegetation control in wetlands contact the Water Management District (WMD) in which you are located:

Northwest Florida WMD (850) 482-9522
Suwannee River WMD (904) 362-1001
St. Johns River WMD (904) 329-4500
Southwest Florida WMD (813) 796-7211
South Florida WMD (561) 682-6201

Control Methods

Prevention

The importation and spread of invasive vegetation can be significantly reduced by public education. **It is the responsibility of those who are aware of the problems caused by invasive non-native plants to educate others about their identity, impacts, and control so that further ecological degradation of native ecosystems can be reduced.**

Biological Control

In Florida, classical biological control (introduction of reproducing populations of foreign insects or diseases) of invasive non-native plants in non-agricultural areas has focused on aquatic weeds. The first biocontrol agent introduced was the alligatorweed flea beetle (*Agasicles hygrophila*) in 1964 for control of alligatorweed (*Alternanthera philoxeroides*). Subsequently, the alligatorweed

thrips (*Aminothrips andersoni*) was released in 1967 and the alligatorweed stem borer (*Vogtia malloi*) in 1971. The flea beetle and stem borer proved to be fairly effective for suppressing growth of alligatorweed, although harsh winters can reduce their populations. Less effective have been introductions of the waterhyacinth weevils (*Neochotina eichhorniae* and *N. bruchi*), released in 1972 and 1974, and the waterhyacinth borer, released in 1977 (*Sameodes albigutalis*) for waterhyacinth (*Eichhornia crassipes)* control. Likewise, effectiveness of a weevil (*Neohydronomous affinis*) and a moth (*Namangama pectinicornis*) released for control of water lettuce (*Pistia stratiotes*) has been unpredictable. Waterhyacinth and water lettuce continue to be problems that require management by other methods. Current biological control research is focused on hydrilla (*Hydrilla verticillata*), waterhyacinth (*Eichhornia crassipes*), melaleuca, and Brazilian pepper.

While classical biological controls are currently under study and will be implemented in the future, their development takes years and they cannot be expected to solve all invasive plant problems. Biological control programs are typically implemented by state and federal agencies, and the potential role of individual resource managers and the public will depend on the particular action being implemented.

Introduction of animals such as cattle, sheep, goats, or weed-eating fish may also be used to control certain invasive plants. However, environmental impacts of using such nonselective herbivores in natural areas should be carefully considered before implementation.

Manual Removal

Manual removal is very time-consuming but often a major component of effective invasive plant control. Seedlings and small saplings can sometimes be pulled from the ground, but even small seedlings of some plants have tenacious roots that will prevent extraction or cause them to break at the root collar. Plants that break off at the ground will often resprout, and even small root fragments left in the ground may sprout. Therefore, repeated hand-pulling or follow-up with herbicide applications is often necessary.

Removal of uprooted plant material is important. Stems and branches of certain species (e.g. ligustrum and melaleuca) that are laid on the ground can sprout roots, and attached seeds can germinate. If material cannot be destroyed by methods such as burning, it should be piled in a secure area that can be monitored and new plants killed as they appear.

Pulling plants from the ground may cause unwanted soil disturbance in some natural areas, especially pine rockland habitat. This soil disturbance may result in further invasion by invasive non-native plant species, again requiring follow-up control measures.

Mechanical Removal

Mechanical removal involves the use of bulldozers, or specialized logging equipment to remove woody plants. Intense follow -up with other control methods is essential after the use of heavy equipment because disturbance of the soil creates favorable conditions for regrowth from seeds and root fragments, and recolonization by invasive non-native plants. Plans for management or replanting of sites with native vegetation following mechanical removal should be carefully developed prior to implementation of mechanical removal. Mechanical removal may not be appropriate in natural areas because of disturbance to soils and nontarget vegetation caused by heavy equipment.

Cultural Practices

Prescribed burning and water level manipulation are cultural practices that are used in management of pastures, rangeland, and commercial forests and may be appropriate for vegetation management in natural areas in some situations. One important consideration is the degree of degradation for the area in question. Cultural practices may have impacts to all parts of the habitat, native species included. If the habitat is so badly degraded that the need to reduce invasives strongly outweighs consideration of remaining native species, more aggressive control strategies can be considered. In

less degraded areas, more careful use of integrated methods may be appropriate.

Land use history is critical in understanding the effects of fire and flooding on the resulting plant species composition. Past practices affect soil structure, organic content, seed bank (both native and invasive non-native species), and species composition. While there is evidence that past farming and timber management practices will greatly influence the outcome of cultural management, very little is known about effects of specific historical practices. Similar management practices conducted in areas with dissimilar histories may achieve very different results. Even less is known about the effects of invasives entering these communities, and the subsequent management effects of fire on the altered communities.

Understanding the reproductive biology of the target and nontarget plant species is critical to effective use of any control methods, but particularly so with methods, such as fire management, that often require significant preparation time. Important opportunities exist when management tools can be applied to habitats when non-native invasive species flower or set seed at different times than the native species.

Prescribed Burning

Fire is a very normal part of most of Florida's many ecosystems, and native species have evolved varying degrees of fire tolerance. Throughout much of Florida, suppression of fire during this century has altered historical plant communities, such as flatwood and oak scrub communities, enhancing fire-intolerant species, and reducing the coverage of species that possess fire adaptations. Within these communities, the fire-tolerant woody species have lingered in smaller numbers, and less fire-tolerant species have replaced ephemeral herbs. Little is known about the amount, frequency, timing, and intensity of fire that would best enhance the historically fire-tolerant plant species, and less is known about how such a fire management regime could be best used to suppress invasive species. Single fires in areas with many years of fire suppression are unlikely to restore historical species composition. Periodic fires in frequently burned areas do little to alter native species composition.

In a special case, invasion of tree stands by exotic vines and other climbing plants has greatly increased the danger of canopy (crown) fires and the resulting death to mature trees.

Added biomass by invasive plants can result in hotter fires, and can greatly increase the risk of fires spreading to inhabited areas. In these situations, use of fire to reduce standing biomass of invasive species may better protect the remaining plant populations than doing nothing, even though impacts to non-target native species will occur. Under these conditions, the expense of reducing standing biomass of invasive plant species might be justified by the savings on subsequent fire suppression.

In general, fire can be used to suppress plant growth, and even kill certain plants that are not fire tolerant. Most often, woody species are reduced while effects are less noticeable on herbaceous species. Some information has been published on responses of individual Florida plant species, but very little is known about the vast majority of native plant species, and less about invasive exotic species. Tolerance to fire can sometimes be predicted in species with thick bark, seeds, either in the soil or held in the canopy, that are adapted to fire (either tolerant of high temperature, or requiring fire for seed release or germination), and seeds that are disbursed over a wide area.

Effects of a single burn are hard to predict, but under some conditions a single fire effect can persist for several growing seasons. The length of effect is due to intensity of fire, time of year of fire (fire during the growing season can be more destructive than during dormant seasons), and the plant species involved. Smoke is now recognized as a germination triggering mechanism for fire-dependent as well as non-fire-dependent species, so plant species composition following a burn is due, in part, to the type of fire and the distribution of the smoke from that fire. A single burn may or may not start a replacement sequence (succession) with its own effects on species composition.

Whether fire can play a logical role in suppression or elimination of invasive exotic plant species depends on many factors. In addition to the principal factors described above, the resource manager must consider potential fire effects on soil loss and water quality, historical and economic impacts to buildings, possible harm to human life, and the potential for escape of a fire to nontarget areas.

Fire has been very successfully used to manage plant species in grasslands, to maintain open savannahs (scattered trees in herbaceous species dominated habitats), and to promote seral (fire-induced or fire-tolerant) stages of forest succession. Very little is known about the use of fire to enhance natives while reducing invasive exotic plant species. As a final caution in the use of fire to manage invasive plant species, too frequent burning has been shown to reduce plant diversity under many conditions, and it appears possible that increased fire frequency could provide opportunities for invasive plants to enter new areas.

Water Level Manipulation

Some success has been achieved regulating water levels to reduce invasive plant species in aquatic and wetland habitats. Dewatering aquatic sites reduces standing biomass, but little else is usually achieved unless the site is rendered less susceptible to repeated invasion when rewatered. Planting native species may reduce the susceptibility of aquatic and wetland sites in some cases.

In most situations, water level manipulation in reservoirs has not provided the level of invasive plant control that was once thought achievable. Ponds and reservoirs can be constructed with steep sides to reduce invadable habitat, and levels can be avoided that promote invasive species, but rarely are these management options adaptable to natural areas.

Carefully timed water level increases following mechanical removal or fire management of invasive species can provide effective control of subsequent germination, and, with some species, resprouting. Specific methods applicable to natural areas have not been described.

Re-establishment of Native Plant Species

Planting native species can be an effective, though expensive, way to reduce the likelihood of exotic species reinvasion following removal of non-native species. Commercial plant nurseries currently provide seed and plants of several wetland and upland species. Since some species cover a wide range of habitats and latitudes, care should be taken to obtain plant material suitable to the habitat under consideration. Seed collected from plants growing in more northern latitudes may do very poorly in Florida. Introduction of seeds, plant parts, or whole plants should include thorough screening for any unwanted pests, plant or animal.

It often takes several years for plantings to become thoroughly established, and extra care (water, nutrients) and protection (from fire and pests) may be necessary for a while. Also during this establishment phase, past management practices may have to be altered to avoid injury to the plantings. If periodic burning or flooding, for example, is part of the current management practice, it may be necessary to reduce the intensity or duration until the plantings are able to exhibit their typical resistance to injury, whatever that may be. Unfortunately, little is known about requirements for successful establishment of many native species, and less is known about their tolerances to cultural invasive plant management techniques. Even when tolerances are better known, responses may be affected by historical site effects, traits of particular genetic strains, site specific nutrition and light conditions, and interactions of soil type, hydroperiod, and microclimate.

Herbicides

Training and Certification

Anyone who applies herbicides in natural areas should have basic training in herbicide application technology. Only topics specifically important to herbicide use in natural areas are emphasized in this circular and the reader is expected to have prior knowledge of basic herbicide application technology.

A pesticide, or some of its uses, is classified as restricted if it could cause harm to humans or to the environment unless it is applied by certified applicators who have the knowledge to use these pesticides safely and effectively. Although none of the herbicides or uses listed in this publication, or commonly used for invasive plant control in natural areas, are classified as restricted-use, the basic knowledge of herbicide technology and application techniques that is needed for safe handling and effective use of any herbicides can be obtained from restricted-use pesticide certification training. This training can be obtained through the University of Florida Institute of Food and Agricultural Sciences. Certification requirements are met by successfully completing testing to ensure that the individual is knowledgeable in the use and supervision of restricted use pesticide application. Once certified, applicators may obtain a license from the Florida Department of Agriculture and Consumer Services as either public applicators or commercial applicators. The fees for a four-year license are $35 for a public applicator and $90 for a commercial applicator. Workshops on use of herbicides for invasive plant control in natural areas can also be arranged. For additional information regarding pesticide applicator training contact the Cooperative Extension Service in your county or the IFAS Pesticide Information Office (352) 392-4721. The EPPC can provide information on training opportunities and assist with organization of workshops for natural area managers through its education committee.

Active Ingredients and Formulations

A herbicide formulation, or product, consists of the herbicide active ingredient dissolved in a solvent (e.g., oil, water, or alcohol), or adsorbed to a solid such as clay. Formulations often include an adjuvant that facilitates spreading, sticking, wetting, and other modifying characteristics of the spray solution. Special ingredients may also improve the safety, handling, measuring, and application of the herbicide. Products mentioned in this publication contain the active ingredients 2,4-D, fluazifop, glyphosate, imazapyr, triclopyr (amine or ester), and hexazinone in varying concentrations (Table 1).

The active ingredients 2,4-D amine, triclopyr amine, imazapyr, and hexazinone are formulated as water-soluble liquids (L). They are not compatible with oil-based diluents and are diluted in water for foliar applications and diluted in water or applied in their concentrated form for cut stump applications. They are not normally used for basal bark applications.

Triclopyr ester, imazapyr, and fluazifop are formulated as emulsifiable concentrates (EC). Emulsifiable concentrates are compatible with oil-based diluents and also contain emulsifiers that allow the formulation to mix with water. Agitation is used to mix the EC in water. They may be diluted in water for foliar applications or mixed with oil based diluents for low volume applications (e.g., basal bark).

Hexazinone is also formulated as an ultra-low-weight soluble granule (ULW) formulation. This formulation is broadcast with specialized ground or aerial equipment.

Where Herbicides Can Be Used

No pesticide may be sold in the United States until the U.S. Environmental Protection Agency (EPA) has reviewed the manufacturer's application for registration and determined that the use of the product will not present unreasonable risk to humans or the environment. **Pesticide users are required by law to comply with all the instructions and directions for use in pesticide labeling.**

EPA approves use of pesticides on specific sites, i.e., for use on individual crops, terrestrial non-crop or aquatic areas. Only those herbicides registered by EPA specifically for use in aquatic sites can be applied to plants growing in lakes, rivers, canals, etc. For terrestrial uses, EPA requires herbicide labels to have the statement: "Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean highmark." Rodeo® is the only product mentioned in this publication that is registered for aquatic use and can be applied directly to water (Table 1). Certain but not all products that contain 2,4-D can also be applied directly to water. The state supplemental special local need label for the imazapyr-containing product,

Arsenal® (EPA SLN NO. FL-940004) allows government agencies and their contractors to use it for injection, frill/girdle or cut stump applications to control melaleuca and Brazilian pepper (addition of Chinese tallow to label applied for) growing in water. Other products mentioned can be used in noncropland areas and variously described low lying areas, including wetlands, but cannot be applied directly to water (Table 1).

Absorption Characteristics

Herbicides recommended in this publication for invasive plant control are systemic. They move within the plant to the site where they are active after being absorbed by foliage, roots, or bark. Triclopyr, 2,4-D imazapyr, and glyphosate can be absorbed by plant leaves and are effective for foliar applications. Addition of an appropriate surfactant, as recommended on the herbicide label, is essential. Triclopyr, 2,4-D and glyphosate are absorbed by soils or broken down quickly in soil and are not absorbed effectively by plant roots, whereas imazapyr and hexazinone are readily absorbed by plant roots (Table 2). Only oil-soluble herbicide formulations, i.e. emulsifiable concentrates, are absorbed readily through tree bark.

Behavior in Soils

Herbicides used for invasive plant control vary in their persistence and sorption to soils (Table 2). The most important factor is the ability of various soil types to chemically bind herbicides. Soil-applied herbicides, such as hexazinone, have label recommendations that vary the application rate for different types of soils. In general, soils with more organic matter and/or clay have greater capacities for binding herbicides than coarse, sandy soils and require higher application rates. Because woody plants are a problem on a range of Florida soils including highly organic muck, sand, and very thin soil layers over limestone, a broad range of herbicide behavior in different soils can be expected.

Selectivity

The ability to selectively control target vegetation with herbicides without harming nontarget plants is related to the relative sensitivities of target and nontarget plants, absorption and chemical characteristics of the herbicides, and placement.

Herbicides vary in their potential to damage nontarget vegetation, and unwanted results can be prevented or minimized by making the best choice of herbicides in conjunction with careful application. Fluazifop, which kills many grasses, can be used to selectively manage invasive grass species among nontarget broadplant species. Formulations that contain the active ingredients 2,4-D or triclopyr can often be used selectively because many broadleaf species are more sensitive to them than to perennial grasses.

Because 2,4-D , triclopyr and glyhosate have negligible root activity and break down quickly (Table 2), they have little potential for causing nontarget damage, due to root absorption, when carefully applied to target vegetation. In contrast, caution must be used with root active herbicides (i.e. hexazinone and imazapyr) to minimize damage to nontarget vegetation by root absorption.

Care must be taken to avoid unwanted contact of herbicide spray (drift) to foliage of nontarget plants when broadcast applications of the foliar active herbicides, 2,4-D, triclopyr, glyphosate, or imazapyr are made. Particulate drift can be minimized by avoiding windy conditions when spraying and using low pressures and large nozzle orifices. Volatile compounds such as ester formulations may cause nontarget damage due to vapor drift when applied on very hot days. This damage, which may be observed as wilting or curling leaves, has been minimal and has not caused permanent harm to woody nontarget plants.

Wildlife Toxicity

Invasive plant management is often conducted in natural areas with the purpose of maintaining or restoring wildlife habitat. Therefore, it is essential that the herbicides themselves are not toxic to wildlife. Risk assessment to wildlife is conducted as part of the registration procedure for herbicides and is determined as the product of hazard and exposure. Hazard is measured as the toxicity of the herbicide to test animals and exposure depends on the use and

persistence of the compound. Herbicides recommended in this publication have shown very low toxicity to wildlife that they have been tested on, with the exception of the relatively low LC_{50} (0.87 ppm) of triclopyr ester and fluazifop (0.57 ppm) for fish, neither of which can be applied directly to water (Table 3). Ester formulations are toxic to fish because of irritation to fishes' gill surfaces. However, because triclopyr ester and fluazifop are not applied directly to water, are absorbed by soil particles, and have low persistence, exposure is low, which results in low risk when properly used.

Herbicide Application Methods

Foliar applications. Herbicide is diluted in water and applied to the leaves with aerial or ground equipment. Dilution is usually about 20 parts water to 1 part herbicide concentrate for aerial applications, and 50 to 400 parts water to 1 part herbicide concentrate when making ground applications for woody plant control. Adjuvants, such as surfactants, drift control agents or other spray modifiers, are often added to the spray mix, as specified on the herbicide label. Ground equipment ranges from handspray bottles for applications to small individual plants, to large high pressure vehicle or boat-mounted sprayers for larger areas. Foliar applications can either be directed, to minimize damage to nontarget vegetation, or broadcast. Broadcast applications are used where damage to nontarget vegetation is not a concern or where a selective herbicide is used.

For directed spray, selective applications, backpack sprayers such as the Solo Model 475 with diaphragm pump or Swissmex SPI are effective and commonly used. A spray tip such as a TP 2503 or TP 2504 produces large spray droplets to reduce spray drift. The 2503 spray tips may be installed in the spray wand that comes with the backpack sprayer, or a Model 30 Gunjet with the 2503 or 2504 spray tip may be attached to any backpack spray unit. If an adjustable tip is used, a Tee-Jet 5500-X8 or equivalent is recommended. All backpack sprayers and spray guns should have chemical-resistant seals for the herbicides being used.

Power-driven ground equipment is commonly used to spray large/tall plants or large areas. Properly adjusted equipment should deliver a uniform spray with nozzle pressures of about 30 to 80 psi and should generate large spray droplets to reduce potential for spray drift. Higher spray pressures produce many small spray particles, which may drift onto sensitive desirable plants adjacent to the treated area. Application is made by directing the spray on the target foliage, being sure to spray the growing tips and terminal leader. Techniques must be employed to prevent the spray from contacting foliage of desirable plants.

Commonly used power equipment consists of portable power driven spray units mounted on a truck or all-terrain vehicle. A wide variety of pumps, tanks, and accessories are used. The most common and maintenance-free pump is a diaphragm pump driven by a gasoline engine, or a self-contained 12-volt pump unit. Routinely used spray guns are Spraying Systems Model 2 and 2A Gunjets. These are adjustable spray guns which produce patterns ranging from a solid stream to a wide cone spray. These spray guns may produce small spray particles at the cone spray setting, resulting in spray drift. Also, a Model 30 Gunjet with a Tee-Jet 5500-X10 adjustable tip is very effective for power sprayers. Dual spray Gunjets that accommodate two flat spray tips with different volumes and patterns are available. The spray gun can immediately be switched from one spray tip to the other by rotating the spray head. The two most commonly used spray tips for the spray gun are TP 0512, TP 4010 or TP 4020. These tips produce few fine spray particles so spray drift potential is reduced.

Basal bark applications. Herbicide is applied, commonly with a backpack sprayer, directly to the bark around the circumference of each stem/tree up to 15 inches above the ground. The herbicide must be in an oil-soluble formulation (EC) and if not in a ready-to-use form it may be mixed with a specially formulated penetrating oil. The spray tip should be a narrow angle (15-25 degrees) flat fan-tip nozzle such as a TP 1502 or TP 1503 or TP 2502/TP 2503, a solid cone nozzle, or an adjustable conejet such as a Tee-Jet 5500-X4 or 5500-X5 or equivalent. Any of these tips may be installed in the spray wand that

comes with the spray unit. A good alternative is a brass tip shut-off wand such as a Spraying Systems Model 31 with brass extension and tip shut-off or a Spraying Systems Model 30 Gunjet. A TP-0001/TP-0002 tip or DE-1/DE-2 disc should be used with the Model 30 Gunjet. The Gunjet may be attached to most backpack spray units that produce pressures between 20 and 50 psi. All backpack sprayers and spray guns should have chemical resistant seals for the herbicides and carriers being used.

Frill or girdle (sometimes called hack-and-squirt) applications. Cuts into the cambium are made completely around the circumference of the tree with no more than 3-inch intervals between cut edges. Continuous cuts (girdle) are sometimes used for difficult-to-control species and large trees. Do not make multiple cuts directly above or below each other because this will inhibit movement of the herbicide. Incisions should be angled downward to hold herbicide and must be deep enough to penetrate the bark and cambium layer. Herbicide (concentrated or diluted) is applied to each cut until the exposed area is thoroughly wet. Frill or girdle treatments are slow and labor intensive but sometimes necessary in mixed communities to kill target vegetation and minimize impact to desirable vegetation. To further minimize potential impact to desirable vegetation, cuts can be wrapped with tape to prevent rainfall from washing herbicide to the soil. Water- or oil-soluble formulations can be used for frill or girdle applications.

Backpack sprayers such as described above or 1- to 2-gallon pump-up sprayers can be suitable for frill or girdle herbicide mixtures as long as they contain chemically resistant seals such as Viton. Hand-held, chemical resistant spray bottles, such as the 1-quart Delta Industries "Spraymaster" are commonly used for applying herbicide for frill and girdle applications.

Stump treatments. After cutting and removing large trees or brush, herbicide (concentrated or diluted) is sprayed or painted on to the cut surface. The cut surface should be as level as possible so that herbicide solution does not run off. Sweep off dirt and sawdust that may prevent the herbicide solution from being taken up by the stump. The herbicide is usually concentrated on the cambium layer on large stumps, especially when using concentrated herbicide solutions. The cambium is next to the bark around the entire circumference of the stump. When using dilute solutions the entire stump is sometimes flooded (depending on label instructions) with herbicide solution. Water- or oil-soluble formulations can be used. Spray equipment previously described can be used as long as they contain chemical resistant seals for the herbicides and carriers being used. Best results are obtained if the herbicide is applied immediately after cutting and with no more than one hour between cutting and applying herbicide, especially when using a water-soluble formulation (seconds can count with less susceptible species). Oil-soluble formulations can be effective when applied after some time has passed and should then be applied to the bark as well. The procedure must ensure that cut stems, branches, or seeds do not take root and produce additional plants.

Soil applications. Granular herbicide formulations can be applied by hand held spreaders, by specially designed blowers, or aerially. Soil-applied water-soluble or water-dispersible formulations can be applied with the same type of application equipment described for foliar applications or spotguns that can accurately deliver a measured amount of herbicide.

Marker Dyes. Marker dyes are very useful for keeping track of what vegetation has been treated when making applications to large numbers of individual trees or stumps. Dyes are also a useful indicator of the applicator's efficiency of limiting herbicide contact with nontarget vegetation and personal contact.

Methods Currently Used by Land Managers in Florida

Control methods being used for invasive non-native plants by land managers in Florida are listed in Table 4. All methods listed have been found effective under certain circumstances. However, many factors can affect the performance of a herbicide application and results can vary. Choice of application method, herbicide, and rate for individual

species depend on environmental conditions and personal experience. Experience has shown that treatment success may vary from site to site and on the same site.

Pesticide product labeling is the primary method of communication between a herbicide manufacturer and the herbicide users and provides instructions on how to use the product safely and correctly. Changes in herbicide label directions may occur that are not concurrently updated in this publication. Because pesticide users are required by law to comply with all the instructions and directions for use contained in the pesticide label, no herbicide applications should be made based solely on information presented in this publication. **Pesticide users must review and comply with all conditions set forth in the pesticide label.**

Table 1. Herbicides commonly used in natural areas of Florida. (Alphabetical by active ingredient. All concentrations are a.i.)

PRODUCT	FORMULATION	COMMENTS
Several	2,4-D various	Some products can be applied directly to water.
Fusilade	Fluazifop 24.5% EC	Post emergence, grass specific. Cannot be applied directly to water.
Rodeo, Aquamaster, Aquaneat, Eagre, AquaPro, GlyPro, Accord	Glyphosate 53.8% L	Can be applied directly to water.
Roundup Pro, Roundup Super Concentrate, Credit, Glyphos, GloPro Plus, Rattler, Honcho, Touchdown Pro, Dupont Glyphosate, Roundup Pro Dry, Gly Gran	Glyphosate 41.0% L	May be applied to ditch banks, dry ditches, dry canals. May not be applied directly to water.
Velpar L	Hexazinone 25% L	May cause ground-water contamination if applied to areas where soils are permeable, especially where the water table is shallow. Nontarget plants can be damaged by root absorption.
Velpar ULW	Hexazinone 75% ULW	Same comments as Velpar L.
Arsenal	Imazapyr 28.7% L	May be applied to non-irrigation ditches and low lying areas when water has drained but may be isolated in pockets due to uneven or unlevel conditions. Otherwise, may not be applied directly to water. May be applied by government agencies or their contractors in Florida, under SLN, by injection, frill and girdle, or cut stump to melaleuca and Brazilian pepper when growing in water. Nontarget plants can be damaged by root absorption.
Stalker	Imazapyr 28.7% L	Can be applied to non-irrigation ditch banks. Nontarget plants can be damaged by root absorption.
Brush-B-Gon	Triclopyr amine 8.0% L	Homeowner packaging readily available in retail stores. Lower concentration than Garlon 3A may require follow-up applications.
Brush Killer	Triclopyr amine 8.8% L	Homeowner packaging readily available in retail stores. Lower concentration than Garlon 3A may require follow-up applications.
Garlon 3A	Triclopyr amine 44.4% L	May be applied to non-irrigation ditch banks, seasonally dry wetlands, flood plains, deltas, marshes, swamps, bogs, and transitional areas between upland and lowland sites. May not be applied directly to water.

Table 1. Herbicides commonly used in natural areas of Florida. (Alphabetical by active ingredient. All concentrations are a.i.)

PRODUCT	FORMULATION	COMMENTS
Garlon 4	Triclopyr ester 61.6% L	Same comments as Garlon 3A.
Pathfinder II	Triclopyr ester 13.6% L	Same comments as Garlon 3A. Ready to use.

Table 2. Soil behavior of herbicides commonly used in natural areas of Florida.

	HALF-LIFE (DAYS)	MOBILITY IN SOIL	ABSORPTION BY PLANT ROOTS
Glyphosate	~47	Little	Negligible
Fluazifop	15	Little	Negligible
Triclopyr	10-46	Moderate	Slight
2,4-D amine	10	Moderate	Slight
Imazapyr	25-142	Mobile	Strong
Hexazinone	~90	Mobile	Strong

Table 3. Toxicity of herbicides commonly used in natural areas of Florida.

	BOBWHITE QUAIL 8-DAY DIETARY LC_{50} *	LABORATORY RAT 96-HR ORAL LD_{50} **	BLUEGILL SUNFISH 96-HR LC_{50} *
2,4-D amine	>5,620	>1000	524
Fluazifop	>4659 (5-day)	2721 (Female)	0.53
Triclopyr amine	>10,000	2574	891
Triclopyr ester	9,026	1581	0.87
Imazapyr	> 5,000	>5000	>100
Glyphosate	> 4,640	>5000	120
Hexazinone	>10,000	1690	420

*LC_{50} is the concentration in food (mg/kg) or water (mg/l) required to kill 50% of the population of test animals.
**LD_{50} is the quantity of herbicide in food that is lethal to 50% of test animals expressed as mg of herbicide per kg body wt.

Table 4. Control methods for non-native plants in use by land managers in Florida.

The development and testing of many of these techniques was made possible through the Post-Hurricane Natural Areas Recovery Program supported by the Knight Foundation and a Florida state legislative appropriation to the Metro-Dade Park and Recreation Department. The following individuals contributed to recommendations listed in this table: Rodell Collins, Laura Flynn, Roger Hammer, Dallas Hazelton, Linda McDonald, Laurie McHargue, Jose Prieto, Robert Stewart, Sandra Vardaman Wells - Metro-Dade Park and Recreation Department; Jim Duquesnel, Mark Ludlow, Greg Jubinsky - Florida Department of Environmental Protection; Doria Gordon - The Nature Conservancy; Brian Nelson - Southwest Florida Water Management District; Wayne Corbin, Johnny Drew, Shawn Moore, Jerry Glance - St. Johns River Water Management District; Ross Hakes, Monsanto; Joe Visaggio, American Cyanamid; Bill Kline, DowElanco; Doug DeVries - National Park Service; Alison Fox, Ken Langeland, Jeff Mullahey, Donn Shilling, Brian Smith - University of Florida Institute of Food and Agricultural Sciences. Deborah Shelley, Jim Burney **NOTE!** All dilutions of Garlon 4 applications (except foliar) are made with oil. All dilutions of Arsenal, Garlon 3A, Rodeo, Roundup Pro, or Roundup Super Concentrate are made with water.	
AGAVACEAE	
Sansevieria hyacinthoides	Bowstring hemp, Mother-in-law's tongue
Treatment:	Foliar apply 5%-10% Garlon 4 in oil or water. Addition of 3% stalker may increase consistency where non-target vegetation will not be endangered. In sandy soils where a greater potential exists for non-target damage plants can be cut and 15%-25% Roundup applied to the cut surfaces.
Comments:	Plants often take six to twelve months to die and follow-up applications are necessary.
ANACARDIACEAE (Cashew Family)	
Schinus terebinthifolius	Brazilian pepper; Florida holly
Treatment:	Cut-stump treatment with 50% Garlon 3A, 10% Garlon 4 or a basal bark application of 10% Garlon 4. Foliar application of Garlon 4, Garlon 3A, Roundup Pro, Rounup Super Concentrate, or Rodeo, according label directions may be used where appropriate. Glyphosate products are less effective when used alone in spring and early summer. Use Rodeo or cut stump application of 50% Arsenal where plants are growing in aquatic sites.
Comments:	Dioecious; female trees produce enormous quantities of bird-dispersed fruit; seed germinate readily; some people experience allergic reactions to the sap; target only female trees if time, funds or herbicide limitations are a factor.
APOCYNACEAE (Oleander Family)	
Alstonia macrophylla ***Alstonia scholaris***	Devil tree Scholar tree
Treatment:	Basal bark application of 10% Garlon 4 or cut stump application of 50% Garlon 3A.
Comments:	Both species Invade hammocks, pinelands and disturbed sites; leaves are reportedly toxic to eat; *A. macrophylla* is becoming widespread in Dade county.
Ochrosia elliptica	Ochrosia; Kopsia
Treatment:	Cut-stump treatment with 50% Garlon 3A.
Comments:	Fruits are bright red, paired and reportedly poisonous to eat; often used in coastal landscaping.

Table 4. Control methods for non-native plants in use by land managers in Florida.

ARACEAE (Arum Family)	
Colocasia esculenta	Wild Taro
Treatment:	Foliar application of 1% Weedar 64 (3lb a.e./gal 2,4-D amine) + 1% Rodeo + 0.5% 1% Kammo (D-limonene) + silicone surfactant.
Comments:	Usually found in aquatic habitats so only herbicides labeled for aquatic sites can be used. Large corms make control very difficult and repeat applications will be necessary.
Syngonium podophyllum	Nephthytis
Treatment:	Hand pull vegetation, remove from site, spray resprouts with 3% Roundup or apply 10% Garlon 4 to stems. Foliar appliction of 3% Garlon 4 in water with surfactant has also acheived reasonable success. Multiple treatments are required.
Comments:	Breaks readily when pulled; roots from nodes; difficult to control; sap is a skin, mouth, and eye irritant; only spreads vegetatively; many populations are the result of discarded landscape material.
Epipremnum pinnatum cv. ***'aureum'***	
Treatment:	Hand pull vegetation, remove from site or place in plastic in plastic bags and leave on-site until decomposed. After it has resprouted from broken stems, treat with 3% Roundup and surfactant. If non-target damage is not a concern, 3% roundup is very effective on large intact patches. Repeated cuttings of climbing vines 4-6' above ground and removal of the lower portion.
Comment:	Roots at nodes; sap is skin, mouth, and eye irritant; may form extensive groundcover; leaves enlarge considerably when plants climb trees or other support; spreads vegetatively, apparently does not set seed in Florida.
ARALIACEAE (Aralia Family)	
Schefflera actinophylla	Queensland umbrella; Umbrella tree
Treatment:	Large individuals (>10 inches dbh) have proven extremely difficult to eradicate. A cut-stump treatment with 50% Garlon 3A or 10% Garlon 4 is recommended. If a cut-stump treatment is not possible, application of a wide band of 10% Garlon 4 may be used on smaller individuals and 20% Garlon 4 may be used on larger individuals. It may take up to 9 months to kill large trees.
Comments:	Grows terrestrially or as an epiphyte; invasive in hammocks, particularly wet, rocky sites; bird-dispersed fruits.
ARECACEAE (Palm Family)	
Caryota mitis	Fishtail palm (clumping species)
Caryota urens	Fishtail palm (solitary-trunked species)
Treatment:	Cut palm below growing point and treat with 50% Garlon 3A or 10% Garlon 4. Alternatively, Garlon 4 can be applied to the apical bud.
Comments:	Unlike any other palm genus, the leaves are twice compound; on multiple-trunked (clumping) species, when one trunk is cut the plant will resprout; fruits abundantly and is a common invasive plant in hammocks; fruit and sap are a skin, mouth, and eye irritant.
Chamaedorea seifrizii	Bamboo palm
Treatment:	Treat as fishtail palm, above.
Comments:	Pinnate-leaved, narrow-trunked, clustering species; invades hammocks.

Table 4. Control methods for non-native plants in use by land managers in Florida.

Livistona chinensis	Chinese fan palm
Treatment:	Hand pull seedlings; cut young specimens at ground level or spray Garlon 4 into the apical bud.
Comments:	Costapalmate leaves; green, curved, sharp spines along petiole; can be mistaken for *Sabal* and *Thrinax* species, but neither of the latter have spines on the petioles; differs from *Washingtonia* by having green, not brown, spines and lacking threadlike fiber on the leaves.
Phoenix reclinata	Senegal date palm
Treatment:	Cut stems near ground level and treat with 50% Garlon 3A or 10% Garlon 4 or apply 10% Garlon 4 to meristem.
Comments:	Common non-native palm in hammocks, especially near coast; pinnate leaves with straight, sharp spines on petiole.
Ptychosperma elegans	Solitaire palm
Treatment:	Hand pull seedlings; cut mature trees down at ground level; remove fruiting stems from site.
Comments:	Pinnate leaves, solitary trunk; commonly invades hammocks; high seed germination; fruit dispersed by birds, raccoons and opossums; very common in the landscape.
Roystonea regia	Royal palm
Treatment:	Hand pull seedlings; chainsaw mature trees down near the base.
Comments:	Commonly escapes into hammocks from landscape trees; best controlled in the seedling stage; Florida royal palm, *Roystonea elata* is similar and some taxonomists lump these two species together as synonyms; royal palms should only be treated as exotics if it is known that they are invading areas outside of their native Florida range; Florida royal palm still occurs as a wild plant in Everglades National park (Royal Palm Hammock), Fakahatchee Strand State Preserve, and Royal Palm Hammock in Collier Seminole State Park in Collier County.
Syagrus romanzoffianum (=*Arecastrum romanzoffianum*)	Queen palm
Treatment:	Treat the same as Royal palm, above.
Comments:	Pinnate leaves, single trunk; common in the landscape; invasive in hammocks.
Washingtonia robusta	Mexican fan palm, Washingtonia palm
Treatment:	Hand pull seedlings; cut young specimens at ground level or spray Garlon 4 into apical bud. Large, mature trees in natural areas will need to be cut down.
Comments:	Palmate leaves with brown, curved, sharp spines along the petioles; mature trees may retain dead leaves along the trunk; leaves characteristically have brown, threadlike fibers attached; can be mistaken for Chinese fan palm, *Livistona chinensis*, but the latter has green petiole spines and costapalmate leaves; invades pinelands and disturbed sites.
ASTERACEAE (Aster Family)	
Wedelia trilobata	Wedelia; Dune sunflower
Treatment:	Treat small patches with 2% Roundup; large, dense populations may be treated by broadcast-spraying 5% Roundup (with follow-up treatments as needed). Or 1/4-1.0% Garlon 4 in water.

Table 4. Control methods for non-native plants in use by land managers in Florida.

Comments:	Trailing species, forming dense groundcover; yellow, daisy-like flowers produced all year; invades a variety of open, sunny habitats, including beaches; often becomes established from discarded landscape material.
BERBERIDACEAE (Barberry family)	
Nandina domestica	Nandina, Heavenly bamboo
Treatment:	Basal bark application of 15% Garlon 4 in mineral oil. Collect and destroy attached fruits.
Comments:	Naturalized in Gadsden, Jackson, Leon, Wakulla, and perhaps other Counties.
CACTACEAE (Cactus Family)	
Hylocereus undatus (=Cereus undatus	Night-blooming cereus
Treatment:	Hand pull and remove from site if possible; if removal is not feasible, lay the plants out on a plastic tarp and spray them with 10% Garlon 4; 15% Roundup has been successful but it takes much longer for the plants to die.
Comments:	Vining cactus that climbs and roots to tree trunks; sometimes epiphytic; very showy, fragrant flowers open at night in summertime.
CAPRIFOLIACEAE	
Lonicera japonica	Japanese honeysuckle
Treatment:	Foliar application of 3%-5% Garlon 3A or 1%-3% Roundup Pro or equivalent concentration of other glyphosate containing product.
Comments:	Twining or trailing woody vine with young stems pubescent. Interrupts succession in once-forested areas by overtopping and smothering young trees, preventing their recruitment to the overstory and can disrupt understory structure in mature forests. May be confused with native honeysuckle, *Lonicera sempervirens*, leaves and stems of which are not hairy and flowers red with yellow within.
CASUARINACEAE (Beefwood Family)	
Casuarina equisetifolia	Australian pine
Casuarina glauca	Beefwood, Brazilian oak
Treatment:	Basal bark treatment with 10% Garlon 4 is very effective, as is a cut-stump treatment with 50% Garlon 3A or 10% Garlon 4. When basal bark treatment is used on trees greater than 1 foot in diameter it may be necessary to slough off loose bark in the application area to prevent the bark from trapping the herbicide. Addition of 3% Stalker will increase consistency on older trees. Broadcut of 4-6 lb Velpar ULW may be used when appropriate.
Comments:	*C. equisetifolia* has a single trunk and produces viable seeds which are wind- and bird-dispersed; *C. glauca* produces suckers at the base of the trunk, rarely sets seed in Florida, and has a weeping growth habit.
CLUSIACEAE (Pitch-apple Family)	
Calophyllum antillanum (=*C. Calaba; C. brasiliense* var. *antillanum*)	Brazilian beauty-leaf
Treatment:	Basal bark treatment with 10% Garlon 4. Follow-up herbicide applications may be necessary.
Comments:	Medium-sized tree with glossy, leathery leaves; has been found principally invading coastal areas, including mangrove fringe.

Table 4. Control methods for non-native plants in use by land managers in Florida.

COMBRETACEAE (Combretum Family)	
Terminalia arjuna	Arjun tree
Terminalia catappa	Indian almond
Terminalia muelleri	Mueller's almond
Treatment:	Basal bark application of 10% Garlon 4 or cut-stump treatment with 50% Garlon 3A.
Comments:	The Indian almond is deciduous and invades coastal habitats, hammocks, and disturbed sites; Arjun tree and Mueller's almond invade hammock interiors and margins.
COMMELINACEAE (Spiderwort Family)	
Tradescantia spathacea (=Rhoeo spathacea)	Oyster plant
Treatment:	Hand pull and remove from site.
Comments:	Succulent with sword-shaped rosettes of leaves, green on upper surface, bright purple on lower surface; highly invasive, forming extensive colonies.
CONVOLVULACEAE (Morning-glory Family)	
Merremia tuberosa	Wood rose
Treatment:	Cut stem at ground level and treat with 50% Garlon 3A or 10% Garlon 4. A basal bark treatment with 10% Garlon 4 also works. The cut-stem treatment is preferred because it is evident within one week which stems were treated and which were missed.
Comments:	Individual plants can cover extensive areas; rarely roots at nodes; bright yellow morning-glory-like flowers produced in late fall, fruits profusely in early winter; later December and early January die backs occur; seeds germinate readily.
CRASSULACEAE (Orpine Family)	
Kalanchoe pinnata	Life plant, Live leaf
Treatment:	Hand pull or treat with direct application of 3% Roundup and surfactant. Roundup is an effective treatment because it kills individual leaves that otherwise may produce new plants along leaf margins. Follow-up hand removal of leaves is necessary to prevent leaves from producing new plants. Basal stem treatments with 10% Garlon 4 is **NOT** recommended. This causes the leaves to drop, resulting in hundreds of new plantlets.
Comments:	Often found along edges of natural areas, generally as a result of discarded landscape material.
DIOSCOREACEAE (Yam Family)	
Dioscorea alata	Water yam
Dioscorea bulbifera	Air-potato; Air yam
Dioscorea sansibarensis	West African yam
Treatment:	Cut and remove as much of the vines as possbile and collect bulbils and remove from site. Apply foliar application of 1.25%-2.0% Garlon 3A or 0.5%-2.0% Garlon 4 to remaining vegetation.Several follow-up applications will be necessary through the growing season and perhaps successive years to control growth.

Table 4. Control methods for non-native plants in use by land managers in Florida.

Comments:	Monocot with heart-shaped leaves; dies back to tubers in winter in response to shortened day length, resprouts in spring from tubers; all three species produce aerial bulbils in late summer, early fall.
EBENACEAE (Ebony Family)	
Diospyros digyna (=*D. ebenaster*)	Black sapote
Treatment:	Large individuals are difficult to kill. Applying 50% Garlon 3A to a freshly cut stump is recommended. Basal bark treatments with Garlon 4 does not work.
Comments:	Black bark, shiny alternate leaves; scattered throughout a few hammocks in South Florida; fruits large, edible; green when ripe.
ELAEAGNACEAE (Oleaster family)	
Elaeagnus pungens	Silverthorn
Treatment:	Basal bark application of 15% Garlon 4 in mineral oil.
Comments:	Naturalized and targeted for removal in Florida Caverns State Park (Jackson County).
EUPHORBIACEAE (Spurge Family)	
Aleurites fordii	Tungoil tree
Treatment:	Basal bark applications with 20% Garlon 4.
Comments:	Found mainly in northern counties to Citrus County.
Bischofia javanica	Bishopwood; toog
Treatment:	Basal bark treatment with 10% Garlon 4 is effective. Large trees require applying a wider band of herbicide on the trunk, or increasing the concentration of Garlon 4 to 20%.
Comments:	Dioecious; compound leaves with three large leaflets; herbicide treatment may cause adventitious roots to form along trunk; female trees produce massive numbers of bird-dispersed fruits that hang in grape-like clusters; target only female trees if time, funds, or herbicide limitations are a factor.
Ricinus communis	Castor bean
Treatment:	Basal bark or cut-stump treatment with 10% Garlon 4. Site must be revisited several times to pull up seedlings.
Comments:	High seed germination: seeds extremely poisonous to eat.
Sapium sebiferum	Chinese tallow, popcorn tree
Treatment:	Cut stump treatment of 20% Garlon 4; or basal bark application of 15% Garlon 4 to trees <10 in dbh or 20% Garlon 4 to trees >10 in dbh (non-aquatic sites only). Addition of 3% Stalker will reduce resprouting on older trees. Experimental cut stump and frill applications of 2-3% Arsenal have proven effective in aquatic sites and an application has been made to add to the label. Low volume foliar application with 0.5%-0.75% Arsenal can be used where appropriate.
Comments:	Use basal bark method when seeds are present on tree to reduce seed spread, apply to run-off. Seedlings up to 10 in tall can be hand pulled.
FABACEAE (Pea Family)	
Abrus precatorius	Rosary pea
Treatment:	Treat base of vine with 10% Garlon 4. Site must be revisited several times to pull seedlings.

Table 4. Control methods for non-native plants in use by land managers in Florida.

Comments:	Seeds black and red, highly poisonous.
Acacia auriculiformis	Earleaf acacia
Treatment:	Basal bark application of 10% Garlon 4 or cut-stump treatment with 50% Garlon 3A. Addition of 3% Stalker will increase consistency.
Comments:	A frequent invader of pinelands and disturbed sites.
Adenanthera pavonina	Red sandalwood
Treatment:	Basal bark treatment with 10% Garlon 4. Cut-stump treatments are also effective with 50% Garlon 3A or 10% Garlon 4. Small seedlings can be hand-pulled.
Comments:	Can be easily confused with *Albizia lebbeck*, which has larger leaflets; bark of red sandalwood is typically reddish; produces hard red seeds which seem to persist in soil.
Albizia lebbeck	Woman's tongue; Rattle pod
Treatment:	Basal bark treatment with 10% Garlon 4. Cut stump treatments are also effective with 50% Garlon 3A or 10% Garlon 4. Small seedlings can be hand-pulled.
Comments:	Large, dry, brown pods with few large seeds, mature principally in winter; common in pinelands and hammocks.
Albizia julibrissin	Mimosa
Treatment:	Basal bark application of 15% Garlon 4.
Comments:	Apply to 1-2 ft of trunk on larger trees. Trees >3 in dbh may require retreatment.
Bauhinia forficata	Spiny orchid tree
Bauhinia purpurea	Orchid tree
Bauhinia variegata	Orchid tree
Treatment:	Basal bark application of 10% Garlon 4 or application of 50% Garlon 3A to cut stump.
Comments:	All three species invade disturbed sites and the edges of natural areas in Dade County.
Dalbergia sissoo	Indian rosewood
Treatment:	Basal bark treatment with 10% Garlon 4.
Comments:	Medium to large tree with compound leaves bearing 3 to 5 leaflets; papery seed pods wind-dispersed; invasive along hammock margin, canopy gaps and disturbed sites.
Delonix regia	Royal poinciana
Treatment:	Cut stump application of 50% Garlon 3A.
Comments:	Large spreading tree with bi-pinnately compound leaves; very popular flowering tree in the landscape; invades hammock margin, canopy gaps and disturbed sites; seeds commonly sprout beneath parent trees.
Leucaena leucocephala	Lead tree, jumble bean
Treatment:	Difficult to control and variable results have been reported. Basal bark or cut-stem treatment with 10%-20% Garlon 4 has been reported to be effective while others report only partial success with 40% Garlon 4. 25% has been effective on trees <3" DBH, while larger trees were not killed. Large trees must be completely girdled for frill/girdle applications.

Table 4. Control methods for non-native plants in use by land managers in Florida.

Comments:	Usually found on edges of natural areas; can be mistaken for native wild tamarind, *Lysiloma latisiliquum*. A larger band of Garlon 4 is applied to larger trees or those growing in sandy soils.
Mimosa pigra (=*M. pelita*)	Catclaw mimosa
Treatment:	Basal bark or cut stump application of Pathfinder or 30%-50% Garlon 4 and oil. Repeat foliar applications of 1.5% Rodeo or 2%-3% Garlon 3A.
Comments:	Repeated site visits are necessary to control seedlings and prevent further seed production. An estimated ten years are estimated to be needed for seed bank eradication.
Mucuna pruriens	Cow itch
Treatment:	Basal bark application of 10% Garlon 4, or hand pull mature vines and seedlings; does not resprout from roots. It is important to continue pulling seedlings until seed bank is exhausted.
Comments:	Hairs on seed pods cause intense itching.
Pueraria montana (=*P. lobata*)	Kudzu
	When actively growing at or beyond bloom stage of growth apply 2% Roundup Pro (or equivalent) diluted in water with hand held equipment. During early to mid growing season apply 2% Garlon 3A. Use sufficient spray volume to thoroughly wet foliage.
Comments:	Follow up treatments are necessary as resprouting occurs from root crowns and tubers.
Wisteria sinensis	Chinese wisteria
Treatment:	Cut vine and treat stump with 20%-30% Garlon 4 or 100% Garlon 3A.
Comments:	High climbing woody vine with showy lavendar flowers in spring. Can top and kill mature trees. Legume densely, velvety pubescent compared to the native *Wisteria frutescens* with glabrous fruits.
GOODENIACEAE (Goodenia Family)	
Scaevola sericea (=*S. frutescens*; *S. taccada*)	Beach naupaka; Half-flower; Scaevola
Treatment:	Hand pull and remove, at least fruit, from site whenever possible; basal treatment with 10% Garlon 4 or treat cut stump with 50% Garlon 3A or 10% garlon 4 if removal is not feasible. Monocultures can be treated foliarly with 4% Garlon 4 in water, using care not to allow drift to non-target vegetation.
Comments:	Semi-woody shrub with either glabrous or pubescent, somewhat succulent leaves; flowers fan-shaped, white or blushed with purple; fruit are white, which helps distinguish it from the black-fruited, native Inkberry, *Scaevola plumieri*; seeds of the exotic scaevola are carried by ocean currents where they sprout and colonize beaches and other shoreline habitats. Branches in contact with ground may root.
LYGODIACEAE (Climbing fern family)	
Lygodium microphyllum	Old World climbing fern
Treatment:	Thoroughly spray foliage to wet with 1.25% Garlon 4 (4 pt per acre), 0.6% Roundup Pro (maximum 5 pt/acre), 1.0%-3.0% Rodeo (maximum 7 pt per acre). Only Rodeo can be used if plants are growing in aquatic site. Plants growing high into trees cut vines and treat lower portions. Do not apply when plants are under environmental stress.

Table 4. Control methods for non-native plants in use by land managers in Florida.

Comments:	Fern with twining, climbing fronds, leaflets unlobed. The most serious natural area weed in Florida. Land managers should be on constant lookout for it and take immediate steps to control it when encountered.
Lygodium japonicum	Japanese climbing fern
Treatment:	Foliar application of 1.5% Rodeo or equivalent glyphosate containing product at proportional glyphosate concentration.
Comments:	Fern with twining, climbing fronds, leaflets lobed. Occurs throughout west and north Florida into central Florida. Smothers seedlings of overstory tree species.
MALVACEAE (Mallow Family)	
Hibiscus tiliaceus	Sea hibiscus; Mahoe
Treatment:	Hand pull seedlings; basal bark treatment with 10% Garlon 4 or cut stump treatment with 50% Garlon 3A.
Comments:	Multi-trunked, large, spreading tree with long-petioled, rounded cordate leaves, hibiscus-like yellow flowers turn pink or red with age; seeds float and drift to new coastal habitats; erroneously considered native by some people.
Thespesia populnea	Seaside mahoe; Portia tree
Treatment:	Seedlings can be hand pulled. 50% Garlon 3A for cut stump applicaitons. Basal bark applications of 10% Garlon 4 have killed trees <2" DBH after 8 weeks. Larger trees with thick corky bark require up to 25% Garlon 4.
Comments:	Multi-trunked, large, spreading tree; heart-shaped leaves with a pronounced drip-tip; hibiscus-like yellow flowers turn pink or red with age; seeds float and drift to new coastal habitats; erroneously considered native by some people.
MELIACEAE (Mahogany family)	
Melia azedarach	Chinaberry, Pride of India
Treatment:	Basal bark application of 15% to 30% Garlon 4. Treat 1-2 ft of trunk for larger trees. Trees > 3" dbh may require retreatment. Fell trees over 6" DBH and treaat stumps with up to 30% Garlon 4. Addition of 3% Stalker may increase consistency. Apply low volume foliar application of 1% Arsenal covering 50% of the foliage.
Comments:	Often shrubby and root-suckering, forming thickets. Fruits poisonous to humans and some other mammals. Most abundantly found in north and west Florida but often escaping cultivation in peninsular counties, south to the Keys.
MORACEAE (Mulberry Family)	
Broussonetia papyrifera	Paper mulberry
Treatment:	Basal bark application of 10%-30% Garlon 4. Addition of 3% Stalker will increase consistency.
Comments:	Large tree with scabrous leaves and reddish-orange balls of flowers. Invades hammocks and disturbed sites; young trees can be mistaken for the native red mulberry, *Morus rubra*.
Ficus altissima	Lofty fig
Ficus benghalensis	Banyan fig
Ficus microcarpa	Laurel fig

Table 4. Control methods for non-native plants in use by land managers in Florida.

Treatment:	Basal bark application of 10% Garlon 4 is effective.
Comments:	All three species invade the interior and edges of hammocks; often found growing as epiphytes (on trees) or epiliths (on rocks or stone structures); exercise care when treating epiphytic figs to ensure that herbicide does not come in contact with the host tree; members of this genus are very sensitive to Garlon 4; extreme care must be taken when treating any vegetation near the native strangler fig and shortleaf fig; spray that contacts surface roots can kill a large tree.
MYRSINACEAE (Myrsine Family)	
Ardisia elliptica (=*Ardisia solanacea*)	Shoe-button Ardisia
Treatment:	Basal bark treatment with 10% Garlon 4 or cut stump application of 50% Garlon 3A. Hand pull seedlings.
Comments:	Often found in wetter areas; prolific reproduction; closely resembles the native *Ardisia escallonioides* (Marlberry) but differs in that new growth, petioles, and stem tips are pink to red, and fruit are produced in axillary, not terminal, clusters.
Ardisia crenata	Coral ardisia
Treatment:	Foliar application of 5% Garlon 4 or basal bark application of 10% Garlon 4. Thorough coverage is essential for foliar application.
Comments:	Small shrub, easily recognized by bright shiny leaves, with crenate (scalloped) magrins and calluses in the margin notches and persistant bright red (sometimes white) fruits.
MYRTACEAE (Myrtle Family)	
Eugenia uniflora	Surinam cherry
Treatment:	For seedlings and small plants up to 1/2 inch diameter, use a basal bark treatment with 10% Garlon 4. This species takes a long time to die, and may require a subsequent herbicide application. For larger stems, use a cut-stump treatment with either 50% Garlon 3A or 10% Garlon 4. Seedlings should be hand pulled.
Comments:	Looks quite similar to native species of *Eugenia*; leaves have a distinct odor when crushed.
Melaleuca quinquenervia	Cajeput; Punk tree; Melaleuca
Treatment:	For seedlings and saplings: (1) hand pull, being sure not to break plant off of root system and remove or place in piles to help reduce the chance that they will reroot or; (2) Treat with foliar, low volume spot application of 5% Rodeo. For mature trees: (1) Fell large trees with chain saw leaving a level surface, or fell small trees with machete and treat with 20% to 40% Arsenal according to directions on SLN; (2) if trees are to be left standing, make girdle application of 20% to 50% Arsenal or mixture of 25% Arsenal and 25% Rodeo according to frill and girdle directions on Arsenal SLN. Monitor for resprouting and retreat as necessary. (3) Mature trees are very difficult to control with foliar applications. Experimental aerial applications of 3 qt Rodeo + 3 qt Arsenal + 4 qt methylated seed oil surfactant have been somewhat successful. Contact manufacturer representatives when planning such large-scale treatments.
Comments:	Tall, highly invasive tree in freshwater wetlands; thick, papery bark; extremely high seed production; seeds dispersed by wind following natural or mechanical disturbance.

Table 4. Control methods for non-native plants in use by land managers in Florida.

Psidium guajava	Guava
Treatment:	Basal bark application of 10% Garlon 4.
Comments:	Yellow, edible fruits; common invader in disturbed areas, hammock margins and wetlands.
Rhodomyrtus tomentosa	Downy rosemyrtle
Treatment:	Basal bark application of 10%-20% Garlon 4.
Comments:	A very aggressive evergreen shrub to 6 ft tall found as far north as Pasco County on the West Coast. Action should be taken immediately to remove it when found in natural areas. Identified by opposite, simple entire leaves, which are glossy green above, densely soft-hairy below, with three main veins form blade base; round, dark purple fruit with sweet aromatic flesh.
Syzygium cumini	Jambolan plum; Java plum
Syzygium jambos	Rose apple
Treatment:	Cut-stump treatment with 50% Garlon 3A or 10% Garlon 4, or use a basal bark treatment with 10% Garlon 4.
Comments:	Large trees, bird- and mammal-dispersed fruits. Mature trees may take up to 9 months to die.
OLEACEAE (Olive Family)	
Jasminum dichotomum	Gold coast jasmine
Jasminum fluminense	Brazilian jasmine
Treatment:	Individual vines of any size can receive a cut-stump treatment with 50% Garlon 3A or 10% Garlon 4, or a basal bark application of 10% Garlon 4. Because basally-applied Garlon 4 does not translocate beyond a few rooted nodes it is often necessary to pull runners back to the main stem, cut and apply Garlon 3A or Garlon 4 to the cut stem. Re-treatment of areas is usually necessary. Newly emerged seedlings can be hand pulled.
Comments:	Jasmines produce a large number of bird- and mammal-dispersed seeds with very high germination; highly invasive.
Ligustrum lucidum	Glossy privet
Ligustrum sinense	Chinese privet
Treatment:	Basal Bark application of 15% Garlon 4. Apply to 1-2 ft of trunk on larger trees.
	L. sinense widespread in northern Florida mesic woods, road shoulders, and farmlands. Invades logged areas, dispersed by mammals, birds, and floodwaters.
PASSIFLORACEAE (Passion-flower Family)	
Passiflora edulis	Passion-flower
Treatment:	Treat stems with a basal application of 10% Garlon 4 or use 10% Garlon 4 in a cut-stem application.
Comments:	Large attractive flower; fruit purple, edible; invasive in hammocks.
PIPERACEAE (Pepper Family)	
Lepianthes peltata	Lepianthes
Piper aduncum	Bamboo piper
Piper auritum	Makulan

Table 4. Control methods for non-native plants in use by land managers in Florida.

Treatment:	Hand pull when possible (broken roots may resprout); remove entire plant from site; if hand pulling is not possible or feasible, use basal bark application of 20% Garlon 4, or cut stems off at ground level and treat stumps with 50% Garlon 3A; remove cut stems from the site to avoid resprouting from nodes.
Comments:	All three of the above species invade hardwood hammocks, especially margins and canopy gaps.
POACEAE (Grass Family)	
Imperata cylindrica	Cogongrass
Treatment:	3-4 qt. Roundup Pro, 2-3 qt. Arsenal, or 0.5 qt Fusulade per acre. For high volume, spot treatment use 3%-5% Roundup Pro or 0.25%-0.5% Arsenal. Herbicides should be used in combination with burning or tillage for optimum control. See IFAS Publication SS-AGR-52 for additional information.
Comments:	If not controlled, cogongrass will spread along roadways and into pastures, mining areas, forest land, parks, and other recreation areas. Extensive rhizomes must be eliminated for long term control.
Neyraudia reynaudiana	Burma reed
Treatment:	Where non-target damage is not a concern, the entire culm can be sprayed with 1-3% Roundup Pro. In areas with surrounding desirable vegetation, the culms can be cut to ground level and sprayed with 5% Roundup Pro when the plant reaches a height of approximately 12 to 18 inches (cut stems should be removed from the site). Removing seedheads before treatment will reduce need for follow-up.Responds quickly after fire and should be targeted as soon as new growth reaches 12 to 18 inches. Most native plants will not have resprouted from the fire by the time Burma reed has reached this height, and it can be easily treated with little concern about non-target damage.
Comments:	Tall cane grass; extremely invasive in pine rockland habitat and open dry habitats, as well as roadsides, vacant lots and other disturbed sites; fire tolerant.
Panicum repens	Torpedograss
Treatment:	Foliar application of 0.75 - 1.5% Rodeo and surfactant solution. Re-apply as necessary when plants regrow to with 4 - 6 inches in height; or foliar application of 0.5% spot treatment or 4 pints per acre broadcast treatment of Arsenal.
Comments:	Numerous dormant buds associated with extensive rhizomes make this plant extremely difficult to control. Several years of re-application may be necessary to completely eliminate a population.
Pennisetum purpureum	Napier grass
Treatment:	Foliar application of 1%-3% Roundup Pro. If non-target damage is a concern, cut stems to ground level and allow sprouts to reach 8-12 inches and treat the same as *Neyraudia* above. Broadcast 3-5 quart/acre Roundup Pro, 2 quart/acre Arsenal, or 1 quart Arsenal and 2 quart Roundup Pro.
Comments:	Tall cane grass with white stripe down the center of the leaf blade and a foxtail-like inflorescence; prefers wetter substrates.
Phyllostachys aurea	Golden Bamboo

Table 4. Control methods for non-native plants in use by land managers in Florida.

Treatment:	Foliar application of 3% Roundup Pro (equivalent formulations should be effective). Application of 5% Roundup Pro to cut culms will reduce resprouting but results are inconsistent.
Comments:	Not a common problem but once established can spread extensively. Populations should be controlled immediately. Can become established by dumping of yard waste.
RHAMNACEAE (Buckthorn Family)	
Colubrina asiatica	Latherleaf; Asian colubrina
Treatment:	Basal bark application of 20% Garlon 4, cut-stump treatment with 50% Garlon 3A, or foliar application with 3% Garlon 3A or Garlon 4 in water with surfactant. Follow up for 3 to 4 weeks Hand pull seedlings.
Comments:	Sprawling shrub commonly invading coastal habitats; has become a serious pest plant in mangrove/buttonwood habitat and in coastal hardwood forests. Capsules spread by tides and currents. Seeds resemble small pebbles and may be used as crop stones by seed eating birds, such as doves, and dispersed.
ROSACEAE (Rose Family)	
Rubus albescens	Mysore raspberry
Treatment:	Cut stem near ground and spray with 50% Garlon 3A or 10% Garlon 4. This species has not been observed resprouting from cut stem segments lying on the ground.
Comments:	Sharp thorns on stems and leaves; arching stems and branches of intact plants root where they touch the ground; seeds bird and mammal dispersed.
Eriobotrya japonica	Loquat
Treatment:	Tree can be cut-stump treated with 50% Garlon 3A or Garlon 4 or with a basal bark application of 10% Garlon 4.
Comments:	Invasive in hammocks; commonly cultivated for its yellow, fuzzy, edible fruit; seeds spread into natural areas by mammals; exotic, free-flying parrots are known to feed on the fruit as well, and may also be vectors of seeds.
RUBIACEAE (Madder Family)	
Paederia cruddasiana	Sewer vine; skunk vine; Chinese fever vine
Treatment:	Low volume foliar applications of 3% RoundupPro where non-target damage is not a concern. Where there are desirable plants, basal bark applications of 10% Garlon 4. Within 2-4 weeks retreat the area with basal applications of 10% Garlon 4. This second treatment can be time-consuming because many underground runners sprout. The area should continue to be monitored for follow-up treatments.
Comments:	Climbing vine; related to *Paederia foetida*, which is established in central Florida; flowers profusely; produces viable seeds.
Paederia foedida	Skunk vine
Treatment:	Apply 0.5% Garlon 3A to thoroughly wet foliage (4-8 pt.acre) or 10% to 6-inch band chest high to foliage of vertically climbing vines. Or apply 0.2%-0.6% Garlon 4 to thoroughly wet foliage or 1.0%-10% to 6 to 20-inch band chest high. Or thoroughly wet foliage with 1.0%-1.5% Plateau. Homeowners can use Brush-B-Gon at maximum label rates.

Table 4. Control methods for non-native plants in use by land managers in Florida.

Comments:	Perennial twining vine from woody rootstock having leaves and stems with disagreeable odor, especially when crushed. Most common in west central Florida, documented northward to Gadsen County and southward to Broward County.
Paederia foetida	Skunk vine
Treatment:	Limited information available. Foliar application of 3% (4 oz/gal) Brush-B-Gone or 1-2% Roundup has been effective. Preliminary data suggests successful control with fire when invading a pyric community.
Comments:	Extremely aggressive, draping, foul smelling vine. Common in West Central Florida and expanding its range.
RUTACEAE (Rue Family)	
Murraya paniculata	Orange jessamine
Treatment:	Hand pull seedlings; basal bark treatment with 10% Garlon 4.
Comments:	Shrub or small tree with small, glossy, compound leaves that are fragrant when crushed; white, citrus-like, heavily perfumed flowers produced in summertime; small orange fruit are bird-dispersed; invasive in hammocks, especially when bordered by residential areas that use this plant in the landscape.
SAPINDACEAE (Soapberry Family)	
Cupaniopsis anacardioides	Carrotwood
Treatment:	Basal bark application of 100% Pathfinder II, or 10%-20% Garlon 4 diluted with oil; or cut stump application of 10% Garlon 3A, 100% Brush-B-Gon, 100% Roundup Pro, 100% Rodeo, or equivalent glyphosate containing product, or 100% Pathfinder II.
Comments:	Invades interior of hammocks; added to Florida Noxious List in 1999; bird dispersed. Note label restrictions with respect to high tide mark and use extra caution near mangroves.
SAPOTACEAE (Sapodilla Family)	
Manilkara zapota	Sapodilla
Treatment:	Hand pull seedlings; basal bark application of 10% Garlon 4, larger trees may require several applications or increasing the Garlon 4 to 20%; or cut stump application with 50% Garlon 3A.
Comments:	Large, spreading tree; edible fruit; seeds dispersed by raccoons and opossums; invades hammock interiors.
Pouteria campechiana	Egg fruit; Canistel
Treatment:	Hand pull seedlings; basal bark application of 10% Garlon 4.
Comments:	Small to medium tree; yellow, edible fruit; prolific invader of hammocks but local in distribution; fruit eaten by raccoons and opossums.
SOLANACEAE (Nightshade Family)	
Cestrum diurnum	Day jessamine
Treatment:	Hand pull when possible (if soil disturbance is not an issue); cut stump treatment with 50% Garlon 3A is effective.
Comments:	Shrub or small tree with small, tubular, very fragrant flowers (in daytime) small purple fruit dispersed by birds.
Solanum tampicense	Wetland nightshade, misleadingly called aquatic soda apple

Table 4. Control methods for non-native plants in use by land managers in Florida.

	Treatment:	Preliminary research results suggest foliar applications of 1.5% Garlon 3A is most effective while similar application rates of Rodeo or Weedar 64 may be somewhat less effective. Aggressive follow-up treatments will probably be necessary to control seedlings.
	Comments:	An aggressive invader of wetlands and floodplains. Should be eliminated whenever located.
Solanum viarum		Tropical soda apple
	Treatment:	Foliar application of 1% Garlon 4, 3% Roundup or 0.5% Arsenal solution in water with surfactant.
	Comments:	Destroy fruit and treat plants immediately after detection. Spreads extremely fast. Livestock and wild animals eat fruits and readily disperse seed. For additional information see IFAS publication SS-AGR-58.
VERBENACEAE (Verbena Family)		
Lantana camara		Shrub verbena; Lantana
	Treatment:	Basal application with 10% Garlon 4 or cut stump treatment with 50% Garlon 3A or 10% Garlon 4.
	Comments:	Shrub with prickly stems and branches; multi-colored flower heads; ripe fruit blue; green unripe fruit highly toxic if eaten; this exotic species should be controlled to help avoid hybridization with the endemic *Lantana depressa*; typically a plant of roadsides and other disturbed sites but also invades pineland as well as hammock margins; numerous cultivars exist in the nursery trade.

Index of Common Names.

Index of Common Names.

COMMON NAME	REFER TO PLANT FAMILY
Bowstring hemp	Agavaceae
Brazilian beauty-leaf	Clusiaceae
Brazilian jasmine	Oleaceae
Brazilian oak	Casuarinaceae
Brazilian pepper	Anacardiaceae
Burma reed	Poaceae
Cajeput	Myrtaceae
Canistel	Sapotaceae
Carrotwood	Sapindaceae
Castor bean	Euphorbiaceae
Catclaw mimosa	Fabaceae
Chinaberry	Meliaceae
Chinese fan palm	Arecaceae
Chinese privet	Oleaceae
Chinese tallow	Euphorbiaceae
Chinese wisteria	Fabaceae
Cogongrass	Poaceae
Coral ardisia	Myrsinaceae
Cow itch	Fabaceae
Day jessamine	Solanaceae
Devil tree	Apocynaceae
Downy rosemyrtle	Myrtaceae
Dune sunflower	Asteraceae
Earleaf acacia	Fabaceae
Egg fruit	Sapotaceae
Ficus	Moraceae
Fishtail palm	Arecaceae
Florida holly	Anacardiaceae
Glossy privet	Oleaceae

Index of Common Names.

COMMON NAME	REFER TO PLANT FAMILY
Gold coast jasmine	Oleaceae
Golden bamboo	Poaceae
Guava	Myrtaceae
Half-flower	Goodeniaceae
Heavenly bamboo	Berberidaceae
Hunter's robe	Araceae
Indian almond	Combretaceae
Indian rosewood	Fabaceae
Jambolan plum	Myrtaceae
Japanese climbing fern	Lygodiaceae
Japanese honeysuckle	Caprifoliaceae
Jasmine	Oleaceae
Java plum	Myrtaceae
Kopsia	Apocynaceae
Lantana	Verbenaceae
Latherleaf	Rhamnaceae
Laurel fig	Moraceae
Lead-tree	Fabaceae
Lepianthes	Piperaceae
Life plant	Crassulaceae
Live leaf	Crassulaceae
Lofty fig	Moraceae
Loquat	Rosaceae
Mahoe	Malvaceae
Makulan	Piperaceae
Melaleuca	Myrtaceae
Mexican fan palm	Arecaceae
Mimosa	Fabaceae
Mother-in-law's tongue	Agavaceae

Index of Common Names.

Index of Common Names.

COMMON NAME	REFER TO PLANT FAMILY
Sapodilla	Sapotaceae
Scaevola	Goodeniaceae
Schefflera	Araliaceae
Scholar tree	Apocynaceae
Sea hibiscus	Malvaceae
Seaside mahoe	Malvaceae
Senegal date palm	Arecaceae
Sewer vine	Rubiaceae
Shoebutton ardisia	Myrsinaceae
Silverthorn	Elaeagnaceae
Skunk vine	Rubiaceae
Solitaire palm	Arecaceae
Surinam cherry	Myrtaceae
Toog	Euphorbiaceae
Torpedograss	Poaceae
Tropical soda apple	Solanaceae
Tungoil tree	Euphorbiaceae
Umbrella tree	Araliaceae
Washingtonia palm	Arecaceae
Water yam	Dioscoreaceae
Wedelia	Asteraceae
West African yam	Dioscoreaceae
Wild taro	Araceae
Woman's tongue	Fabaceae
Wood rose	Convolvulaceae

Index of Botanical Names.

GENUS NAME	REFER TO PLANT FAMILY
Abrus	Fabaceae

Index of Botanical Names.

GENUS NAME	REFER TO PLANT FAMILY
Acacia	Fabaceae
Adenanthera	Fabaceae
Albizia	Fabaceae
Aleurites	Euphorbiaceae
Alstonia	Apocynaceae
Ardisia	Mysinaceae
Bauhinia	Fabaceae
Bischofia	Euphorbiaceae
Broussonetia	Moraceae
Calophyllum	Clusiaceae
Caryota	Arecaceae
Casuarina	Casuarinaceae
Cereus	Cactaceae
Cestrum	Solanaceae
Chamaedorea	Arecaceae
Colocasia	Araceae
Colubrina	Rhamnaceae
Cupaniopsis	Sapindaceae
Dalbergia	Fabaceae
Delonix	Fabaceae
Dioscorea	Dioscoreaceae
Diospyros	Ebenaceae
Elaeagnus	Elaeagnaceae
Epipremnum	Araceae
Eriobotrya	Rosaceae
Eugenia	Myrtaceae
Ficus	Moraceae
Hibiscus	Malvaceae
Hylocereus	Cactaceae

Index of Botanical Names.

GENUS NAME	REFER TO PLANT FAMILY
Imperata	Poaceae
Jasminum	Oleaceae
Kalanchoe	Crassulaceae
Lantana	Verbenaceae
Lepianthes	Piperaceae
Leucaena	Fabaceae
Ligustrum	Oleaceae
Livistona	Arecaceae
Lonicera	Caprifoliaceae
Lygodium	Lygodiaceae
Manilkara	Sapotaceae
Melaleuca	Myrtaceae
Melia	Meliaceae
Merremia	Convolvulaceae
Mimosa	Fabaceae
Mucuna	Fabaceae
Murraya	Rutaceae
Nandina	Berberidaceae
Ochosia	Apocynaceae
Neyraudia	Poaceae
Paederia	Rubiaceae
Panicum	Poaceae
Passiflora	Passifloraceae
Pennisetum	Poaceae
Phoenix	Arecaceae
Phylostachis	Poaceae
Piper	Piperaceae
Pouteria	Sapotaceae
Ptychosperma	Arecaceae

Index of Botanical Names.

"Adopt-A-Pond" is a volunteer-based program sponsored by
Hillsborough County and the Southwest Florida
Water Management District.
2420 N Falkenburg Rd. Tampa, FL 33619
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Chapter 4
Prevention

- ✓ A Word on Water Quality
- ✓ A Little Pond Ecology
- ✓ Water Testing Kits
- ✓ Safe Alternatives
- ✓ Storm Drain Marking Program
- ✓ What Can I Do For My Pond?
- ✓ Landscape Maintenance Quiz
- ✓ Fertilizer Do's & Don'ts
- ✓ Florida Yardstick Checklist
- ✓ The ABC's of Fertilizers
- ✓ Considerations for Developing a Landscape Maintenance Contract
- ✓ Environmentally Friendly Landscaping

The goal of this notebook is to help you develop a management plan that can be used to maintain your pond as a healthy functioning ecosystem and stormwater facility. Often this means that your group has to get out in the pond and do some cleaning.
But we all know it's usually easier to stop a problem before it starts. And no good management plan would be complete without a serious effort to prevent problems from occurring and recurring in your pond.

This chapter contains information on what you can do to keep your pond healthy and save your group a lot of endless catch-up work.

Some of the suggestions require a little bit of change in our old habits, but you'll find the benefits far outweigh the hassle of learning something new.

WATER QUALITY

Water Quality is what Adopt-A-Pond is all about! The whole reason for all of our work is to improve the health of the pond, and this means improving the quality of the water that goes into and comes out of the pond.

Poor water quality can lead to algae blooms, excessive weeds like duckweed, and even fish and wildlife kills. It can even affect people since the water in the ponds eventually makes its way back into our water source!

We know that the plants help clean the water, but they can only do so much. The rest is up to the people around the pond and in the areas that drain into it.

The following pages contain information on what you can do to prevent toxins and nutrients from entering your pond so they never have a chance to be a problem.

REMEMBER……

The water quality in your pond is a direct indicator of how well your pond ecosystem is functioning. All of the plants, animals and minerals in your pond work together to create a living system that regulates nutrient content and keeps the pond healthy for all who depend on it.

Things such as clarity, dissolved oxygen, and nutrient levels are some of the indicators we watch.

The only way to keep track of your water quality is by regular testing. Adopt-A-Pond has test kits available for pond groups who would like to keep a record.

A Little Pond Ecology

Just like all living things, plants in your pond require nutrients to live, whether they are large plants (macrophytes) or miniscule plants (algae). If there are more nutrients, there will be more plants and if there are fewer nutrients there will be fewer plants. The amount of plants in any pond ecosystem is often held in check by the level of nutrients. The same is true of the plants in your yard, especially grass. And to provide the extra nutrients for grass, we often use fertilizer. In our situation, this can present a particularly difficult problem.

Our ponds are all stormwater facilities. This means they are designed and built for the purpose of holding water that would otherwise be in your streets, yards, and homes. The water that flows into your pond has already passed through the yards around it and any other yards that drain to it through the system of gutters. As it flows, the water picks up some of the nutrients in the soil and carries them into the pond. Naturally, the nutrients then provide for the growth of either algae, or other plants, depending on conditions.

At Adopt-A-Pond we try to replace the unwanted plants with better ones that will strain out these nutrients as well, but if there are too many nutrients, something *will* grow until it uses them up, or is limited by another factor (such as light). It is nature's way of balancing the pond. Around here this plant is often algae, or duckweed.

You could just leave it there, but if you want to control it, you'll have to look beyond the edge of your pond. Changes in landscaping habits in the yards that flow to your pond can reduce the amount of nutrients and improve the water quality. Unfortunately getting the neighbors three blocks from the pond to help out can sometimes be difficult.

The resources we've included can help you learn how to keep a beautiful and environmentally safe yard. It really works, so give it a try!

POND WATCH

There's only one sure way to know what condition your pond water is in, and that's to test the water!

Adopt-A-Pond encourages each of our groups to take monthly water samples and test for a variety of parameters. We provide the kits and the training to make sure you're getting accurate results. All you have to do is drop off some samples and send in a report.

With consistent monthly samples, you'll get an excellent source of information to gauge your restoration efforts. What's more, your reports get compiled with other groups' to provide valuable data on water quality trends in Hillsborough County.

You'll test for:

- pH
- Dissolved Oxygen
- Turbidity
- Temperature

You'll take samples for:

- Total Phosphorous
- Total Nitrogen
- Chlorophyll A

Trainings are held once a year.
To sign up for the next training contact our office at 744-5671.

SAFE ALTERNATIVES

Aluminum Spot Removal	2 tablespoons cream of tartar and 1 quart water, boil 10 minutes
Ants (in house)	Locate entry points and seal with caulk. Kill visible ants with soapy water or vacuum. Remove all sources of food and water.
Bleach	Borax, use only when necessary
Brass Polish	Paste of equal parts vinegar, salt, and flour. Be sure to rinse completely afterward to prevent corrosion.
Chrome Polish	Vinegar
Cleaners:General household	1 tsp liquid soap plus 1 tsp borax plus one squeeze of lemon in quart of warm water, or just use liquid soap and water.
Coffee Cup Stain Removal	Moist salt or baking soda
Copper Cleaner	Paste of equal parts vinegar, salt, and flour. Be sure to rinse completely afterward to prevent corrosion
Decal Remover	Soak in hot water if practical, otherwise use white vinegar.
Drain Cleaner	Try plunger first. Then pour 1/2 cup baking soda down then 1/2 cup vinegar, wait a few minutes then follow with 2 quarts boiling water. Repeat if necessary.
Fertilizer	Compost
Furniture Polish	Olive oil or almond oil
Hand cleaner: Paint/Grease	Baby oil or margarine, then wash with soap and water
Insecticides	Identify insect and select appropriate control: hand or water spray removal, soapy water spray, barriers and traps are least toxic.
Linoleum Floor Cleaner	1 cup white vinegar plus 2 gallons water
Mildew Remover	Equal parts vinegar and salt; borax works well on shower curtains.
Oven Cleaner	Baking soda and water or non-chlorinated scouring powder
Paint (oil based)	Latex paint; avoid aerosols
Porcelain Stain Removal	Baking soda
Roaches	Remove all sources of food and water. Caulk or plug cracks and crevices. Last resort is to use boric acid.
Rug/Carpet Cleaner	Sprinkle baking soda, then vacuum
Scouring Powder	Baking soda
Silver Cleaner	Rub gently with baking soda and damp sponge (large objects). For small objects place in pot of water on stove with small piece of aluminum foil, add 1 tsp baking soda and 1 tsp salt, boil 2-3 minutes.
Stainless Steel Cleaner	Baking soda
Stainless Steel Polish	Olive oil
Toilet Bowl Cleaner	Baking soda
Tub and Tile Cleaner	1/4 cup baking soda and 1/2 cup white vinegar mixed with warm water
Wine Stain Removal	Water or rubbing alcohol
Window Cleaner	1/2 cup vinegar in 1 quart warm water; plain or soapy water, rinse, then dry

ADOPT-A-POND

Your Storm Drain Marking Kit

Use our colorful markers to add a pollution prevention message to your neighborhood storm drains. The message is "No Trash in Drains, Keep Your Water Clean." Kit includes door hangers.

We're glad you're doing your part to teach your neighbors about stormwater pollution prevention. Stormwater pollution - water pollution that is carried from our yards & streets by rain runoff - is easy to prevent! Make sure everyone in your neighborhood knows that storm drains are only for rain - not oil, not grass clippings, not leaves, not fertilizers, not litter.

Follow these easy guidelines for a successful storm drain marking event:

1. Kids love this event – it's easy, it's in your neighborhood, and it's educational.
2. Be safe - at least one person on your storm drain marking team should be the "safety look-out" for traffic.
3. Bring a broom to sweep loose dirt from the storm drain - the glue will hold better if the surface is swept first.
4. Mark all storm drains around your pond, as well as those across the street, because those lead to your pond, too.
5. Distribute the door hangers in your kit to your neighbors.
5. Fill out the tracking form so that we can keep an accurate record of your storm drain marking event.

Call us at 744-5671 to order your storm drain marking kit.

What Can I Do For My Pond?

Put your pond on a diet!

You are what you eat, and just like you might suffer from too much sugar and fat; your pond suffers from too much nitrogen and other nutrients. So, here's how to put your pond on a diet and reach your goal for clean water:

- **Yard waste and falling leaves:** don't let them wash into storm drains: compost it or mulch it! Check our calendar of events for composting seminars.

- **Fertilize wisely:** twice a year may be enough! Spring and fall are the best times.

- **Know your dirt:** have your soil analyzed by the Cooperative Extension Service (744-5519) to find out what your soil really needs. They recommend only ½-pound of nitrogen per 1000 square feet (how much are you applying?).

- **Slow is best:** look for the words "slow release" or "insoluble" on the fertilizer label, and it will stay in your yard, not in your pond! This goes for both nitrogen ("blue-chip" or "IBDU") & potassium ("sulfur-coated sulfate of potash").

- **Fertilizer-free zones:** stay *50* feet from the pond (if you don't have the space, create as large a zone as you can), and a few feet from pavement with fertilizer applications. The run-off to those areas will then have less fertilizer in it.

- **Washing the car:** wash your car over the grass using a mild biodegradable, **phosphate-free detergent**. And, please, conserve water by only running it during the wetting and rinsing process.

What's the point?

We can divide water pollution into two major categories: **point source pollution and nonpoint source pollution**. ***Point sources*** are specific points of pollution discharges, such as sewage treatment plants or industrial facilities. ***Nonpoint sources*** are dispersed and nonspecific; nonpoint source pollution includes litter, oils and grease on pavement, fertilizer runoff, and yard waste. **Non-point sources of pollution are the major cause of water quality degradation in our state (Florida Lakes, 1991).**

Storm water run-off => nonpoint source pollution => a polluted pond

Urban areas have lots of pavement, which means lots of stormwater runoff. This stormwater runoff carries nonpoint source pollutants, like those mentioned above, into storm drains. And where does all this pollution go? You guessed it right into your pond.

Take The Landscape Maintenance Quiz!

True or False

☐ ☐ 1. A landscape is an ecosystem, and it can achieve a “natural balance” if designed and managed properly.

☐ ☐ 2. “Preventive maintenance” means you should apply pesticides regularly, whether you identify a problem or not.

☐ ☐ 3. Watering, mowing, fertilizing, and weeding are all independent maintenance procedures: how you do one has no impact on the other.

☐ ☐ 4. Always wait until a plant begins to wilt before watering.

☐ ☐ 5. Lawns and landscape plants do best when they receive ½ to 1 inch of water per application.

☐ ☐ 6. Mulching is a costly extra with no benefits beyond appearance.

☐ ☐ 7. Leaf litter makes a great source of mulching material and helps build a healthy, nutrient-rich soil.

☐ ☐ 8. Yellow leaves on plants always indicate a lack of nitrogen.

☐ ☐ 9. At least 30% of nitrogen in fertilizers should be in “slow- release” form.

☐ ☐ 10. Leaving grass clippings on the lawn eliminates the need for at least one fertilizer application per year.

☐ ☐ 11. Native plants don’t need as much fertilizer as non-natives to grow and be healthy.

☐ ☐ 12. Storm drains are connected to sewage lines, and stormwater runoff gets treated at sewage treatment plants.

☐ ☐ 13. Fertilizer runoff from yards is a common cause of algae blooms and nuisance plant growth in stormwater ponds.

Your score is _____ out of 13!

1. T 6. F 11. T
2. F 7. T 12. F
3. F 8. F 13. T
4. T 9. T
5. T 10.T

FERTILIZER DOs & DON'Ts

I. Fertilizer is not plant *food.*

- **A. Food is the sugars made through photosynthesis.**
- **B. Fertilizer nutrients are used in the process.**
- **C. Fertilizer can't substitute for or overcome a lack of photosynthesis. (Examples: A shaded lawn. A houseplant in low light).**

II. Plants need 16 essential nutrients:

- **A. Carbon, Hydrogen, Oxygen - obtained from the atmosphere.**
- **B. Nitrogen, Phosphorus, Potassium - *Macronutrients* most needed.**
- **C. Magnesium, Sulfur, Calcium - *Secondary nutrients.***
- **D. Iron, Manganese, Zinc, Boron, Copper, Molybdenum, Chlorine - *Micronutrient.***

III. Amounts of nutrients needed:

- **A. Nitrogen and Potassium needed in largest amounts.**
- **B. Micronutrient needed in very small amounts - but are just as important.**

IV. Characteristics of West-Central Florida Soils:

- **A. Sandy - Low water- and nutrient-holding capacity.**
- **B. High phosphorus content.**
- **C. pH (measure of acidity or alkalinity) governs solubility/availability of nutrients to plants.**
  - **1. Best pH range for most plants is *5.5 - 6.5* (slightly acid).**
  - **2. "Acid-loving" plants, such as azaleas prefer micronutrients which are very soluble in acid soils (below 5.5).**
  - **3. Alkaline pH (above 7.0) exists with most coastal soil, some fill soils and around foundation of homes (from concrete and stucco debris. Most nutrients are insoluble/less available to plants on alkaline soils.**
  - **4. Can "raise" acid pH with lime. Very difficult to "lower" pH.**
- **D. Soil/Nutrient Relationship: Nitrogen, potassium, magnesium and micronutrient move quickly through sandy soil.**
- **E. Deficiencies In iron, manganese, magnesium, potassium and nitrogen are common on certain plants in our area-particularly high pH soils.**
- **F. Micronutrient deficiencies occur on *new* growth. Macronutrient and secondary nutrient deficiencies occur on *old* growth.**
- **G. Micronutrient and magnesium deficiencies best corrected with foliar sprays.**

V. How to Read a Fertilizer Bag

A. Common Sales Pitches:

1. "100% Organic" - (Must state what % is *synthetic organic* (i.e., urea) and what % is *natural organic* (manures, compost, and other natural materials).

2. "Complete Fertilizer" - Contains nitrogen, phosphorus and potassium.

3. "Made for Florida Mix" - In what way?

4. "Contains Micronutrient" - Small amounts of micronutrient in bags will not correct a severe deficiency. Leaving grass clippings on the lawn and mulching usually provides enough micronutrient to most plants.

VI. Managing Nitrogen:

A. Consequences of too much nitrogen:

1. Top growth increases too fast (thatch, more mowing and pruning).

2. Increased pests: insects, diseases and nematodes.

3. Pollution of ground and surface water.

B. Benefits of slow-release nitrogen:

1. Increased longevity.

2. Plants don't over-respond (less problems)

3. Burn and Leaching potential are low.

C. Types of nitrogen in a fertilizer bag:

1. Nitrate - fast-release

2. Ammoniacal - *fast* release

3. Water soluble organic (urea) - *fast* release

4. Water insoluble - *slow* release (natural and coated forms of N)

5. Look for terms such as IBDU, Ureaform, Sulfur-coated urea)

VII. Fertilizing Strategies:

A. Amount to Apply: 1 pound of N per 1000 square feet. (Divide first number on bag(nitrogen percentage) into 100 = pounds of that fertilizer to apply over 1000 square feet.

B. Frequency of application: depends on stage of plant.

1. Establishment (root growth stage): 1 time per year

2. Growth: 1- 4 times per year.

3. Maintenance: 1 time every 2-3 years! (According to Dr. Stuart Warren, N. C. State)

C. Time of year: When active root growth is occurring (Feb-March or Oct-Nov).

D. Methods: Surface broadcast, auger, liquid, spikes and briquettes, foliar spray, trunk injection, incorporation into soil.

THE BOTTOM LINE

DO:

*** Read the fertilizer tag before purchasing a product.**

*** Fertilize "as needed" according to the age (self-sufficiency) of plants.**

*** Be mindful of the pest, maintenance and environmental problems caused by excessive nitrogen.**

*** Use fertilizers containing slow- or controlled-release nitrogen.**

*** Use compost and organic mulch to increase the nutrient holding ability of soil.**

DON'T

* **Don’t give established trees and shrubs surrounded by fertilized lawn areas extra nutrients.**
* **Don’t try to correct a micronutrient or magnesium deficiency with a complete fertilizer. Instead, apply the missing nutrient(s)-preferably as a foliar spray.**
* **Don’t “deep-root” or auger fertilizers except on slopes or berms.**
* **Don’t use fertilizers to try to overcome poor growth associated with shaded or low light areas. Remember, fertilizer is <u>not</u> plant food!**

Presented by: Sydney Park Brown, Environmental Horticulture Agent. Hillsborough County Cooperative Extension Service. 1996 Eco-Gardening Conference

Florida Yards & Neighborhoods
UNIVERSITY OF FLORIDA EXTENSION
Institute of Food and Agricultural Sciences

Name:_____
Address:_____
_____
Phone:_____

Date:_____
Evaluated by:_____

FLORIDA YARDSTICK CHECKLIST

The Florida YardStick Checklist is a companion to the Florida YardStick and contains the current requirements for *Florida Yard* certification.

****To be certified, yards must receive full points on then actions.**
****To be certified, yards must receive at least partial credit for these actions.**

WATER EFFICIENTLY

**	Mow lawns high to encourage a deeper, more drought & pest tolerant root system. (p. 36, 40)	**2"** _____
**	Put a rain gauge in your yard to track irrigation amounts. (p. 20)	**1"** _____
	Irrigate lawn & landscape only when they wilt. Apply ½-¾" water per application. (p. 35)	**3"** _____

→ ***For yard that uses an irrigation system (in-ground or hose-end sprinklers):***

**	Calibrate irrigation/sprinkler system to apply ½ to ¾ inches water. (p. 35)	**1"** _____
	Maintain irrigation system & make sure sprinkler heads are properly positioned.	**1"** _____
**	For in-ground systems, install rain shut-off device. (pg. 34)	**2"** _____
	Make sure irrigation system waters lawn areas separately from plant beds. (p. 33)	**2"** _____
	Use drip or micro-irrigation in plant & flower beds. (p. 35)	**1½"** _____

→ ***For yard that does not use an irrigation system:***

**	Design & maintain a landscape that exists predominately on rainfall once plants are established.	**6"** _____

MULCH

**	Maintain a 2-3" layer of organic mulch over tree roots, shrubs, plant beds. Leave 2" space between plant base and the mulch. (p. 38)	**2"** _____
	Create self-mulching areas under trees where leaves can remain as they fall. (p. 38)	**2"** _____
	Use by-product mulches such as pine bark, melaleuca or recycled mulches. (p. 38)	**2"** _____

RECYCLE

**	Whenever possible, recycle grass clippings by allowing them to remain on the lawn. (p. 36)	**2"** _____
	Use leaves & pine needles found in your yard as mulch. (p. 38)	**2"** _____
	Create & maintain a compost pile with yard clippings, leaves, kitchen scraps, etc. (p. 29-30)	**3"** _____

WILDLIFE

	Plant vines, shrubs & trees that provide cover, nesting areas or food sources for birds, butterflies and other wildlife. (p. 15, 19 & 21)	**3"**
	Provide a water source, such as a bird bath or a small pond for wildlife. (p. 21 - 23)	**1"** _____
	Provide wildlife shelters such as a bat house, bird house, brush pile, etc.	**1"** _____

YARD PESTS

	Check your landscape every one to two weeks for signs of problems. (p. 40)	**2"** _____
**	Treat only affected plants or lawn areas with pesticide applications. Avoid indiscriminate spraying. (p.42)	**3"** _____
	Learn to identify 5 beneficial insects that provide natural control of harmful pests. (p. 45)	**2"** _____
	Use environmentally friendly pesticides such as horticultural oils & insecticidal soaps. (p. 42)	**3"** _____

TOTAL PAGE 1: _____

RIGHT PLANT - RIGHT SPOT

	Replace problem-prone plants with low maintenance native or non-native species. (p. 18)	**2”**	____
	Group plants according to their water and maintenance needs. (p. 11)	**2”**	____
	Determine how much grass you need for children, pets and recreation. Replace the rest with low maintenance ground covers or shrubs, mulch or other porous surface. (p. 17)	**4”**	____
	Use trees & shrubs to shade eastern & western walls of home and air conditioner compressor.	**1”**	____
	Use deciduous trees on southern exposures to allow the sun to passively heat your home in winter.	**1”**	____
**	Ensure that your landscape does not contain plants identified by code as “invasive exotics.”(p. 16)	**1½”**	____

(In Hillsborough County, Melaleuca, Brazilian pepper, Chinese tallow and Australian pines are designated by code as invasive exotics.)

FERTILIZING

*	Fertilize as needed to maintain quality of lawns and landscape plants. (p. 29)	**2”**	____
*	Use natural organic or other slow release fertilizers. (p. 30)	**2”**	____
	Use iron instead of nitrogen to make your lawn green during the summer. (p. 32)	**1”**	____

STORMWATER RUNOFF

*	Direct downspouts & gutters to drain onto the lawn, plant beds or containment areas. (p. 24, 25)	**1”**	____
*	Plant groundcovers (or use mulch) on thinly vegetated areas to decrease erosion. (p. 17)	**1 ½”**	____
	Use mulch, bricks, flagstones, gravel or other porous surfaces on walkways, patios or driveways. (p. 27)	**2”**	____
	Collect and use rainwater to irrigate plants. (p. 26)	**2”**	____
	Create swales or terracing to catch and filter stormwater. (p. 25)	**3”**	____

ON THE WATERFRONT — *Where applicable*

**	Protect your mangroves. All pruning must be in compliance with existing laws. (p. 52)	**1”**	____
	Establish a border of low maintenance plants between your lawn and shoreline/seawall to absorb nutrients and provide wildlife habitat. (p. 50)	**4”**	____
	Where feasible, plant native vegetation in the littoral zone front of your seawall or along shoreline. (p. 50)	**4”**	____
	Decrease wave action and increase habitat by placing clean, native limestone rock in front of your seawall. (p. 50, 51)	**3”**	____

TOTAL PAGE 2: ____

TOTAL FORWARD FROM PAGE 1: ____

GRAND TOTAL: ____

Note: Florida Yard Certification is contingent upon compliance with existing codes and laws.

THE A B C'S OF FERTILIZERS

Sydney Park Brown, Extension Agent
Horticulture and Water Management
Hillsborough County Cooperative Extension Service

Does confusion reign when you shop for fertilizers? Do you become overwhelmed by the endless choice of products and, in desperation, either pick the cheapest fertilizer or the most expensive, most advertised product? Well, you're not alone. Understanding fertilizers is one of the most complex, technical processes a home gardener faces. This article presents some simple explanations and guidelines that will hopefully help you make the right decisions the next time you shop for a fertilizer.

THE 16 ESSENTIAL ELEMENTS

Let's start with the basics. Plants require sixteen nutrients for growth. These are usually divided into four categories:

(1) The Atmospheric Elements which occur naturally in air and water:

Carbon (C)
Hydrogen (H)
Oxygen (0)

(2) The Primary Elements which are required in relatively large quantities and are supplied by fertilizers:

Nitrogen (N)
Phosphorus (P)
Potassium (K)

(3) The Secondary Elements which are usually supplied by liming materials and for fertilizers:

Calcium (Ca)
Magnesium (Mg)
Sulfur (S)

(4) And finally the Micronutrients which are needed in very small amounts but are as essential as all the above:

Boron (B)
Chlorine (Cl)
Copper (Cu)
Iron (Fe)
Manganese (Mn)
Molybdenum (Mo)
Zinc (Zn)

(Here's an easy acronym for remembering all the elements:
C HOPKINS CaFe Mg B Mn CuZn MoCl. Read:
C. Hopkins Cafe managed by my cousin Mocell".)

FERTILIZER TERMS

Gardening books and pamphlets will use certain terms which you should be familiar with:

Complete/Incomplete- A complete fertilizer contains Nitrogen, phosphoric acid (the oxide equivalent of actual phosphorus) and Potash (the oxide form of potassium). It may contain other elements as well. Incomplete fertilizers contain one or two primary elements, but not all three. An example is Nitrate of Soda which contains primarily Nitrogen.

Balanced- A fertilizer is balanced when it contains nitrogen, phosphoric acid and potash in equal amounts. A 5-6-6 or
10-10-10 fertilizer is a complete, balanced fertilizer.

Ratio- refers to the relative amounts of nitrogen, phosphoric acid and potash. In other words the ratio of a 6-6-6 fertilizer is 1-1-1. The ratio of a 16-4-8 is 4-1-2. Fertilizer recommendations often are made in terms of ratio. The other important thing to remember about ratio is this: Even though a 6-6-6 fertilizer has the same 1-1-1 ratio as a 12-1 2-1 2, it contains half the amount of nutrients.

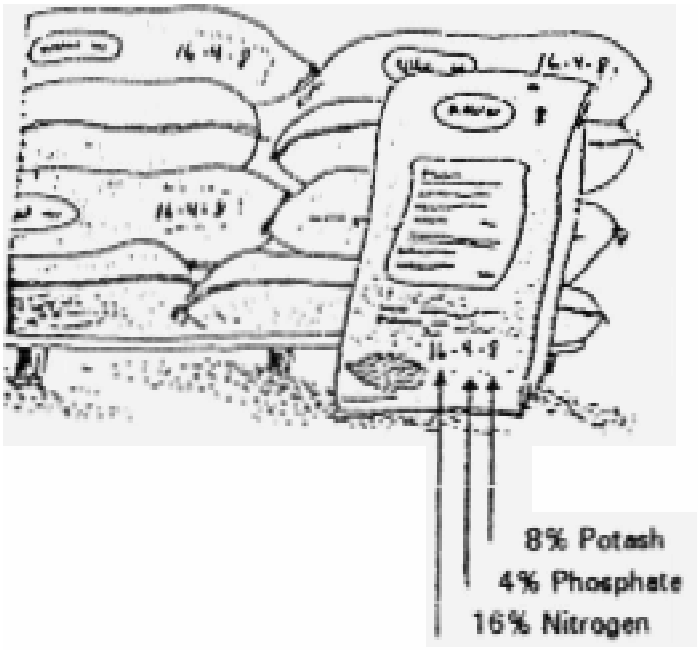
HOW TO READ A FERTILIZER BAG

Learning how to read the fertilizer bag is the key to shopping for fertilizers. The first thing to look for is the Analysis or Grade of the fertilizer. This is the three numbers on the bag. The analysis is the percent by weight of nitrogen, phosphoric acid and potash in that order. For example: a 100 pound bag of 16-4-8 contans 1 6% nitrogen, 4% phosphoric acid and 8% potash--or 1 6 rounds N, 4 pounds P, 8 pounds K. A 50 pound bag would contain half that amount.

Fertilizer manufacturers are required by Florida law to supply a tag. A wealth of information can be derived from it. Let's analyze a sample tag line by line beginning at #1-Net Weight.

#1- Net Weight- The actual weight present in the bag or package. Check it out. Sometimes what appears to be a 50 pound bag is actually 35 pounds.

#2- When the term "organic" is used on the label, it usually refers only to the nitrogen content, and it must be qualified as to what percent is synthetic and what percent is natural. Synthetic organic seems like a contradiction in terms, doesn't it? But urea, a form of nitrogen commonly used in fertilizers, is actually an "organic" compound which is synthetically produced. Natural organic materials are manures, sludge, etc.



#3,8,9 These lines refer to the percentages of nitrogen, phosphoric acid and potash which comprise the analysis-in this case 16-4-8.

#4,5,6,7 These lines are the types of nitrogen which make up the 16% total nitrogen. This is one of the most important statements on the bag and will be discussed in detail later in this article.

#10 Chlorine must be stated as "Not more than" because it may be toxic to some plants or reduce their quality.

#11 "The derived from:" is a statement of the actual sources for the primary plant nutrients,

#12 The "Statement of Secondary Plant Nutrients" will list all the secondary elements and micronutrients contained in the fertilizer mixture.

#13 A "Derived from:" statement must be included to give the sources of the secondary plant nutrients.

The Florida Fertilizer Label

Florida Registration Number

BRAND NAME

Name and Address of Registrant

1 Net Weight

2 Nitrogen-50% Organic (30% synthetic, 20% natural)

GUARANTEED ANALYSIS

3	Total Nitrogen	%
4	Nitrate Nitrogen	%
5	Ammoniacal Nitrogen	%
6	Water Soluble Organic Nitrogen And/or Urea Nitrogen	%
7	Water Insoluble Nitrogen	%
8	Available Phosphoric Acid	%
9	Soluble Potash	%
10	Chlorine, Not More Than	%
11	Derived from: (Actual source materials for primary plant nutrients)	
12	Statement of Secondary Plant Nutrients	
	Total Magnesium as Mg	%
	Water Soluble Magnesium as Mg	%
	Manganese as Mn	%
	Copper as Cu	%
	Sulfur (combined) as S	%
	Sulfur (free) as S	%
13	Derived from: (Actual materials and in forms used on the fertilizer mixture, e.g., Manganese Oxide or Manfanese Sulfate, etc.)	

WHAT ELSE?

You may have noticed that 16 pounds of nitrogen, 4 pounds of phosphoric acid and 8 pounds of potash does not add up to the actual net weight of the fertilizer-i.e. 100 pounds. This weight is made up by the **Conditioners and Fillers** in the bag which keep the fertilizer in a granular, easily spread form. Fillers often consist of dolomite,sand or raw phosphate. Home gardeners frequently complain that the fertilizer stays on the soil months after they have applied it. What they are actually seeing are the fillers and/or conditioners which are very slow to break down.

Some fertilizers also contain an insecticide or weed killer but, if so, they must have a yellow label with lettering in a conspicuous, contrasting color.

NITROGEN SOURCES

Still with me? Well, now we get down to the real nitty-gritty-- nitrogen sources. It's important to single out nitrogen for more discussion because it's the most expensive component in a fertilizer bag and the various nitrogen sources that are used behave very differently once applied.

For example, **Nitrate** nitrogen dissolves readily in water and moves freely in the soil with the movement of water. The nitrate form is readily absorbed by plants and will give quick growth results, but remember it leaches through the soil rapidly and will not stay around for long.

Ammoniacal nitrogen also dissolves readily in water, but does not leach from the soil as rapidly as nitrate nitrogen. However, soil bacteria usually convert it to the nitrate form in a few weeks. Ammoniacal nitrogen acidifies the soil as it converts to nitrate and is, therefore, almost always found in "acid-forming" fertilizers such as Azaleas-Camellia Special fertilizer.

Water-Soluble Organic Nitrogen is supplied mainly from urea.As explained above, urea is an organic compound that is synthetically produced. Water-soluble nitrogen changes to ammoniacal nitrogen within a few days of application. Urea is a comparatively inexpensive form of nitrogen.

Water-Insoluble Nitrogen originally meant natural organic materials such as manure or dried blood. Natural materials such as these break down very slowly and yield their nitrogen over a long period of time. Today, however, many forms of water-insoluble nitrogen have been developed such as IBDU and sulfur coated urea. These materials also release nitrogen slowly and therefore, are included under water-insoluble nitrogen. This form of nitrogen is the most expensive of the four discussed, but it will provide a continued release of nitrogen over an extended period of time. Another selling point for this nitrogen form is that it does not burn plants when applied in fairly large amounts.

WHAT IS A GOOD FERTILIZER BUY?

When you shop for a good fertilizer buy, look for a few key things:

(1) The nitrogen sources. If you want quick results, look for fertilizers that contain the majority of the nitrogen in the nitrate, ammoniacal and/or urea forms. If you want long-lasting results, shop for a product with a high percent of water-insoluble nitrogen, grit your teeth and pay the higher price. The best buy for routine lawn and garden maintenance is a combination of fast and slow release nitrogen.

(2) Get the most bang for your buck. Once you've decided on your nitrogen sources, check for secondary plant nutrients and buy the fertilizer which offers these extra goodies.

(3) If you find two or more fertilizers that fit your needs, but the prices vary, calculate the actual cost per pound of plant nutrients. Add up the analysis (For example 16+4+8=28) and divide it into the cost of the product. Remember that a higher analysis fertilizer will probably cost more, but you will apply less of it than a lower analysis (6-6-6) material.

(4) Just because a fertilizer is labeled as a lawn fertilizer (or tomato or citrus or whatever) doesn't mean it can't be used on everything in your yard if it meets the nutritional requirements of the other plants. The exception of course is if a fertilizer also contains a weed killer or insecticide which might be injurious to certain plants. Don't buy six different fertilizers if one would fit the bill.

All these shopping tips depend on your ability to read and understand the fertilizer label. You'll know this article helped if you find yourself at the local garden center flipping fertilizer bags over, debating the pros and cons of various tags and doing calculations on your pocket calculator. You'll wreak havoc on the garden department, but you'll make an informed decision and walk out with a good buy.

UNIVERSITY OF FLORIDA
EXTENSION
Institute of Food and Agricultural Sciences

SS-ENH-09

Considerations for Developing a Lawn and Landscape Maintenance Contract[1]

Sydney Park Brown and Michael J. Holsinger[2]

The following sample contract includes landscape maintenance practices which are in accordance with University of Florida recommendations. These recommendations are based on research and objective-based information specific to Florida and reflect the philosophy of Environmental Landscape Management (ELM). The ELM concept integrates environmental concerns into landscape maintenance. Water and energy conservation, fertilizer and pesticide management, and the reduction and reuse of plant clippings are important components of ELM.

The sample contract suggests additional topics which you should consider when creating a contract or reviewing one. This sample was developed as an educational resource for lawn and landscape professionals and users of their services. *However, final decisions on what to incorporate in a lawn and landscape contract must be made by individual professionals and their clients.* **This publication is distributed with the understanding that the authors are not engaged in rendering legal advice or opinion, and that the information contained herein is not to be regarded or relied upon as a substitute for professional legal service. If you require legal advice or opinion seek the services of an attorney.**

Sample Lawn and Landscape Maintenance Contract

Part I--Lawn Maintenance Considerations

A. Mowing, Edging and Trimming: Contractor will mow turf areas as needed according to seasonal growth. No more than 1/3 of the leaf blades should be removed per mowing. Mowing shall be with a (reel/rotary/or mulching) mower. Mower blades will be sharp at all times to provide a quality cut. Mowing height will be according to grass type and variety (see attached recommendations for mowing heights). Contractor will leave clippings on the lawn as long as no readily visible clumps remain on the grass surface 36 hours after mowing. Otherwise, contractor will distribute large clumps of clippings by mechanical blowing or by collecting and removing them. In the case of fungal disease outbreaks, contractor will collect clippings until the disease is undetectable.

1. This document is SS-ENH-09, which replaces Fact Sheet OHC-10, a series of the Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. First published: May 1994. Reviewed: January 1995. Revised: February 2001. Please visit the EDIS Web site at http://edis.ifas.ufl.edu.

2. Sydney Park Brown, extension agent, Environmental Horticulture, Hillsborough County; Michael J. Holsinger, extension agent, Environmental Horticulture, Sarasota County, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL 32611.

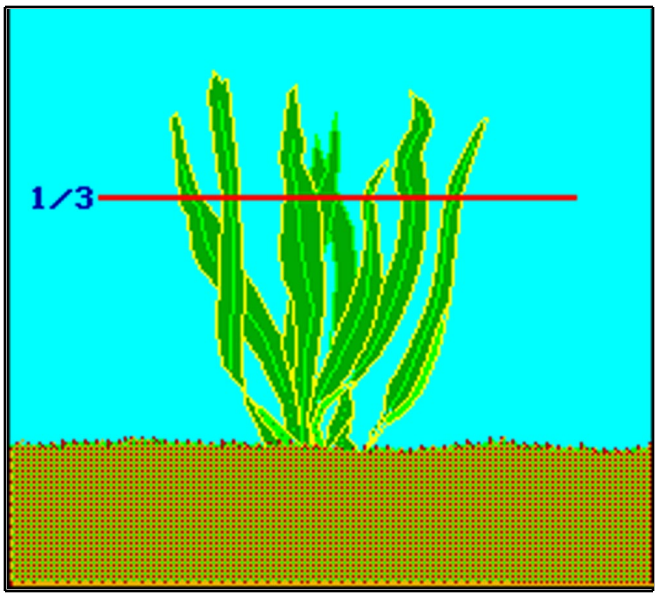


Figure 1. Remove No More Than 1/3 of the Leaf Blades

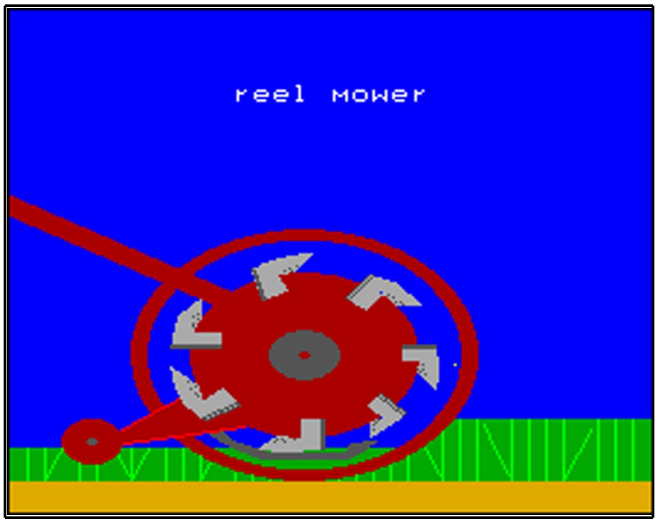


Figure 2. Reel Mower

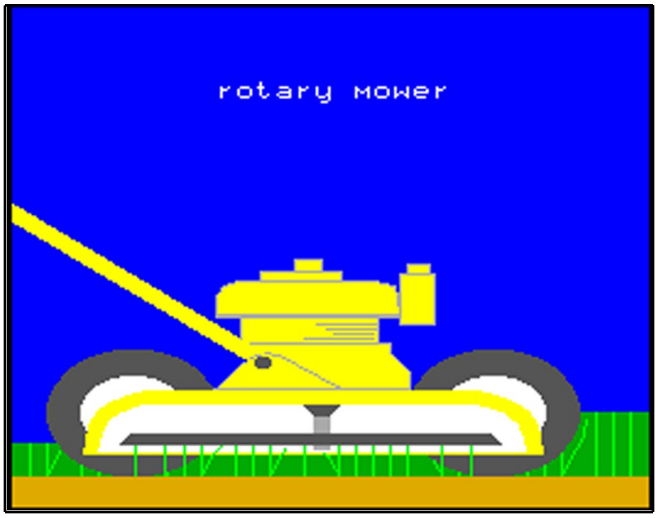


Figure 3. Rotary Motor

Figure 4. Mulching Mower

Figure 5. Remove Large Clumps of Clippings by Mechanical Blowing or Collecting

Contractor will edge tree rings and plant beds and all buildings, sidewalks, fences, driveways, parking lots, and other surfaced areas bordered by grass will be edged every other mowing during the growing season. Turf around sprinkler heads will be trimmed or treated with a non-selective herbicide so as to not interfere with or intercept water output. Isolated trees and shrubs growing in lawn areas will require mulched areas around them (minimum 2-foot diameter) to avoid bark injury from mowers and filament line trimmers and to reduce root competition from grass. Establishment and maintenance of such mulched areas will be charged to the customer. Contractor will clean all clippings from sidewalks, curbs, and roadways immediately after mowing and/or edging. Contractor will not be sweep, blow or otherwise dispose of clippings in sewer drains.

B. Fertilization: Contractor will fertilize turf areas as per the maintenance specifications attached (see the University of Florida recommendations provided as an example at the end of this document). Complete fertilizers shall be granular in composition and contain 30% to 50% or more of the nitrogen in a slow- or controlled-release form. The ratio of nitrogen to potash will approximate 1:1 or 2:1 for complete fertilizer formulations (Examples: 15-5-15, 16-4-8, 15-0-15, 12-2-14, 14-3-14). While nitrogen fertilization is based on the desired growth rate and type of turfgrass being grown, the phosphorus fertilization rate should be based on the analysis of a lawn soil sample and the recommendations obtained from it. The fertilizer shall also contain magnesium and micro-nutrients (i.e., manganese, iron, zinc, copper, etc.). Iron shall be in the sulfate, sucrate or chelated form. Fertilizer will be swept off of walks and drives onto lawns or beds. After fertilization, a minimum of 1/4 inch of water will be applied by the client.

C. Pest Control: The contractor will inspect lawn areas each visit for indications of pest problems and advise the client or representative of such problems.

Upon confirmation of a specific problem requiring treatment, the contractor will apply pesticides as needed and only in affected spots, whenever possible using the least toxic, effective pesticide. All applications of pesticides and fertilizations will be performed when temperatures are below 90°F and wind drift is negligible. No pesticide will be applied to turf areas without the express approval of the client. This includes weed and feed formulations. The contractor will keep records on pests identified and treatment(s) rendered for control.

All pest control service is *in addition* to the basic contract charges. The contractor will charge the client per job, based on materials cost plus labor. The cost will be agreed on by client and contractor before such service is rendered.

Pesticide applications will be made in accordance with the rules and regulations governing use of pesticides in Florida. The contractor will post alerts and notify pesticide-sensitive persons (if applicable) of the pesticide application. The pest control applicator will be operating under License # _____. Expiration Date _____.

D. Thatch Control: (See Part III--Optional Services)

Part II--Landscape Plant Maintenance Considerations: Trees, Palms, Shrubs, Ground Covers

A. Fertilization: Ornamental shrubs, trees and ground covers planted less than three (3) years shall be fertilized 4 to 6 weeks after planting and then two to three times per year for the following 3 years. Two of the annual applications are normally scheduled around February and October for south Florida, March and September for north Florida. A third application can be made during the summer. Rate will be 1 pound of nitrogen per 1,000 square feet per application.

Mature palms in the landscape shall be fertilized four times per year at a rate of 5 to 8 lbs. each application. Palms under 8 feet tall will receive 2-5 lbs. per application four times per year.

Fertilizers should contain equal amounts of nitrogen and potassium, and 30% or more of both elements should be available in slow-release form. The fertilizer should also contain magnesium and a complete micronutrient amendment. The fertilizer analysis shall be similar to 8-2-8, 15-5-15, 14-3-14, 12-2-14, etc.

Established shrubs and trees in lawn areas exposed to lawn fertilizations will not be fertilized supplementally. Fertilizer applied to shrubs and trees planted in beds shall be broadcasted over the entire plant bed. Fertilizer may be punched shallowly into the soil on berms and slopes where runoff is likely.

Nutrient deficiencies shall be treated with supplemental applications of the specific lacking nutrient according to University of Florida Cooperative Extension recommendations.

B. Pest Control: Contractor shall practice Integrated Pest Management (I P M) to control insects, diseases and weeds on and around perennials, ground covers, shrubs, vines and trees. This will include frequent monitoring and spot treatment as

necessary using the least toxic methods. All applications will be performed when temperatures are below 90°F and when wind drift is negligible. First choice will be insecticidal soaps, horticultural oils and biological controls such as *Bacillus thuringiensis* (*Bt*) formulations. Weeds in beds or mulched areas will usually be removed mechanically or by hand. Upon client approval, herbicides may be employed for heavy weed infestations.

C. Pruning: Shrubs will be pruned with hand shears as needed to provide an informal shape, fullness and blooms. Palm pruning will be done one (1) time per year to remove brown fronds and seed heads. No green palm fronds shall be removed. No pruning will be done during or immediately following growth flushes, branches will be pruned just outside the branch collar, and pruning paint *will not* be applied. Sucker growth will be removed by hand from the base of trees. No herbicides will be used for this purpose. The contractor will remove all litter. It is recommended that an ISA Certified Arborist be consulted and/or utilized for tree work.

D. Mulching: All mulched areas will be replenished once a year during the winter months (Nov. - Feb). "Alternative" mulches (pine bark, pine needles, melaleuca, eucalyptus, recycled, etc.) should be considered. Mulch should be maintained at a depth of 3 inches. All curb, roadway and bed edges will be trenched to help contain the applied mulch. Additional mulch will be billed at $____ /yard. Mulch will not be placed against the trunks of plants.

Part III--Considerations for Optional Services

A. Annual Flowers: Replacement of existing annuals will be done ____ times per year. Major renovation of annual beds shall be accomplished once per year in ____.

Replacement of dead or injured plants due to pests or contractor negligence will be done without cost to client. Replacement of stolen, vandalized or damaged flowers will be charged to the client at a rate of ____ /plant.

Annuals and perennial bedding plants shall be fertilized monthly, at a rate of 1/2 pound of nitrogen per 1,000 square feet of area every 3-4 weeks. An optional fertilizer schedule would use a slow-release fertilizer such as Osmocote or Nutricote incorporated in the bed at planting, and applied thereafter according to label directions. The contractor will be responsible for weed control. Pest control will follow IPM principles.

B. Irrigation Systems: The contractor shall inspect and test rain shut-off devices and other components and zones in the irrigation system monthly and shall reset zone times according to seasonal evapotranspiration changes. Minor adjustments and repairs such as head/emitter cleaning or replacement, filter cleaning, small leaks, and minor timer adjustments shall be made by the contractor, with the client paying for parts. Once a year, the contractor will recalibrate each zone to allow for the application of 1/2 inch - 3/4 inch of water per irrigation. During weekly maintenance, the contractor will note and report to client any symptoms of inadequate or excessive irrigation, drainage problems, etc. If the contractor is responsible for irrigation scheduling, timers will be shut off during the summer rainy season and the system will be turned on manually as needed.

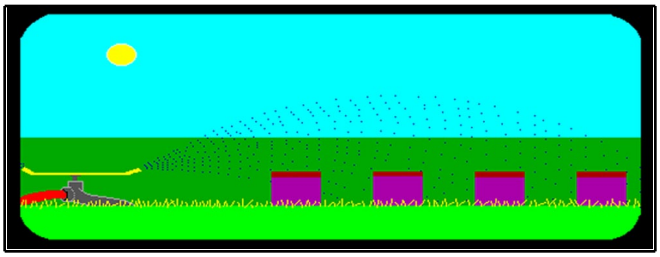


Figure 6. Recalibrate the Sprinkler System

Repairs or system service beyond the above scope will be charged to the client at an hourly rate per worker plus parts. The contractor will notify the client or client's agent, of the nature of the problem before repairs are made.

C. Thatch Removal/Scalping: Removal of thatch (a spongy, build-up of dead and living grass shoots, stems and roots) should be considered when thatch thickness exceeds one inch. The best time for thatch removal is March through August when the turfgrass is rapidly growing. Thatch removal is not included in the basic contract charges. Verticutting, using a vertical mower, is the recommended method of

mechanically removing thatch from Bermuda, St. Augustine, Zoysiagrass, and Centipede lawns. Blade spacing shall be 3" for St. Augustine, 2-3" for Centipedegrass, and 1-2" for Bermudagrass and Zoysiagrass .

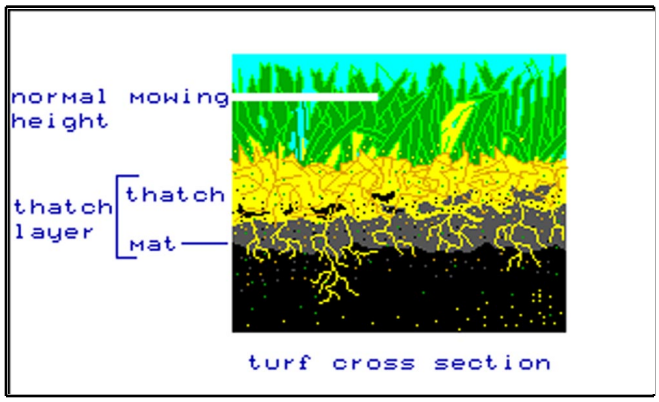


Figure 7. Thatch Layer

Figure 8. Removing Thatch with a Vertical Lawnmower (Verticutting)

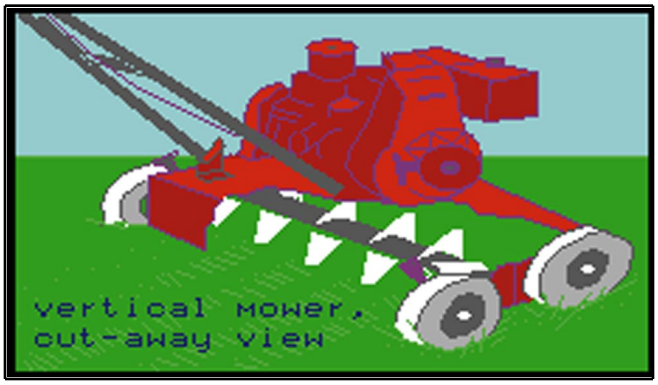


Figure 9. Vertical Mower

Bahiagrass lawns can be power-raked rather than verticut. Contractor will remove resulting debris. Remaining turf will be mowed and irrigated with at least 1/2 inch of water. One week after dethatching,

Figure 10. St. Augustinegrass

Figure 11. Bahiagrass

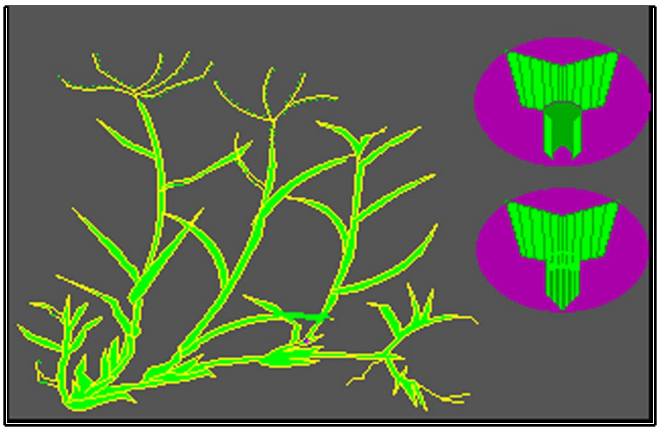


Figure 12. Bermudagrass

apply 1/2 to 1lb. of soluble nitrogen (e.g. 1-3 lbs. ammonium nitrate, or 2.5-5 lbs. ammonium sulfate per 1000 square feet to encourage recovery). Fertilizers must be watered in immediately following

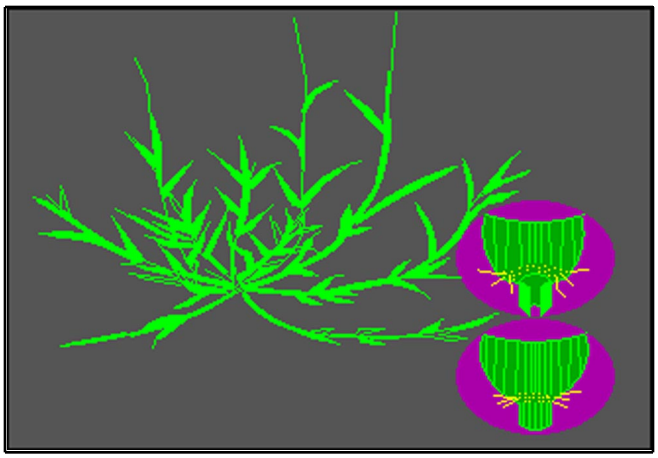


Figure 13. Zoysiagrass

application to avoid plant burn. *Scalping (close mowing) is not a substitute for vertical mowing and is not recommended for this purpose.*

D. Other Services Available: (Priced per job by contractor):

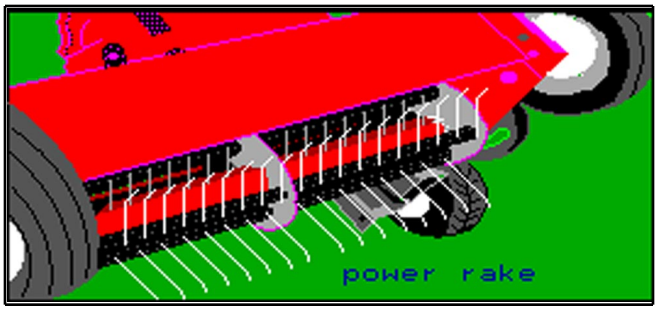


Figure 14. Power-Rake

- Installation of a rain shut-off device for irrigation systems.
- Landscape additions/renovations/transplanting. Transplanting of existing trees will be accomplished during January/February for dormant species, and April - August for palms
- Plant or turf replacement (not attributed to contractor negligence).
- Maintenance of aquatic sites.
- General hauling.
- Major irrigation system modifications.
- Interior plant maintenance.

Part IV--Considerations for Insurance, Licenses, Permits and Liability

The contractor will carry liability amounts and worker's compensation coverage required by law on his/her operators and employees and require same of any sub-contractors and provide proof of same to the client. The contractor is also responsible for obtaining any licenses and/or permits required by law for activities on client's property.

Situations which the Contractor may deem are his/her responsibility:

1. Any damage due to operation of his equipment in performing the contract.
2. Failure to comply with all laws pertaining to protected plant species, such as the mangrove.
3. Damage to plant material due to improper horticultural practices.
4. Improper replacement or retrofitting of irrigation system components.
5. Injury to nontarget organisms due to application of pesticides.

Situations which the Contractor may deem are *not* his/her responsibility:

1. Death or decline of plant materials due to improper selection, placement, planting or maintenance done before the time of this contract.
2. Damage due to improper irrigation components existing at the time of contract execution.
3. Exposed cables/wires or sprinkler components/lines normally found below the lawn's surface.
4. Flooding, storm, wind, fire or cold damages.
5. Disease or damage to lawns or landscape plants caused by excessive irrigation or lack of water due to inoperative irrigation components provided he/she reported these to client, or irrigation restrictions imposed by the Water Management District or civil authorities.

6. Damage caused by or to any item hidden in the landscape and not clearly guarded or marked.

7. Damage due to vandalism.

Part V--Property Description, Services Provided, Terms, Conditions and Charges (for possible inclusion)

1. Contracts are normally for maintenance of property at an identified location and specifically described.

   _____
   _____
   _____

2. The term of the contract. A contract can be for a single year or multiple years with a beginning and ending date. A cancellation provision should be included.

3. The charge for monthly services should be specified. A deadline date should be included and late payment charges should also be considered. Any additional or unscheduled services agreed upon by client and contractor could be billed separately.

4. Contract renewal provisions may also be included.

The contract is signed and dated by both parties, and can be witnessed or notarized.

Additional Information

Table 1 lists mowing height recommendations, and Table 2 lists fertilizer recommendations for various types of grasses. Both are provided for informational purposes. These are recommendations of the Cooperative Extension Service, University of Florida, Institute of Food and Agricultural Sciences as of August, 2001.

Specific Lawn Fertilization Guidelines

General Information Pertaining to All Lawn Grasses

Do a soil test every year. These tests form the basis for a lawn fertility program and recommendations from the soil tests should take precedence over recommendations given here. In particular, phosphorous levels are best determined by soil testing. Since many Florida soils are high in phosphorous, little or no phosphorous may be needed for satisfactory lawn growth. Your county's Cooperative Extension Service office has instructions and bags for taking soil samples and submitting them to the Extension Soil Testing Lab at the University of Florida for analysis.

In general, two weeks after spring re-growth, apply a complete fertilizer (such as 16-4-8) with at least 30% of the nitrogen in slow-release form (e.g. natural organics such as sludge or coated ureas, IBDU, ureaform, etc.). Slow-release (water-insoluble) nitrogen, provides nutrients to lawns over an extended period. Therefore, fewer applications are required annually to sustain a healthy lawn.

Fertilizer recommendations are made in terms of *pounds of nitrogen.* Fertilizers are normally applied at the rate of 1 pound of nitrogen per 1000 square feet. This is calculated by dividing the percent nitrogen (the first number of the analysis) into 100. Example: If applying a 16-4-8 fertilizer, divide 16 into 100 which equals approximately 6. Therefore, 6 pounds of the 16-4-8 should be spread over 1000 square feet of lawn area.

In the fall, apply a fertilizer high in potassium (such as 12-2-14). Potassium helps the grass overwinter, tolerate cold temperatures, and green-up quickly in the spring. Do not apply nitrogen too late in the growing season, as this can slow re-growth the following spring. A general guideline for the last fertilizer application is mid-September for north Florida, early October for central Florida and late October for south Florida. Note: Where applications of iron are recommended below, be advised that iron materials will stain sidewalks, driveways, and other masonry surfaces.

Zoysia

To look their best, zoysiagrasses require frequent fertilization. They should receive 3 to 6 pounds of nitrogen during the growing season.

Bermuda

Generally, bermudagrasses require higher levels of fertilizer than other warm-season grasses for acceptable growth, durability and appearance. For use in a landscape application, most bermudagrass cultivars should receive 3 to 7 pounds of nitrogen during the growing season from start of spring.

Centipede

Established centipedegrass lawns have very low fertility requirements and do not respond well to excessive use of fertilizer, especially nitrogen. *Do not over-fertilize centipedegrass with nitrogen to equal the color of St. Augustinegrass.* Over-fertilization of centipedegrass can result in centipedegrass decline, insect pressure and thatch accumulation. Centipedegrass should receive 1 to 3 pounds of nitrogen during the growing season.

A common problem of centipedegrass is a yellowing called chlorosis, which is usually caused by iron deficiency. This condition is most severe where soil pH is high (above 6.5) or where the soil contains large quantities of calcium or phosphorus. This yellowing is generally worst in early spring, when daytime temperatures are warm but nighttime temperatures are still cool. Warm daytime air temperatures promote leaf and stolon growth, but cool nighttime temperatures limit root growth. The roots then cannot assimilate enough nutrients to supply the growing leaves, and the leaves turn yellow. As soils become warmer, this temporary nutrient deficiency disappears. If the soil is naturally iron deficient, iron fertilization is necessary. You can apply chelated or ferrous sulfate iron evenly and easily with a hose-end applicator. Apply the ferrous sulfate at the rate of 2 ounces in 3 to 5 gallons of water per 1000 square feet. Consult the label for chelated iron rates.

St. Augustine

St. Augustinegrass should receive 2 to 6 pounds of nitrogen during the growing season. A low-maintenance St. Augustinegrass lawn should be fertilized twice a year, once in the spring and again in the late summer while the grass is actively growing. At the maximum maintenance level, a St. Augustinegrass lawn should receive 4 to 6 pounds of nitrogen per 1000 square feet per year. Apply fertilizer four or more times per year. Consider complete fertilizers containing micro-nutrients, such as manganese (Mn), iron (Fe), sulfur (S), magnesium (Mg) and boron (B), especially if the soil test reveals micro-nutrient deficiencies. A newly sprigged or plugged lawn will require additional applications to encourage rapid coverage. This fertility level, combined with the proper watering practices, will result in a good quality lawn with minimal thatch buildup. Heavy fertilization rates will produce a faster buildup of thatch than lower rates. High rates of fertilizing can also encourage insect damage to the turf. Additionally, the mowing and watering work increases with the amount of fertilizer you apply.

On high pH (>7.0) soils or where high pH water is applied, yellow appearance may be an indication of iron or manganese deficiency. For iron deficiency, spray ferrous sulfate (2 ounces in 3 to 5 gallons of water per 1000 square feet) or a chelated iron source (refer to the label for rates), to temporarily enhance color. Iron applications every 6 weeks will help maintain green color and, unlike nitrogen will not promote excessive top-growth. If applications of iron do not correct the problem, a manganese deficiency may be the cause of yellowing. Apply manganese as a fertilizer with micro-nutrients or as straight manganese sulfate ($MnSO_4$) bimonthly at 0.41 pound per 1000 square feet (18 pounds per acre) to relieve deficiency symptoms if they are present.

Bahia

Established bahiagrass lawns have relatively low fertility requirements. Bahiagrass should receive 2 to 4 pounds of nitrogen during the growing season.

One of the disadvantages of bahiagrass is its tendency to yellow due to iron deficiency. You can overcome this problem by using a complete fertilizer, which contains iron, or by adding a separate iron

material. Soluble iron sources you can be use include ferrous ammonium sulfate, ferrous sulfate and various iron chelates. Avoid oxide forms of iron, as they will be much less effective than sulfates or chelated forms in alleviating iron deficiency. Apply ferrous sulfate at the rate of 2 ounces in 3 to 5 gallons of water per 1000 square feet. This can be applied evenly and easily with a hose-end applicator. Follow chelated iron label directions if using one of these materials. Iron applications every 6 weeks will help maintain green color and unlike nitrogen will not promote excessive top-growth.

Table 1. Mowing Height Recommendation: The heights listed are the suggested lengths of the grass blade *after* mowing. The depth of thatch (if it exists) should not be included in this measurement.

Type Turfgrass	Mowing Height
Bahiagrass and St. Augustinegrass varieties (Raleigh, Floratam, Floralawn, Bitterblue, Floratine, FX 10)	3.0 - 4.0"
Semi-dwarf St. Augustine varieties (Seville, Del Mar, Jade, Palmetto)	1.5 - 2.5"
Bermudagrass (Hybrids)	.75 - 1.5"
Bermudagrass (Common)	1.5"
Centipedegrass	1.5 - 2.0"
Zoysiagrass	1.0 - 3.0"

Table 2. Calendar Guide to Annual Zoysiagrass Fertilization[1,2]

Maintenance Level	J	F	M	A	M	J	J	A	S	O	N
North Florida											
Basic			C		SRN				C		
Moderate			C		SRN		SRN		C		
High			C	N	SRN		SRN		C		
Central Florida											
Basic			C		SRN				C		
Moderate			C		SRN			SRN		C	
High		C		N	SRN		SRN		N		C
South Florida											
Basic			C		SRN		SRN			C	
Moderate		C		N		SRN		SRN			C

Table 2. Calendar Guide to Annual Zoysiagrass Fertilization[1,2]

Maintenance Level	J	F	M	A	M	J	J	A	S	O	N

[1]North Florida in this example is considered to be anything north of Ocala. Central Florida is defined as anything south of Ocala to a line extending from Vero Beach to Tampa. South Florida includes the remaining southern portion of the state.
[2]C=complete fertilizer application (NPK); N=nitrogen application only; SRN=nitrogen only in a slow release form; Fe=iron application only.

Table 3. Calendar Guide to Annual Bermudagrass Fertilization [1,2]

Maintenance Level	J	F	M	A	M	J	J	A	S	O	N
North Florida											
Basic			C		SRN				C		
Moderate			C		SRN		SRN		C		
High			C	SRN	C		SRN	Fe	C		
Central Florida											
Basic			C		N		SRN		C		
Moderate		C		N		SRN		SRN		C	
High		C	N	SRN		C	Fe	SRN		C	
South Florida											
Basic		C		N		SRN			C		C
Moderate		C	N		C		SRN		SRN		C
High		C	N	SRN	C	SRN	Fe		SRN		C

[1]North Florida in this example is considered to be anything north of Ocala. Central Florida is defined as anything south of Ocala to a line extending from Vero Beach to Tampa. South Florida includes the remaining southern portion of the state.
[2]C=complete fertilizer application (NPK); N=nitrogen application only; SRN=nitrogen only in a slow release form; Fe=iron application only

Table 4. Calendar Guide to Annual Centipedegrass Fertilization [1,2,3]

Maintenance Level	J	F	M	A	M	J	J	A	S	O	N
North Florida											
Basic				C							
Moderate				C		Fe					
High				C		SRN	Fe				
Central Florida											
Basic			C			SRN					
Moderate			C			SRN	Fe				

Table 4. Calendar Guide to Annual Centipedegrass Fertilization [1,2,3]

Maintenance Level	J	F	M	A	M	J	J	A	S	O	N

[1]North Florida in this example is considered anything north of Ocala. Central Florida is defined as anything south of Ocala to a line extending from Vero Beach to Tampa. South Florida includes the remaining portion of the state.
[2]For initial spring application, particularly in North Florida, the recommended time to fertilize is after the last frost.
[3]C=complete fertilizer application (NPK); N=nitrogen only; SRN=nitrogen only in a slow release form; Fe=iron application only.

Table 5. Calendar Guide to Anuual St. Augustinegrass Fertilization[1,2,3]

Maintenance Level	J	F	M	A	M	J	J	A	S	O	N
North Florida											
Basic			C			Fe			C		
Moderate			C		SRN		Fe		C		
High			C		SRN	Fe	SRN		C		
Central Florida											
Basic			C				Fe		C		
Moderate			C		SRN		Fe	SRN		C	
High		C		N	SRN		Fe	SRN		C	
South Florida											
Basic			C		SRN		SRN			C	
Moderate		C		N		SRN		SRN			C
High		C		N	SRN		SRN		SRN		C

1North Florida in this example is considered to be anything north of Ocala. Central Florida is defined as anything south of Ocala to a line extending from Vero Beach to Tampa. South Florida includes the remaining portion of the state.
2For initial spring application, particularly in North Florida, the recommended time to fertilize is after the last frost.
3C=complete fertilizer application (NPK); N=nitrogen application only; SRN=nitrogen only in a slow release form; Fe=iron application only.

Table 6. Calendar Guide to Annual Bahiagrass Fertilization [1,2,3]

Maintenance Level	J	F	M	A	M	J	J	A	S	O	N
North Florida											
Basic			C					C			
Moderate			C		SRN			C			
High			C		SRN		Fe	C			
Central Florida											

Table 6. Calendar Guide to Annual Bahiagrass Fertilization [1,2,3]

Maintenance Level	J	F	M	A	M	J	J	A	S	O	N

[1]North Florida in this example is considered to be anything north of Ocala. Central Florida is defined as anything south of Ocala to a line extending from Vero Beach to Tampa. South Florida includes the remaining portion of the state.
[2]For initial spring application, particularly in North Florida, the recommended time to fertilize is after the last frost.
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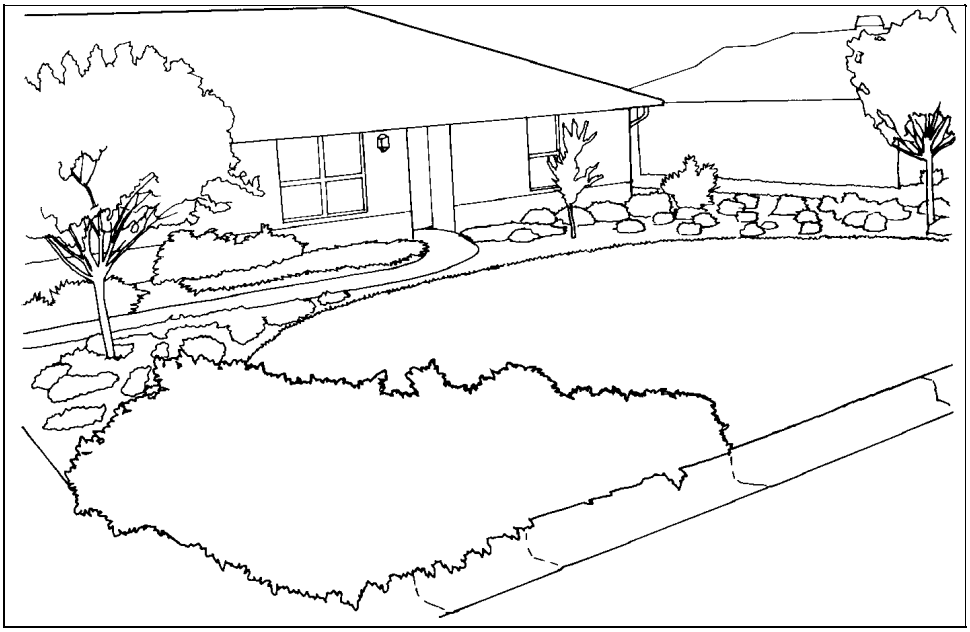
FLORIDA GUIDE TO ENVIRONMENTAL LANDSCAPING

by

Edward F. Gilman and Sydney Park Brown



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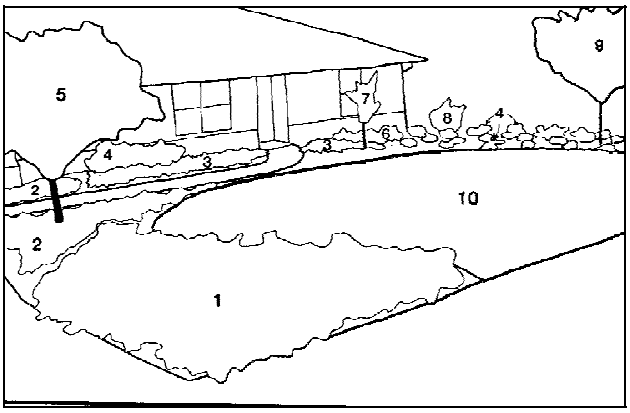

1. Lantana
2. Dwarf Jasmine
3. Blue rug Juniper
4. Indian Hawthorn
5. Crape Myrtle
6. Schellings Holly
7. Winged Elm
8. Dwarf Burford Holly
9. Chinese Elm
10. St. Augustinegrass

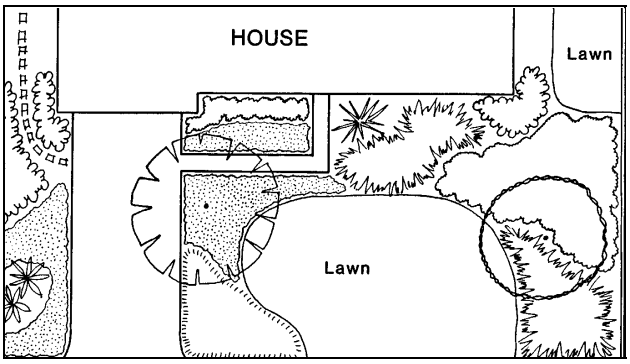

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Table of Contents

FLORIDA GUIDE TO ENVIRONMENTAL LANDSCAPING[1]

Edward F. Gilman and Sydney Park Brown[2]

INTRODUCTION

Why This Guide was Developed

Exciting changes are taking place in Florida gardens. People are seeking ways to have healthy, attractive landscapes using environmentally safe and energy conscious products and practices.

Florida is blessed with a sunny, warm climate that provides nearly year-round growing conditions for our lawns and landscapes. The state receives over 50 inches of rain each year, but it's concentrated between June and October. At other times, there are drought periods and a need for irrigation.

Fine weather also means high pest populations--insects, diseases, weeds and nematodes — which enjoy this favorable climate as much as we do. This combination of factors has resulted in the significant use of fertilizers, water and pesticides. To complicate this scenario, we have sandy, well-drained soils which don't retain the water, fertilizer and some pesticides we apply. The unwise use of these materials may jeopardize the aquifers which provide more than 85% of our drinking water.

During five to seven months of the year, the weather is hot and humid and we depend on air conditioning to stay comfortable. Residential energy use comprises almost 25% of the total state energy expenditure. Add to this the energy consumed in maintaining landscapes — not just the fuel for power tools, but also the energy required to produce and transport equipment, water, fertilizers and pesticides. For these reasons, and others, it's important for every resident and visitor to realize that the way we design and manage our landscapes can have significant impacts on the state's environment.

This environmental landscaping guide is a package of research-based information which can help you design and maintain your outdoor home (Table 1). It supports and builds on the principles of xeriscaping™. If it is designed and maintained with energy and the environment in mind, your landscape can reduce home heating and cooling costs by 30% and water bills by up to 50%. Another benefit is that attractive, healthy landscapes increase the value of your home (Figure 1).

Table 1. This guide will show you how to design and manage landscapes in an environmentally sensible way. You will learn how to:

- Design and install your landscape
- Choose proper plants
- Reduce home energy use
- Retain wildlife habitat
- Conserve water
- Use fertilizers wisely
- Apply less pesticides
- Reduce, reuse and recycle yard clippings

1. This document was published as Circular 922, Florida Cooperative Extension Service, reviewed 3/91. For more information, contact your county Cooperative Extension Service office.

2. Assistant Professor, Environmental Horticulture Department, Gainesville and Extension Agent III, Hillsborough County, Institute of Food and Agricultural Sciences, University of Florida, Gainesville.

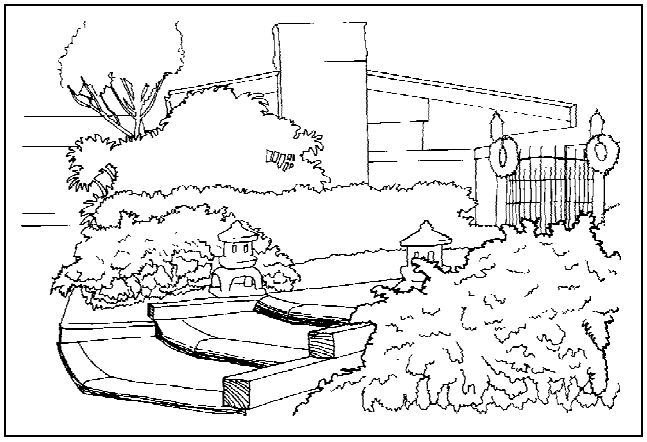


Fig 1a. Invest in a good landscape design to increase the value of your property by up to 15%.

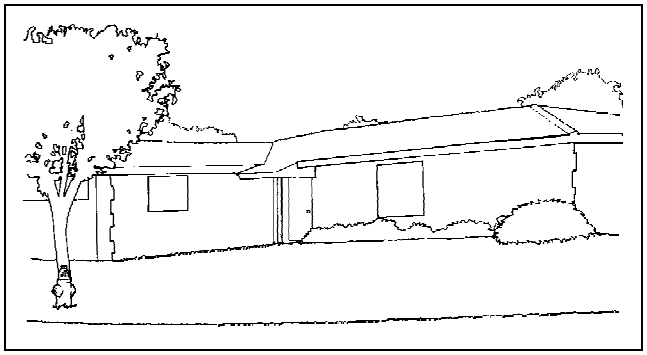


Fig 1b. A house with little landscaping is less valuable than one that has a well-designed landscape.

How to use this Guide

There are four main sections in this guide - (1) "Planning a Landscape", (2) "Selecting Plants", (3) "Planting and Establishment", and (4) "Managing an Established Landscape". The "Planning a Landscape" section is written for those who are designing a new landscape or considering modifications to an existing one. The "Selecting Plants" section will show you how to identify which plants are most suited for your landscape, and will provide tips on choosing plants from the nursery. The "Planting and Establishment" section will show you the best techniques for installing a landscape and caring for it until it is established. The "Managing an Established Landscape" section is meant to be used as a guide for those maintaining an established landscape. Following the practices in this guide will help you create a beautiful yard, save you money, enhance the environment and help conserve energy, water and other resources. For more information about this topic, contact your local County Cooperative Extension Service Office about Environmental Landscape Management (see Appendix 1).

SECTION I - PLANNING A LANDSCAPE

Determine What You Have

Save time and money later with proper evaluation now

Sketch the Property

The first step in designing a new landscape or modifying an older one is to determine the attributes and problems of the site. Do this by making a bird's eye sketch on a large piece of graph paper (Figure 2). Your builder may be able to provide a plat plan for you.Show on the sketch the approximate location of property lines and existing or planned "hard" structures—the house, driveway, walks, deck or patio. Draw in the significant trees and plants you wish to keep on the site. Use this sketch to record characteristics about the site such as condition of existing plants, sunlight patterns, soil characteristics, water runoff and location of utility lines. Techniques for evaluating these are given below. This information will be extremely useful later when you choose and install plants.

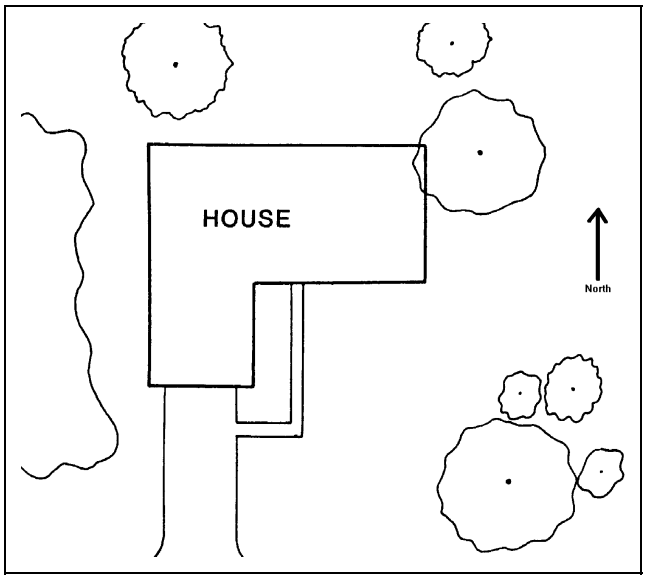


Fig 2. Make a bird's eye sketch of the property.

Plants to Keep for Maximum Energy Savings

Trees and other plants can modify the effects of Florida's hot and humid climate on your home. Determine the shading patterns cast by existing trees and shrubs onto the building. Save plants which shade the east or west walls to reduce air conditioning costs (Figure 3). Allow the winter sun to reach southern and western walls to help heat the home. This can be done by saving or planting deciduous trees and by pruning existing trees so sun light shines through or under them onto the walls. Shade the air conditioner unit for an additional 10% savings. Note where more shade may be needed.

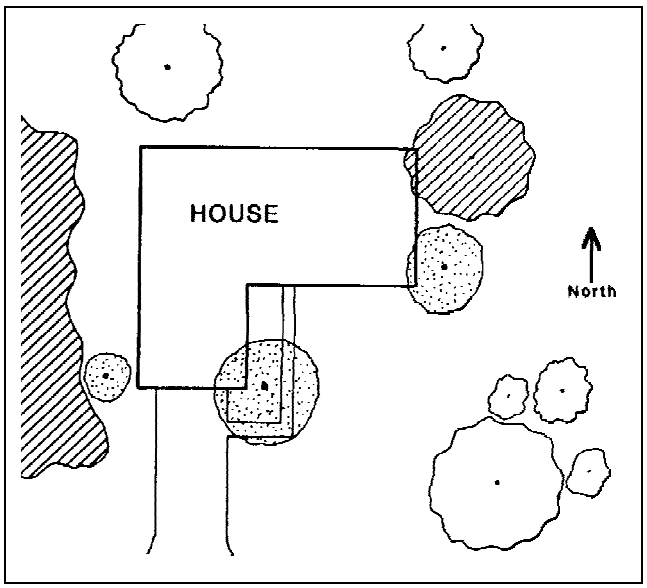


Fig 3. Save plants which shade the east & west walls to reduce utility costs. Consider planting trees to produce shade in these areas.

A professional tree expert or urban forester can evaluate the health and soundness of trees. Do not save trees which are unhealthy, but consult local ordinances and landscape codes before removing them.

Determine Shade Patterns

During a sunny day note how many hours of direct sun each area of the landscape receives (Figure 4). Are some areas shaded all day or only in the morning or afternoon? Some shade loving plants will do poorly if they receive as little as an hour or two of afternoon sun, even during the winter. Many plants require sun for at least four or five hours each day. Remember, the sun is at it's highest point in the sky in late June. In winter, the sun is low in the southern sky and will shine under trees which provided mid-day shade in June.

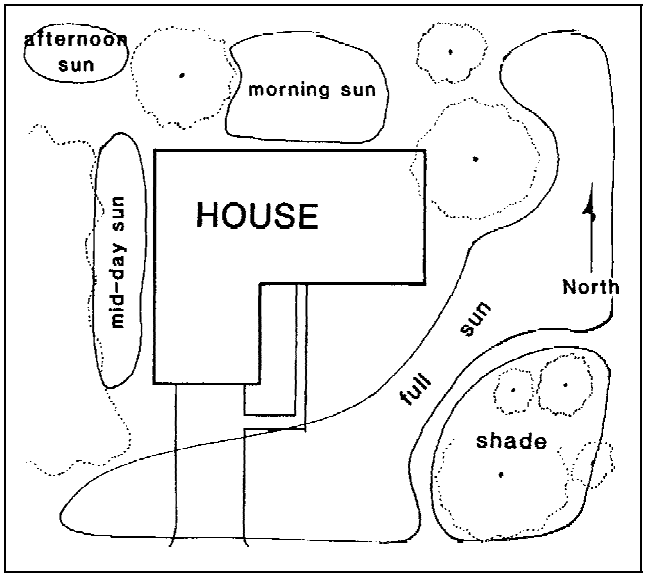


Fig 4. Indicate the sunlight patterns in the various areas of the landscape.

Locate Areas With Hard Soil and Poor Drainage

Compacted and poorly drained soils contain little oxygen--an element that plant roots need to survive and grow. Compaction results when vehicles or heavy equipment are parked or operated on the site.

Poor drainage can be a product of compaction or natural soil conditions. To check for compaction and drainage, dig several holes 18" deep in each section of the site (Figures 5 and 6 a). Compacted areas will be difficult to dig in. Proper soil preparation, plant selection and planting are essential in soils which are compacted or have poor drainage.

When rain occurs, study the flow of water across your property. Note where changes should be made in the slope of the land to prevent erosion and runoff.

Locate Utility Lines

To avoid damaging utility lines while digging, have the utility companies locate underground gas, water, sewer, phone, cable TV, and power lines (Figure 7). They will often do this free of charge. Above-ground power lines should also be noted as you will want to avoid planting large trees near them.

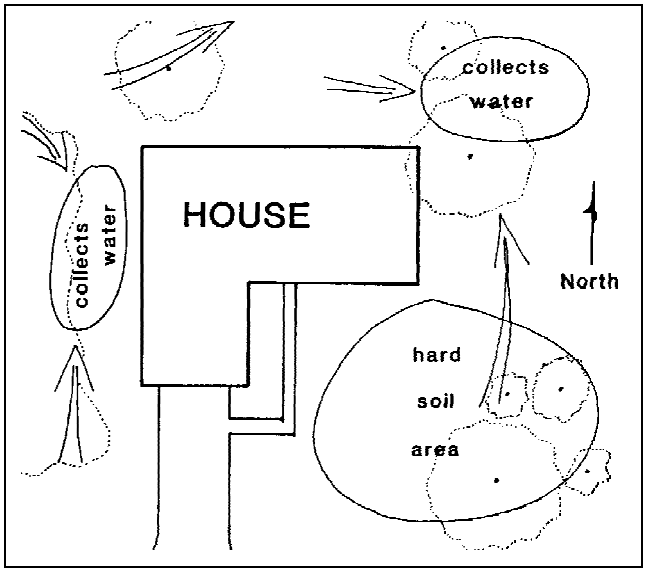


Fig 5. Locate areas with hard soil and poor drainage. Indicate the direction of water flow.

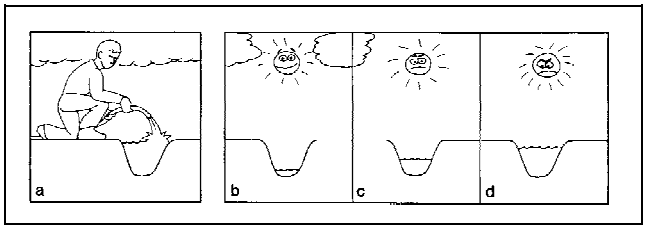


Fig 6. Check soil drainage: a) Just after it rains 1 inch or more, dig and fill several 18 inch-deep holes with water. b) Drainage is good if water drains away within an hour. c) Drainage is poor if water takes several hours to a day to drain. d) There is a high water table if water stands indefinitely.

Collect Soil for pH Testing

The pH of a soil governs the availability of nutrients to plants and also affects the activity of soil microorganisms. If soil pH is alkaline, micronutrient deficiencies may develop on some plants. A pH test should be conducted in two or three areas of your lot wherever the soil color or texture appears distinctly different, or where special gardens or plants will be grown (rose bed, vegetable garden, etc).

Dig about 10 small holes in each area of the yard with a trowel or shovel (Figure 8). Remove a slice of soil from the side of each hole from the surface down to 6 inches deep. You might choose to use a soil coring device to collect the samples if one is available. Mix the soil together in a plastic bag or jar. Contact your local County Cooperative Extension Service for more information on soil testing. See Appendix 1 for

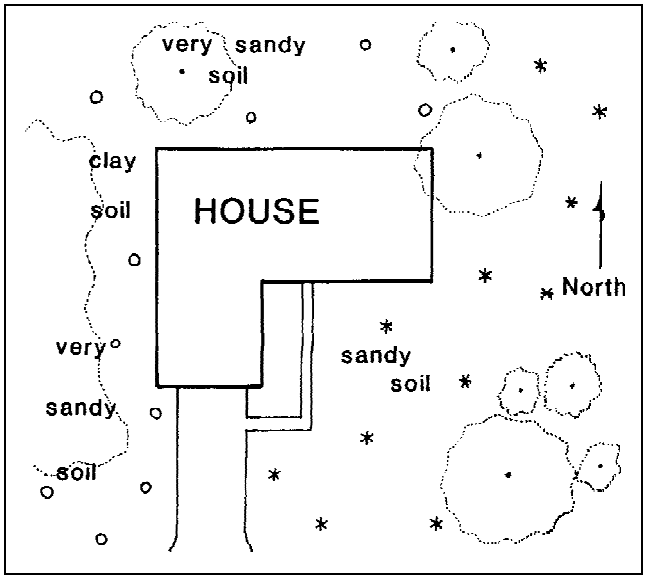


Fig 8. Combine soil samples from similarly marked areas into one composite sample.

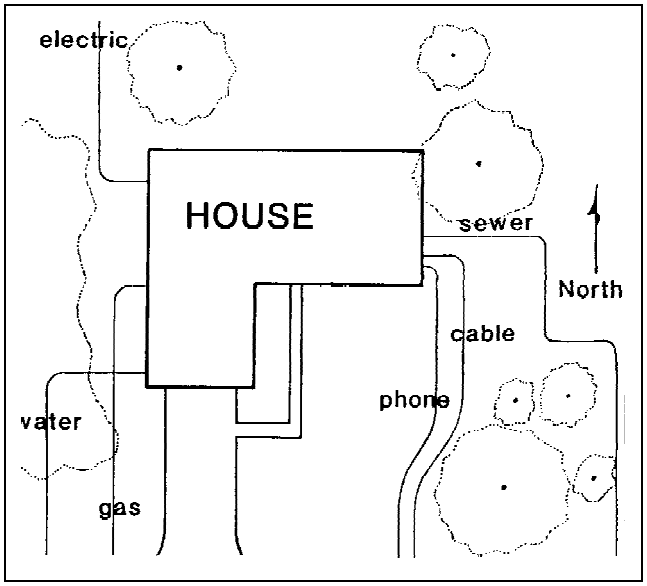


Fig 7. Locate the underground utility lines which feed into your house.

the office nearest you. The test report will include corrective measures for adjusting the pH if required.

As you dig the cores, take note of the color and texture of the soil. Indicate on your landscape sketch which areas contain loose, sandy soil, which contain limerock and which contain dense clay or other types of soil (Figure 8). This information will help you later in your irrigation and site preparation decisions.

Coastal Concerns

If you live near the coast, you should identify the areas of your landscape which receive salt spray during storms or high winds (Figure 9). You should also test well water used for irrigation to determine the level of salts. Coastal wells contaminated by salt water can damage many plants. Most County Cooperative Extension Service offices or local labs can conduct this simple test.

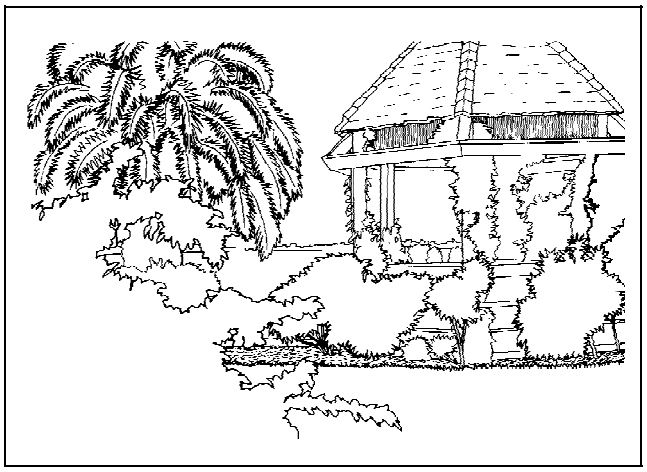


Fig 9. Salt spray along the coast can impact landscape plants.

Designing or Modifying the Landscape

Here are ways to reduce landscape maintenance.

Protect Your Trees

Trees provide enormous benefits to the landscape and the environment (Table 2). Save healthy trees and other existing vegetation because less maintenance and little irrigation will be needed (Figure 10).

If you are fortunate enough to have existing trees on your site you must protect them from the devastating effects of land alteration, fill, soil compaction and building construction. Homeowners are frequently dismayed when the trees on their lot begin to die. They often end up paying twice for the trees — when they buy the lot and again when dead trees are cut down.

Table 2. Benefits trees provide are that they:

- Lend permanence to landscape
- Cool air temperature
- Reduce the "greenhouse effect"
- Produce oxygen
- Provide homes and food for wildlife
- Prevent erosion and runoff
- Reduce home energy costs
- Healthy trees increase property value
- Offer pleasant setting for outdoor activities.
- Intercept air pollution

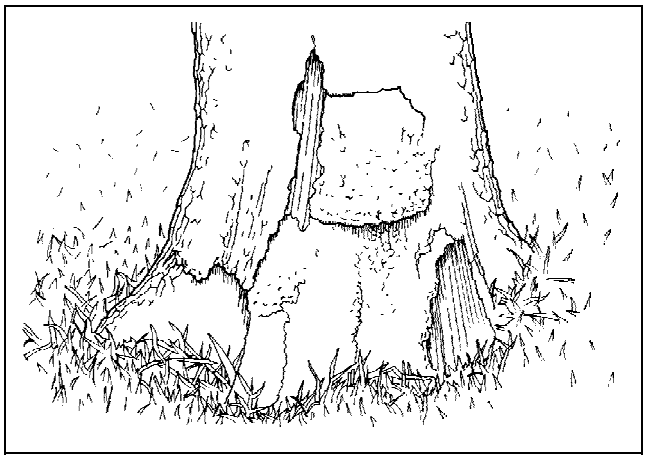


Fig 10b. Trees with severely damaged bark can become hazards and should be removed.

Figure 11 illustrates diagrammatically what the root system of a tree looks like beneath the soil. Notice that more than half the root system is outside the leaf canopy of the tree. Also note the fine roots are located within several inches of the soil surface. This emphasizes the need for protecting roots, especially beneath the canopy. If roots beneath the canopy are left undisturbed, the tree has a good chance of surviving, provided it is irrigated regularly during and following construction.

Do not store or spread *any* amount of soil beneath the canopy of the trees which are to be saved (Figure 13). Be sure that soil grade changes do not channel water toward these trees. Both activities suffocate and kill roots. The trees usually die, although it may take them several years to die.

Trees which were not adequately protected are often attacked and killed by borers. These insects prefer stressed trees. Look for small holes in the bark or the characteristic pile of fresh, light colored saw dust or frass at the base of the tree. The best treatment is to cut down the tree, dispose of the wood and treat the bark of nearby trees with a pesticide labeled for borer control. This will help prevent the spread of the insects to nearby trees.

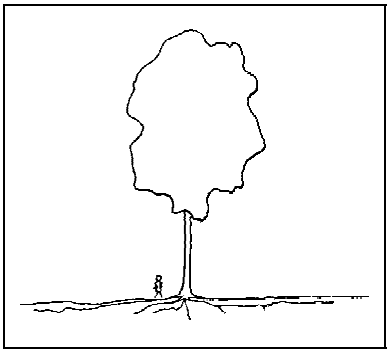


Fig 11. Many of the roots are fairly shallow and more than half of the root system is outside of the canopy.

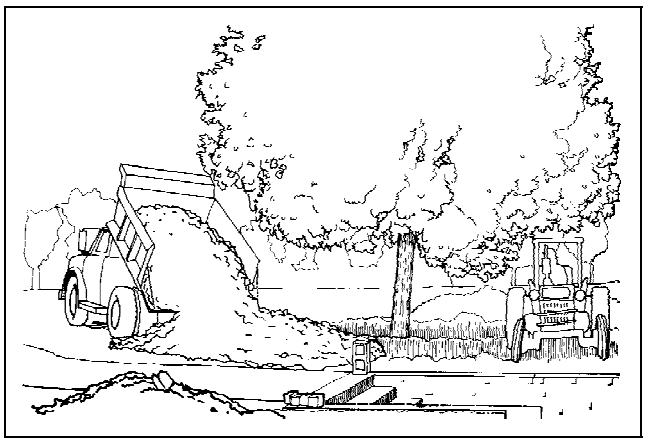


Fig 13a. Consider removing a tree if heavy equipment is operated beneath the canopy. Much of the root system was damaged and the tree will eventually die.

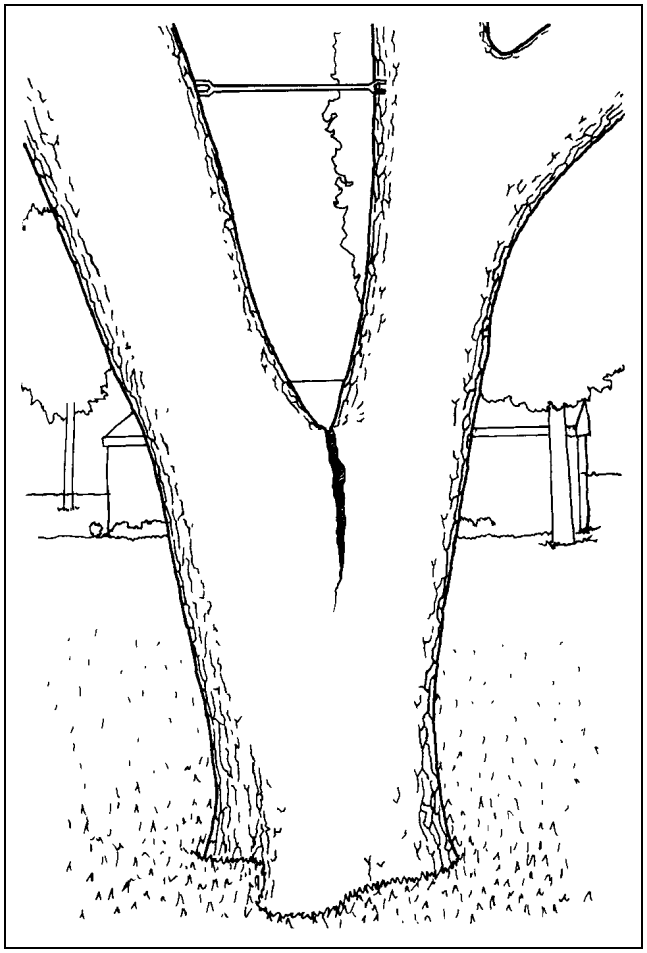


Fig 10a. Don't save defective or severely damaged trees such as those with split trunks unless repair is possible by a professional.

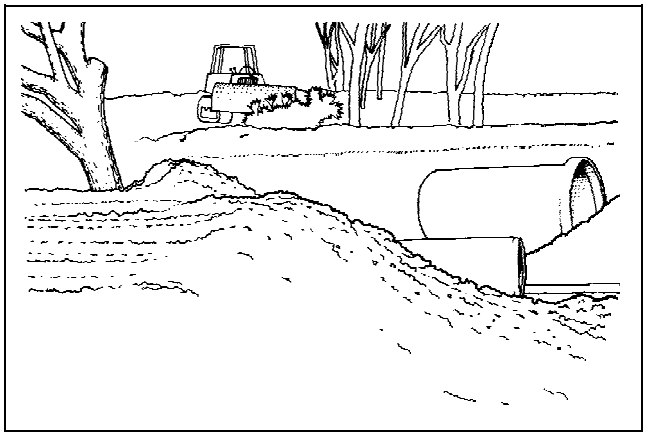


Fig 13b. As little as several inches of soil added around a tree can kill it.

Groups of trees usually stand a greater chance of survival and provide more environmental benefit than single specimens (Figure 12). Wildlife habitat is retained if the shrubs and other understory plants are left along with the trees. It is often wiser, especially on small lots, to save young healthy trees (trunk diameter of less than 12 inches) since they tend to withstand construction damage better than older, mature trees. In addition, long lived trees such as live oak provide an extended benefit to the property than short-lived species such as laurel or water oak. And live oak is less likely to drop branches.

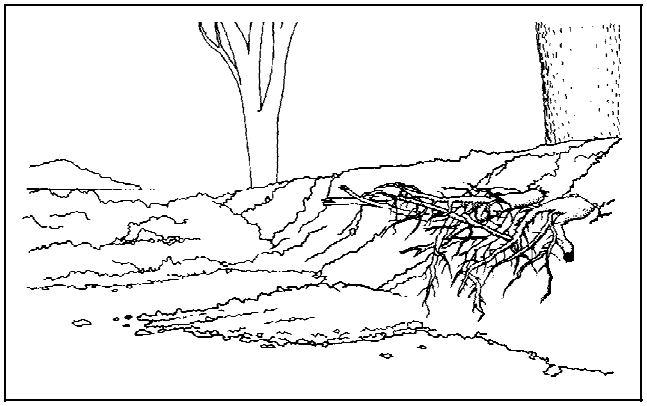


Fig 13c. As little as several inches of soil removed from around a tree can kill it.

Prevent Soil Compaction

Compacted soils damage existing trees and retard growth of new plants. The only way to prevent this is to eliminate all vehicular traffic from the site. Since this is not practical, reduce the effects of construction equipment by confining vehicles to one or two well marked paths on the site.

Spread a 6-10 inch layer of mulch over the paths. For maximum protection, cover the mulch with steel plates. If vehicles must pass beyond the paths, insist that the vehicle drive on a cushioning layer of mulch. This mulch can later be used in the landscape beds. Also, don't store construction

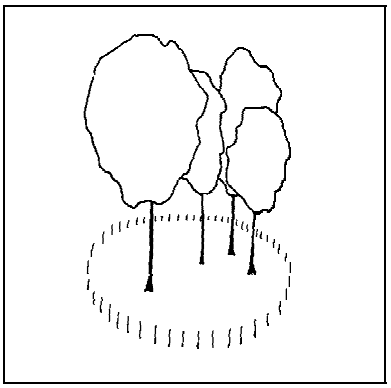


Fig 12. To protect trees during construction and grade changes, construct sturdy fences outside their canopies to ensure enough roots are left undisturbed.

equipment or materials under trees (i.e. block, brick, lumber, etc.) and don't park cars and trucks beneath trees. If the site is compacted during construction, trees will often decline or die over a period of several years.

Landscapes to Fit Your Lifestyle

Decide how the landscape is or will be used and prioritize your needs (Table 3). You can install the landscape in phases over a period of years according to these priorities. Consider the trade-offs of initial cost versus maintenance. For example, decks or patios provide extra living space for your family and cost from several hundred to several thousand dollars. Will the low maintenance costs of these structures offset the initial cost?

Table 3. Possible landscape uses.

Vegetable/Herb/ Fruit Garden	Yard games
	Drying laundry
Picnic area	Storage area
Children's play area	Pool, spa, hot tub
Outdoor entertainment	Lounging
Water garden	Hobby greenhouse
Pet area	Horticultural display
Wildlife habitat	Privacy

Create the Design

Once you have examined your landscape site and prioritized your needs, you are ready to create the landscape plan. A well designed landscape allows you to efficiently use and maintain it and adds beauty to the yard. Landscape design advice, books, computer programs and brochures are available through book stores, garden centers, the Cooperative Extension Service and libraries. Or you may wish to hire a professional landscape designer or landscape architect to prepare the plan.

People often wonder which plants are best for reducing landscape maintenance. However, an appropriate landscape design is as much or more responsible for reducing maintenance as proper plant selection.

To get started, place tracing paper over the sketch of your property and draw in a rough design. First draw in the bed lines (the line separating the lawn from the landscape beds), then add the trees, ground cover and shrubs. You will probably have to sketch several before you create the right one. A lawn area plays an important role in the landscape due to its high resistance to wear. Therefore locate it where it serves that function: children's play and yard game areas, and as access to other parts of the landscape.

Arrange lawn areas so their width is at least half their length. Place the lawn in the center of the yard, surrounded by ground covers and shrubs. This looks attractive and allows for more efficient irrigation. Don't use grass on steep slopes or in narrow strips where it will be difficult to mow and irrigate. Use ground covers or low growing shrubs instead. Also, design the size and shape of the landscape beds so they can be irrigated efficiently.

Figure 14 suggests two designs for the same property based on different lifestyles. The working or retired couple may use the landscape primarily for entertaining. They may have little time for or interest in maintenance and upkeep. A small turf area to set off the landscape combined with lots of ground cover and shrubs may be suitable. The family with children may need a play area and a larger lawn area.

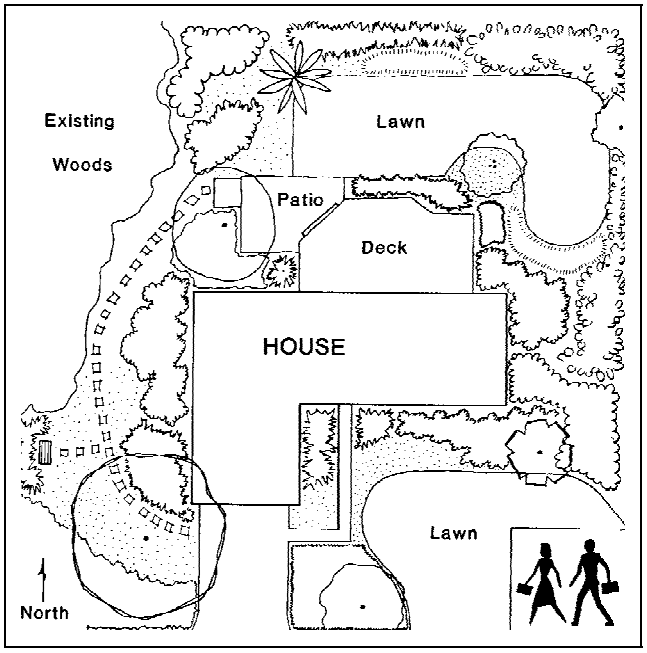


Fig 14a. This landscape is designed with low maintenance in mind.

Design flaws can be easily spotted and corrected by hiring a reputable landscape maintenance firm to review your design before it is installed. This might reduce costs

and simplify maintenance. Be sure not to make the mistakes shown in Figure 15.

Consider two designs created for the same back yard. The traditional one provides a spacious lawn area for recreational games. This design could be suitable for the family which requires a large lawn area for sports or other activities.

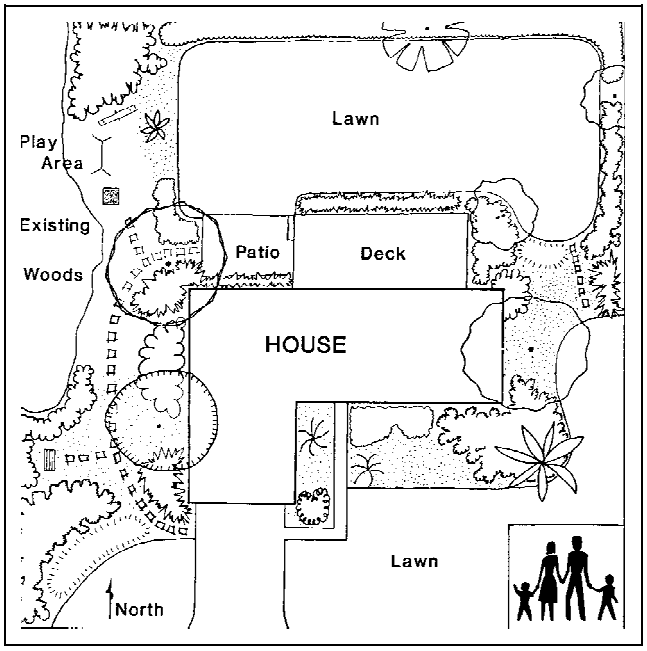


Fig 14b. This design may be more suitable for the family with children because it has a larger lawn area.

A low maintenance landscape (Figures 16 a-c) provides a smaller lawn area. Mowing time, pesticide and irrigation costs will be further reduced in this yard if pest resistant, low water requiring plants are installed. This landscape also includes flowering trees and shrubs, and a deck and patio which can be used for outdoor entertaining. Initial cost would be higher, but less regular maintenance would be required in this yard. Wildlife would be more attracted to this yard because of the diversity of plants.

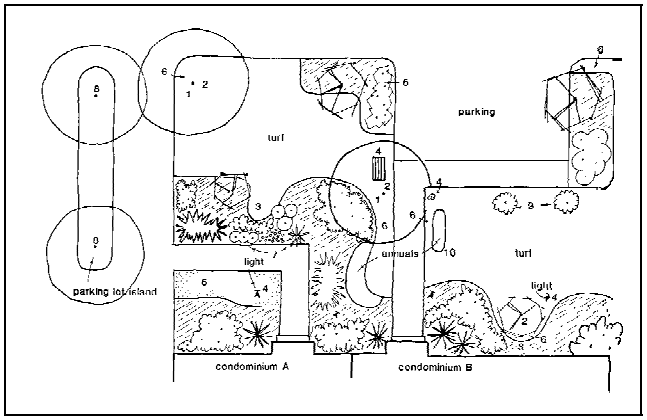


Fig 15. Reduce maintenance by avoiding design pitfalls. (see 15b for key to design pitfalls)

Fig 15b. Key to design pitfalls

1. Locate large trees at least 5-feet away from curbs and sidewalks to avoid damage.
2. Locate trees in beds or mulched areas to avoid difficult mowing conditions.
3. Smooth out bed lines. Wavy lines often distract from an otherwise good design.
4. Don't place obstacles in the lawn, put them in beds.
5. Large shrubs in the parking lot block visibility.
6. Eliminate narrow strips of grass. They add to mowing costs and are difficult to irrigate.
7. Don't complicate the design with too many kinds of plants.
8. Allow at least a 10 X 10 foot soil-area for proper tree growth. Trees planted in small areas grow poorly or raise the curb.
9. Eliminate individual shrubs growing in lawn. They increase maintenance and distract from a good design.
10. Locate annuals in beds, not in the lawn.

Design for Water Conservation

Most trees and shrubs are relatively drought tolerant once they are well established. Grasses such as bahiagrass and centipedegrass are also drought tolerant. Despite this, there may be dry times during the year when even these plants need supplemental irrigation.

Many annuals and some other plants require frequent watering. Florida rainfall amounts to over 50 inches of rain a year, but it's concentrated in the summer. Irrigation to supplement rain is often desirable or

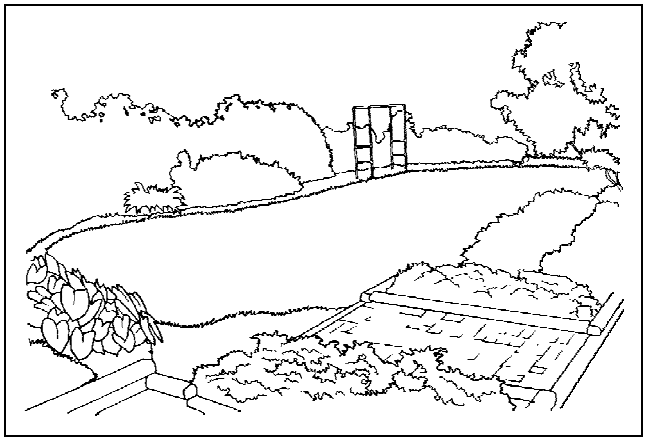


Fig 16a. low maintenance backyard.

necessary during periods of low rainfall.

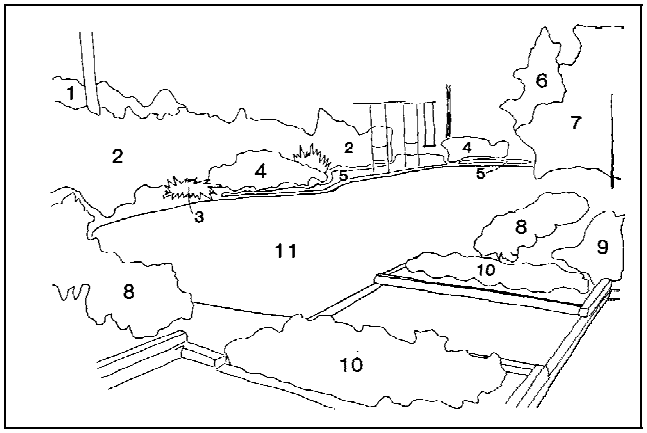


Fig 16b. silhouette of landscape identifying plants.

1) Wax myrtle, 2) Sandankwa viburnum, 3) Variegated ginger, 4) Azalea, 5) Dwarf Jasmine, 6) Southern magnolia, 7) Crape myrtle, 8) Caladium, 9) Shrimp plant, 10) Annuals, 11) Lawn.

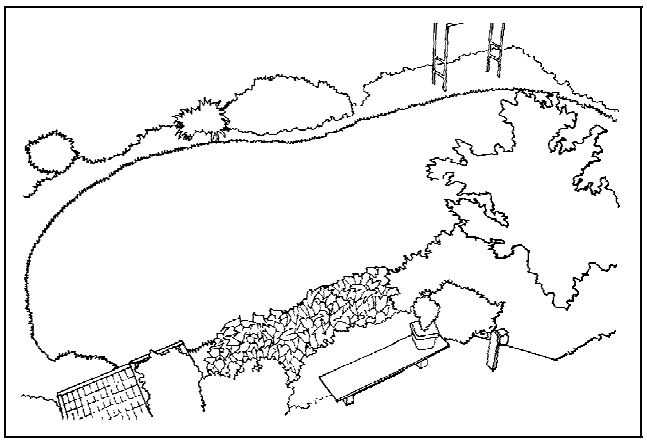


Fig 16c. plan (bird's eye) view of the above landscape.

Water efficient landscape design - Irrigation can be applied efficiently, only if the landscape and the irrigation system are designed properly. Group plants with similar water requirements together so that they can be irrigated together and water will not be wasted on plants that don't need it. For example, placing azaleas, which require shade and more irrigation in the same bed with junipers which are drought tolerant and require full sun will waste water and demand more maintenance. The drought tolerant junipers will be over watered and unhealthy.

Mass planting - Planting large areas with the same kind of plant looks nice and allows for efficient irrigation and maintenance (Figure 17 a). A large mixture of plants in one area of the yard is difficult to maintain, wastes resources and can look messy and unorganized. Leave areas of undisturbed native vegetation, since they require almost no irrigation (Figure 17 b).

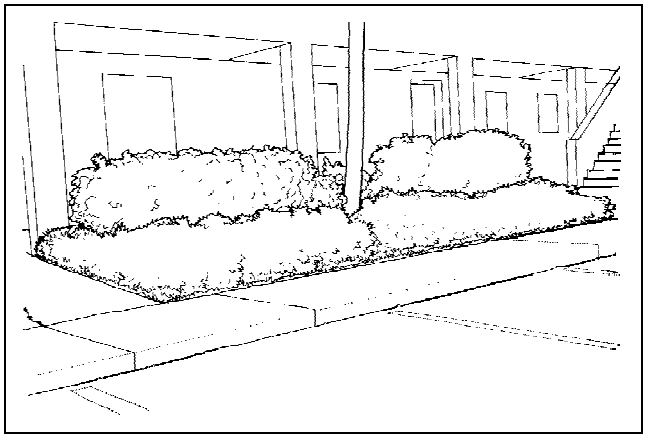


Fig 17a. Massing ground covers and shrubs together allows for efficient irrigation.

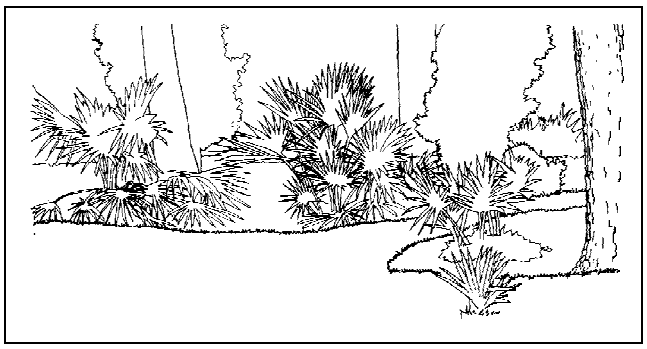


Fig 17b. Existing native ground covers, trees and shrubs will subsist with almost no irrigation.

Efficient irrigation systems - Consider how you will irrigate the landscape as you design it. If you select a permanent, in-ground irrigation system, it should be installed before the landscape plants. Employ the services of a qualified landscape irrigation designer/installer to ensure purchase of a properly designed, properly installed, and efficient system.

Multi-zoned systems - The most efficient system waters the lawn separately from beds of ground covers, shrub beds or tree groupings. In addition, use separate zones for shady and sunny areas since plants in sunny areas require more frequent irrigation during the summer. A multi-zoned system allows you to water only those areas that need it. This saves significant amounts of water and energy. Remember that annuals and other plants requiring frequent irrigation should be located so they can be watered easily with a hose, with a separate irrigation zone, or with a micro-irrigation system (Figure 18). You will pay extra to install this more sophisticated design.

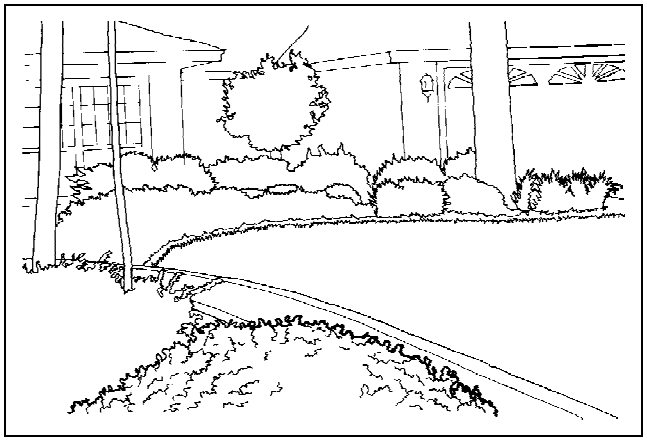


Fig 18a. Water conserving landscapes can include color. Impatiens require frequent irrigation.

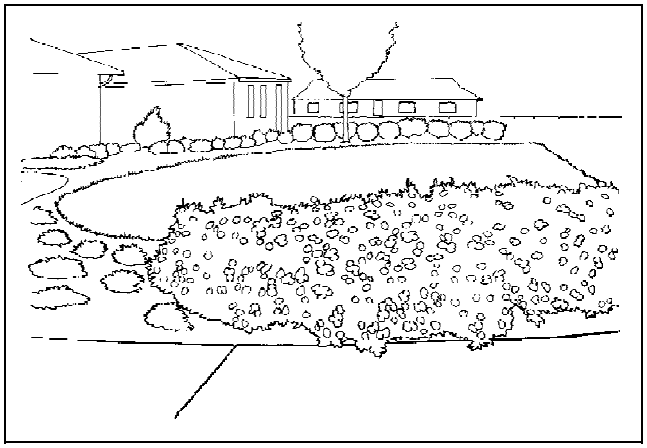


Fig 18b. Other plants provide year-round color (lantana) with little irrigation.

Group plants together with similar water requirements.

Micro-irrigation system - A micro-irrigation system is another way to water efficiently. Water is dripped or sprayed at the base of plants through small nozzles called emitters (Figure 19). They conserve water by dispensing it at a slow rate. Poor water quality or debris can clog up these emitters, so they need to be checked frequently. A micro-irrigation system can be used to irrigate shrubs, ground covers, annuals, and fruit and vegetable gardens.

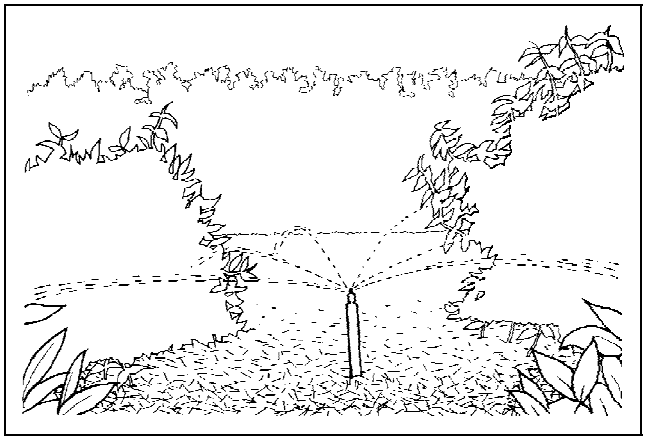


Fig 19. Save water by installing a micro-irrigation system.

Micro-irrigation kits are available at many home and garden stores and are easy to assemble. Many can be simply connected to hoses or faucets. More sophisticated systems can be designed and installed by a professional. Contact an irrigation or plumbing supply store that sells the equipment.

Operating an irrigation system - Time clocks are not needed to operate an irrigation system efficiently. You (not a time clock) are the best judge of when plants in a particular area of the yard need water (see page 20, Section IV - "Managing an Established Landscape - Water — the Misunderstood Resource"). If you have a well-designed system, you can irrigate only those areas which require water on a given day.

If you want the system controlled automatically, purchase a time clock which will allow you flexibility in scheduling. However, set the time clock to "off" and manually switch on the system only when you determine that plants need water. Only operate those zones containing plants that need water that day. Unfortunately, many inexpensive time clocks water every zone every time the system comes on. This is usually unnecessary and wastes water and energy. The "automatic" setting on the time clock is useful when you will be away from the property for more than a few days.

How often have you seen a sprinkler system operating in the rain? This obvious waste of water can be prevented by installing a rain shut-off device. This device overrides the system and prevents it from turning on in the rain. It is relatively inexpensive and easy to install, even on an existing system.

Modifying an existing irrigation system - You don't have to live with the existing irrigation system. Have an irrigation specialist evaluate the system for efficiency. Sometimes small modifications such as installing a different type of sprinkler head, replacing worn out heads or redesigning a portion of the system can eliminate needless water waste. Read page 9, Section I - "Design for Water Conservation" for details on efficient irrigation design.

Design for Energy Conservation

A home or other building can be made more energy efficient by planting trees, shrubs and vines on the east and west sides to shade the windows and walls (Figure 3). Vines trained to grow on a trellis placed about 1 foot from the house will shade a wall. Small to medium sized trees and shrubs planted within 20 feet of the home will provide shade within five years. Trees planted close to the home provide more benefit because they shade for a longer period of time during the day and over a greater part of the summer season.

Trees and well placed shrubs combined with good building insulation can reduce energy consumption in the Florida home by up to 30%.

If you depend on air conditioning to cool your home, divert breezes away from the house to save energy. A windbreak can be designed along the side of the home receiving the breezes. Shrubs can be planted close to walls to create a dead air space that will also reduce the cost of heating and cooling the home (Figure 20).

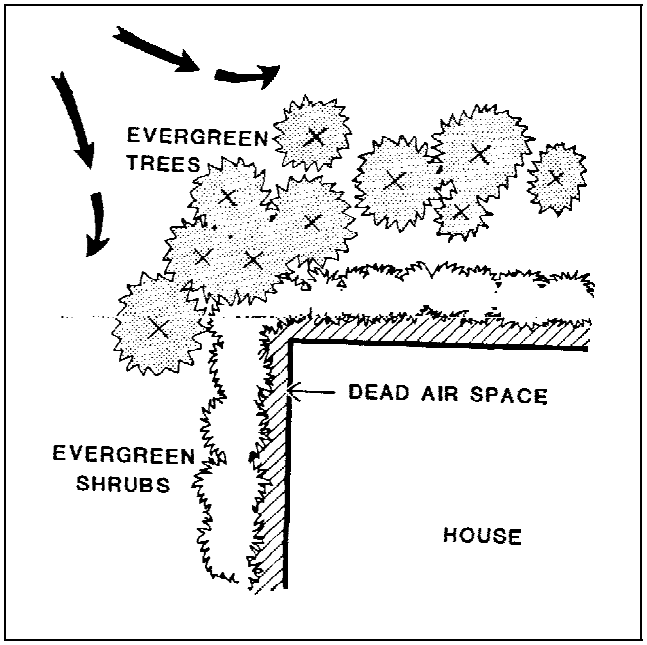


Fig 20. Lower your energy bills by deflecting prevailing winds away from the house.

Preparing the Site for Planting

Break up Compacted Soils

Compacted soils can be rototilled, but avoid doing this beneath the canopy of existing trees. Significant root damage will occur and the tree may die. A coring machine or pitchfork can also be used to aerate compacted soil. If the site is located in a low area where surface water collects from surrounding areas, rototilling will not help. Correct the effects of poor drainage with underground drains, diversion ditches or adding soil to raise the land. Or you can plant trees and shrubs which tolerate wet sites. Be sure not to divert water where it will stand near existing trees because this could kill them. Consult page 16, "Section III - Planting and Establishment" for additional tips.

Ideally, top (fill) soils brought onto the site should be mixed together before they are spread. This helps prevent problems caused by layering of different soil types. It is costly but will reduce landscape maintenance. If this is not practical, fill soils should be as uniform as possible. The texture of the fill soil should be about the same as or slightly coarser than the texture of the existing soil. If different types of fill soil are used, the landscape will probably require more labor to maintain due to their different moisture and nutrient holding capacities (Figure 21).

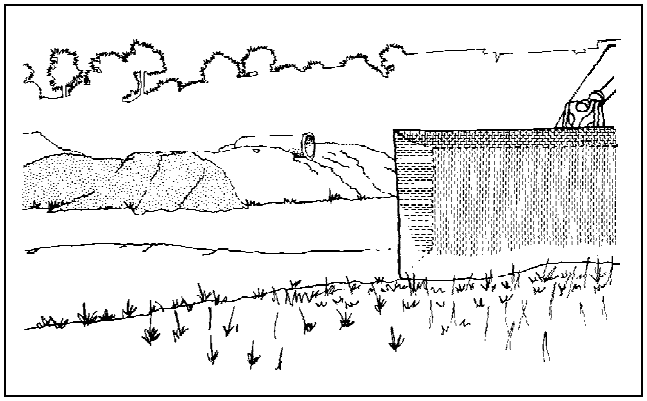


Fig 21. Don't buy different types of top (fill) soil.

Reduce Water-runoff

Water running off the site can carry soil, pesticides and fertilizers which contribute to environmental degradation. Grade (shape) the soil surface to minimize runoff. Installing gutters along the roof can also reduce water runoff from the landscape. Direct the water to a dry well or other area that collects water so it percolates through the soil and doesn't run off the site. Shallow ditches can be constructed to direct the flow of water. Direct it away from poorly drained areas. Eliminate berms, mounds and slopes by constructing a terrace. Building retaining walls helps to level the site allowing water to percolate through the soil instead of running off. They can add to the attractiveness of the yard if they are properly designed and installed (Figure 22).

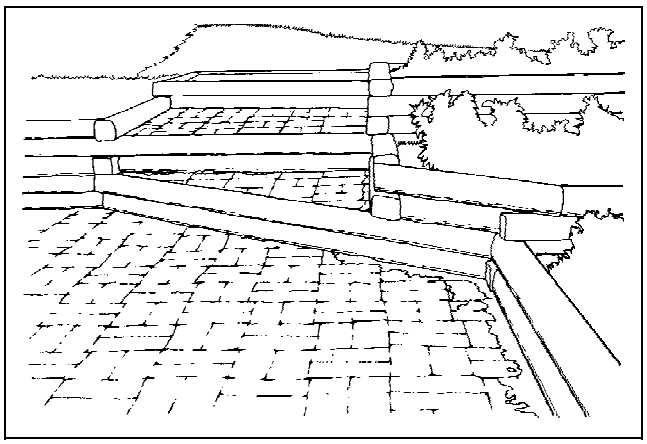


Fig 22. Reduce runoff by terracing.

Improve the Soil

It is difficult to improve most Florida soils. The exceptions are limerock soils or areas with very restricted soil space. The latest information indicates that organic soil amendments decay quickly and provide only short-term improvements in nutrient- and water-holding capacity. Annual plants like vegetables and flowering annuals can benefit from peat and compost that is mixed into sandy soil before planting. Colloidal phosphate, a byproduct of phosphate mining, can be used as an inorganic amendment for sandy soils. Its improving affects can last 10 years or more. Synthetic soil amendments also are being developed and may be useful in the future. If soil amendments are used they should be mixed into the top 6-12 inches of large areas of soil before planting.

Low, acidic pH can be corrected with dolomite or lime. Alkaline soil, with a naturally high pH cannot be corrected permanently by any practical means. Unless the high pH was caused by overliming, applications of elemental sulfur will provide only a temporary drop in soil pH. This could help prevent nutrient deficiency symptoms by allowing uptake during this short period of time. A better solution is to use plants that tolerate high pH.

SECTION II - SELECTING PLANTS

Choosing Plants for the Landscapes

Selecting Trees, Shrubs and Ground Covers

Now you are ready to begin selecting specific plants for your landscape design. To some, the ornamental benefit of a plant requiring high maintenance is worth the extra care. Others would be better off selecting a different plant which might provide the same ornamental or functional benefits at a fraction of the maintenance.

One common mistake is planting a fast-growing shrub for a hedge. The plants grow to the desired size rapidly, but you will pay for this convenience with frequent pruning (Figure 23). A better alternative is to choose a moderate- or slow-growing plant.

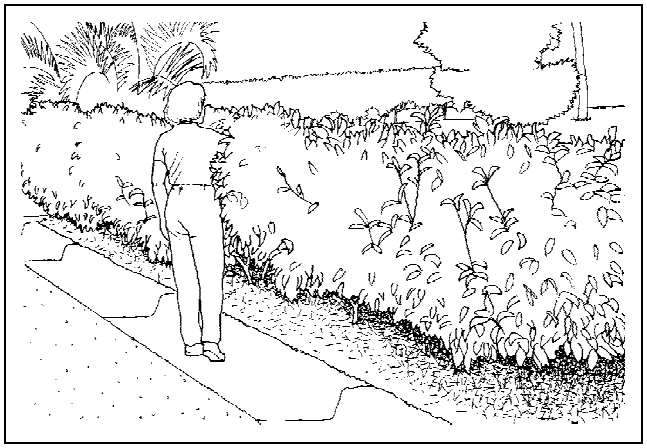


Fig 23. Reduce maintenance by choosing shrubs with moderate to slow growth. Photinia (shown here) and other fast growing plants require frequent pruning.

Match plants to the site (Table 4). Begin in Step 1 by checking the site characteristics which match those found in the specific areas where you will be planting. Remember that site characteristics can differ for different parts of the same landscape. Proceed to Steps 2 and 3 and select characteristics which you would like your plants to have. Now develop a plant list and make your final selections in Step 4. See Figure 24 and the front and inside cover for an example of the plant selection process.

Select the Right Lawngrass

Select a grass according to the site characteristics, its anticipated use and maintenance requirements (Table 5).

Table 4. Match plants to the site.

Step 1. You've determined that your site has these characteristics.

☑ sunny ☑ loose soil
☑ sandy ☑ well-drained
☑ acid pH

☐ Central Florida ☐ sandy ☐ alkaline pH
☐ loamy ☐ compacted soil
☐ well-drained soil
☐ coastal ☐ poorly drained soil
☐ acid pH

Steps 2 and 3. These are the characteristics you want your plants to have.

☑ drought resistance
☑ low growing shrubs/ground covers
☑ pest resistance
☑ attractive flowers

Step 2. Choose among plants with these characteristics to

Step 4. You've chosen these plants for your landscape design because 1) they match your site characteristics and 2) many have the characteristics you've chosen in steps 2 & 3.(See front cover and inside front cover).

1. Lantana
2. Dwarf Jasmine
3. Blue rug Juniper
4. Indian Hawthorn
5. Crape Myrtle
6. Schellings Holly
7. Winged Elm
8. Dwarf Burford Holly
9. Chinese Elm
10. St. Augustinegrass

Step 3. Additional characteristics to consider.

☐ attracts wildlife
☐ bears edible fruit
☐ attractive flower
☐ other

Step 4. Consult these sources to develop a list of plants which match these characteristics. (See Figure 24 for an example.)

Cooperative Extension Service (See inside back cover to locate the office nearest you.)
Division of Forestry (located in many counties)
Florida Water Management Districts
Garden Center
Library
Selected Books

Fig 24. Plant selection example. See Table 4 to determine your own site characteristics.

AT THE NURSERY - SHOP TOUGH

Select Plants With the Correct Form

Small trees (with trunks less than 2 inches diameter) do not need to look like miniatures of a mature tree. Only the bottom 1/3 of the trunk should be clear of branches, no more. Foliage should be evenly distributed in the upper 2/3 of the tree, not concentrated at the top (Figure 25).

Although a tree with a symmetrical outline looks attractive, it doesn't assure that the tree is good quality. Look inside the branch crown for quality. Pass over trees with only upright branches which form narrow angles with the trunk (Figure 26a). Do not plant oaks and other

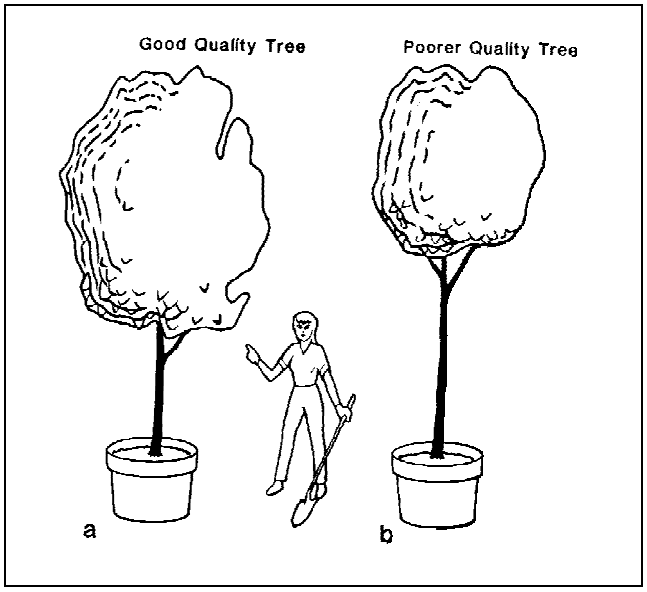


Fig 25. a) Branches should be distributed along the upper 2/3 of the trunk. b) Poorer quality trees have no branches along the lower half of the trunk.

large-growing trees which have two or more trunks because these can become hazards as the tree grows larger (Figure 26b). Except for small-growing, multi-stemmed plants such as crape myrtle and ligustrum, select specimens with a single trunk and spreading branches (Figure 26c). Do not purchase any shrub or tree with injury to the trunk.

Select Healthy Plants From the Nursery

Healthy plants establish quickly in the landscape. Plants in poor health attract pests and require more maintenance. Examine the leaves and shoots. Plants with yellow or spotted leaves should be rejected (unless this is a normal characteristic of the plant). Select those which have an abundance of leaves. Never install sod or plants which contain weeds or which have diseases or insects. This is one way that various pests are introduced to your site (Figure 27).

Slip the container from the root ball. The root ball should stay together but be somewhat pliable when the container is removed. Do not purchase pot-bound plants. A pot-bound plant has many roots circling around the outside of the root ball, or the root ball may be very hard (Figure 28). These plants may have trouble establishing, and the circling roots may choke it as it grows older.

Table 5. Lawngrass selection guide.

Turfgrass Name	Drought tolerance	Salt tolerance	Shade tolerance	Wear tolerance	Maintenance level	Establishment methods
Bahiagrass	Excellent	Very Poor	Poor	Good	Low	Seed, Sod
Bermudagrass	Excellent	Excellent	Very Poor	Excellent	High	Sod, Sprigs, Plugs, Seed
Carpetgrass	Very Poor	Poor	Fair	Poor	Low	Seed, Sprigs
Centipedegrass	Good	Poor	Fair	Poor	Low	Seed, Plugs, Sprigs
St. Augustinegrass	Fair	Good	Good (Cultivar depen-dent)	Fair	Moderate	Sod, Plugs, Sprigs
Zoysia-grass	Excellent	Good - Excellent	Fair	Excellent	High	Sod, Plugs, Sprigs

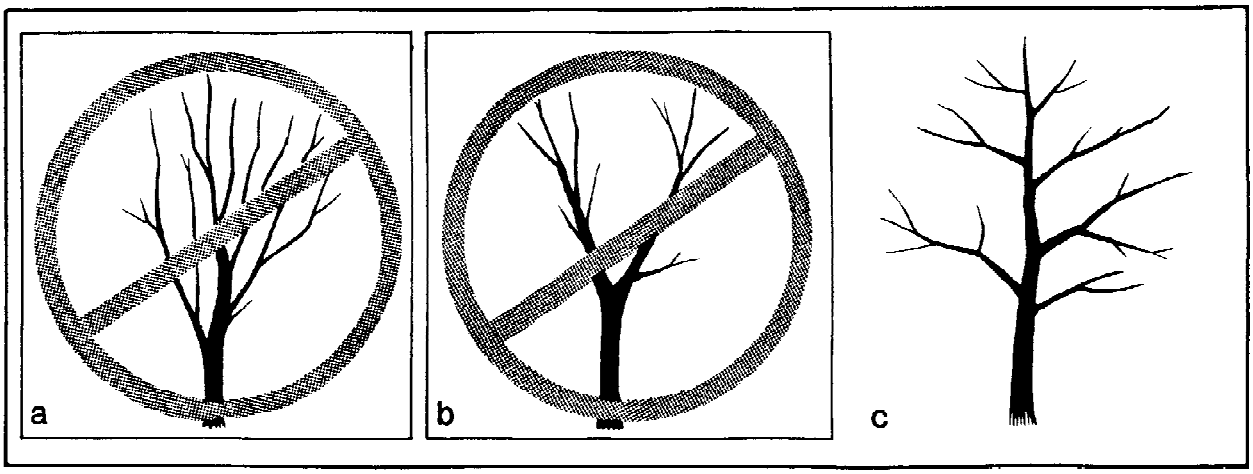


Fig 26. Buy quality trees. Avoid large-growing trees with, a) only upright branches, or b) double or multiple trunks. c) Select trees with a central trunk.

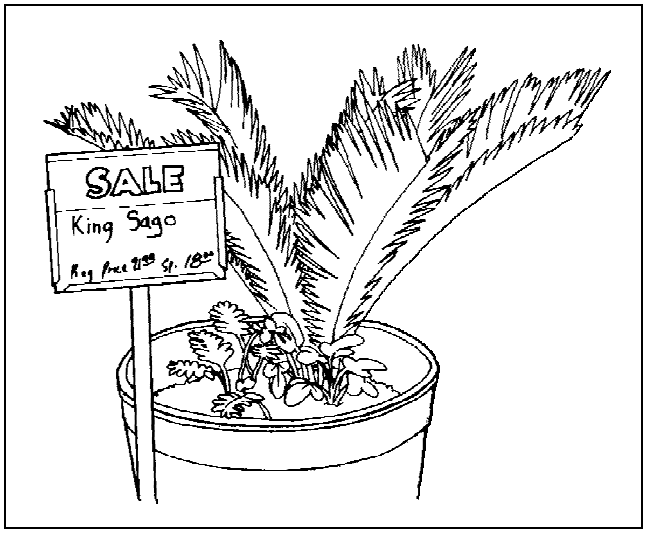


Fig 27. Don't buy plants which look off color or those with weeds in the root ball.

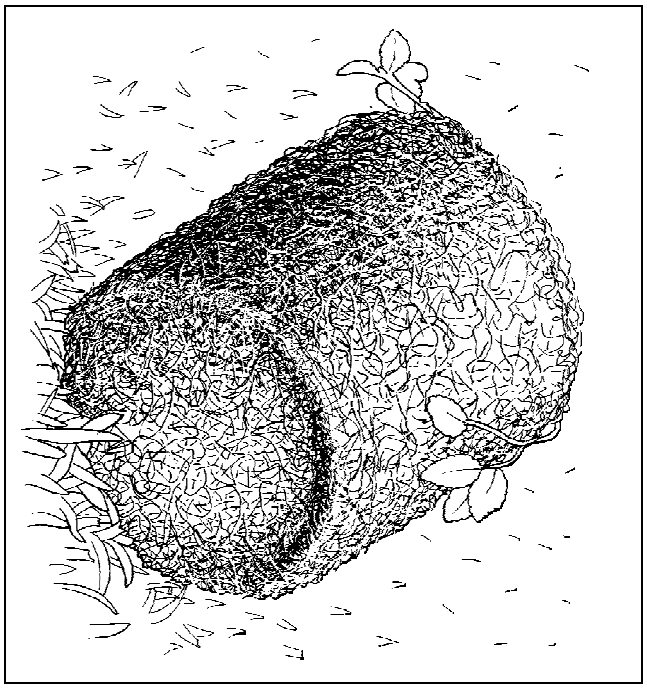


Fig 28. Avoid pot-bound plants.

SECTION III - PLANTING AND ESTABLISHMENT

Newly installed plants, particularly trees which are more than 2 inches in diameter, will require intensive management (especially water) to get them established. It's important to put adequate thought, time and money into this initial period. This effort will pay you back later in healthier plants.

Planting Trees and Shrubs

Two of the most common causes of poor plant establishment are planting too deep and under or over watering.

The planting hole should be as deep as or slightly shallower than the root ball of the plant (Figure 29). Disturbing the soil beneath the plant may cause it to settle too deep in the soil. Never plant so the top of the root ball is below the surface of the soil. In poorly drained soils, dig a hole only 2/3 as deep as the root ball and construct a mound or berm to cover the sides of the root ball. Newly installed plants (except aquatics) will not grow if they are inundated by water on a regular basis.

Installing Individual Plants

Dig the hole 2 to 3 times the diameter of the root ball for planting individual trees and shrubs. Prior to planting trees in compacted soils, also rototill the area prior to planting 10-15 feet or more in diameter around the tree. This will help the plant become established because the lateral roots will grow rapidly into the loosened soil.

After placing the root ball into the planting hole, backfill with existing soil. According to the best information now available, amendments incorporated only into the planting hole around trees and shrubs generally provide no benefit, except when planting in limerock or in other areas with very restricted soil space. In this case, obtain good soil to fill in around the root ball to allow roots to grow out of the root ball. Construct a soil ring around the edge of the root ball to hold irrigation water (Figure 29).

Installing Groups of Plants

The best way to prepare the soil for a group of shrubs or ground covers is to loosen the entire bed to a 6 to 12 inch depth. The backfill soil added to the planting hole need not be amended. However, there may be some benefit to amending the entire planting bed (see page 12, "Section I - Preparing the Site for Planting-Improve the Soil"). Then dig holes to accommodate the root balls and backfill with soil.

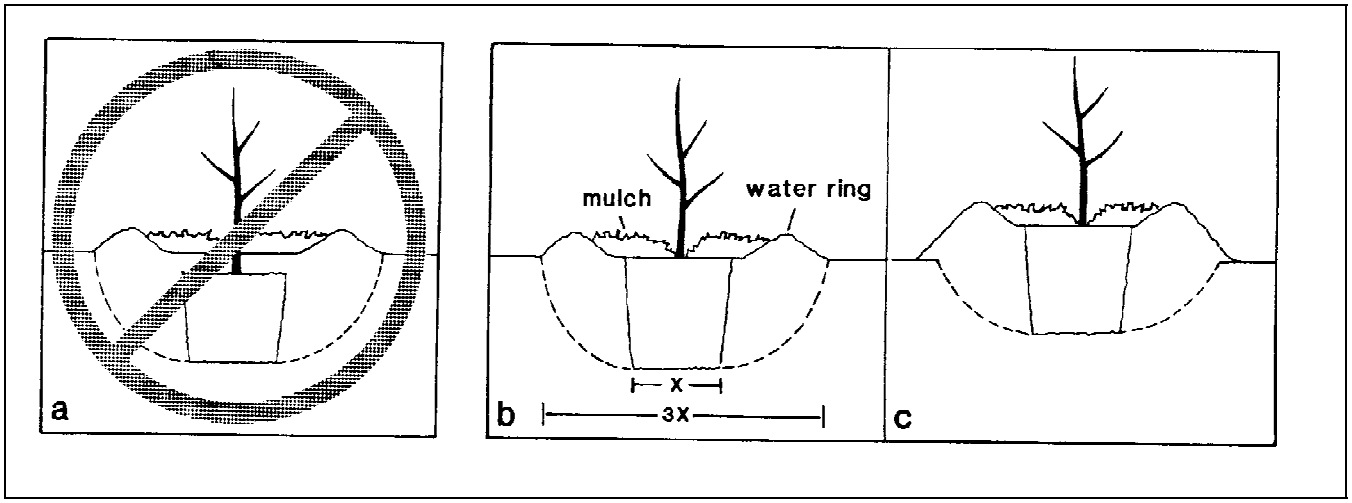


Fig 29. a) Never plant trees or shrubs too deep. b) In most soils the top of the root ball should be planted even with the soil line. c) In poorly-drained soil, 1/3 of the root ball should be above grade.

Don't Prune at Planting

Do not prune the plant to compensate for root loss at planting. The latest research indicates that this does not help the plant overcome transplanting shock as long as the plant receives adequate irrigation. Begin pruning for structural development 6 to 12 months after planting (see page 26, "Section IV - Managing an Established Landscape - Pruning").

Newly Installed Plants Need T.L.C.

Staking

Many container-grown trees or those moved with a tree spade do not require staking. Read this section to determine if staking is needed. If not, don't use them. There are 3 types of staking, each used for a different purpose: protective staking, support staking and anchor staking.

Protective staking serves to protect the tree from accidental injury from lawn maintenance equipment. Three or more stakes are driven into the ground several feet from the trunk, but they are not attached to the tree. These stakes can remain indefinitely.

Anchor staking is used to hold the tree upright in the soil until roots grow to sufficient length and density to anchor the tree. These are required when the tree is top heavy and the root ball tilts when the wind blows. In most instances, these should be removed within 1 year after planting. If anchor stakes are required for more than a year, there is a problem with the tree.

Support staking is used to hold a weak trunk straight, in the upright position. Trees grown under poor nursery practices often require this type of staking. The best alternative to support staking is not to plant trees which have a weak trunk.

The trunk should be secured to the anchor or support stake with material which is wide and smooth. This will damage the trunk less than any other type of securing mechanism. Wire threaded through garden hose is frequently used to secure the trunk to the stake. This system of attachment can damage the trunk as it moves in the wind and rubs against the hose. It can also begin to girdle the tree if it is not removed 6 to 12 months after planting.

Mulching

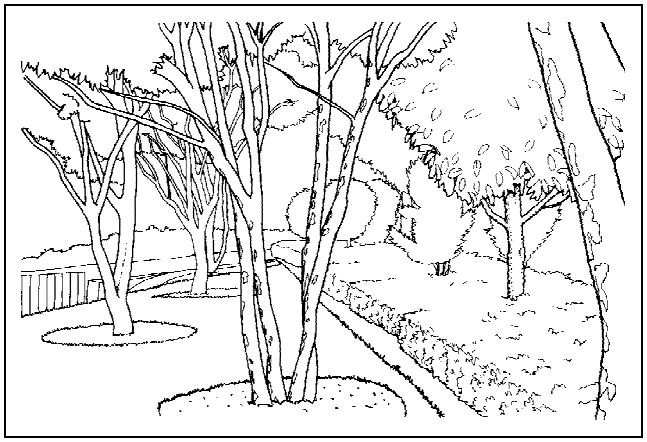


Fig 30. A large mulched area increases tree health.

For maximum benefit, apply mulch in a 3-inch deep layer (Table 6). Mulch entire beds of shrubs and ground covers. When planting trees, create a circle of mulch about 2 feet in diameter for each inch of trunk diameter (Figure 30). Increase the size of the mulched area as the tree grows. This technique will establish a tree quickly by eliminating competition from turf and other plants. Pull mulch 1 to 2 inches away from tree trunks and shrub stems to prevent moisture from promoting bark decay.

Table 6. Benefits of mulch.

- Reduces water loss from soil
- Insulates soil temperatures
- Enhances root growth
- Inhibits weed growth
- Adds a finished look to landscape

Plant annuals close enough together (8 to 10 inches apart for many, see instructions on the plant tag) so that the plants will touch each other within 3 to 4 weeks. Mulch will not be needed because weeds will be shaded out.

Organic mulches provide the greatest benefits (Table 7). From an environmental standpoint, the best organic mulches are "renewable" (shed leaves and pine needles), "by-products" (pine bark, pecan hulls, etc.) or "recycled" (chipped or composted yard wastes, etc.). The most environmentally sound and least expensive mulch is compost, chipped branches or leaves generated on the property.

Table 7. Types of mulch.

Organic	Inorganic
• Wood chips • Pine needles • Grass clippings • Leaves • Compost	• Stones • Plastic • Woven plastic • Woven fabric

Watering and Fertilizing

When new plants die, blame is often placed on "bad plants" or pests. However, many plants die from too little or too much water during the first few months after planting. Specific recommendations for watering are impractical due to varying soil and environmental conditions around the state. You must determine when to water by familiarizing yourself with the characteristics of your site. Strive to maintain constant moisture in the root ball, but avoid keeping it saturated.

The first few weeks after planting, apply small amounts of water to the root ball every day. Ask the nursery operator how much was applied and apply this amount. Plants installed during the cooler months may need less frequent irrigation, depending on the weather. One week after planting, gently dig a small hole just outside of the root ball to check soil moisture. Squeeze some soil in the palm of your hand. If water drips out between your fingers, you are watering too much (Figure 31 a). If the soil stays together as you open your fingers, soil moisture is just right (Figure 31 b). If the soil crumbles and falls out of your hand as you open your fingers, you are watering too little (Figure 31 c). Several weeks or months after planting, you may be able to cut back irrigation to every other day or every third day. Gradually decrease the frequency of irrigation.

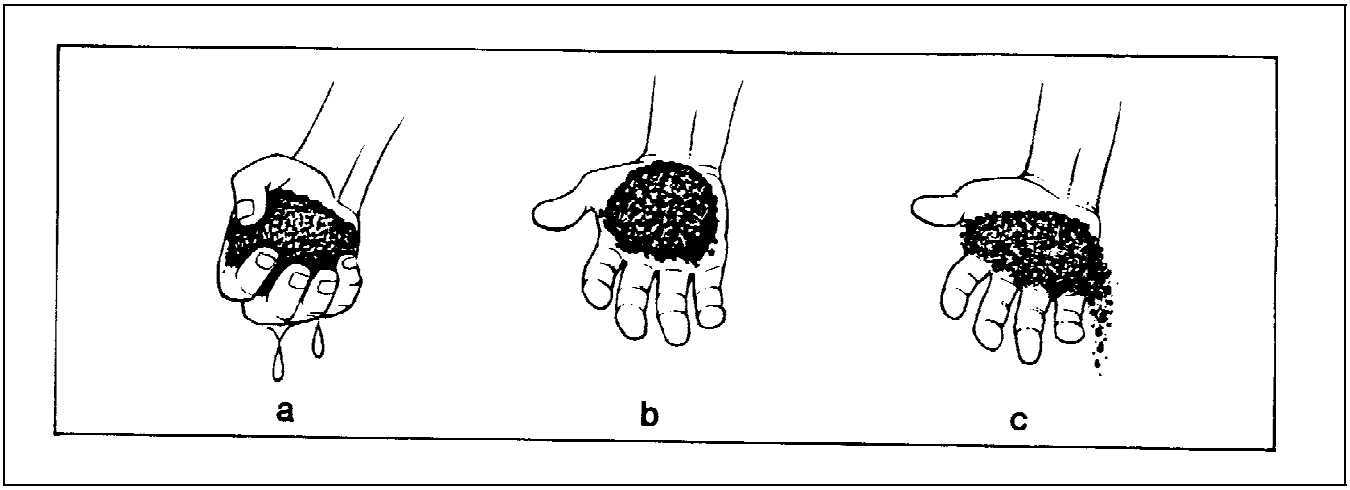


Fig 31. Checking soil moisture. a) soil contains too much water, you are overwatering, b) soil moisture is just right, c) soil is too dry, increase watering.

In a well drained sandy soil, it may be beneficial to water large trees and shrubs (1"-3" trunk diameter) almost daily for several months or more. Gradually increase the area irrigated around recently installed trees and shrubs to accommodate root growth. Roots of trees and shrubs grow about 1 inch or more per week during the first 2-3 years after planting.

Apply a small amount of slow-release fertilizer to the top of the root ball 4 to 6 weeks after planting. Annuals generally benefit from an application of slow-release fertilizer immediately at planting.

WHEN CAN A LANDSCAPE BE CONSIDERED ESTABLISHED?

Established plants are tolerant of drought and other adversities. See Table 8 for general guidelines.

Table 8. Time required for landscape establishment.

Plant	Size	Time to establish
Trees	all sizes	6 to 12 months per inch trunk diameter
Shrubs and ground covers	1 gallon container	6 to 12 months
	3 gallon container	1 to 2 years
Grass	sod	1 month
	sprigs/plugs	3 months

SECTION IV - MANAGING AN ESTABLISHED LANDSCAPE

Determine What You Have

The maintenance of a landscape can have significant impacts on energy and water consumption and on the environment. The following guidelines are designed to reduce pesticide, fertilizer and water use, and protect the environment. The result will be a healthier, lower maintenance landscape and much less work on your part. The dollar savings can be significant too!

You should start with a map of your property. Write the plant names on the map. If you do not know them, take samples to a local nurseryman, landscape consultant

or County Cooperative Extension Service office (see Appendix 1 for the office nearest you).

DEVELOP A PREVENTIVE MAINTENANCE PLAN

Preventive maintenance works as well for plant health as it does for human health. However, preventive maintenance does not mean to apply cover sprays to the entire landscape as was practiced in the past. A landscape will be healthier and more problem free if some simple principles are recognized:

1. The landscape is an ecosystem. A natural "balance" can be achieved if the landscape is designed and managed properly. This means less maintenance inputs from you.

2. A few problem plants can demand lots of time & resources. Remove plants which are not growing well because they are not adapted to existing conditions, or are insect or disease infested. Replace with hardy, pest resistant ones.

3. Fertilizer, water and pesticides are best applied on an **as needed** basis.

4. Cultural practices affect each other and the environment. The way you water affects fertilizer usage. The way you fertilize affects pest populations. Mowing affects irrigation requirement, weed infestations and so on. The following sections will show you how to manage a landscape.

Maintain Your Mulch

The cost of mulch is quickly recovered in labor saved and plant benefits (for benefits and precautions, see page 17, "Section III - Planting and Establishment"-" Newly Installed Plants Need TLC").

Mulching reduces maintenance time and costs.

It’s important to maintain mulch by replenishing it as it degrades (Figure 32). Mulch may need replenishing every year or two in some areas. Apply it so you have no more than a 3-inch thick layer around trees and in landscape beds. Shallow plant roots grow up and into the moist mulch and they will die if the mulch is allowed to decay or wash away. There is no need to add additional mulch for a "freshened" look. Gently rake the existing mulch to expose the layers underneath.

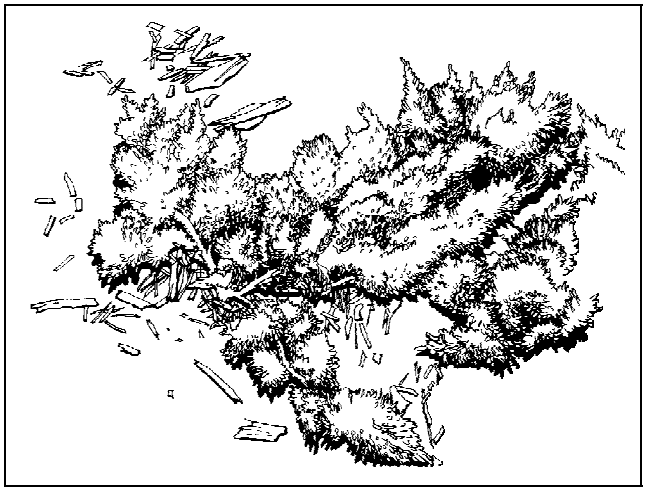


Fig 32. Replace mulch as it degrades. If it washes away, correct the water drainage pattern.

Shrub and ground cover beds located close to or beneath trees receive leaves and other debris from the tree. Often, this eliminates the need to add additional mulch in these areas. Leaves raked from the lawn can be spread in these beds for additional cover. Beds which are not close to large trees may need additional mulch every year or two.

Water - The Misunderstood Resource

Problems Caused by Overwatering

The most prominent environmental issue in Florida is probably water (Figure 33). It’s use is regulated throughout the state to help ensure continued, high quality supplies of water. More than 85% of our drinking water comes from aquifers below ground, and they can be impacted by landscape maintenance and other land use practices.

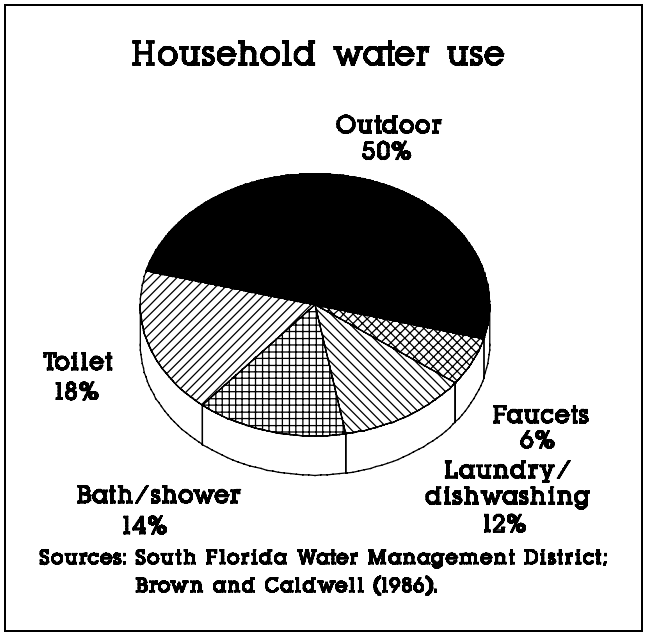


Fig 33. Home uses of water. As much as 50% of residential water use is for irrigation, pools and other outdoor uses.

Many people irrigate with the philosophy that "if a little is good, more must be better". We all know that plants need water to survive, but you may not realize how overwatering increases problems for you, your plants and the environment (Table 9).

Table 9. Consequences of overwatering.

- Increases landscape maintenance costs
- Wastes water
- Promotes plant disease
- Increases weed infestation
- Increases mowing/pruning requirement
- Leaches fertilizer and some pesticides

When to Irrigate

No established plant (including grass) ever needs daily irrigation. Irrigation during the summer is not normally required for at least 3-5 days following a rainfall (or irrigation) of at least 1 inch. You can wait much longer during the cooler months, or in a heavier soil. For this reason, it is important to have a rain gauge. This could be any straight-sided container or a purchased device placed in an open area of the landscape.

Landscape plants - The best way to determine when to water is to check the plants for wilting. If a plant continues to wilt into the evening hours, water it the following day (Figure 34). Some, like impatiens and coleus, regularly wilt during the heat of the day, but no amount of water will prevent this.

Fig 34. Water plants when they remain wilted into the evening hours.

During a summer drought some established plants (see page 19, Table 8) growing in sandy soils in full sun may need water every 3-5 days. The same plant growing in a little shade or in a heavier soil may only need water once a week, or less.

Some plants wilt before others do and require more frequent irrigation. Drought tolerant plants need less frequent irrigation. It is wasteful to turn on the whole irrigation system just to satisfy a few wilting plants. Instead, hand water only those that need it with the hose or with a portable sprinkler. Better yet, relocate these plants with other "thirsty" plants and allocate a separate

irrigation zone just for these. This will save water and reduce the handwatering requirement.

Trees - Many trees and shrubs never wilt. It is difficult to determine when these require water. Because of the extensive root system on established trees and shrubs, the irrigation requirement may be less than you think. Most of these plants will not need irrigation except during prolonged periods of drought.

Lawngrass - Irrigate grass only when 30-40% of it shows water deficiency symptoms (Figure 35). Significant amounts of water can be saved with this approach and the quality of the lawn is not diminished. Water when the grass blades fold together, exposing their bases or, the lawn takes on a dull blue-green color, or, footsteps on the lawn remain compressed for more than a few seconds. Significant amounts of water can be saved with this approach and the quality of the lawn is not diminished.

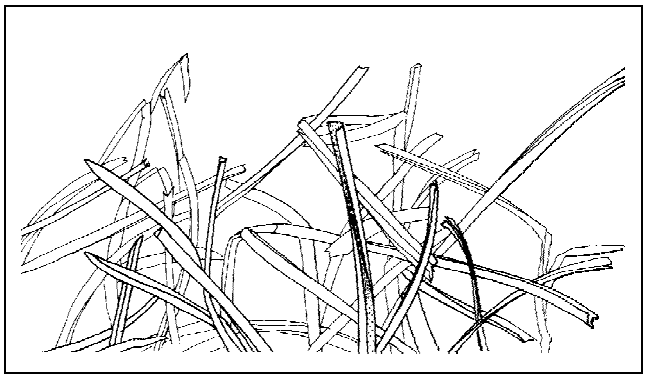


Fig 35. This grass needs to be watered.

How Much Irrigation

When you irrigate, apply 1/2 to-3/4 inch of water to most Florida soils. It may be necessary to apply only 1/4 inch of water at a time to prevent runoff and to allow water to be absorbed by the soil. After water is absorbed, apply the next 1/4 inch. Calibrate your irrigation system to determine how long it takes your system to deliver this amount (Table 10).

Operating an Irrigation System

There are three ways to operate an automatic, in-ground sprinkler system: with a time clock, with a soil moisture sensor or manually. Scheduling irrigation with a time clock is easy but wasteful. The time clock turns the system on rain or shine, whether the plants need it or not. Soil moisture sensors show promise for operating irrigation systems efficiently, but most current soil moisture sensors either require a lot of maintenance or are not accurate.

Table 10. Calibrating the irrigation system.

For an in-ground system, place several coffee cans or straight sided, flat-bottomed containers randomly throughout the irrigated area. For portable, hose-end sprinklers, the containers should be arranged in a straight line away from the sprinklers to the edge of the water pattern.

Step 1. Turn sprinklers on for 15 minutes.

Step 2. Measure depth of water in each container.

Step 3. Add the depths together.

Step 4. Divide by the number of containers. This gives you the amount of water applied by your system in 15 minutes.

Step 5.

If your system applied this much in 15 minutes:	Run your system this long each time you irrigate.
1/8 inch	1 to 1.5 hours
1/4 inch	30 to 45 minutes

Therefore, set time clocks to "off" and manually switch on the system only when you determine that plants need water (see page 21, "Section IV - Water - The Misunderstood Resource-When to Irrigate"). Only operate those zones containing plants that need water that day. The automatic position on the time clock is useful when you are away from the property for more than a few days. Even then, the clock can be made to operate more efficiently by installing a rain shut-off device that overrides the system when rain occurs.

Irrigate Legally

When you decide it is time to irrigate, be sure that it is in accordance with local and regional water regulations. Many areas only allow irrigation on certain days and during specified hours. If you have a choice,

irrigate at night or in the early morning hours when it is cooler and calmer. Also, check the local weather channels for the possibility of rain before turning on the sprinklers. You can save a lot of water using this technique.

Convert to a More Efficient Irrigation System

This may be the best investment you can make in a landscape. An existing irrigation system can be redesigned to deliver water more uniformly and efficiently (see page 9, "Section I -Designing or Modifying the Landscape - Design for Water Conservation").

FERTILIZER - THE RIGHT STUFF WHEN PROPERLY USED

Problems Caused by Over-Fertilizing

Many lawn pest problems are increased when the lawn is overstimulated with soluble nitrogen: chinch bugs, sod webworms, nematodes and brown patch (Figure 36 a-d). Too much nitrogen also promotes excessive growth and thatch buildup which greatly increases maintenance costs. Mowing and pruning increase proportionately. Disposing of tree and shrub clippings is an additional expense to you and your community.

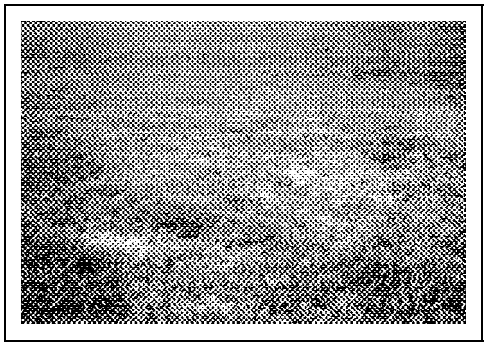
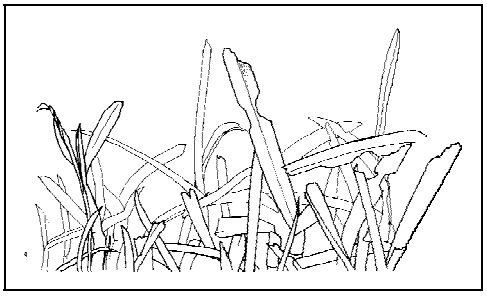
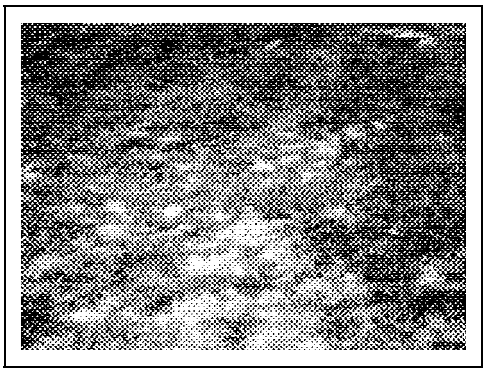


Fig 36. Lawn pest problems are increased when too much nitrogen fertilizer is used.
a) chinch bugs



b) sod webworms



c) nematodes

Application of too much soluble nitrogen can take an environmental toll as well if it leaches into water supplies or pollutes surface waters like lakes, rivers, bays and retention pounds.

When to Apply Fertilizer

Most established landscape plants (including lawngrasses) grow well with 2 (north Florida) or 3 (south Florida) fertilizer applications per year. One application is normally scheduled in late winter/early spring and another in late summer/early fall. A third application in south Florida can be made during the summer and supplies mainly slow-release nitrogen.

Iron sulfate (2 oz in 3 to 5 gallons of water per 1000 square feet of lawn) can be applied in spring and/or summer to green-up the lawn without stimulating growth.

How and Where to Apply Fertilizer

The fertilizer should be broadcasted over the surface of the landscape--for lawn, trees and shrubs alike. Fertilizer can be applied directly on top of the mulch. There is no need to place it below the mulch because it

quickly moves downwards with water. It is easier to apply fertilizer with a rotary spreader than with a drop spreader. However, drop spreaders should be used when applying fertilizers containing weed killer to the lawn. This helps prevent the material from coming in contact with nearby ground covers, shrubs and trees which could be harmed by the herbicide.

Since most feeder roots on trees and shrubs are shallow (within the top 12 inches of soil) there is no need to inject or place fertilizer deep in the soil. However, shallow soil injections (4 to 6 inches deep) on mounds, berms and slopes, in compacted soil, and in other areas where runoff is likely would reduce the amount of the fertilizer washing off the landscape. To minimize leaching, always use a slow-release fertilizer when injecting into the soil (see section below).

Applying too much fertilizer causes problems in the landscape.

Most established trees growing in landscapes where the lawn, ground covers and shrubs are fertilized do not need additional fertilizer. Their root systems extend throughout the lawn and landscape (Figure 11), and receive nutrients when these areas are fertilized. In south Florida, supplemental applications are needed beneath the canopy for some trees, especially palms, or nutrient deficiencies can develop.

Supplemental fertilizer may also be applied to young trees and shrubs to encourage faster growth. However, never make more than six applications per year since most plants do not utilize more than this amount. Apply supplemental fertilizer under the canopy and 1 1/2 to 2 times beyond the canopy (Figure 37).

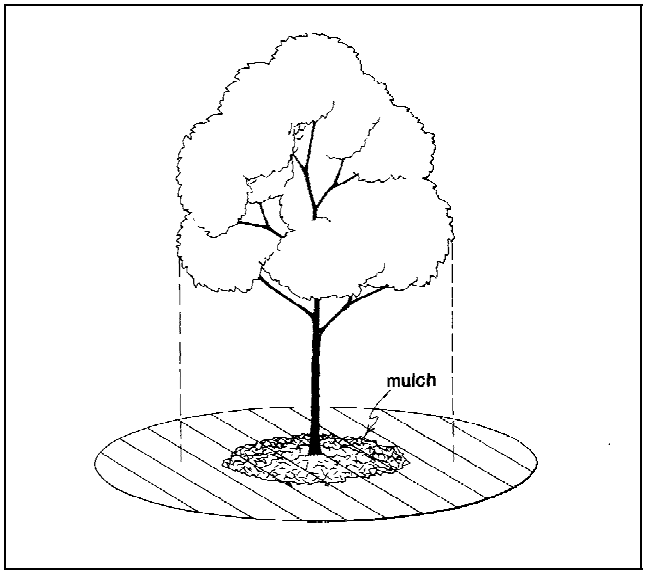


Fig 37. Apply fertilizer evenly on the mulched and unmulched surfaces out to about 1.5 - 2 times the canopy diameter.

Trunk injection of micronutrients is another method of tree fertilization which should be used only as a last resort when conventional fertilization is not possible or is ineffective. Trees are permanently damaged by trunk injections and the potential benefits must outweigh this damage. Consult a tree specialist (arborist or urban forester) for more information.

What Type is Best?

Look for the "guaranteed analysis" section on the fertilizer bag. It will list the percentage of nitrogen, phosphorus and potassium, respectively, in the fertilizer. Most Florida soils have adequate phosphorus, so this is generally not needed in your fertilizer unless your soil test indicates otherwise. A good fertilizer would have 1 1/2 to 2 times as much nitrogen as potassium.

Look for terms like "slow release", "controlled release", "sulfur coated urea", "resin coated", "plastic coated", IBDU, water insoluble, and ureaformaldahyde. These are all forms of fertilizer which are released slowly to plants. At least 30% of the nitrogen (preferably more) should be in a slow-release form. This is beneficial because it is available to plants over a long period of time, less nitrogen is leached and pest problems are not stimulated. You will pay more for these types of fertilizers and the benefits they provide.

Fertilizer containing water soluble nitrogen (either granular or liquid) is less expensive but it leaches quickly through the soil. In sandy soils, most of it may leach past the root system after only several inches of rainfall or irrigation. In more fertile marl, clay or muck soils leaching will be slower, but runoff may be greater. If you use soluble fertilizers, apply it more frequently than slow release forms, but use less of it each time you fertilize. (For example, make four applications of 1/2 pound of soluble nitrogen per 1000 square feet during the year instead of two 1-pound applications of slow-release fertilizer. - see the next section).

Apply a complete fertilizer containing micronutrients each year. Despite this preventive treatment, certain plants growing on high pH soils may still develop nutrient deficiencies. These can be treated with specially formulated fertilizer or foliar sprays (for micronutrient deficiencies). Only in the case of severe deficiencies should you consider applying one micronutrient alone because of the danger of applying excessive amounts. In alkaline soils, plants may benefit from the temporary local reduction in pH provided by so called "acid forming" fertilizers containing ammonium nitrogen.

Slow-release fertilizer supplies a more uniform level of nutrients.

How Much Fertilizer?

Many people overfertilize. Each time you fertilize, apply a maximum of one pound of "actual" nitrogen per 1000 square feet of lawn, ground cover or shrub bed area. This sounds complicated, but it is easy to calculate from the information given on every fertilizer bag.

Example: You have purchased a 10-5-10 (N-P-K) fertilizer. Divide the nitrogen (N) content (10) into 100. 100/10 = 10 pounds

To apply the correct amount, spread 10 pounds of 10-5-10 per 1000 square feet of lawn and landscape area.

Other Considerations

When unthrifty plants do not respond to fertilizer, the plant is being stressed from other problems, or the incorrect fertilizer was used. In fact, some nutrient deficiency symptoms are actually due to the plant’s inability to absorb the nutrients from the soil, not a soil deficiency. Perhaps the roots are diseased or damaged, the soil pH is incorrect, the site is too wet or compacted or the plant was planted too deeply. Read page 2, "Section I - Planning a Landscape" and page 16, "Section III - Planting and Establishment" to find out how to determine site conditions, and how you would modify your landscape to correct the problem.

More information on using and understanding fertilizers can be obtained from your County Cooperative Extension Service (see Appendix 1 for the office nearest you).

MOW PROPERLY - INCREASE LAWN QUALITY IMMEDIATELY

Mowing Height

Increasing the mowing height of a lawn will save you money, water, fertilizer, pesticides and work.

Mowing too low ruins many lawns (Table 11). When a lawn is mowed higher, more leaf surface is available to absorb sunlight and produce food. As a result, a denser lawn and a deeper root system develops. A thick lawn looks nice and shades out weeds and reduces the need for manual or chemical weed control. The deeper, more extensive root system is more efficient at absorbing the nutrients and water applied and more capable of tolerating damage from pests like mole crickets and nematodes.

Table 11. Suggested mowing practices on Florida's lawngrasses during the growing season.

Turfgrass name	Optimal mowing height (inches)	Frequency (Days)	Best Mower Type
Bahiagrass	3.0 - 4.0	4 - 7	Rotary/ flail
Bermudagrass	0.5 - 1.5	3 - 5	Reel
Carpetgrass	1.0 - 2.0	10 - 14	Rotary
Centipedegrass	1.5 - 2.0	10 - 14	Rotary
St. Augus-tinegrass	2.5 - 4.0	4 - 7	Rotary
Zoysiagrass	1.0 -2.0	10 - 14	Reel

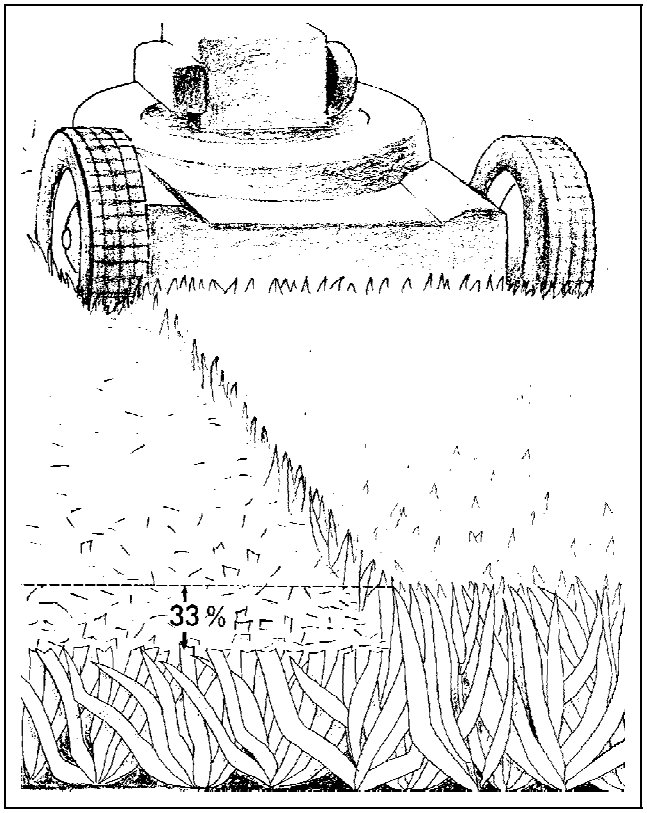


Fig 38. Remove no more than about 1/3 of the grass blade at each mowing.

Mowing infrequently can also stress grass. Mow often enough so that no more than 1/3 of the grass blade is removed per mowing (Figure 38). For example, if the recommended mowing height is 3 inches, it should be mowed when it reaches a height of about 4 inches. Never cut the grass when it is wet since this can spread disease.

Keep the Blade Sharp

Mowing prunes and wounds grass. The larger this wound, the greater chance disease pathogens have of establishing. A dull mower blade makes a ripping cut, creating two or three large wounds on each grass blade (Figure 39). A sharp mower blade makes a clean cut and reduces incidence of disease. Inspect your grass after mowing it. A white, ragged cut means its time to sharpen you mower blades.

Don't Collect the Clippings

On most lawns, clippings should be left on the grass to recycle nutrients. If you enjoy the exercise, they can be collected and spread in a very thin layer in shrub beds

Fig 39A. Keep the blade sharp. A sharp blade makes a clean cut.

for mulch. They can also be incorporated into a compost pile. However, you will need to apply more fertilizer to the lawn (and less to the shrub bed) since you are removing a valuable source of nutrients from the lawn. There is one situation were clippings should be collected. That is to help prevent the spread of a lawn disease or weed which you are trying to control.

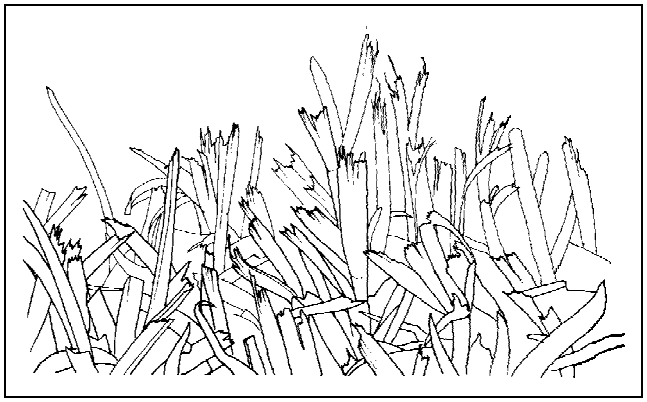


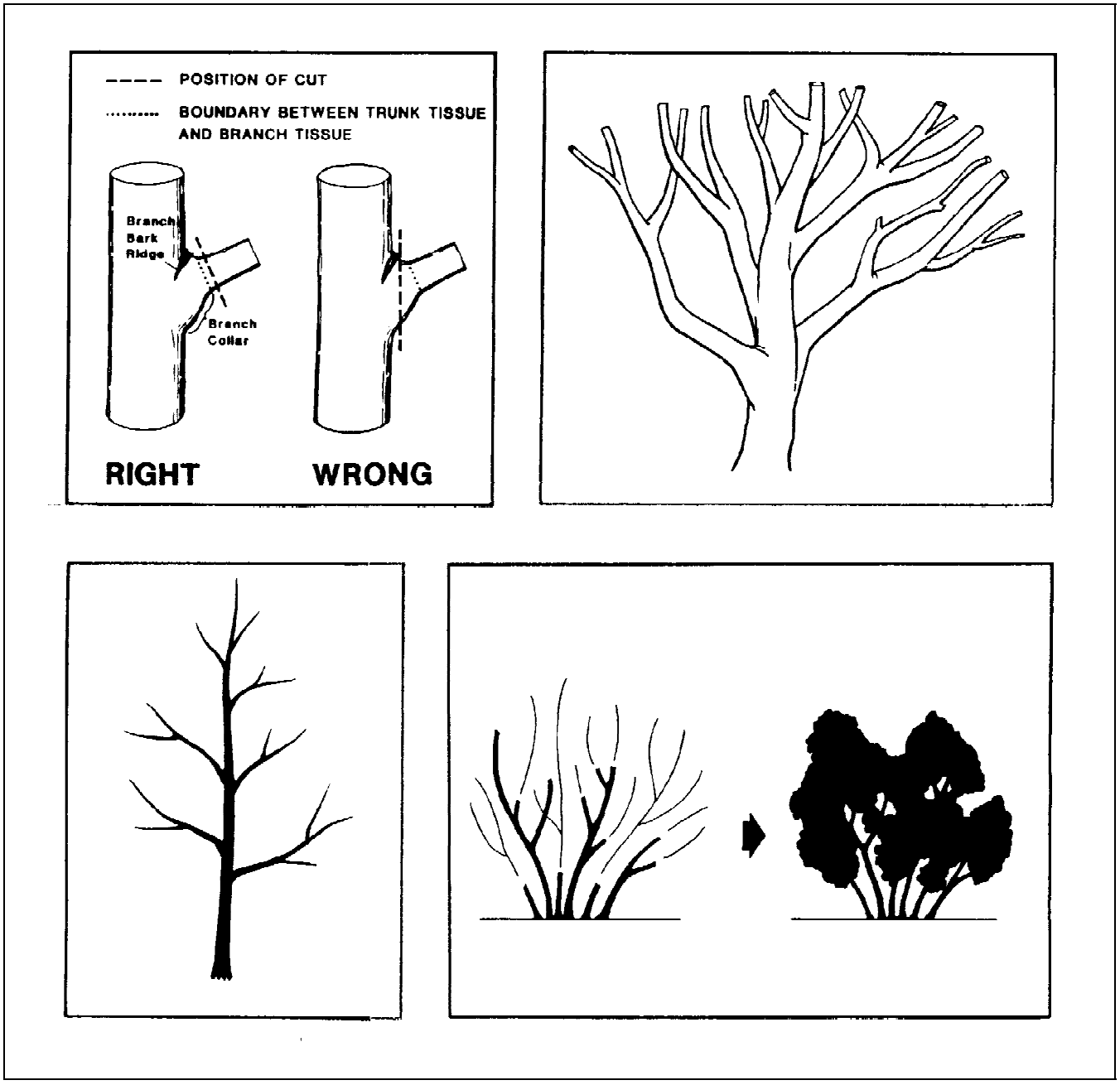
Fig 39b. A dull blade makes a ragged cut and casts a brown or white shade to the lawn.

Pruning

Properly Removing a Branch

The proper cut removes the branch just to the outside of the branch collar, a swollen area of tissue at the base of the branch (Figure 40 a). Branch collars contain chemically active areas that provide barriers to disease and decay organisms that attempt to invade the exposed wood. Most of us were taught to remove a branch flush with the trunk but recent

Fig 40. The way we prune trees and shrubs has a dramatic impact on their appearance, health and longevity; a) Proper branch removal;



b) Topping damages trees; c) Most trees should be trained in this way; d) Heading back shrubs to several different heights creates a fuller looking plant.

research has conclusively shown that flush cuts are extremely detrimental to trees.

Never cut off a branch flush with the trunk. This causes severe injury to the tree.

Don't Top Trees

Topping is a sure way to shorten the life of a tree. In many areas of the state, trees are regularly topped (also called sheared, headed back, dehorned, etc.) in perceived fear that they are getting too big (Figure 40 b). This procedure is very damaging to trees and is not recommended. There are two courses of appropriate action. One, plant trees which are small at maturity, or

two, regularly thin to increase resistance to storm damage (Figure 41).

Proper Tree Thinning

A thinned tree is more resistant to storm damage.

Start thinning and training the tree when it is young (Figure 41). A thinned tree allows wind to pass through it. This is accomplished by removing certain branches by a technique called drop crotching. It is best to have the tree thinned lightly on a regular basis, since severe pruning can generate undesirable sprout growth and can initiate decay. To help reduce unwanted sprouting, never remove more than about 25% of the foliage at one pruning.

Proper Tree Structure

Large-sized shade trees should be trained to one central trunk with well spaced branches along the trunk (Figure 40 c). Branches should form wide, not narrow, angles with the trunk. Trees which mature at a small size can have multiple trunks if desired.

Pruning Shrubs

Shearing produces shrubs which have all the foliage on the outer perimeter of the plants. Constant shearing will ultimately weaken some plants. Natural pruning is recommended. Hand shears are used to reduce and shape the plant (Figure 40 d). It is a more precise form of pruning which results in healthier landscape plants more natural in appearance. If you do shear hedges, be sure the top is slightly narrower than the bottom. This will prevent the bottom of the hedge from becoming thin and sparsely foliated.

When to Prune

The best time to prune trees and shrubs is toward the end of the dormant season. The next best is any time the plant is not making new leaves. Pruning while the shoots and leaves are growing often encourages formation of sprouts, which are undesirable in trees and some shrubs.

CONTROLLING PESTS THE ENVIRONMENTAL WAY

Integrated Pest Management

Overwatering, overfertilizing, improper mowing and incorrect pruning all contribute to pest and other problems.

The use of insecticides has unfortunately become a one-dimensional approach to pest control and problems have resulted: environmental contamination, pest resistance, misuse, destruction of beneficial organisms and outbreaks of secondary pests.

The environmental alternative is a combination of pest control strategies called IPM -Integrated Pest Management. Avoid cultural practices which make lawns and landscapes susceptible to pests. This reduces the need to spray pesticides. When they are needed, use them to minimize pests and their effects, not eradicate them.

Check Plants Regularly

Most plants have few problems if they are properly located in the landscape and moderately cared for. They demand little more than an occasional watering, fertilizing and light pruning. Only a few problem-prone species are routinely damaged by nutritional deficiencies, insects or diseases. These are called key plants.

Make it a habit to walk around your yard at least every two weeks and closely look at plants. By this regular monitoring, you will quickly learn which are the problem prone key plants in your landscape. Your pest control program can be focused on this small handful of key plants. Table 12 lists some of the common key plants along with their typical, "key pests" you would want to monitor for. Notice that a plant (except some lawngrasses) rarely has more than one major problem. Lawns can be damaged or killed quickly by insects such as chinch bugs, mole crickets, worms or grubs. Therefore, lawn areas may require weekly monitoring during summer and fall.

Table 12. Key plants and their typical problems.

Key Plant	Key Pest/ Problem	Time of Year Occurring
Oleander	Oleander caterpillar	warm months
Pittosporum	Root rot, Leaf spot	warm, wet months
Roses	Black spot	warm months
Lawngrass	Many	year-round
Camellias	Tea scale	year-round
Junipers	Spider mites	warm, dry months
Red tip photinia	Leaf spot	warm months
Azalea	Mites, lace bug	warm months
Mahogany	Caterpil-lars, borers	warm months
Sweet gum/hickory	Fall webworm	fall
Flowering dogwood	Twig borers, leaf spot	spring, warm months
Crape Myrtle	White powdery mildew	spring
Some palms	Lethal yellowing	year-round
Ixora/some palms	Nutrient deficiency	year-round

Work With Nature

Perfect, complete control isn't practical in the landscape and pests should be treated only when significant damage is likely. Pesticides are often used on pests which, left alone, would never have become a problem. In fact it may be best if some of the destructive insects are not killed. This will help maintain the populations of beneficial insects and organisms which provide natural, biological control (Figure 42). Planting a variety of flowering plants in the landscape may also increase the population of beneficial insects.

Fig 42 a-d. Don't kill these insects. They feed on other insects, not plants.

Treat Problems Early

Your options for controlling a pest problem are greatly increased if you detect it early. This is where regular monitoring comes in handy. Early stages of insect infestations on small trees and shrubs can be simply hand picked or pruned from the plant.

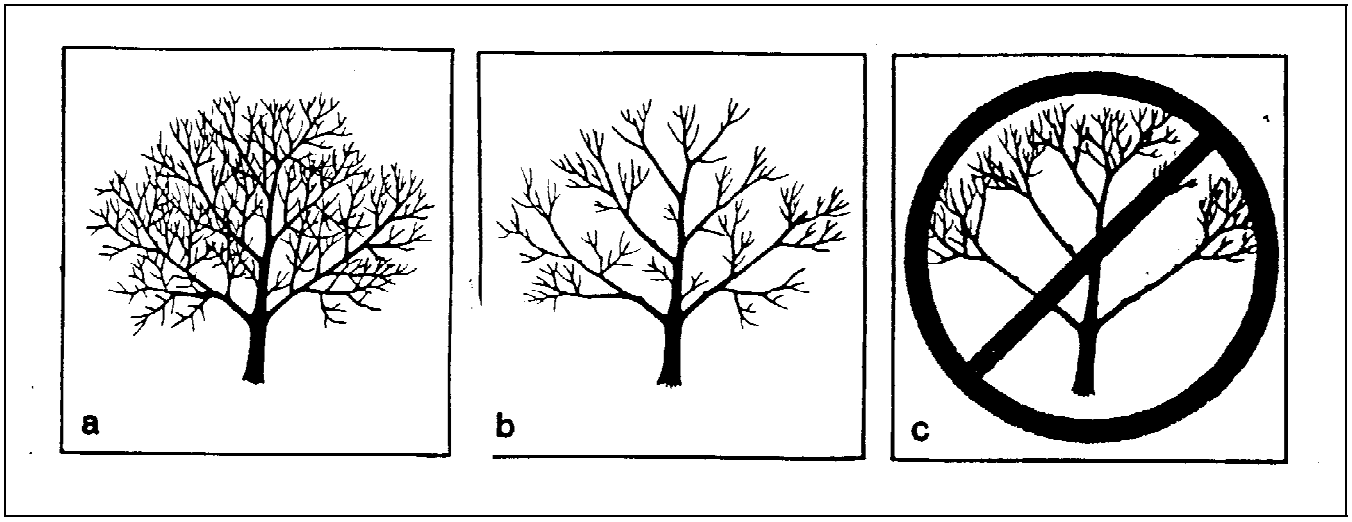


Fig 41. Proper tree thinning.

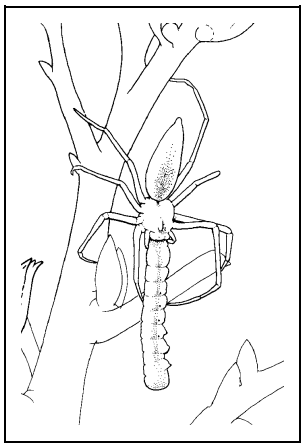


Fig 42b

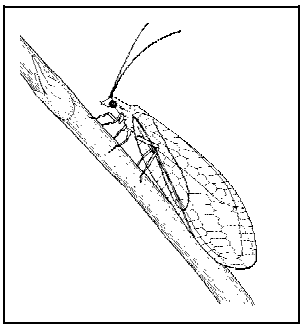


Fig 42c

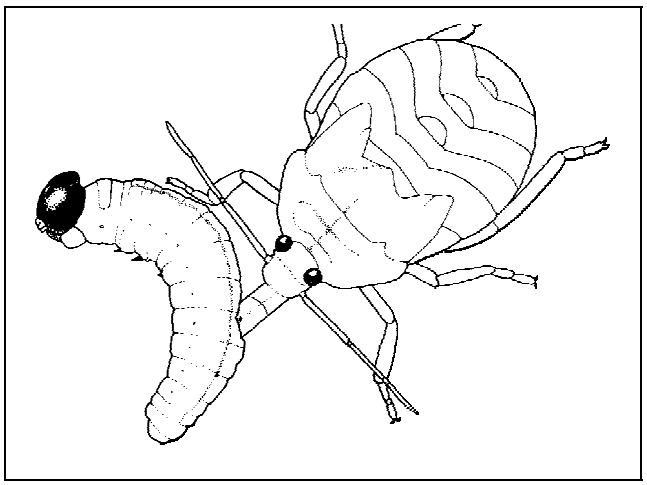


Fig 42d

Spot Treat

When chemical treatment is warranted, be sure to just treat the affected plant or plants. There is no need to spray every plant in the landscape. On lawns, spray the affected area and a 5 foot buffer area around it. Blanketing the lawn or landscape with pesticides is wasteful and could be environmentally damaging. Beneficial organisms and insect predators are killed when pesticides are used indiscriminately. Beneficial populations are usually slower to rebuild following a pesticide application than the pests!

Some pesticide labels only give directions for mixing 1 or more gallons of spray. Use the conversions in Table 13 for mixing smaller quantities. Use effective pesticides which are least toxic to the applicator and the environment (Table 14). The label on the pesticide will indicate the toxicity. **Always read the label before mixing and applying pesticide.**

Table 13. Handy conversions for mixing small amounts of pesticide.

1 teaspoon (tsp)/gallon = 1/4 tsp/quart
1 tablespoon (tbsp)/gallon = 3/4 tsp/quart
2 tablespoons = 1 ounce (oz.)
3 teaspoon = 1 tablespoon
1 pound (lb) = 16 ounces

Table 14. Choose the least toxic pesticide.

If label says	The pesticide has a
Caution	low user toxicity
Warning	moderate user toxicity
Danger	high user toxicity

Be Biorational

Insecticides which are safe for the environment and people who use them are termed "biorational". Products such as refined horticultural oil, *Bacillus thuringiensis* (BT), and insecticidal soaps are biorational and are effective against most of the insect pests of trees and shrubs encountered in the landscape. They also tend to be less damaging to beneficial insects than some conventional pesticides.

Biorational pesticides are effective against insects and safe for the environment.

Mistaken Identity

Keep in mind that plant problems are frequently caused by something other than an insect or disease. Yellow leaves may be caused by drought, cold damage, too much sun, nutrient imbalances and root problems. Target the problem with a specific treatment. Never apply a variety of chemicals in hopes that "one of these chemicals has to help".

Recycle, Reduce and Reuse Yard Waste

Disposing of yard wastes such as twigs, leaves and grass clippings is a headache for the homeowner and a serious problem for our state. Plant clippings make up 15% or more of many communities' solid waste (Figure 43). During summer, this amount increases up to 50% with grass clippings accounting for much of it. Not only is this a tremendous burden on waste disposal systems, it wastes energy and a valuable resource--organic matter.

Here are five ways to recycle, reduce and recycle yard waste:

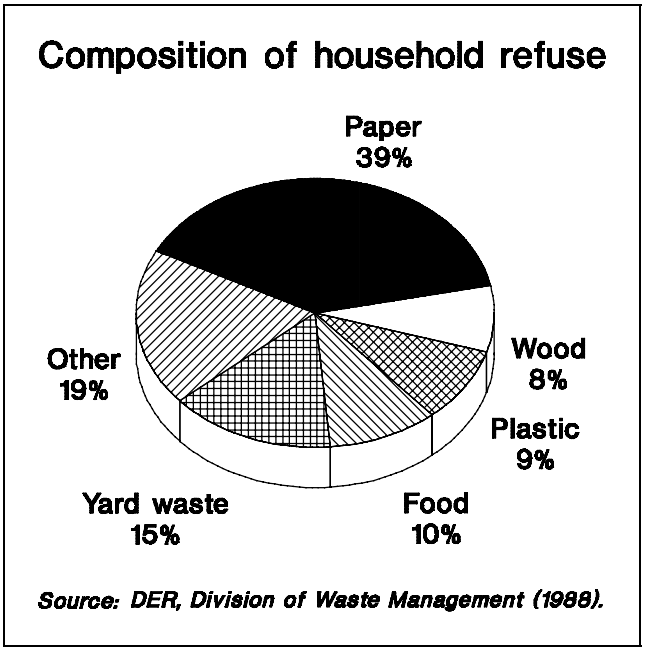


Fig 43. Yard wastes account for more than 15% of household garbage.

1) Use it as a mulch. The best source of mulch may be your own yard. Tree leaves, pine needles, shredded twigs and branches, and grass clippings all make good, free mulch. And they're renewable.
2) Leave grass clippings where they fall. Bagging and throwing away grass clippings is a lot of work and a waste of free fertilizer. Do not bag clippings. Research shows that contrary to popular belief, they will not harm your lawn.
3) Compost it. Garden and landscape by-products can be converted into usable mulch or soil amendment, through composting.
4) Reduce lawn and landscape clippings. The easiest and most energy efficient way to cope with yard wastes is to reduce the amount you generate. Choose slow-growing shrubs which mature at the height suited to their place. Reduce the amount of water and fertilizer which you apply. This will help keep plant growth in check.
5) Create "self-mulching" areas. Plant shade tolerant ground covers or shrubs beneath the trees. When leaves are shed they can remain where they fall as a mulch.

A beautiful, high-quality landscape can be created and managed with minimal environmental impacts and without huge expenditures of energy, time and money.

For more information on any of the topics discussed in this guide, contact your county's Cooperative Extension Service regarding the Environmental Landscape Management (ELM) program.

APPENDIX 1

LIST OF COOPERATIVE EXTENSION OFFICES IN FLORIDA. Some counties have more than one extension office. The phone number to the main office is listed here.

Alachua
904-336-2402

Baker
904-259-3520

Bay
904-784-6105

Bradford
904-964-6280

Brevard
407-632-9505

Broward
305-370-3728

Calhoun
904-674-8323

Charlotte
813-639-6255

Citrus
904-726-2141

Clay
904-284-6355

Collier
813-774-8370

Columbia
904-752-5384

Dade
305-248-3311

Desoto
813-494-0303

Dixie
904-498-3330

Duval
904-387-8850

Escambia
904-477-0953

Flagler
904-437-3122

Franklin
904-653-9337

Gasden
904-627-6315

Gilchrist
904-463-2022

Glades
813-946-0244

Gulf
904-229-6123

Hamilton
904-792-1276

Hardee
813-773-2164

Hendry
813-675-5261

Hernando
904-796-9421

Highlands
813-382-5248

Hillsborough
813-621-5605

Holmes
904-547-3602

Indian River
407-567-8000

Jackson
904-482-9620

Jefferson
904-997-3573

Lafayette
904-294-1279

Lake
904-343-4101

Lee
813-335-2421

Leon
904-487-3003

Levy
904-486-2165

Liberty
904-643-2229

Madison
904-973-4138

Manatee
813-722-4524

Marion
904-629-8067

Martin
407-288-5654

Monroe
305-294-4641

Nassau
904-879-1019

Okaloosa
904-682-2711

Okeechobee
813-763-6469

Orange
407-244-7570

Osceola
407-846-4181

Palm Beach
407-233-1712

Pasco
904-521-4288

Pinellas
813-586-5477

Polk
813-533-0765

Putnam
904-329-0318

St. Johns
904-824-4564

St. Lucie
407-468-1660

Santa Rosa
904-623-3868

Sarasota
813-951-4240

Seminole
407-323-2500

Sumter
904-793-2728

Suwannee
904-362-2771

Taylor
904-584-4345

Union
904-496-2321

Volusia
904-736-0624

Wakulla
904-926-3931

Walton
904-892-5415

Washington
904-638-0740

"Adopt-A-Pond" is a volunteer-based program sponsored by
Hillsborough County and the Southwest Florida
Water Management District.
2420 N Falkenburg Rd. Tampa, FL 33619
Phone (813) 744-5671 FAX (813) 744-5674

Chapter 5
Wildlife & Habitat

This notebook has discussed the role of aquatic plants, water quality, and even humans in your stormwater pond. It has referred to the pond as a living ecosystem that strives to balance itself. But the discussion would not be complete without some information about a crucial link in the web of interactions that give the pond its living quality—wildlife.

Just like plants, the many organisms that live in your pond, from microbes to large animals, all have an affect on the overall quality of the pond. And as an added benefit, you get the opportunity to enjoy these creatures, knowing that your pond group is a part of the intricate framework of support and sustenance that makes up your stormwater pond ecosystem.

In most cases the animals will move into the pond by themselves. You may find turtles, rabbits, dragonflies, butterflies, mice, snakes, spiders, alligators, and birds species too numerous to list. It is important to remember that there are no “bad animals”, each plays a crucial role in the ecosystem and should be respected as such. That said there are things that your group can do to attract certain types of animals that you would enjoy seeing.

A Word on Habitat

As we develop Florida for human use one of the hidden prices is always loss of habitat for animals. We may not see this as a big deal, but we must remember that these animals play an important role in sustaining the natural services we take for granted, such as clean drinking water, clean air, erosion control, topsoil production, even slowing winds and influencing rainfall. The more we reduce the area for animals to live, the more we limit their ability to survive in large enough numbers to resist disease epidemics and lean years. You can only pull so many threads out of a fabric before it becomes too weak to support its use. The same goes for our natural services.

That is why Adopt-A-Pond plays such an important role. By creating a viable freshwater wetland habitat, your pond group is helping to increase and sustain an ecosystem that provides many of the services we need—even more than many other ecosystems because of the high productivity in wetlands. In addition you are proving that it is possible for us to live in a way that cooperates with nature.

And besides… it makes the pond a whole lot nicer to live around!

SS-WIS-09

UNIVERSITY OF FLORIDA
Florida Cooperative Extension Service

Native Plants that Attract Wildlife: Central Florida[1]

Craig N. Huegel[2]

Gardening for wildlife is rapidly increasing in popularity. Home landscapes can help offset the habitat loss that occurs in urban areas. This allows a greater variety of wildlife to live near us.

Plants are the key to attracting wildlife to your property. Your plant choices and your landscape design both will determine what animals you will attract. A yard landscaped with wildlife in mind need not appear "wild." A more traditional landscape design also can have great benefits.

There are several considerations to make in gardening for wildlife. A very important one is your choice of plants. In most cases, wildlife do best in landscapes with plants native to the region in which they live. These plants often are better at providing the food and cover that is required. When used in the proper location, naive plants also require less attention and water.

There are a great many native trees and shrubs to choose from in Florida. Every plant has some value to wildlife, but some are better than others. Tables 1, 2 and 3 list native Florida trees and shrubs that provide both food and cover. Not all of these are native to central Florida, but all of them can be grown here. Also, many of these are not available from a wide variety of commercial sources at this time.

This list is intended to be as thorough as possible, but it is not complete. Information for wildlife with specific requirements such as hummingbirds (*Florida's Hummingbirds*, SS-WIS-21) and butterflies (*Butterfly Gardening in Florida*, SS-WIS-22) is available from a variety of other sources.

Plants listed as "tall trees" (greater than 30 feet at maturity) often are used best as a canopy (Table 1). These trees also produce shade. The "small trees" (30 feet or less) can be used below the canopy when they are shade-tolerant or as a low canopy in areas where large trees are not desired or appropriate (Table 2). Shrubs are used best near trees. Shrubs (Table 3) here are defined as woody plants that have a bushy form. Shade-tolerant shrubs can be planted directly beneath the canopy. Others can be planted at the edge of the shade zone so that they receive ample sunlight.

Some plants produce either male **or** female flowers. These are known as dioecious. Other plants produce both male and female flowers. These are called monoecious. Monoecious plants can set fruit by themselves. For dioecious plants, you need to have both sexes nearby and only the female plants produce fruit. Because fruit production is important to a wildlife landscape, be aware of this when you make your plant choices. Consider the size of the fruit because large fruit may be difficult for small wildlife to use. Also be aware of the season when the

1. This document, SS-WIS-09, is part of a series published by the Cooperative Wildlife Program, a cooperative effort of the Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida and the Florida Game and Fresh Water Fish Commission's Nongame Wildlife Program.

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fruit ripens and try to have food available throughout the year.

The best wildlife landscapes require a minimum amount of care. Frequent watering, fertilizing, spraying and pruning disturbs animals and limits their use of the area. Use plants that are adapted to existing growing conditions.

It also is important that your landscape be attractive to you. The column for aesthetics lists some characteristics of the plants that may be of interest to people. Balance your desires with the needs of the wildlife you wish to attract.

For more information on wildlife gardening contact the Florida Game and Fresh Water Fish Commission (620 S. Meridian St., Tallahassee, FL 32399-1600) for a copy of *Planting a Refuge for Wildlife* or your local County Cooperative Extension Service office.

The following is a key to the headings used in the tables:

1. ***Common name:*** The name most commonly used; others used in parentheses

2. ***Scientific name:*** The botanical name most commonly used; others used in parentheses

3. ***Hgt:*** Average height in feet of mature plant; plants may grow taller after many years under ideal conditions

4. ***Leaf type:*** (D) Deciduous, (S) Semi-deciduous, (E) Evergreen

5. ***Sex:*** (D) Dioecious - male and female flowers on separate trees, (M) Monoecious - male and female flowers on same tree

6. ***Moisture:*** Preferred soil moisture for best growth

7. ***Light:*** (S) Full sun, (P) Partial sun, (Sh) Shade

8. ***pH:*** Soil pH preferred: (Av) Wide pH tolerance, (Ac) Acid, (Al) Alkaline

9. ***Salt:*** Degree of salt tolerance: (H) High, (M) Medium, (N) Low to none, (U) Unknown

10. ***Wildlife use:*** Major uses for wildlife

11. ***Aesthetics:*** Aesthetic considerations

The following is a key to the footnotes used in the tables:

1. * Indicates plants that will suffer damage from severe or prolonged freezing temperatures.

2. ** Oaks are classified as either black (B) or white (W). White oak acorns often are sweeter and more preferred by wildlife than black oak acorns.

Table 1. Native Tall Trees for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Moisture	pH	Salt
Florida maple	*Acer saccharum floridanum* (*Acer barbatum*)	50	D	Moist	Av	N
Wildlife Use of Native Plants: Seeds used mostly by squirrels						
Native Plant Aesthetics: Good fall color, stately shade tree						
Boxelder	*Acer negundo*	60	D	Moist	Av	N
Wildlife Use of Native Plants: Seeds used mostly by squirrels						
Native Plant Aesthetics: Fairly short-lived, weak wood						
Red maple	*Acer rubrum*	80	D	Moist	Av	N
Wildlife Use of Native Plants: Seeds used mostly by squirrels						
Native Plant Aesthetics: Very good fall color, red flowers and fruits in spring						
Water hickory	*Carya aquatics*	90	D	Moist	Av	N
Wildlife Use of Native Plants: Nuts are important wildlife food						
Native Plant Aesthetics: Nuts bitter, narrow leaves and crown						
Scrub hickory	*Carya floridana*	30	D	Dry	Av	N

Table 1. Native Tall Trees for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Moisture	pH	Salt
Wildlife Use of Native Plants: Nuts are important wildlife food						
Native Plant Aesthetics: Nuts edible, tree often multi-trunked and crooked						
Pignut hickory	*Carya glabra*	70	D	Avg	Av	N
Wildlife Use of Native Plants: Nuts are important wildlife food						
Native Plant Aesthetics: Good fall color, nuts bitter, good shade tree						
Mockernut hickory	*Carya tomentosa*	60	D	Avg	Av	N
Wildlife Use of Native Plants: Nuts are important wildlife food						
Native Plant Aesthetics: Nuts edible, good shade tree						
Sugarberry	*Celtis laevigata*	80	D	Moist	Av	N
Wildlife Use of Native Plants: Fruits used by many birds						
Native Plant Aesthetics: Excellent shade tree						
Flowering dogwood	*Cornus florida*	40	D	Moist-Avg	Ac-Av	N
Wildlife Use of Native Plants: Fruits used by many birds						
Native Plant Aesthetics: Very showy white flower bracts						
Persimmon	*Diospyros virginiana*	60	D	Avg	Av	N
Wildlife Use of Native Plants: Fruit attractive to opossums and other mammals						
Native Plant Aesthetics: Edible fruit, attractive flowers						
Willow bustic*	*Dipholis salicifolia*	40	E	Avg	Av	U
Wildlife Use of Native Plants: Small purple fruits used by some birds						
Native Plant Aesthetics: Young branches rusty hairy						
White ash	*Fraxinus americana*	80	D	Moist	Av	N
Wildlife Use of Native Plants: Seeds used by many birds, good seed set only every 2-3 years						
Native Plant Aesthetics: Important timber and shade tree						
Green ash	*Fraxinus pennsylvanica*	65	D	Moist	Av	N
Wildlife Use of Native Plants: Seeds used by many birds, good seed set annually						
Native Plant Aesthetics: Important limber and shade tree						
Pumpkin ash	*Fraxinus profunda*	90	D	Wet	Av	N
Wildlife Use of Native Plants: Seeds used by many birds						
Native Plant Aesthetics: Good shade tree for low moist areas						
Water locust	*Gleditsia aquatica*	60	D	Wet	Av	N
Wildlife Use of Native Plants: Seeds eaten by mammals and quail, excellent nesting cover						
Native Plant Aesthetics: Very thorny, "beans" can be messy after they fall						
Dahoon holly	*Ilex cassine*	40	E	Moist	Av	M
Wildlife Use of Native Plants: Berries excellent food for many wildlife						
Native Plant Aesthetics: Masses of red berries on female trees						
American holly	*Ilex opaca*	40	E	Avg	Av	M
Wildlife Use of Native Plants: Berries excellent food for many wildlife						
Native Plant Aesthetics: Bright red berries and shiny foliage, many cultivars offered						
Southern red cedar	*Juniperus silicicola*	50	E	Avg	Av-Al	H
Wildlife Use of Native Plants: Small fruits used by birds, excellent nesting cover						
Native Plant Aesthetics: Very adaptable long-lived tree						
Sweet gum	*Liquidambar styraciflua*	50	D	Avg	Av	N
Wildlife Use of Native Plants: Seeds of limited use to some birds and mammals						
Native Plant Aesthetics: Good fall color, spiny seed balls						
Southern magnolia	*Magnolia grandiflora*	80	E	Avg	Av	M
Wildlife Use of Native Plants: Red seeds used by variety of wildlife						
Native Plant Aesthetics: Large aromatic white flowers						

Table 1. Native Tall Trees for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Moisture	pH	Salt
Sweet bay	*Magnolia virginiana*	60	E	Moist	Ac-Av	N
Wildlife Use of Native Plants: Small red seeds used by variety of wildlife						
Native Plant Aesthetics: Small aromatic white flowers, tree less stately than above						
Red mulberry	*Morus rubra*	50	D	Avg	Av	N
Wildlife Use of Native Plants: Fruits highly prized by variety of wildlife						
Native Plant Aesthetics: Fruits edible, very "messy" tree as fruits stain property						
Water tupelo	*Nyssa aquatica*	80	D	Wet	Av	N
Wildlife Use of Native Plants: Dark purple fruit used by many birds and mammals, bee tree						
Native Plant Aesthetics: Good fall color						
Ogeechee lime	*Nyssa ogeche*	30	D	Wet	Av	N
Wildlife Use of Native Plants: 1.5" bright red fruit used by large birds and mammals						
Native Plant Aesthetics: Best grown in permanently wet sites						
Black gum (Tupelo)	*Nyssa sylvatica biflora*	70	D	Moist	Av	N
Wildlife Use of Native Plants: Blue fruit eaten by many birds and mammals, bee tree						
Native Plant Aesthetics: Brilliant fall color						
Wild olive	*Osmanthus americana*	45	E	Avg	Ac-Av	M
Wildlife Use of Native Plants: Fruits of limited use by birds/mammals						
Native Plant Aesthetics: Very fragrant small flowers						
Red bay	*Persea borbonia*	65	E	Moist	Av	M
Wildlife Use of Native Plants: Purple fruit eaten by birds and squirrels						
Native Plant Aesthetics: Aromatic leaves can be used to season food						
Silk bay	*Persea humilis*	30	E	Dry	Av	M
Wildlife Use of Native Plants: Purple fruit eaten by birds and squirrels						
Native Plant Aesthetics: Lower surface of aromatic leaves with copper colored hairs						
Swamp bay	*Persea paiustris*	40	E	Moist	Av	M
Wildlife Use of Native Plants: Purple fruit eaten by birds and squirrels						
Native Plant Aesthetics: Aromatic leaves and leaf stalks hairy						
Sand pine	*Pinus clausa*	70	E	Dry	Av	M
Wildlife Use of Native Plants: Seeds eaten by variety of wildlife						
Native Plant Aesthetics: Short-needled pine easily damaged by overwatering, often used as Christmas tree						
Slash pine	*Pinus elliottii*	90	E	Moist	Av	M
Wildlife Use of Native Plants: Seeds eaten by variety of wildlife						
Native Plant Aesthetics: Use south Florida variety (P. e. densa) for best results						
Spruce pine	*Pinus glabra*	90	E	Moist	Av	N
Wildlife Use of Native Plants: Seeds used by variety of wildlife						
Native Plant Aesthetics: A "soft" needled pine for moist areas						
Longleaf pine	*Pinus palustris*	90	E	Avg	Ac-Av	M
Wildlife Use of Native Plants: Seeds eaten by variety of wildlife						
Native Plant Aesthetics: Stately, long-lived tree, with good disease resistance						
Pond pine	*Pinus serotina*	60	E	Wet	Av	N
Wildlife Use of Native Plants: Seeds used by variety of wildlife						
Native Plant Aesthetics: Adapted to high and fluctuating water tables, irregular canopy						
Loblolly pine	*Pinus taeda*	90	E	Avg	Av	M
Wildlife Use of Native Plants: Large seed crops used by variety of wildlife						
Native Plant Aesthetics: Fast-growing, long-needled pine but susceptible to insect and disease damage						

Table 1. Native Tall Trees for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Moisture	pH	Salt
Planer elm	*Planera aquatica*	40	D	Wet	Av	N
Wildlife Use of Native Plants: Seeds used by many wildlife						
Native Plant Aesthetics: Excellent tree for areas that frequently flood						
Cherry laurel	*Prunus caroliniana*	40	D	Avg	Av	N
Wildlife Use of Native Plants: Fruit used by many wildlife species						
Native Plant Aesthetics: Attractive flowers, may be pruned and used as a hedge						
Black cherry	*Prunus serotina*	80	D	Avg	Av	N
Wildlife Use of Native Plants: Very important food source, foliage poisonous to livestock						
Native Plant Aesthetics: Attractive flowers and good fall color						
Bluff oak (W)**	*Quercus austrina*	80	D	Avg	Av	N
Wildlife Use of Native Plants: Acorns .5"						
Native Plant Aesthetics: Southern version of the white oak, leaves with elongate rounded lobes						
Southern red oak (B)	*Quercus faicata*	50	D	Avg	Av	N
Wildlife Use of Native Plants: Acorns .5"						
Native Plant Aesthetics: Broad crowned, leaves with pointed lobes						
Cherrybark oak (B)	*Quercus faicata pagodifolia*	80	D	Moist	Av	N
Wildlife Use of Native Plants: Acorns .5"						
Native Plant Aesthetics: A large attractive oak that survives periodic flooding						
Turkey oak (B)	*Quercus laevis*	50	D	Dry	Av	N
Wildlife Use of Native Plants: Acorns 1"						
Native Plant Aesthetics: Thrives in very poor soils, leaves with deep pointed lobes						
Laurel oak (B)	*Quercus laurifolia*	80	s	Avg	Av	N
Wildlife Use of Native Plants: Acorns .5", abundant						
Native Plant Aesthetics: Commonly used landscape tree, straight trunk with rounded crown						
Overcup oak (W)	*Quercus lyrata*	80	D	Wet	Av	N
Wildlife Use of Native Plants: Large acorns (1"), heavy production only every 3-4 years						
Native Plant Aesthetics: Broad crowned tree, leaves long and narrow with irregular rounded lobes						
Swamp chestnut oak (W)	*Quercus michauxii*	90	D	Moist	Av	N
Wildlife Use of Native Plants: Acorns 1-1.5"						
Native Plant Aesthetics: Leaves with numerous shallow rounded lobes						
Water oak (B)	*Quercus nigra*	80	D	Moist	Av	N
Wildlife Use of Native Plants: Acorns .5"						
Native Plant Aesthetics: Attractive light bark, leaves spatula shaped						
Shumard oak (B)	*Quercus shumardii*	70	D	Avg	Av	N
Wildlife Use of Native Plants: Acorns .5-1"						
Native Plant Aesthetics: Broad, rounded crown, leaves with many deeply pointed lobes						
Post oak (W)	*Quercus stellata*	65	D	Avg	Av	N
Wildlife Use of Native Plants: Acorns .5-1", good production only every 2-4 years						
Native Plant Aesthetics: Leaves 5-lobed, crucifix shaped						
Live oak (W)	*Quercus virginiana*	45	E	Avg	Av	M
Wildlife Use of Native Plants: Abundant acorns 1"						
Native Plant Aesthetics: Very broad crowned, long-lived shade tree						
Cabbage palm	*Sabal palmetto*	70	E	Avg	Av	H
Wildlife Use of Native Plants: Fruits important to many wildlife						
Native Plant Aesthetics: Florida state tree, very adaptable						

Table 1. Native Tall Trees for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Moisture	pH	Salt
Pond cypress	*Taxodium ascendens*	100	D	Wet	Av	N
Wildlife Use of Native Plants: Small seeds used by some birds and squirrels						
Native Plant Aesthetics: Small leaves closely pressed against stems						
Bald cypress	*Taxodium distichum*	100	D	Wet	Ac-Av	N
Wildlife Use of Native Plants: Small seeds used by some birds and squirrels						
Native Plant Aesthetics: Leaves spread away from stems, giving "leathery" appearance						
Florida trema	*Trema micrantha*	60	E	Avg	Al	u
Wildlife Use of Native Plants: Small fruit used by some birds						
Native Plant Aesthetics: Short-lived "weedy" tree						
Winged elm	*Ulmus alata*	50	D	Avg	Av	N
Wildlife Use of Native Plants: Seeds of minor use						
Native Plant Aesthetics: Corky "wings" on branches, open rounded crown						
Florida elm	*Ulmus americana floridana*	70	D	Avg	Av	N
Wildlife Use of Native Plants: Seeds of minor use						
Native Plant Aesthetics: Excellent shade tree, graceful spreading form						
Cedar elm	*Ulmus crassifolia*	50	D	Moist	Av-Al	N
Wildlife Use of Native Plants: Seeds of minor use						
Native Plant Aesthetics: Branches often with corky "wings"						
* Indicates plants that will suffer damage from severe or prolonged freezing temperatures.						
** Oaks are classified as either black (B) or white (W). White oak acorns often are sweeter and more preferred by wildlife than black oak acorns.						

Table 2. Native Small Trees for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Sex	Moisture	pH	Salt
Sweet acacia	*Acacia farnesiana*	20	S	M	Avg	Av	M
Wildlife Use of Native Plants: Seeds inside "beans" used by large birds, nesting cover							
Native Plant Aesthetics: Bright yellow fragrant flower heads, used in perfume							
Red buckeye	*Aesculus pavia*	20	D	M	Avg	Av	N
Wildlife Use of Native Plants: Buckeyes eaten by squirrels, flowers attract hummingbirds							
Native Plant Aesthetics: Red tubular flowers in spring, needs some shade							
Downy serviceberry	*Amelanchier arborea* (*Amelanchier canadensis*)	30	D	M	Avg	Av	N
Wildlife Use of Native Plants: Berries highly prized by most wildlife							
Native Plant Aesthetics: Berries edible, bell-like white flowers in spring							
Pond apple*	*Annona glabra*	30	E	M	Wet	Av	M
Wildlife Use of Native Plants: Large yellow "apples" mostly used by mammals							
Native Plant Aesthetics: 1" cream white to pale yellow flowers, leaves aromatic							
Devil's walking stick	*Aralia spinosa*	15	D	M	Moist	Av	N
Wildlife Use of Native Plants: Many purplish berries widely used by wildlife							
Native Plant Aesthetics: Leaf stems with spines, fast grower, may spread by suckers							
Saffron plum*	*Bumelia celastrina*	15	E	M	Avg-Dry	Av	H
Wildlife Use of Native Plants: Sweet black fruits used by birds, good nesting tree							
Native Plant Aesthetics: Thorny, fruits edible							
Gum bumelia	*Bumelia lanuginosa*	20	D	M	Avg	Av	N
Wildlife Use of Native Plants: Small black fruits used by some birds, good nesting tree							
Native Plant Aesthetics: Leaf undersides dense wooly							

Table 2. Native Small Trees for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Sex	Moisture	pH	Salt
Buckthorn bumelia	*Bumelia lycioides*	20	D	M	Moist	Av	N
Wildlife Use of Native Plants: Small black fruits used by some birds							
Native Plant Aesthetics: Leaves without hairs, no thorns							
Tough bumelia	*Bumelia tenax*	20	E	M	Dry	Av	M
Wildlife Use of Native Plants: Small black fruits used by some birds, tree forms are good nesting cover							
Native Plant Aesthetics: Thorny branches, often shrubby, leaf undersides with dense copper hairs							
Blue hornbeam (ironwood)	*Carpinus caroliniana*	30	D	M	Ave	Av	N
Wildlife Use of Native Plants: Seeds and catkins used by birds and squirrels							
Native Plant Aesthetics: Excellent understory tree, trunk "muscled" in appearance							
Ashe chinkapin	*Castanea pumila*	20	D	M	Avg	Av	N
Wildlife Use of Native Plants: Small chestnuts eaten by wide variety of wildlife							
Native Plant Aesthetics: Sweet nuts similar to American chestnut							
Redbud	*Cercis canadensis*	30	D	M	Avg	Av	N
Wildlife Use of Native Plants: Beans provide seeds for some birds							
Native Plant Aesthetics: Very showy pink-red flowers in spring							
Pygmy fringe tree	*Chionanthus pygmaeus*	6	D	D	Dry	Av	N
Wildlife Use of Native Plants: Purple fruits used by birds							
Native Plant Aesthetics: Profuse clusters of fragrant white flowers in spring, small and multitrunked							
Fringe tree	*Chionanthus virginicus*	30	D	D	Avg	Av	N
Wildlife Use of Native Plants: Purple fruits used by birds							
Native Plant Aesthetics: Profuse clusters of fragrant white flowers in spring, multitrunked							
Swamp dogwood	*Cornus foemina*	20	D	M	Wet	Av	N
Wildlife Use of Native Plants: Blue berries used by wide variety of birds							
Native Plant Aesthetics: Flat-topped clusters of small white flowers in spring							
May haw	*Crataegus aestivalis*	20	D	M	Moist-Avg	Av	N
Wildlife Use of Native Plants: Medium-sized pale-orange "haws" eaten by variety of wildlife, good nesting cover							
Native Plant Aesthetics: Small apple-like flowers in clusters, fruit makes fine-flavored jelly							
Cockspur haw	*Crataegus crus-galli* (*Crataegus pyracanthoides*)	25	D	M	Avg	Av	N
Wildlife Use of Native Plants: Small green-dull red fruit eaten by variety of wildlife, good nesting cover							
Native Plant Aesthetics: Long thorns, small white flowers in clusters							
Summer haw	*Crataegus flava*	25	D	M	Dry	Av	N
Wildlife Use of Native Plants: Orange-red "haws" eaten by variety of birds and mammals, good nesting cover							
Native Plant Aesthetics: Thorns, twisted weeping branches, medium-sized flowers in small clusters							
Parsley haw	*Crataegus marshallii*	20	D	M	Moist	Av	N
Wildlife Use of Native Plants: Small scarlet "haws" eaten by variety of wildlife, good nesting cover							
Native Plant Aesthetics: Finely cut leaves (similar to parsley) very attractive, small flowers in large clusters							
Littlehip haw	*Crataegus spathulata*	25	D	M	Avg	Av	N
Wildlife Use of Native Plants: Small red "haws" eaten by variety of wildlife, good nesting cover							
Native Plant Aesthetics: Long thorns, small flowers in clusters							
One-flowered haw	*Crataegus uniflora*	12	D	M	Avg	Av	N
Wildlife Use of Native Plants: Small yellowish-green "haws", good nesting cover							
Native Plant Aesthetics: Numerous long thorns, small flowers usually not in clusters							
Green haw	*Crataegus viridis*	30	D	M	Moist	Av	N
Wildlife Use of Native Plants: Small orange-red "haws" eaten by variety of wildlife, good nesting cover							
Native Plant Aesthetics: Largest of native hawthorns, branches largely spineless, small flowers in clusters							

Table 2. Native Small Trees for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Sex	Moisture	pH	Salt
Inkwood*	*Exothea paniculata*	30	E	D	Avg	Av	M
Wildlife Use of Native Plants: Small purple fruits used by birds							
Native Plant Aesthetics: Reddish flaky bark							
Pop ash	*Fraxinus caroliniana*	30	D	D	Wet	Av	N
Wildlife Use of Native Plants: Seeds eaten by some birds and mammals							
Native Plant Aesthetics: Will tolerate shallow water for months							
Carolina silverbell	*Halesia caroliniana*	30	D	M	Avg	Av	N
Wildlife Use of Native Plants: Winged seeds used by some wildlife							
Native Plant Aesthetics: Very showy white bell-shaped flowers in spring							
Two-winged silverbell	*Halesia diptera*	25	D	M	Avg	Av	N
Wildlife Use of Native Plants: Winged seeds used by some wildlife							
Native Plant Aesthetics: Very showy white bell-shaped flowers in spring							
Little silverbell	*Halesia parviflora*	20	D	M	Avg	Av	N
Wildlife Use of Native Plants: Winged seeds used by some wildlife							
Native Plant Aesthetics: Very showy white bell-shaped flowers in spring							
Carolina holly	*Ilex ambigua*	20	D	D	Avg-Dry	Av	N
Wildlife Use of Native Plants: Abundant red fruit in early fall widely used by wildlife							
Native Plant Aesthetics: Abundant red fruit very colorful in landscape							
Large gallberry	*Ilex coriacea*	20	E	D	Wet	Ac-Av	N
Wildlife Use of Native Plants: Nonpersistent purple fruit used late fall and early winter							
Native Plant Aesthetics: Dark fruit & shrubby appearance less eye-catching than most							
Possumhaw holly	*Ilex decidua*	30	D	D	moist	Ac-Av	N
Wildlife Use of Native Plants: Orange-red fruit widely used late fall and winter							
Native Plant Aesthetics: Persistent fruit adds winter color on leafless branches							
Gallberry	*Ilex glabra*	6	E	D	Moist	Ac-Av	N
Wildlife Use of Native Plants: Nonpersistent black fruit used in late fall and winter							
Native Plant Aesthetics: An open "bushy" tree, may produce runners							
Tawnyberry*	*Ilex krugiana*	30	E	D	Avg	Av	U
Wildlife Use of Native Plants: Black fruit mature in summer							
Native Plant Aesthetics: Unique long-pointed leaf tips and fruit color							
Myrtle holly	*Ilex myrtifolia*	25	E	D	Moist	Ac-Av	N
Wildlife Use of Native Plants: Red fruit widely used in late fall							
Native Plant Aesthetics: Similar to dahoon, but smaller leaves, winter color							
Scrub holly	*Ilex opaca arenicola*	15	E	D	Dry	Av	M
Wildlife Use of Native Plants: Red fruit, but good fruit production variable							
Native Plant Aesthetics: Very similar to American holly with spiny leaves, attractive, but slow grower, very susceptible to root rot in all but well-drained soils							
Winterberry	*Ilex verticillata*	25	D	D	Wet	Ac	N
Wildlife Use of Native Plants: Very persistent red fruit widely used in winter							
Native Plant Aesthetics: Fruit color and foliage nice, used in holiday decorations							
Yaupon	*Ilex vomitoria*	25	E	D	Avg	Av	M
Wildlife Use of Native Plants: Red fruit widely used late fall and winter							
Native Plant Aesthetics: Very adaptable, tolerant of pruning, good color							
Simpson stopper	*Myrcianthes fragrans*	25	E	M	Avg	Av	M
Wildlife Use of Native Plants: Red berries used by many birds							
Native Plant Aesthetics: Small white fragrant flowers in spring, reddish flaky bark							

Table 2. Native Small Trees for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Sex	Moisture	pH	Salt
Lancewood	*Nectandra conacea*	30	E	M	Avg	Av	M
Wildlife Use of Native Plants: Dark blue fruit used by some wildlife							
Native Plant Aesthetics: Small fragrant flower clusters in late spring							
Scrub olive	*Osmanthus megacarpa*	15	E	D	Dry	Av	M
Wildlife Use of Native Plants: Large "olives" marginally used by some birds and mammals							
Native Plant Aesthetics: Small fragrant flowers, large evergreen leaves							
Eastern hophornbeam	*Ostrya virginiana*	25	D	M	Avg	Av	N
Wildlife Use of Native Plants: Nutlets used by some birds and mammals							
Native Plant Aesthetics: Fruiting structure looks similar to hops, light flaky bark							
American plum	*Prunus americana*	30	D	M	Avg	Av	N
Wildlife Use of Native Plants: Medium-sized plums mostly used by mammals							
Native Plant Aesthetics: Showy white flowers in spring, plums used for jelly							
Chickasaw plum	*Prunus angustifolia*	20	D	M	Avg	Av	N
Wildlife Use of Native Plants: Reddish plums (.5" diameter) widely used by wildlife							
Native Plant Aesthetics: Showy white flowers in spring, red sour plums used in cooking							
Flatwoods plum	*Prunus umbellata*	20	D	M	Avg	Av	N
Wildlife Use of Native Plants: Purple plums (.5") widely used by wildlife							
Native Plant Aesthetics: Showy small white flowers in spring, purple plums edible, used in jelly							
Chapman oak (W)	*Quercus chapmanii*	20	S	M	Dry	Av	M
Wildlife Use of Native Plants: Acorns (.5-1")							
Native Plant Aesthetics: Broad crown, lobed leaves							
Sand live oak (W)	*Quercus geminata*	30	E	M	Dry	Av	H
Wildlife Use of Native Plants: Acorns (.5-1")							
Native Plant Aesthetics: Smaller than live oak with very narrow leaves							
Bluejack oak (B)	*Quercus incana*	30	D	M	Dry	Av	N
Wildlife Use of Native Plants: Acorns (.5")							
Native Plant Aesthetics: Rounded crown, leaves with bluish cast							
Inopina oak (B)	*Quercus inopina*	8	E	M	Dry	Av	U
Wildlife Use of Native Plants: Acorns (.5")							
Native Plant Aesthetics: Shrubby tree with round leaves often held vertical to ground							
Myrtle oak (B)	*Quercus myrtifolia*	25	E	M	Dry	Av	M
Wildlife Use of Native Plants: Acorns (.3")							
Native Plant Aesthetics: A bushy tree with round leaves and dense foliage							
Sand post oak (W)	*Quercus stellata margaretta*	30	D	M	Dry	Av	N
Wildlife Use of Native Plants: Acorns (.5")							
Native Plant Aesthetics: Nearly identical to post oak, with leaves less lobed							
Carolina buckthorn	*Rhamnus caroliniana*	30	D	M	Moist-Avg	Av-Al	N
Wildlife Use of Native Plants: Numerous black berries used by many birds							
Native Plant Aesthetics: Berries once used as source of yellow dye, flower clusters attractive							
Sassafras	*Sassafras albidum*	30	D	D	Avg	Av	N
Wildlife Use of Native Plants: Fruit (sets poorly in south 1/2 of FL) used by birds							
Native Plant Aesthetics: Small fragrant flowers, aromatic leaves and bark used in tea							
Sparkleberry	*Vaccinium arboreum*	20	E	M	Avg	Ac	N
Wildlife Use of Native Plants: Blueberries eaten by wide variety of birds							
Native Plant Aesthetics: Berries very bitter, attractive bell-like flowers in spring							

Table 2. Native Small Trees for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Sex	Moisture	pH	Salt
Hercules club	*Zanthoxylum clava-herculis*	30	D	D	Avg	Av	M
Wildlife Use of Native Plants: Seeds used by some birds, good nesting cover for some birds							
Native Plant Aesthetics: Trunk and main branches thorny, leaves very aromatic							
*Indicates plants that will suffer damage from severe or prolonged freezing temperatures.							
**Oaks are classified as either black (B) or white (W). White oak acorns often are sweeter and more preferred by wildlife than black oak acorns.							

Table 3. Native Shrubs for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Sex	Moisture	Light	pH	Salt
Marlberry (Marbleberry)*	*Ardisia escallonioides*	8	E	M	Avg	S-Sh	Av	M
Wildlife Use of Native Plants: Round purple fruits produced mostly fall-winter, widely used by wildlife								
Native Plant Aesthetics: Large clusters of fragrant white flowers, white trunk								
Slender buckthorn	*Bumelia reclinata*	25	E	M	Dry	S	Av	H
Wildlife Use of Native Plants: Small black fruits used by some birds								
Native Plant Aesthetics: Thorns								
Beautyberry	*Callicarpa americana*	6	D	M	Avg	P	Av	N
Wildlife Use of Native Plants: Small purplish fruits used by some birds in late winter								
Native Plant Aesthetics: Clusters of berries around stems very attractive								
Iguana hackberry*	*Celtis iguanaea*	8	E	M	Avg	S	Av-Al	H
Wildlife Use of Native Plants: Medium-sized orange fruits used by many wildlife species								
Native Plant Aesthetics: Spiny twisted branches, edible fruit								
Spiny hackberry*	*Celtis pallida*	8	E	M	Avg	S	Av-Al	H
Wildlife Use of Native Plants: Medium-sized orange fruits used by many wildlife species								
Native Plant Aesthetics: Spiny twisted branches, edible fruit								
Snowberry	*Chiococca alba*	10	E	M	Avg	P	Av	M
Wildlife Use of Native Plants: White berries produced year-round, used by many wildlife								
Native Plant Aesthetics: Flowers green-white to yellow, white stems with dark leaves								
Cocoplum*	*Chrysobalanus icaco*	6	E	M	Avg	S	Av	H
Wildlife Use of Native Plants: Purple "plums" used by mammals and large birds								
Native Plant Aesthetics: Two color forms (green and red lipped), edible fruit								
Seagrape*	*Coccoloba uvifera*	10	E	M	Avg	S	Av	H
Wildlife Use of Native Plants: Purple "grapes" used by mammals and large birds								
Native Plant Aesthetics: Large attractive leaves, edible fruit								
Scrub haw	*Crataegus lepida*	8	D	M	Dry	S	Av	N
Wildlife Use of Native Plants: Red "haws" eaten by variety of wildlife, nesting cover								
Native Plant Aesthetics: White flowers, weeping thorny branches								
White stopper*	*Eugenia axillaris*	25	E	M	Avg	S-P	Av	M
Wildlife Use of Native Plants: Blue-black fruits in winter used by many birds								
Native Plant Aesthetics: Fruits edible, leaves emit unpleasant odor when crushed								
Spanish (Boxleaf) stopper*	*Eugenia foetida*	15	E	M	Avg	S-P	Al	M
Wildlife Use of Native Plants: Small black fruits used by many birds								
Native Plant Aesthetics: Reddish scaly bark, leaves emit unpleasant odor								
Hearts a bustin'	*Euonymus americanus*	6	E	M	Avg	P	Av	N
Wildlife Use of Native Plants: Red seeds used by some wildlife, foliage often browsed								
Native Plant Aesthetics: Orange-red seed capsules with bright red seeds in fall								

Table 3. Native Shrubs for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Sex	Moisture	Light	pH	Salt
Swamp privet	*Forestiera acuminata*	30	D	D	Moist	S-P	Av	U
Wildlife Use of Native Plants: Lavender wrinkled fruit used by some wildlife								
Native Plant Aesthetics: Weak leaning shrub, may sprout where branches contact soil								
Flatwoods privet	*Forestiera ligustrina*	10	D	D	Avg	S-P	Av	N
Wildlife Use of Native Plants: Small purple fruit used by many birds								
Native Plant Aesthetics: Similar to Florida privet, but deciduous								
Pineland privet*	*Forestiera pinetorium*	10	E	D	Avg	S	Av	M
Wildlife Use of Native Plants: Abundant small purple fruits used by many birds								
Native Plant Aesthetics: Low-growing relative of Florida privet								
Florida privet	*Forestiera segregate*	10	s	D	Avg	S-P	Av-Al	M
Wildlife Use of Native Plants: Abundant small purple fruits used by many birds, good nesting cover								
Native Plant Aesthetics: Very dense dark-green foliage								
Blolly*	*Guapira discolor*	25	E	M	Avg	S-P	Al	M
Wildlife Use of Native Plants: Red fruit used by birds								
Native Plant Aesthetics: Shiny green foliage, bright red fruit								
Sarvis holly	*Ilex amelanchier*	15	D	D	Avg	S-P	Ac-Av	N
Wildlife Use of Native Plants: Dull-red berries used by many birds in late fall and winter								
Native Plant Aesthetics: Large shrub with open rounded crown								
Pond spice	*Litsea aestivalis*	9	D	M	Wet	S-P	Av	N
Wildlife Use of Native Plants: Bright red fruits used by many wildlife species								
Native Plant Aesthetics: Attractive yellow spring flowers, colorful fruit								
Christmas berry	*Lycium carolinianum*	6	E	M	Avg	S	Av	H
Wildlife Use of Native Plants: Red egg-shaped berries produced year-round, widely used by wildlife								
Native Plant Aesthetics: Bluish flowers, succulent leaves on thorny stems								
Wax myrtle	*Myrica cerifera*	20	E	D	Avg	S-P	Av	H
Wildlife Use of Native Plants: Small waxy berries used by many birds, good nesting cover								
Native Plant Aesthetics: Extremely adaptable, may be used as a hedge, aromatic leaves								
Evergreen bayberry	*Myrica heterophylia*	15	E	D	Wet	S-P	Av	M
Wildlife Use of Native Plants: Small waxy berries used by many birds, good nesting cover								
Native Plant Aesthetics: Branches nearly black, leathery aromatic evergreen leaves								
Odorless bayberry	*Myrica inodora*	20	E	D	Wet	S-P	Av	M
Wildlife Use of Native Plants: Small waxy berries used by many birds, good nesting cover								
Native Plant Aesthetics: Bark almost white, leaves odorless								
Dwarf wax myrtle	*Myrica pumila*	3	E	D	Avg	S-P	Av	H
Wildlife Use of Native Plants: Small waxy berries used by many birds								
Native Plant Aesthetics: A small version of common wax myrtle								
Scrub plum	*Prunus geniculata*	6	D	M	Dry	S	Av	N
Wildlife Use of Native Plants: Small sweet plums prized by wildlife								
Native Plant Aesthetics: White flowers, thorny zigzag branches								
Wild coffee*	*Psychotria nervosa*	2	E	M	Avg	P-Sh	Av	N
Wildlife Use of Native Plants: Red fruits used by many wildlife species								
Native Plant Aesthetics: Dark shiny leaves and bright red fruit								
Dwarf oak (B)**	*Quercus minima*	2	D	M	Avg	S-P	Av	N
Wildlife Use of Native Plants: Acorns widely used by wildlife								
Native Plant Aesthetics: Good groundcover for sunny areas								

Table 3. Native Shrubs for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Sex	Moisture	Light	pH	Salt
Running oak (B)	*Quercus pumila*	3	D	M	Avg	S-P	Av	N
Wildlife Use of Native Plants: Acorns widely used by wildlife								
Native Plant Aesthetics: Good groundcover for sunny areas								
White indigo berry*	*Randia aculeata*	6	E	M	Avg	S	Av	M
Wildlife Use of Native Plants: White-skinned fruits used by some birds								
Native Plant Aesthetics: Spines, attractive form but messy fruit								
Myrsine	*Rapanea punctata*	10	E	D	Avg	P-Sh	Av	M
Wildlife Use of Native Plants: Small black fruits along stem in winter used by some birds								
Native Plant Aesthetics: Bright green leathery leaves								
Needle palm	*Rhaphidophyllum hystrix*	6	E	M	Avg	P-Sh	Av	N
Wildlife Use of Native Plants: Yellowish fruits used by mammals and,large birds								
Native Plant Aesthetics: Trunks covered with needle-like spines								
Winged sumac	*Rhus copallina*	10	D	M	Avg	S	Av	N
Wildlife Use of Native Plants: Red fruits used by some birds during winter								
Native Plant Aesthetics: Good red fall color								
Sand blackberry	*Rubus cuneifolius*	4	E	M	Avg	S	Av	N
Wildlife Use of Native Plants: Berries greatly prized by wildlife, excellent cover								
Native Plant Aesthetics: Berries edible, white flowers in spring, very thorny and sprawling								
Scrub palmetto	*Sabal etonia*	3	E	M	Dry	S	Av	M
Wildlife Use of Native Plants: Round black fruits used by many mammals and large birds								
Native Plant Aesthetics: Leaf stems without teeth, trunks mostly underground								
Dwarf palmetto	*Sabal minor*	6	E	M	Moist	P	Av	H
Wildlife Use of Native Plants: Round black fruits used by mammals and large birds								
Native Plant Aesthetics: Leaves bluish and without teeth, trunks often underground								
Elderberry	*Sambucus canadensis*	12	D	M	Moist	S-P	Av	N
Wildlife Use of Native Plants: Purple fruit used by many birds, good nectar source								
Native Plant Aesthetics: Fruits used in jellies and wine, fragrant white flowers								
Saw palmetto	*Serenoa repens*	8	E	M	Avg	S-P	Av	H
Wildlife Use of Native Plants: Round black fruits used by many mammals and large birds								
Native Plant Aesthetics: Leaf stems with teeth, excellent groundcover beneath trees								
Mullein nightshade	*Solanum erianthum*	15	E	M	Avg	S	Av	M
Wildlife Use of Native Plants: Clusters of yellow berries used by some birds								
Native Plant Aesthetics: Open clusters of white flowers produced year-round								
Bay cedar*	*Suriana maritima*	8	E	M	Avg	S	Av	H
Wildlife Use of Native Plants: Seeds used by some birds, good nesting cover								
Native Plant Aesthetics: Small yellow flowers year-round, dense, succulent foliage								
Highbush blueberry	*Vaccinium corymbosum*	12	E	M	Avg	P	Ac	N
Wildlife Use of Native Plants: Berries greatly prized by wildlife								
Native Plant Aesthetics: Sweet edible berries, bell-shaped flowers in spring								
Little blueberry	*Vaccinium darrowii*	2	E	M	Avg-Dry	S-P	Ac	N
Wildlife Use of Native Plants: Berries greatly prized by wildlife								
Native Plant Aesthetics: Sweet edible berries, foliage with bluish cast								
Shiny blueberry	*Vaccinium myrsinites*	2	E	M	Avg-Dry	S-P	Ac	N
Wildlife Use of Native Plants: Berries greatly prized by wildlife								
Native Plant Aesthetics: Sweet edible berries, shiny green foliage								

Table 3. Native Shrubs for Central Florida

Common Name	Scientific Name	Hgt	Leaf Type	Sex	Moisture	Light	pH	Salt
Deerberry	*Vaccinium stamineum*	8	D	M	Avg	S-P	Ac	N
Wildlife Use of Native Plants: Berries used by many wildlife species								
Native Plant Aesthetics: Berries bitter, bell-shaped flowers in spring								
Possumhaw viburnum	*Viburnum nudum*	15	D	M	Moist	P-Sh	Av	N
Wildlife Use of Native Plants: Small blue-black fruit used by many birds								
Native Plant Aesthetics: Large clusters of small white flowers in spring, sprawling								
Walter's viburnum	Viburnum obovatum	15	E	M	Moist	S-Sh	Av	N
Wildlife Use of Native Plants: Small black fruit used by many birds, good nesting cover								
Native Plant Aesthetics: Clusters of small white flowers in spring, easily pruned, versatile								
Rusty viburnum	Viburnum rufidulum	20	0	M	Avg	S-Sh	Av	N
Wildlife Use of Native Plants: Small black fruit used by many birds								
Native Plant Aesthetics: Large clusters of small white flowers in spring								
Hog plum	Ximenia americana	10	E	M	Dry	S	Av	M
Wildlife Use of Native Plants: Yellow "plums" used by some wildlife								
Native Plant Aesthetics: "Plums" tart, but edible, very thorny								

*Indicates plants that will suffer damage from severe or prolonged freezing temperatures.

**Oaks are classified as either black (B) or white (W). White oak acorns often are sweeter and more preferred by wildlife than black oak acorns.

UNIVERSITY OF FLORIDA
Florida Cooperative Extension Service

SS-WIS-901
December 1990

Helping Cavity-nesters in Florida[1]

Joe Schaefer[2]

Cavities or holes in trees are required nesting sites for 25 bird species in Florida. Some cavity-nesters have very specific preferences for their homes. For example, the red-cockaded woodpecker excavates its nesting cavity only in older living pine trees that are infected with red heart rot, and in areas with little or no hardwood understory. On the other hand, Carolina wrens are quite adaptable and even have been known to set up house-keeping in pockets of accessible clothing articles, mailboxes, and old hornet nests.

Some cavity-nesters such as woodpeckers, Carolina chickadees, and brown-headed nuthatches prefer to excavate their own nest cavities in dead or decaying wood. Others select old woodpecker holes or cavities formed by lightning, disease, decay, or insects.

Turkey vultures are the largest cavity-nesters with wing-spans of about 6 feet (2 meters). Their nest site often is at or near ground level in hollow trees or logs. When these structures are not available, they will nest in caves or in dense shrubbery.

The smallest hole-nester in Florida is the brown-headed nuthatch which is only 3 1/2 inches (9 centimeters) long. These birds often nest in small cracks and crevices that do not have noticeable rounded openings like woodpecker holes.

Of the 25 species of cavity-nesters in Florida, two are legally classified as species in jeopardy of extinction. The southeastern American kestrel is a state-listed threatened species and the red-cockaded woodpecker is a federally-listed endangered species. The ivory-billed woodpecker also is doubly listed as endangered but probably is already extirpated from the state. The Florida Committee on Rare and Endangered Plants and Animals has recommended listing the hairy woodpecker and the white-breasted nuthatch.

NEST SITES

Nest sites for cavity-nesters usually are in shorter supply than food and water. Dead trees (snags) often are removed from forests, parks, and yards. Whenever possible, snags should be left for birds; however, if you are concerned that a dead tree may fall, it can be shortened and supported with cables.

Properly built bird houses or nest boxes can mimic natural cavities and help to increase the availability of this limiting habitat component. Some cavity-nesters in Florida, such as black and turkey vultures, chimney swifts, and pileated and red-cockaded woodpeckers will not readily use bird houses. However, there can be exceptions to this general rule. Preferred habitats, house dimensions, entrance specifications, and other special requirements are fairly specific for each species. Refer to Table 1: Bird House Specifications.

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2. Joe Schaefer, urban wildlife extension specialist, Wildlife and Range Sciences Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL 32611-0304.

Bird houses can be set out at any time of the year. However, making them available just before the major nesting season (March-June) will enhance their use.

The following general considerations apply to all bird houses.

- Cleaning - Include a hinged door or other means for easily checking and cleaning out the house. Birds will do their own cleaning as they do in natural cavities, but your help will increase use.

- Drainage - The bottom should contain 3 or 4 1/4-inch holes to allow drainage of rain water that may enter.

- Attachment - Houses built for wrens can be suspended under an eave or a tree limb. All other houses should be firmly attached to a post, tree, or building.

- Perches - Natural cavities do not have perches, so do not attach perches on any built houses. Perches will only encourage use by exotic English sparrows and European starlings. A nail or knife can be used to scratch the outside surface below the entrance if smooth boards are used. Cavity-nesters perch on vertical roughened surfaces such as bark.

- Roof - The front edge of the roof should overhang about 1-2 inches (2.5-5 centimeters) to help protect the entrance from wind-driven rain.

- Ventilation - Ventilation holes or slits should be located at the top of both sides just beneath the roof.

- Nails - Use galvanized nails.

- Floor - The floor should be situated between and about 1/4 inch above the bottom edges of the front, back, and sides. This will help prevent the rain from seeping into the bottom of the nest.

- Wood - 1" x 4", 1" x 6", or 1" x 12", untreated boards are the best materials to use.

- Paint - Newly painted or oiled houses are less attractive to birds until they have weathered. However, it is desirable to paint the top surfaces of purple martin houses white to reflect the sun's heat.

- Style - The shape and style of the house are not as important as the dimensions.

- Size - House dimensions should be close to those given in this pamphlet, but they do not have to be exact.

Providing houses for cavity nesting birds is not only recommended to help reverse declining trends for some populations, but it is also a rewarding activity for many Floridians. What have you done for wildlife lately?

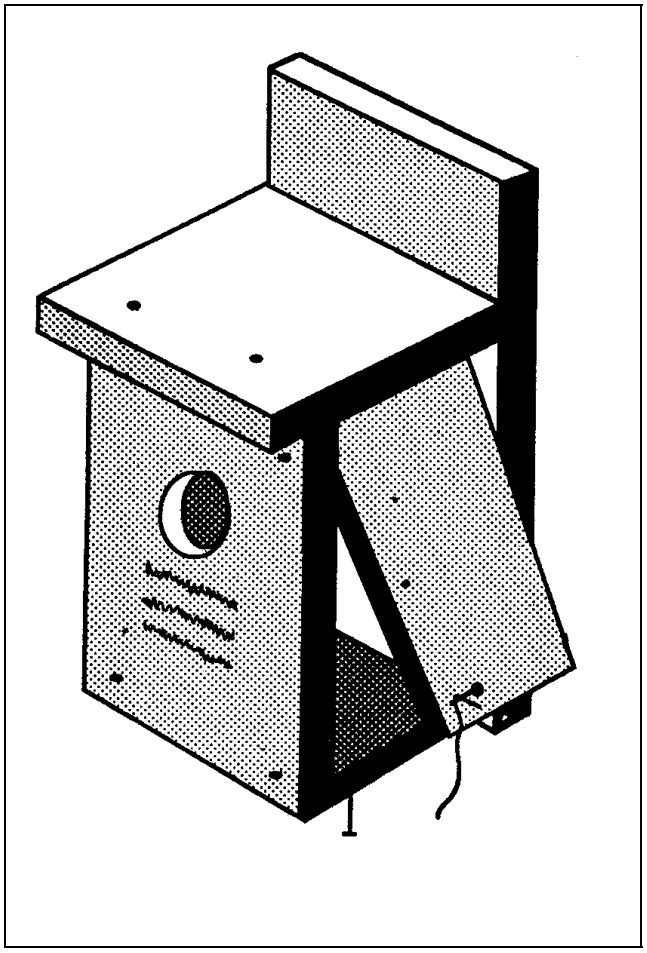

Figure 1. Basic birdhouse design.

Table 1. Bird House Specifications.

Width (in)	Height (in)	Entrance		Height of house (ft)
		Size (in)	Height above floor (in)	
Barn-owl				
22	18	10 square	centered at the top	in open building near roof
Preferred habitat: open canopy wood-lands or edges of thick woodlots				
Special tips: 2" of woodchips on bottom				
Barred owl				
12	24	7	12	20-30
Preferred habitat: old growth, wetland forests				
Special tips: 3" of woodchips on bottom, a perch should be close but not block entrance				
Brown-headed nuthatch				
4	10	1 1/4	7	10-25
Preferred habitat: pine woodlands				
Special tips: outer material should be pine bark				
White-breasted nuthatch				
4	10	1 1/4	7	6-25
Preferred habitat: deciduous woodlands				
Special tips: outer material should be bark				
Carolina wren				
4	8	1 1/2	1-6	6-10
Preferred habitat: woodlands with thick underbrush				
Special tips: bird house can be hung from limb or human house eave				
Carolina chickadee				
4	8	1 1/8	6	4-10
Preferred habitat: all woodlands				
Special tips: place house in area with about 1/2 sunlight				
Common flicker				
7	24	2 1/2	18	8-20
Preferred habitat: all woodlands				
Special tips: outer material should be bark				
Downy woodpecker				
4	10	1 1/4	7	8-25
Preferred habitat: all woodlands				
Special tips: fill house tightly with sawdust, outer material should be bark				
Eastern bluebird				
5	9	1 1/2	5	4-8
Preferred habitat: open fields, yards, golf courses				
Special tips: place house in open area facing and about 10 feet away from a bush or along a wire fence on which young can perch				
Eastern screech-owl				
8	16	3	10	15-30
Preferred habitat: woodland edges				
Special tips: 3" of woodchips on bottom				
Great-crested flycatcher				
6	10	2	6	8-20
Preferred habitat: all woodlands				
Special tips: place house in shade				

Table 1. Bird House Specifications.

Width (in)	Height (in)	Entrance		Height of house (ft)
		Size (in)	Height above floor (in)	
Hairy woodpecker				
6	15	1 1/2	10	12-25
Preferred habitat: all woodlands				
Special tips: fill house tightly with sawdust, outer material should be bark				
Pileated woodpecker				
11	24	4	18	20-30
Preferred habitat: old growth woodlands				
Special tips: 2" thick boards, fill house tightly with sawdust, outer material should be bark				
Prothonotary warbler				
4	8	1 1/4	6	2-12
Preferred habitat: swamps and along rivers				
Special tips: place house "next to" or "over" water				
Purple martin				
6	6	2 1/2	1	10-20
Preferred habitat: open fields, yards, and golf courses				
Special tips: must have several compartments, place house on pole at least 25’ from trees and other tall structures				
Red-bellied woodpecker				
7	15	2	10	20-40
Preferred habitat: old growth woodlands				
Special tips: fill house tightly with sawdust, outer material should be bark				
Red-headed woodpecker				
6	15	2	10	20-40
Preferred habitat: open canopy woodlands and edges				
Special tips: fill house tightly with sawdust, outer material should be bark				
Southeastern kestrel				
9	16	3	11	13-16
Preferred habitat: open areas and edges of woodlands				
Special tips: 2" of woodchips on bottom				
Tufted titmouse				
4	10	1 1/4	7	4-15
Preferred habitat: old growth woodlands				
Special tips: place house in shade				
Wood duck				
10	24	4x3 horizontal oval	20	4-6 over water; 15-25 over land
Preferred habitat: bottomland hardwoods and wetlands				
Special tips: 4" of woodchips on bottom, 18"x3" strip of 1/4" hardware cloth on inside below entrance				
Hooded merganser				
10	24	4x3 horizontal oval	20	4-6 over water; 20-30 over land
Preferred habitat: bottomland hardwoods and wetlands				
Special tips: 4" of woodchips on bottom, 18"x3" strip of 1/4" hardware cloth on inside below entrance				

UNIVERSITY OF FLORIDA
Cooperative Extension Service
Institute of Food and Agricultural Sciences

WEC-21

Butterfly Gardening in Florida[1]

Joe Schaefer, Craig N. Huegel, and Frank J. Mazzotti[2]

Background

Few outdoor activities are more rewarding and easily available than attracting butterflies to a well-designed butterfly garden. Creating a butterfly garden can be as simple as planting a windowsill box or as complex as landscaping many acres. To be successful in any situation, however, requires the correct choice of plants.

The total butterfly garden takes into account the food preferences of both adult butterflies and their caterpillars. Many butterfly species will drink nectar from a variety of flowering plants, but their caterpillars often are greatly limited in the number of plants on which they can feed. It is not necessary to plant larval food plants to attract butterflies, but adults tend to stay fairly close to the areas where their larval food plants can be found.

All of this requires planning. There are a few basic rules to follow. You can be as creative as you wish, but you must start with a plan that considers the requirements of the butterflies you wish to attract and the plants you will use to lure them.

Butterfly gardening is an exacting (not difficult) pursuit and must be based on butterfly preferences-not human ones. Luckily, butterfly and human favorites are mostly compatible.

Butterfly Facts and Biology

Of the 760 butterfly species that occur in North America, about 100 can be found in Florida. These do not include the skippers (of which Florida is home to an additional 70 species). Skippers, which are not listed in this publication, have relatively stout bodies and shorter wings than true butterflies. Moths are different from butterflies and skippers by having fluffy antenna instead of a club at the end. Other differences are that moths are active at night, and tend to hold their wings open while feeding or resting.

There are four stages in the amazing butterfly life cycle: egg, larva, chrysalis (resting), and adult. Butterfly eggs are laid on the larval food plant and caterpillars emerge within a few days. Some species overwinter in this stage. These larva have enormous appetites and do nothing but eat. When their skin is stretched as far as possible, they molt or shed that skin. After a few molts, they seek a sheltered place. Some spin a safety belt that holds them upside down on a twig or similar object, while others hang on with special hooks on their abdomen. At this time, the final molt takes place and the larva skin is replaced with a stiff butterfly chrysalis (pupa). During this stage, the once worm-like caterpillar transforms into a beautiful, flying adult.

1. This document is WEC-21, one of a series of the Wildlife Ecology and Conservation department , Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Publication: December, 1990, as SS-WIS-26. Reviewed: January, 1999. Please visit the EDIS Web site at **http://edis.ifas.ufl.edu**

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Butterflies

Most adult butterflies found in Florida feed on flower nectar. Some visit a variety of flowers and others seem to prefer a more specialized menu. Butterflies generally are attracted to brightly colored simple flowers that are not too deep and that are wide enough for good perching platforms. Universal nectar favorites include: phlox, zinnias, asters, marigolds, daisies, coneflowers, black-eyed Susan, milkweeds, thistles, and butterflybush. Flowers in the composite family (e.g. daisies and asters) and flowers in clusters (e.g. milkweed and viburnum) also are good. Double-flowered varieties of cultivated flowers are never as good as the single ones.

White varieties are inferior to other colors as far as butterflies are concerned. A wide assortment of flowers is preferable to having just a few different kinds or a variety of similar flower types. As a rule, small butterflies nectar from small flowers and large butterflies nectar from larger ones. Flowers that produce the most scent generally furnish the most nectar. Nectar also should be available for the greatest number of months possible. Therefore, it is best to choose your flowers so that at least some of them are always blooming. Remember that many flowers are not designed to be pollinated by butterflies and are seldom, if ever, visited by them.

Adults of some butterfly species rarely visit flowers but instead are attracted to aphids, manure, rotting fruit, mud, or tree sap.

Caterpillars

Larval (caterpillar) food plants must be tailored to specific butterflies. Some plants are hosts to several different butterflies (e.g., passion vine), but often each species requires its own plant. So, unless you have acres of land at your disposal, you will have to be selective in your plantings for specific butterflies. You also must remember that these plants ultimately will be chewed on if you are successful.

Birds and other predators are quick to eat these larva so few reach adulthood or get large enough to do extensive damage. In fact, very few butterfly species (unlike moths) cause significant problems to vegetable gardens. Most feed singly or in small groups, as their eggs are laid. Most butterfly gardeners are quite pleased to share their carrots and dill for the pleasure of the company of black swallowtails; they simply plant some extra for the caterpillars. If you must use insecticides, use them sparingly as they are just as deadly to butterflies as they are to other insects.

Planning Your Garden

Butterfly Basics

You can't attract butterfly species that are not present naturally in your region, nor can you grow plants that aren't adapted to the soils and climate in your region of the state. Butterfly gardening should not try to improve nature but complement it as the best horticultural practices have always done. Follow these easy steps to plan your garden.

Your Butterfly Region Map

Look at the map provided (Figure 1) and determine the region in which you live.

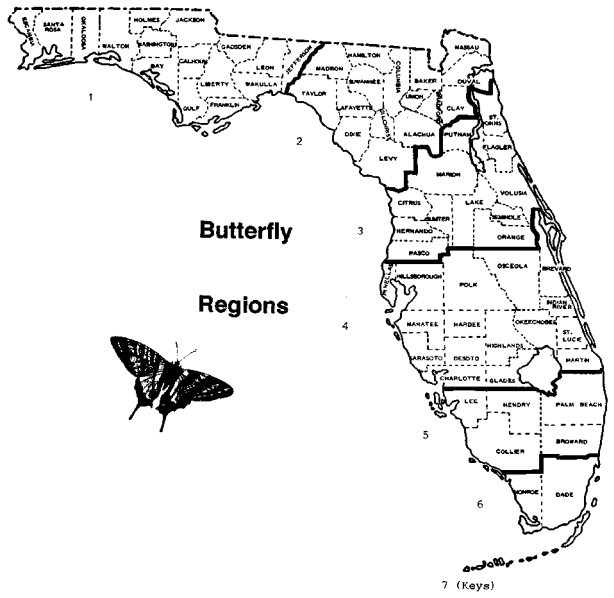

Figure 1. Florida's seven butterfly regions.

Your Butterfly Region Table(s)

Then, look for your region in the Florida butterflies tables (Tables 1-9), highlight the species that occur in your area, and use habitats that can be found within 1/4 mile of the site you are considering for your butterfly garden.

Butterfly nectar plants by region. Table 10 lists butterfly nectar plants for north and central Florida (regions 1-4). Table 11 lists butterfly nectar plants for south Florida regions 5-7).

Keys to using the tables

Determine the larval and adult foods for each species from the tables. Butterflies tend to stay fairly close to the areas where their natural larval food plants can be found.

The "flight season" indicates the months when the adults are active.

Note: If you are not interested in trying to attract the greatest variety of butterflies, you can select plants from the butterfly nectar sources listed at the end of this publication. This approach also will help you to create a beautiful garden that also is appealing to some butterfly species.

Keys to the tables

Selected References

Gerberg, E. J., and R. H. Arnett, Jr. 1989. Florida butterflies. Natural Science Publications, Inc., Baltimore. 90 pp.

Howe, W. H. 1975. The butterflies of North America. Doubleday & Company, Inc., Garden City. 633 pp.

Table 1. Swallowtails

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities.*

Species of Butterfly	Regions	Habitats	Flight Season
Pipevine Swallow	1-4	Fields, gardens, wetlands, orchards	Feb.-Nov.
Larval Foods: Herbaceous plants--Dutchman's pipe (*Aristolochia* spp.)			
Adult Foods: Other Adult Foods-Flowers, nonspecific			
Gold Rim Swallowtail	1-5	disturbed areas, gardens, fields	All year
Larval Foods: Herbaceous plants-Dutchman's pipe (*Aristolochia* spp.)			
Adult Foods: Shrubs and Vines-Lantana (*Lantana camara*)			
Zebra swallowtail	1-7	wetlands	March-Dec.
Larval Foods: Shrubs and Vines-Pawpaw (*Asimina* spp.)			
Adult Foods: Other Adult Foods-Flowers, nonspecific			
American swallowtail	1-7	open areas	All year
Larval Foods: Herbaceous plants-Parsley (*Umbelliferae*)* and Wild carrot (*Daucus carota*)			
Adult Foods: Other Adult Foods-Flowers, nonspecific			
Giant swallowtail	1-7	open areas, forest edges, citrus groves	All year
Larval Foods: Trees-Citrus trees (*Citrus* spp.)* and Common hoptree (*Ptelea trifoliata*); Shrubs and Vines-Torchwood (*Amyris elemifera*)			
Adult Foods: Other Adult Foods-Flowers, nonspecific and manure			
Schaus' swallowtail	7	tropical hammocks	May-July
Larval Foods: Trees-Bay, red (*Persea borbonia*); Shrubs and Vines-Torchwood (*Amyris elemifera*)			
Adult Foods: Unknown			
Eastern tiger swallowtail	1-6	open areas, orchards, gardens	March-Nov.
Larval Foods: Trees-Ash (*Fraxinus* spp.), Plums (*Prunus* spp.), Yellow poplar (*Liriodendron tulipifera*)			
Adult Foods: Other adult foods-Carrion, flowers-nonspecific, and mud			
Spicebush swallowtail (Figure 2)	1-7	forest edges, wetlands, fields, gardens	March-Dec.
Larval Foods: Trees-Bays (*Persea* spp.), Camphor tree (*Cinnamomum camphora*)**, Pines (*Pinus* spp.), Prickly ash (*Zanthoxylum coriaceum*), Sassafras (*Sassafras albidum*); Shrubs and Vines-Spicebush (*Lindera benzoin*)			
Adult Foods: Flowers, nonspecific and Mud			
Laurel swallowtail	1-6	swamps	March-Dec.
Larval Foods: Trees-Avocado (*Persea americana*)*, Bay, red (*Persea borbonia*), Bays (*Persea* spp.), Sweet bay (*Magnolia virginiana*)			
Adult Foods: Flowers, nonspecific and Mud			

Table 2. Sulfurs, Whites, and Orange-tip Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species of Butterfly	Regions	Habitats	Flight Season
Florida white	5-7	hardwood hammocks, wetlands	All year
Larval Foods: Shrubs and Vines--Capers (*Capparis* spp.), Guiana plum (*Drypetes lateriflora*)			
Adult Foods: Unknown			
Checkered white	1-7	disturbed areas, fields	March-Nov.
Larval Foods: Herbaceous Plants--Mustards (Cruciferae), Peppergrass (*Lepidium virginicum*), Spider flower (*Cleome spinosa*)*			
Adult Foods: Herbaceous Plants--Mustards (Cruciferae), Peppergrass (*Lepidium virginicum*)			
European cabbage butterfly	1-7	gardens, fields	March-Nov.
Larval Foods: Herbaceous Plants--Mustards (Cruciferae), Nasturtiums (Tropaeolaceae)*, and Watercress (*Nasturtium officinale*)*			
Adult Foods: Unknown			
Great southern white	2-7	beaches, salt marshes, coastal strand	All year
Larval Foods: Herbaceous Plants--Mustards (Cruciferae), Peppergrass (*Lepidium virginicum*), Saltwort (*Batis maritima*), Spider flower (*Cleome spinosa*)*			
Adult Foods: Other Adult Foods--Flowers, nonspecific			
Falcate orange tip	Liberty County	deciduous forests, oak-pine forests	March-April
Larval Foods: Herbaceous Plants--Avocado (*Persea americana*), Bittercress (*Cardamine* spp.), Mustards (Cruciferae)			
Adult Foods: Herbaceous Plants--Peppergrass (*Lepidium virginicum*)			
Orange sulfur butterfly	1-7	open areas, alfalfa fields	March-Dec.
Larval Foods: Herbaceous Plants--Beans (Fabaceae), Clover, sweet (*Melilotus* spp.), Vetch (*vicea* spp.)			
Adult Foods: Other Adult Foods--Flowers, nonspecific and Mud			
Common sulfur	1-2	open areas, pastures	March-Dec.
Larval Foods: Herbaceous Plants--Clover, white (*Trifolium* spp.)			
Adult Foods: Unknown			
Eastern dogface	1-6	sandhills, scrub, flatwoods	All year
Larval Foods: Shrubs and Vines--Dalea (*Dalea* spp.); Herbaceous Plants--Alfalfa (*Medicago sativa*)*, Clover, sweet (*Melilotus* spp.), Lead plant (*Amorpha* spp.), Soybean (*Glycine max*)*			
Adult Foods: Shrubs and Vines--Dalea (*Dalea* spp.); Herbaceous Plants--Alfalfa (*Medicago sativa*)*, Clover, sweet (*Melilotus* spp.), Lead plant (*Amorpha* spp.), Soybean (*Glycine max*)*			
Large orange sulfur	4-7	scrub	March-Dec.
Larval Foods: Shrubs and Vines--Blackbeard (*Pithecellobium keyense*), Cat claw (*Pithecellobium unguis-cati*); Herbaceous Plants-Senna (*cassia* spp.)			
Adult Foods: Shrubs and Vines-Lantana (*Lantana camara*); Herbaceous Plants-Hibiscus (*Hibiscus* spp.)			
Cloudless sulfur	1-7	open areas, gardens, beaches, wetlands	All year
Larval Foods: Herbaceous Plants--Clovers (*Trifolium* spp.), Partridge pea (*Cassia fasciculata*), Senna (*cassia* spp.)			
Adult Foods: Trees--Geiger tree (*Cordia sebestena*); Shrubs and Vines-Lantana (*Lantana* spp.); Herbaceous Plants--Hibiscus (*Hibiscus* spp.)			
Orange barred sulfur	4-7	gardens, scrub	All year
Larval Foods: Herbaceous Plants--Poinsettia (*Poinsettia pulcherrima*), Senna (*cassia* spp.)			
Adult Foods: Other Adult Foods--Flowers, nonspecific and mud			
Migrant sulfur	4-7	coastal strand, keys, beaches	Feb.-Nov.
Larval Foods: Trees--Lignum vitae (*Guaiacum sanctum*); Shrubs and Vines--False violet (*Dalbergia ecastophyllum*)			
Adult Foods: Unknown			

Table 2. Sulfurs, Whites, and Orange-tip Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species of Butterfly	Regions	Habitats	Flight Season
Guayacan sulfur	5-7	open areas	May-August
Larval Foods: Trees--Lignum vitae (*Guaiacum sanctum*)			
Adult Foods: Trees--Mangrove, black (*Avicennia germinans*); Herbaceous plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
Barred sulfur	1-7	beaches, scrub, disturbed areas	All year
Larval Foods: Herbaceous plants--Beans (Fabaceae), Pencil flower (*Stylosanthes biflora*), Shy leaves (*Aeschynome viscidula*)*			
Adult Foods: Herbaceous plants--Beans (Fabaceae)*, Pencil flower (*Stylosanthes biflora*), Shy leaves (*Aeschynome viscidula*)*			
Little sulfur	1-7	disturbed areas, open areas, fields	All year
Larval Foods: Trees--Legumes (Fabaceae); Herbaceous plants--Clovers (*Trifolium* spp.), Senna (*Cassia* spp.)			
Adult Foods: Other Adult Foods--Flowers, nonspecific			
Bush sulfur	5-7	flatwoods, fields	All year
Larval Foods: Shrubs and Vines--Mexican alvaradoa (*Alvaradoa amorphoides*)			
Adult Foods: Herbaceous Plants--Composites (Compositae)			
Blacktip sulfur	6-7	forest edges	May-Dec.
Larval Foods: Herbaceous Plants--Sensitive plant (*Mimosa pudica*)			
Adult Foods: Herbaceous Plants--Composites (Compositae)			
Rambling orange	1-7	fields, forest edges, scrub, sandhills	All year
Larval Foods: Herbaceous Plants--Clovers (*Trifolium* spp.), Partridge pea (*Cassia fasciculata*), Senna (*Cassia* spp.)			
Adult Foods: Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*; Other Adult Foods--Flowers, nonspecific			
Dainty sulfur	2-7	disturbed areas, pastures	All year
Larval Foods: Herbaceous Plants--Asters, smooth-leaved (Asteraceae), Common chickweed (*Stellaria media*), Marigold, bur (*Bidens pilosa*), Marigold, garden varieties (*Tagetes* spp.)*, Sneezeweed (*Helenium autumnale*)			
Adult Foods: Herbaceous Plants--Asters, smooth-leaved (Asteraceae), Common chickweed (*Stellaria media*), Marigold, bur or Spanish needle (*Bidens pilosa*)*, Marigold, garden varieties (*Tagetes* spp.)*, Sneezeweed (*Helenium autumnale*)			

Table 3. Hairstreaks, Coppers, and Blue Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species of Butterfly	Regions	Habitats	Flight Season
The harvester	Local distribution in panhandle, Jacksonville, Tampa and Orlando areas	Wetlands, swamps	Feb.-Dec.
Larval Foods: Animals--Aphids on alders, witch hazel, wild currants, hawthorn, beech, ash and other plants			
Adult Foods: Other Adult Foods--Aphid honeydew and Manure			
Coontie hairstreak	5-7	Forest edges, Hammocks	All year
Larval Foods: Shrubs and Vines--Coontie (*Zamia floridana*)			
Adult Foods: Shrubs and Vines--Saw palmetto (*Serenoa repens*), scrub palmetto (*Sabal etonia)*			
Great blue hairstreak	1-3	Hammocks	All year
Larval Foods: Herbaceous Plants--Mistletoe (*Phoradendron serotinum*)			

Table 3. Hairstreaks, Coppers, and Blue Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species of Butterfly	Regions	Habitats	Flight Season
Adult Foods: Trees--Plums (*Prunus* spp.), Hercules-club (*Zanthoxylum clava-herculis*); Shrubs and Vines--Frog fruit (*Lippia nodiflora*); Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
Verde azul hairstreak	7	Hammocks	All year
Larval Foods: Trees--Lead tree (*Albizia lebbeck*)*			
Adult Foods: Trees--Brazilian peppertree (*Schinus terebinthifolius*)**; Shrubs and Vines--Sweet pepper bush (*Clethra alnifolia*); Herbaceous plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
Silver banded hairstreak			
Larval Foods: Shrubs and Vines--Heart seed (*Cardiospermum halicacabum)*			
Adult Foods: Other Adult Foods--Flowers, nonspecific			
Coral hairstreak	Tallahassee	Deciduous forest edges	May-July
Larval Foods: Trees--Cherries (*Prunus* spp.)			
Adult Foods: Herbaceous plants--Butterfly weed (*Asclepias tuberosa*)			
Banded hairstreak	1-3	Deciduous forests	April-June
Larval Foods: Trees--Hickories (*Carya* spp.), Oaks (*Quercus* spp.), Walnuts (*Juglans* sp.)			
Adult Foods: Herbaceous plants--Indian hemp (*Apocynum cannabinum*), Milkweeds (*Asclepias* spp.); Other Adult Foods--Flowers, nonspecific			
Sweetleaf hairstreak	1	Coastal strand, hammocks, swamps	May-June
Larval Foods: Trees--Sweetleaf (*Symplocos tinctoria*); Shrubs--Azaleas (*Rhododendron* spp.)			
Adult Foods: Trees--Oaks (*Quercus* spp.)			
Striped hairstreak	1-3	Deciduous forests, fields, disturbed areas	May-June
Larval Foods: Trees--Hawthorns (*Crataegus* spp.); Shrubs and Vines--Blueberry (*Vaccinium* spp.)			
Adult Foods: Herbaceous plants--Clover, white sweet (*Melilotus* spp.), Indian hemp (*Apocynum cannabinum*), Milkweeds (*Asclepias* spp.)			
Tiny hairstreak	6-7	fields	April-Dec.
Larval Foods: Trees--Lead tree (*Albizia lebbeck*)*, wild tamarind (*Lysiloma latisiliqua*)			
Adult Foods: Shrubs and Vines--Scrub palmetto (*Sabal etonia*); Herbaceous plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
Red banded hairstreak	1-7	open areas, forest edges	All year
Larval Foods: Trees--Oaks (*Quercus* spp.); Shrubs and Vines--Croton (*Croton* spp.), Sumac, winged (*Rhus copallina*), Wax myrtle (*Myrica cerifera*)			
Adult Foods: Trees--Cherry (*Prunus* spp.); Shrubs and Vines--Sweet pepperbush (*Clethra alnifolia*); Herbaceous Plants--Indian hemp (*Apocynum cannabinum*), Milkweeds (*Asclepias* spp.)			
Cedar hairstreak	1-3	fields, coastal hammocks, dunes	Feb.-Sept.
Larval Foods: Trees--Cedar, southern red (*Juniperus silicicola*), Cedar, eastern red (*Juniperus, virginiana*)*			
Adult Foods: Trees--Plum, wild (*Prunus americana*); Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
White cedar hairstreak	Liberty and Santa Rosa counties	bogs and swamps	April-July
Larval Foods: Trees--Cedar, Atlantic white (*Chamaecyparis thyoides*)			
Adult Foods: Other Adult Foods--Flowers, nonspecific and Mud			
Woodland elfin	1-3	coastal strand, sandhills, oak-pine forests	Feb.-April
Larval Foods: Trees--Dahoon (*Ilex cassine*), Redbud (*Cercis canadensis*); Shrubs and Vines--Blueberry (*Vaccinium* spp.), Persimmon (*Diospyros virginiana*)			
Adult Foods: Other Adult Foods--Flowers, nonspecific and Mud			
Eastern pine elfin	2	sandhills, oak-pine forests	March-April

Table 3. Hairstreaks, Coppers, and Blue Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species of Butterfly	Regions	Habitats	Flight Season
Larval Foods: Trees--Pines (*Pinus* spp.) **Adult Foods**: Other Adult Foods--Flowers, nonspecific and Mud			
Southern oak hairstreak	1-7	hammocks	March-May
Larval Foods: Trees--Oaks (*Quercus* spp.) **Adult Foods**: Trees--Oak, chinquapin (*Quercus muhlenbergii*); Shrubs and Vines--Viburnum (*Viburnum* spp.); Herbaceous Plants--Clover, sweet (*Melilotus* spp.)			
White M hairstreak	1-7	hammocks, sandhills, scrub	March-Dec.
Larval Foods: Trees--Oaks (*Quercus* spp.) **Adult Foods**: Shrubs and Vines--Lantana (*Lantana camara*), Sweet pepperbush (*Clethra alnifolia*), Viburnum (*Viburnum* spp.); Herbaceous Plants--Milkweeds (*Asclepias* spp.)			
Gray hairstreak	1-7	sandhills, disturbed areas, flatwoods	April-Oct.
Larval Foods: Trees--Hawthorns (*Crataegus* spp.); Herbaceous Plants -Beans (Fabaceae), Mallows (Malvaceae), Mints (Lamiaceae) **Adult Foods**: Other Adult Foods--Flowers, nonspecific			
Blue and gray hairstreak	5-7	open fields along the coast	All year
Larval Foods: Trees--Trema, florida (Trema micrantha); Shrubs and Vines--Bay cedar (*Suriana maritima*) **Adult Foods**: Trees--Brazilian peppertree (*Schinus terbinthifolius*)**; Shrubs and Vines--Bay cedar (*Suriana maritima*), Lantana (*Lantana camara*); Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
Bartram's hairstreak	5-7	hammocks	All year
Larval Foods: Shrubs and Vines--Croton, narrow leafed (*Croton linearis*) **Adult Foods**: Shrubs and Vines--Croton, narrow leafed (*Croton linearis*); Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
Dotted hairstreak	5-7	fields	All year
Larval Foods: Shrubs and Vines--Avocado (*Persea americana*); Herbaceous Plants--Mallows (Malvaceae), Mints (Lamiaceae) **Adult Foods**: Other Adult Foods--Flowers, nonspecific			
Fulvous hairstreak	6-7	coastal strand, hammocks, wetlands	All year
Larval Foods: Trees--Brazilian peppertree (*Schinus terbinthifolius*)**; other unknown **Adult Foods**: Trees--Brazilian peppertree (*Schinus terbinthifolius*)**; Shrubs and Vines--Sea grape (*Coccoloba uvifera*); Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
Eastern pigmy blue	East 2-3; West 1-7	salt marshes and tidal flats	All year
Larval Foods: Herbaceous Plants--Glasswort, annual (*Salcornia bigelovii*) **Adult Foods**: Shrubs and Vines--Saw palmetto (*Serenoa repens*); Herbaceous Plants--Saltwort (*Batis maritima*)			
Tropical striped blue	3-7	gardens, forest edges	All year
Larval Foods: Herbaceous Plants--Leadwort, ornamental (*Plumbago capensis*) **Adult Foods**: Herbaceous Plants--Beans (Fabaceae)*, Clover, sweet (*Melilotus* spp.)			
Miami blue	6-7	fields	All year
Larval Foods: Shrubs and Vines--Ballon vine (*Cardiospermum* spp.)* **Adult Foods**: Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			

Table 3. Hairstreaks, Coppers, and Blue Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species of Butterfly	Regions	Habitats	Flight Season
Southern blue	1	sandhills, beach	All year
Larval Foods: Trees--Legumes (Fabaceae); Herbaceous Plants--Beans (Fabaceae); Partridge pea (*Cassia fasciculata*)			
Adult Foods: Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)* ; Other Adult Foods--Flowers, nonspecific			
Eastern tailed blue	1-2	fields	Feb.-Nov.
Larval Foods: Trees--Legumes (Fabaceae); Herbaceous Plants--Beans (Fabaceae); Clovers (*Trifolium* spp.)			
Adult Foods: Other Adult Foods--Flowers, nonspecific, Mud			
Spring azure	1-2	hammocks, swamps	January-Oct.
Larval Foods: Trees--Legumes (Fabaceae), Plums (*Prunus* spp.); Shrubs and Vines--Blueberry (*Vaccinium* spp.), Sumac, winged (*Rhus copallina*), Viburnum (*Viburnum* spp.)			
Adult Foods: Herbaceous Plants--Milkweeds (*Asclepias* spp.); Other Adult Foods--Flowers, nonspecific			

Table 4. Metalmark Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, not recommended for planting because of its tendency to spread and adversely affect natural communities*

Species	Regions	Habitats	Flight Season
Little metalmark	1-7	sandhills, salt marsh, southern flatwoods	All year
Larval Foods: Herbaceous Plants--Thistle, yellow (*Cirsium horridulum*)			
Adult Foods: Herbaceous Plants--Composites (Compositae)			

Table 5. Snout Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species	Regions	Habitats	Flight Season
Snout butterfly	1-7	wetlands, deciduous forests	January-August
Larval Foods: Trees--Hackberry (*Celtis* spp.)			
Adult Foods: Herbaceous Plants--Asters (Asterceae); Other Adult Foods--Flowers, nonspecific			

Table 6. Brushfooted Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species	Region	Habitats	Flight Season
Gulf fritillary (Figure 3)	1-7	gardens, fields	All year
Larval Foods: Shrubs and Vines--Passion flower (*Passiflora incarnata*)			
Adult Foods: Shrubs and Vines--Lantana (*Lantana camara*); Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
Orange long wing	5-7	hammocks, fields, gardens	All year
Larval Foods: Shrubs and Vines--Maypops (*Passiflora* spp.), Passion flower (*Passiflora incarnata*)			
Adult Foods: Shrubs and Vines--Lantana (*Lantana camara*); Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
Zebra long wing	1-7	hammocks, fields, gardens	All year
Larval Foods: Shrubs and Vines--Maypops (*Passiflora* spp.), Passion flower (*Passiflora incarnata*)			
Adult Foods: Shrubs and Vines--Lantana (*Lantana camara*); Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
Variegated fritillary	1-7	open areas	March-Dec.
Larval Foods: Shrubs and Vines--Passion flower (*Passiflora incarnata*); Herbaceous Plants--Beggar's tick (*Desmodium* spp.), Plantain (*Plantago lanceolata*), Spurges (Euphorbiaceae), Stonecrop (*Sedum* spp.)			
Adult Foods: Other Adult Foods--Flowers, nonspecific			
Streamside checkerspot	Marianna	deciduous forests	March-Sept.
Larval Foods: Herbaceous Plants--Composites (Asteraceae)			
Adult Foods: Herbaceous Plants--Clover, red (*Trifolium pratense*)*, Composites (Asteraceae), Milkweeds (*Asclepias* spp.)			
Seminole crescent	1-3	wetlands	March-Nov.
Larval Foods: Herbaceous Plants--Alder, hazel (*Alnus serrulata*), Water willow (*Justicia* spp.)			
Adult Foods: Unknown			
Black crescent	5-7	fields	All year
Larval Foods: Herbaceous Plants--Shrimp plant (*Justicia brandegeana*)*			
Adult Foods: Unknown			
Mat plant crescent	1-7	swamps, bogs, marshes	March-Dec.
Larval Foods: Herbaceous Plants--Frog fruit (*Lippia nodiflora*)			
Adult Foods: Herbaceous Plants--Composites (Compositae), Frog fruit (*Lippia nodiflora*)			
Pearl crescent	1-6	swamps, fields, wetlands	All year
Larval Foods: Herbaceous Plants--Asters, smooth leaved (Asteraceae)			
Adult Foods: Herbaceous Plants--Composites (Compositae), Milkweeds (*Asclepias* spp.)			
Question mark	1-4	deciduous forests, wetlands, orchards	All year
Larval Foods: Trees--Elms (*Ulmus* spp.), Hackberry (*Celtis* spp.), Mulberries (*Morus* spp.); Herbaceous Plants--Parsley (Umbelliferae)*			
Adult Foods: Other Adult Foods--Carrion, Manure, Mud, Rotting fruit, Sap			
Comma angelwing	1-2	deciduous forests, wetlands, fields	May -Sept.
Larval Foods: Trees--Elms (*Ulmus* spp.); Herbaceous Plants--Nettles (Urticaceae)			
Adult Foods: Other Adult Foods--Carrion, Mud, Rotting fruit, Sap			
Mourning cloak	Jacksonville, Tampa	deciduous forests, wetlands, gardens	Feb.-March
Larval Foods: Trees--Beech (*Fagus* spp.), Elms (*Ulmus* spp.), Hackberry (*Celtis* spp.), Hollies (*Ilex* spp.); Shrubs and Vines -Alder, hazel (*Alnus serrulata*)			
Adult Foods: Other Adult Foods--Decaying plants, Flowers, non specific, Mud, Sap			
American painted lady (Figure 4)	1-7	open areas, gardens, wetlands, fields	All year

Table 6. Brushfooted Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species	Region	Habitats	Flight Season
Larval Foods: Herbaceous Plants--Asters, smooth leaved (Asteraceae), Mallows (Malvaceae), Thistle, yellow (*Cirsium horridulum*)			
Adult Foods: Other Adult Foods--Flowers, non specific, Mud			
Red admiral	1-7	deciduous forests,fields, gardens,riparian	All year
Larval Foods: Trees--Mulberries (*Morus* spp.); Herbaceous Plants--False nettle (*Boehmeria cylindrica*), Nettles (Urticaceae)			
Adult Foods: Other Adult Foods--Bird droppings, Rotting fruit, Sap			
The buckeye	1-7	wetlands, fields, open areas	All year
Larval Foods: Herbaceous Plants--Acanthus (Acanthaceae), Plantain (*Plantago lanceolata*), Stonecrop (*Sedum* spp.), Vervains (Verbenaceae)			
Adult Foods: Herbaceous Plants--Composites (Compositae)			
Black mangrove	5-7	mangrove swamps, tidal flats, fields	All year
Larval Foods: Trees--Mangrove, black (*Avicennia germinans*); Shrubs and Vines--Blue porterweed (*Stachytarpheta* spp.); Herbaceous plants--Vervains (Verbenaceae)			
Adult Foods: Other Adult Foods--Flowers, nonspecific			
White peacock	2-7	swamps, wetlands	All year
Larval Foods: Herbaceous Plants--Figworts (Scrophulariaceae)			
Adult Foods: Herbaceous Plants--Marigold, bur or Spanish needle (*Bidens pilosa*)*			
Malachite	5-7	Citrus groves, scrub	All year
Larval Foods: Herbaceous Plants--Cajetin (*Blechum brownei*), Ruellia (*Ruellia* spp.)			
Adult Foods: Other Adult Foods--Flowers, nonspecific, Manure, Rotting fruit			
Red spotted purple	1-3	sandhills, flatwoods, forest edges, hammocks	March-Oct.
Larval Foods: Trees--Apples (*Malus* spp.), Cherries (*Prunus* spp.), Leadwort, ornamental (*Plumbago capensis*), Willows (*Salix* spp.)			
Adult Foods: Herbaceous Plants--Composites (Compositae); Other Adult Foods--Carrion, Manure, Rotting fruit, sap			
Viceroy	1-6	wetlands, marshes	April-Sept.
Larval Foods: Trees--Apples (*Malus* spp.), Cherries (*Prunus* spp.), Willows (*Salix* spp.)			
Adult Foods: Other Adult Foods--Carrion, Manure			
Large purplewing	5-7	coastal hammocks	July-May
Larval Foods: Trees--Crabwood (*Gymnanthes lucida*)			
Adult Foods: Other Adult Foods--Manure, Mud, Rotting fruit, sap			
Dingy purplewing	5-7	hammocks	May-Dec.
Larval Foods: Trees--Gumbo limbo (*Bursera simaruba*)			
Adult Foods: Other Adult Foods--Manure, Mud, Rotting fruit, sap			
Red dagger wing	3-7	hammocks, swamps	All year
Larval Foods: Trees--Fig (*Ficus* spp.), Short-leaf fig (*Ficus citrifolia*); Shrubs and Vines--Cashews (*Anacordium occidentale*)*			
Adult Foods: Herbaceous Plants--Milkweeds (*Asclepias* spp.); Other Adult Foods--Mud, Rotting fruit			

Table 7. Goatweed Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species	Regions	Habitats	Flight Season
Goatweed butterfly	1-3	swamps, forest edges, fields	April-August
Larval Foods: Shrubs and Vines--Croton (*Croton* spp.), Croton, narrow leafed (*Croton linearis*)			
Adult Foods: Other Adult Foods--Bird droppings, Manure, Rotting fruit, Sap			
Florida leafwing	6-7	forest edges, scrub	All year
Larval Foods: Shrubs and Vines--Croton, narrow leafed (*Croton linearis*)			
Adult Foods: Other Adult Foods--Manure, Rotting fruit			
Hackberry butterfly	1-7	deciduous forests, riparian	March-Nov.
Larval Foods: Trees -Elms (*Ulmus* spp.), Hackberry (*Celtis* spp.)			
Adult Foods: Other Adult Foods--Carrion, Manure, Persimmons, Sap			
Tawny emperor	1-4	deciduous forests, riparian	March-Nov.
Larval Foods: Trees--Hackberry (*Celtis* spp.)			
Adult Foods: Trees--Hackberry (*Celtis* spp.); Other Adult Foods--Carrion, Manure, Rotting fruit, Sap			

Table 8. Nymphs and Satyrs

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species	Regions	Habitats	Flight Season
Southern pearly eye	1-3	hammocks, wetlands	April-Nov.
Larval Foods: Grasses--Switch cane (*Arundinaria gigantea*), Grasses (Poaceae), Maidencane (*Panicum hemitomom*)			
Adult Foods: Other Adult Foods--Carrion, Manure, Rotting fruit, Sap			
Woods eyed brown	1	swamps, bogs, wetlands	June-Oct.
Larval Foods: Grasses--Inundated beak-rush (*Rhynchospora inundata*)*			
Adult Foods: Other Adult Foods--Mud, Sap			
Jeweled satyr	1-3	tall grass fields, wetlands	Feb.-Nov.
Larval Foods: Grasses--Bermuda grass (*Cynodon dactylon*)*			
Adult Foods: Unknown			
Southern satyr	1-6	fields, hammocks, wetlands	All year
Larval Foods: Grasses--Grasses (Poaceae)			
Adult Foods: Other Adult Foods--Rotting fruit, Sap			
Orange oval satyr	1-7	fields, sandhills, flatwoods	All year
Larval Foods: Grasses--Grasses (Poaceae)			
Adult Foods: Unknown			
Little wood satyr	1-2	fields, hammocks, wetlands	March-June
Larval Foods: Grasses--Grasses (Poaceae), Sedges (Cyperaceae)			
Adult Foods: Other Adult Foods--Aphid honeydew, Sap			
Viola's wood satyr	1-3	grassy wooded areas	April
Larval Foods: Grasses--Grasses (Poaceae)			
Adult Foods: Unknown			
Common wood nymph	1-3	sandhills, fields, marshes, wetlands	June-July
Larval Foods: Grasses--Grasses (Poaceae)			
Adult Foods: Other Adult Foods--Rotting fruit			

Table 9. Milkweed Butterflies

*Key for Larval and Adult Foods: * = non-native species; ** = non-native species, **not** recommended for planting because of its tendency to spread and adversely affect natural communities*

Species	Regions	Habitats	Flight Season
Monarch	1-7	fields, gardens	All year
Larval Foods: Herbaceous Plants--Indian hemp (*Apocynum cannabinum*), Milkweed, scarlet (*Asclepias curassavica*)*			
Adult Foods: Herbaceous Plants--Composites (Compositae), Milkweeds (*Asclepias* spp.)			
Queen	1-7	fields, sandhills, flatwoods	All year
Larval Foods: Shrubs and Vines--Oleander (*Nerium oleander*), White vine (*Sarcostemma clausum*)*; Herbaceous Plants--Milkweeds (*Asclepias* spp.)			
Adult Foods: Herbaceous Plants--Frog fruit (*Lippia nodiflora*); Milkweeds (*Asclepias* spp.)			
Soldier	5-7	sandhills, flatwoods, fields, gardens	Feb.-Oct.
Larval Foods: Shrubs and Vines--White vine (*Sarcostemma clausum*)*; Herbaceous Plants--Milkweeds (*Asclepias* spp.), West Indian pinkroot (*Spigelia anthelmia*)			
Adult Foods: Other Adult Foods--Flowers, nonspecific			

Table 10. Butterfly Nectar Plants. North and Central Florida: Regions 1-4.

***** *indicates non-native species*

Common Name	Scientific Name	Flowering Season
	SHRUBS	
False indigo bush*	*Amorpha fruticosa*	Summer-Fall
Tarflower	*Befaria racemosa*	Summer
Butterfly bush*	*Buddleia officianalis*	Spring-Fall
New Jersey tea	*Ceanothus americanus*	Spring
False heather	*Cuphea hyssopifolia*	Spring-Winter
Garberia	*Garberia fruticosa*	Fall
Hibiscus	*Hibiscus* spp.	Spring-Winter
Lantana	*Lantana* spp.	Spring-Winter
Plumbago*	*Plumbago capensis*	Spring-Fall
Azalea	*Rhododendron* spp.	Spring
Viburnum	*Viburnum* spp.	Spring
	PERENNIALS	
Butterfly milkweed	*Asclepias tuberosa*	Summer-Fall
Aster	*Aster* spp.	Summer-Fall
Paint brush	*Carphephorus corymbosus*	Fall
Vanilla plant	*Carphephorus odoratissimus*	Fall
Golden aster	*Chrysopsis* spp.	Fall
Dalea	*Dalea* spp.	Fall
Purple coneflower	*Echinacea purpurea*	Summer
Mistflower	*Eupatorium coelestinum*	Summer-Fall
Sunflower	*Helianthus* spp.	Summer-Fall
Blazing star	*Liatris* spp.	Summer-Fall
Cardinal flower	*Lobelia cardinalis*	Summer-Fall
Purple lobelia	*Lobelia puberula*	Summer-Fall
Mint*	*Mentha, Nepeta,* others	Spring-Fall
Pentas*	*Pentas lanceolata*	Spring-Fall
Phlox	*Phlox* spp.	Spring-Summer
Pennyroyal	*Piloblephis rigida*	Spring
Yellow coneflower	*Ratibida pinnata*	Summer

Table 10. Butterfly Nectar Plants. North and Central Florida: Regions 1-4.
***** *indicates non-native species*

Common Name	Scientific Name	Flowering Season
Wild petunia	*Ruellia caroliniensis*	Spring-Fall
Salvia (Sage)	*Salvia* spp.	Summer-Fall
Sedum	*Sedum spectabile*	Fall-Winter
Rosinweed	*Silphium asteriscus*	Summer-Fall
Goldenrod	*Solidago* spp.	Summer-Fall
Stoke's aster	*Stokesia laevis*	Summer
Thyme*	*Thymus* spp.	Spring-Fall
Verbena	*Verbena* spp.	Spring-Fall
Ironweed	*Vernonia* spp.	Summer
ANNUALS		
Ageratum*	*Ageratum* spp.	Spring-Summer
Spanish needle	*Bidens pilosa*	Spring-Fall
Borage*	*Borage officinalis*	Summer-Fall
Shasta daisy*	*Chrysanthemum* spp.	Spring-Summer
Sweet William*	*Dianthus* spp.	Spring-Summer
Gaillardia	*Gaillardia pulchella*	Spring-Summer
Strawflower*	*Helichrysum* spp.	Spring-Summer
Phlox	*Phlox drummondii*	Summer
Black-eyed Susan	*Rudbeckia hirta*	Summer-Fall
Marigold (Marietta)*	*Tagetes* spp.	Summer-Fall
Clover	*Trifolium* spp.	Summer-Fall
Zinnia*	*Zinnia* spp.	Summer-Fall

Table 11. Butterfly Nectar Plants. South Florida: Regions 5-7.
***** *indicates non-native species*

Common Name	Scientific Name	Flowering Season
TREES		
Bottlebrush*	*Callistemon* spp.	Summer-Fall
Citrus*	*Citrus* spp.	Spring
SHRUBS		
Buttonbush	*Cephalanthus occidentalis*	Summer
Geiger tree	*Cordia* spp.	Summer-Winter
Firebush	*Hamelia patens*	Summer-Winter
Lantana	*Lantana* spp.	Spring-Winter
PERENNIALS		
Scarlet milkweed*	*Asclepias curassavica*	Summer-Fall
Florida or Blue sage	*Eranthemum nervosum*	Summer-Fall
Mistflower	*Eupatorium coelestinum*	Summer-Fall
Blazing star	*Liatris* spp.	Summer-Fall
Pentas*	*Pentas lanceolata*	Summer-Fall
Pennyroyal	*Piloblephis rigida*	Spring
ANNUALS		
Beggar-ticks	*Bidens alba*	Summer-Fall
Red root	*Lachnanthes caroliniana*	Summer
Frog fruit	*Lippia nodiflora*	Spring-Fall

UNIVERSITY OF FLORIDA
EXTENSION
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WEC21

Hummingbirds of Florida[1]

Joe Schaefer and Craig N. Huegel[2]

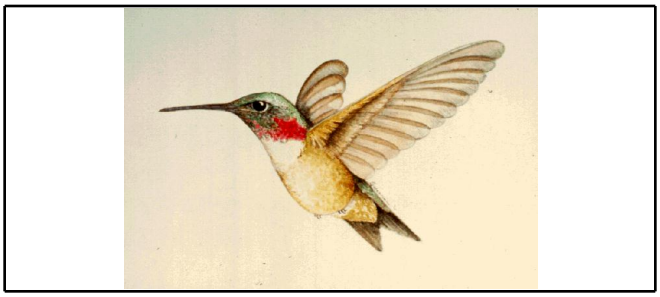
Centuries ago their plumage was used to adorn Indian ceremonial costumes. Even today, some people believe that the hummingbird's glittering plumage contains mythical powers. However, most of us merely enjoy watching these sparkling gems of the bird world.

DESCRIPTION

Hummingbirds live only in the Americas. Of the 338 species known, 16 are found in the United States and 3 occur in Florida. Black-chinned and rufous hummingbirds occasionally can be seen in Florida during the winter. The ruby-throated hummingbird is by far the most common hummer in the state. This feathered jewel is about 3 inches (7.5 centimeters) long and weighs as little as a penny (1/4 ounce). Its name describes the most brilliant part of the mature male's plumage. The throat feathers contain air bubbles that give off an iridescent red tone in full light. Both sexes, young and mature birds, have metallic green backs and white-tipped tail feathers.

RANGE

The ruby-throat's breeding range extends from central Kansas to the east coast and from Saskatchewan to central Florida. Although, some



ruby-throated hummingbird.

birds may stay in south Florida year-round, most winter in Mexico and South America. Males arrive in Florida in March. Females follow them about a week later.

NESTING

Nesting in Florida begins in April. The nest is a walnut-size structure of plant down, adorned with lichens, moss, and bound with spider webs or fine plant fibers. Nests frequently are built over water. The female lays 2 eggs less than 1/2 inch (1.2 centimeters) long. After 20 days of incubation and 4 weeks of growing, young hummingbirds leave the nest.

1. This document is Fact Sheet SS-WIS-21, one of a series of the Department of Wildlife Ecology & Conservation, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Originally published in cooperation with the Florida Fish and Wildlife Conservation Commission's Nongame Wildlife Program. Published December, 1990 as "Florida's Hummingbirds". Reviewed: February, 2001. Minor Revisions: July, 2001. Please visit the Edis Web site at http://edis.ifas.ufl.edu

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FLYING FEATS

One of the most fascinating things about hummingbirds is their helicopter-like flying stunts. Not only can hummers suspend their bodies in midair as shown in Figure 1 , they also can fly backward, upward, even upside down. These maneuvers are possible because of an unique design that allows the wing to move very freely and in almost any direction at the shoulder. Soaring is the only maneuver they can not perform. Contrary to popular belief, hummingbirds do not hum. The sound is made by their rapid wing movements (50-200 beats per second).

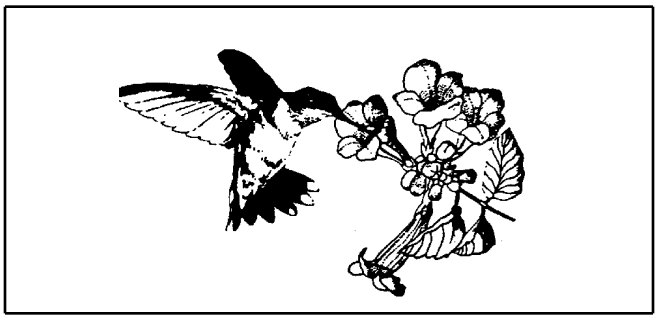


Figure 1.

FEEDING

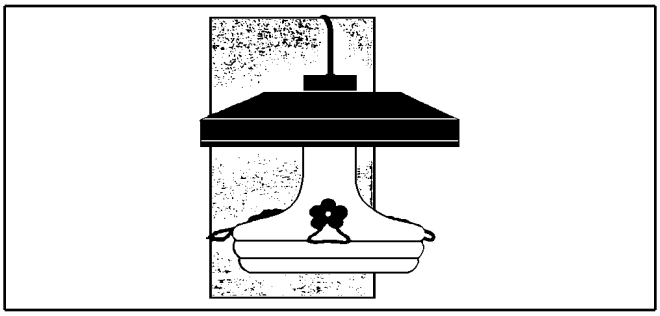
To acquire enough strength to support all of this high speed activity, hummingbirds need to consume large amounts of high energy food. Adult hummingbirds feed primarily on nectar. Young are fed insects by their parents, but are switched to a mostly nectar diet by the time they leave the nest. Nectar is an energy-rich food that is used rapidly. One hummingbird may need nectar from hundreds of blossoms every day to maintain its body weight.

Hummingbirds are well adapted to a liquid diet. Long needlelike bills and specially adapted tongues allow them to reach nectar in deep tubular flowers (Figure 1). The last half-inch of the long tongue is divided into equal halves, each grooved on the outside edge to form two tube-like structures. Nectar is drawn into the tongue much the same way liquid travels up a straw. Hummingbirds can lick at a rate of 13 times per second, and their stomach is capable of holding about 0.18 ounces (5 grams) of nectar at one time. They also feed to a lesser extent on insects.

For their size, hummingbirds have among the largest appetites in the bird world. They feed every 10 or 15 minutes from dawn until dusk. During this period, they eat more than half their weight in food and 8 times their weight in water. Hummingbirds have developed 2 adaptations to help them survive the hours of darkness when they cannot feed. First, they eat as much as they can just before dark. During the night, their heart rate and body temperature drop to conserve energy. If they did not go into this sort of daily hibernation stage, they likely would starve.

ARTIFICIAL FEEDERS

Artificial feeders will attract hummingbirds. Because feeders can be placed almost anywhere, they increase your opportunities to view hummers from inside your house. However, feeders should not be the sole source of food provided. The sugar solution may appeal to the hummingbirds' sweet tooth, but it provides little nourishment. Nectar is much more than just water and sugar.



Artificial feeders.

Packages of instant nectar may be found at many lawn and garden stores. You also can prepare your own solution with 1 part white, granulated, cane sugar to 4 parts water. Boil the sugar solution to help dissolve the sugar. Then allow it to cool before filling a feeder. This concentration is about the same as that in wildflower nectar. Using a sweeter solution, sugar substitutes or honey could be lethal to hummers. It also is not necessary to add red food coloring. The birds will be attracted to the red feeders.

Several different feeder styles are available. The ones with perches are not necessary, but they do provide an unusual view of this bird without its wings beating rapidly. The upside-down jar-and-tube feeders have a tendency to leak.

Most feeders come with bee guards (Figure 2). Although hummingbirds will feed right next to bees, clusters of these insects will keep them away. If ants are attracted, moisten the hanging wire with cooking oil.

Hummingbirds are very possessive of feeders and usually will not tolerate another bird feeding from the same feeder at the same time. The less dominant ones just wait their turn. Juveniles are a bit more sociable than adults. If you are using more than 1 feeder, arrange them at least 10 feet apart so that all can feed peacefully at once.

Place the feeder where rain will not dilute nectar in the end of the tube. Also avoid direct sunlight as heat stimulates bacterial growth.

Sugar solutions must be kept fresh. Florida's hot weather can cause rapid bacterial growth in these feeders and birds that drink contaminated water could die. To avoid this, change the solution every 3-5 days. Clean the feeders with hot water and white vinegar. Do not use soap or chlorine bleach (Clorox™).

GARDENING FOR HUMMINGBIRDS

To be successful in keeping hummingbirds around your house, you must garden for them. The ideal flower color is red, orange, or pink. Hummingbirds are not born with an attraction to certain colors but learn by trial and error which flowers give the best results. Because most nectar-bearing flowers within the range of the ruby-throat are red and orange, they quickly come to favor those colors. Hummingbirds also have been known to show an interest in red-colored lipstick, fingernails, and clothing.

Tubular flowers that are either large and solitary or in loose drooping clusters are best. Generally, tubular flowers hold large amounts of nectar at their base.

Blooming season is another important gardening consideration. Nesting hummingbirds will need nectar from March to September. Therefore, your garden should have numerous nectar plants available throughout this time. It is best to plant a variety of species and to arrange these flowers in several groupings. Nesting hummingbirds are very aggressive and territorial around their food source. Having more than one flower garden will allow several hummers to feed at the same time without conflict.

HUMMINGBIRD PLANTS

Certain plants are among the favorites used by hummingbirds in north and central Florida:

Table 1. Hummingbird Plants - Trees

Table 2. Hummingbird Plants - Shrubs

Table 3. Hummingbird Plants - Vines

Table 4. Hummingbird Plants - Perennnials

Table 5. Hummingbird Plants - Annuals

While red flowers dominate the list, others have been added to allow for a varied planting. Plants native to Florida often are preferable when given the proper growing conditions for the species.

Table 1.

Table 1. Hummingbird Plants - Trees.

Common Name	Adaptability to area	Scientific Name	Blooming Season
Red Buckeye	Native species; not recommended for S. Florida	*Aesculus pavia*	Spring
Mimosa	---	*Albizia julibrissin*	Spring
Bottlebrush	---	*Callistemon* spp.	Spring-Fall

Table 2.

Table 2. Hummingbird Plants - Shrubs.

Common Name	Adaptability to area	Scientific Name	Blooming Season
Butterfly Bush	Used as annual and perennial in Florida	*Buddleia alternifolia*	Summer
Coral Bean	Native Species	*Erythrina herbacea*	Spring
Firebush	Native Species; will return from roots in cold areas	*Hamelia patens*	Spring-Winter
Red Star Hibiscus	Native Species	*Hibiscus coccineus*	Summer-Fall
Lantana	Native Species	*Lantana camara*	Spring-Winter
Firespike	Frost sensitive but will return in the spring	*Odontonema stricta*	Summer-Fall
Cardinal's Guard	Not recommended for N. Florida	*Pachystachys coccinea*	Summer-Fall
Wild Azalea	Native species	*Rhododendron* spp.	Spring-Summer

Table 3.

Table 3. Hummingbird Plants - Vines.

Common Name	Adaptability to Region	Scientific Name	Blooming Season

Table 3.

Table 3. Hummingbird Plants - Vines.			
Cross Vine	Native species	*Bignonia capreolata*	Spring
Trumpet Vine	Native Species	*Campsis radicans*	Spring-Summer
Coral Honeysuckle	Native species	*Lonicera sempervirens*	Spring-Summer

Table 4.

Table 4. Hummingbird Plants - Perennials.			
Common Name	Adaptability to Region	Scientific Name	Blooming Season
Butterfly Milkweed	Native Species	*Asclepius tuberosa*	Spring-Fall
Red Basil	Native Species	*Calamintha coccinea*	Spring
Shrimp Plant	Used as an annual in Florida	*Justicia brandegeana*	Spring-Summer
Cardinal Flower	Native Species	*Lobelia cardinalis*	Summer-Fall
Obedient Plant	Native Species	*Physostegia* spp.	Summer-Fall

Table 5.

Table 5. Hummingbird Plants - Annuals.			
Common Name	Adaptability to Region	Scientific Name	Blooming Season
Scarlet Morning Glory	Native Species	*Ipomea coccinea*	Summer-Fall
Cypress Vine	Native Species	*Ipomea quamoclit*	Summer-Fall
Standing Cypress	Native Species	*Ipomopsis rubra*	Summer
Four O'Clock	Not recommended for S. Florida	*Mirabilis jalapa*	Fall

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WEC-32

Bats: Information for the Florida Homeowner[1]

Amy K. Taylor, Frank J. Mazzotti, and Craig N. Huegel[2]

Background

Bats are an essential link in the balance of nature. In Florida, bats provide a valuable service by consuming mosquitoes and other night-flying insects--while posing little threat to human health. Curiously, bats have been feared and maligned by man since the Dark Ages. Some of this fear comes from the misconception that most bats carry rabies when, in fact, less than 1/2 of 1 percent carry the disease. There is no evidence that widespread destruction of bats or their roosts has reduced the already low health hazard. Bat control should be done by excluding entry into buildings, not by killing bats.

About Bats

Some people wrongly believe bats are flying mice. In fact, bats form a separate and distinguishable group of mammals more closely related to moles, shrews, and even monkeys than to rodents. Bats are the only flying mammals, and, except for certain unique features, their anatomy is similar to that of most other mammals.

Bat's wings are very different from those of birds, and built upon the same general pattern as the limbs of other mammals. The wing is composed of an upper arm, forearm, wrist, and hand with thumb and four fingers. The hand and fingers are greatly elongated in order to spread and control the wing. The hind limbs of the bat are attached at the hip in reverse, pointing the knees backward. This arrangement is thought to facilitate the bat's ability to alight upside down and hang by its toes.

Bats occur worldwide. Of the approximately 850 species of bats only 39 occur in the United States and of those, 17 occur in Florida. (For details on specific species see "A Checklist of Florida's Mammals", Florida Game and Fresh Water Fish Commission (GFC).)

Florida bats are highly beneficial because they consume tremendous numbers of night-flying insects, including mosquitoes. Bats locate insects at night using a very sophisticated sonar system (echolocation), emitting supersonic sounds and listening for echoes. Bats are most frequently seen on warm nights feeding over bodies of water, around buildings or forest edges, or around lights. During the day, bats find shelter in a variety of secluded places, preferring small, dark, poorly ventilated spaces that heat up during the day. Tree cavities, snags, and especially unpruned cabbage palms are important roost sites. Due to increasing urbanization, the number of these natural roosting sites has been reduced and window shutters, drain pipes, billboards, roof tiles, and attics have become popular roosting site substitutes.

Bats in the home

The presence of a bat in the home may be a sign that the house is not weather-tight. If so, take appropriate measures to locate openings and seal them. The best way to remove a single bat from the home is not to panic, but simply open a window in the room. The bat usually will circle the room, using its sonar, until it detects the open window and flies out on its own. If possible, stay in the room with the lights on and make sure the bat leaves.

1. This document is WEC-32, one of a series of the Wildlife Ecology and Conservation department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Published: June, 1991. Reviewed: January, 1999. Please visit the EDIS Web site at **http:/edis.ifas.ufl.edu**

2. Amy K. Taylor, former undergraduate assistant; Frank J. Mazzotti, Ph.D., associate professor, Wildlife Ecology and Conservation department, University of Florida, Everglades REC, Belle Glade, FL 33430, and Craig N. Huegel, former assistant extension scientist, Pinellas County, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611.

This should only take a few minutes. Another method is to use leather gloves and simply pick up the bat. *Never handle a bat with bare hands because it may try to bite to protect itself.*

If the bat "disappears" in the room, it probably has landed behind a curtain or in some hidden nook. In this case: open a window, turn off the lights, close the door behind you, and isolate the bat by blocking the space under the door with a towel. The bat should find its way out within an hour after dark as long as the weather is not too cold. One or two bats in the home may mean only that they came in through an open window. However, their presence could be a sign that a colony of bats has established a roost in a crawl space or attic. An

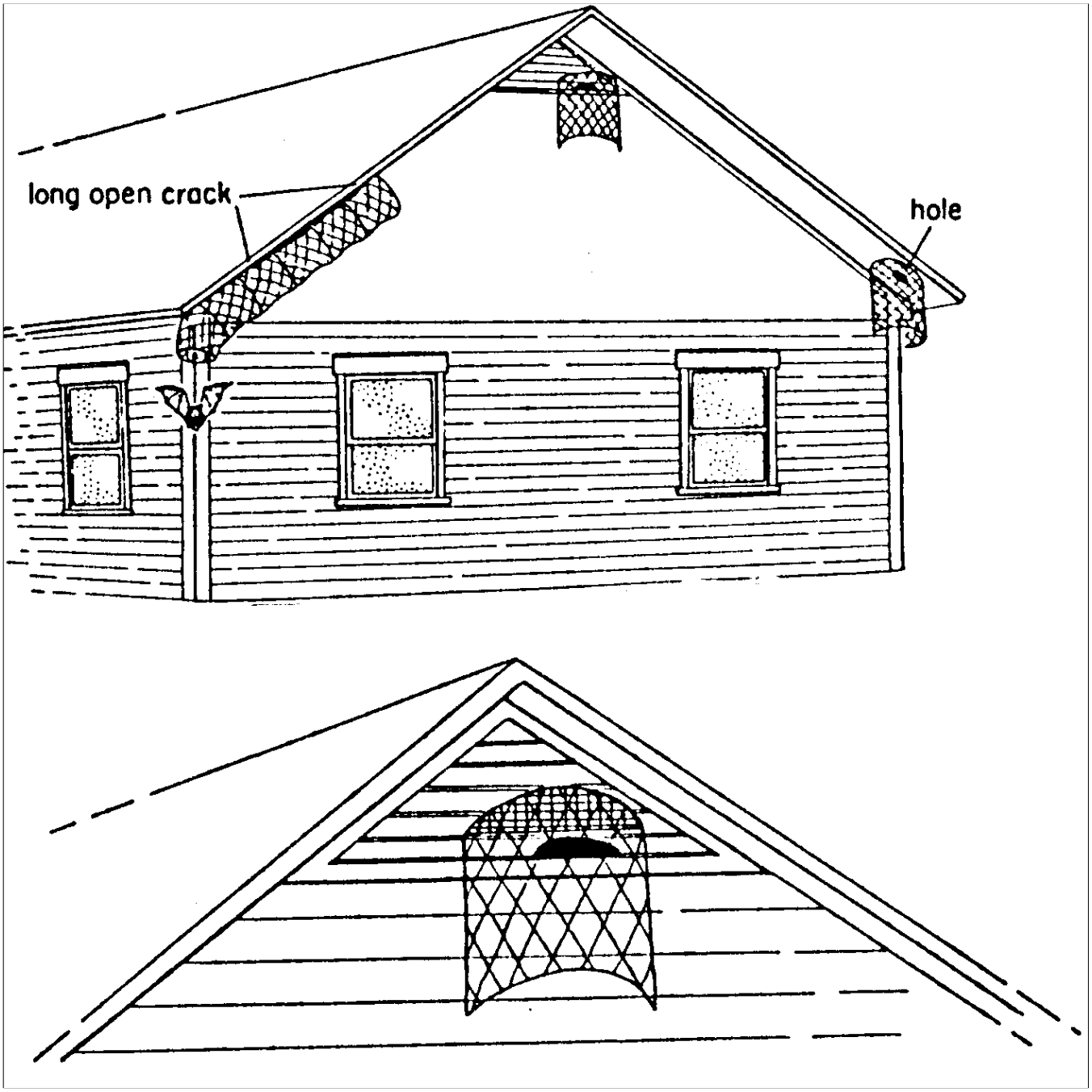


Figure 1. Enclose top and sides of entrances with nylon netting or wire screening, with an opening 2' below the entrance.

obvious sign that a bat colony has taken up residence is when bats are observed flying in and out of a hole in the house. If they become a nuisance, the only long-term solution is to bat proof the building (Figure 1).

Bat Control Methods

In light of bats' beneficial feeding habits, give careful consideration before implementing any control measures. Pesticides, pollution, people, and habitat loss have reduced bat populations significantly. That is why non-lethal control measures are recommended.

Exclusion Method

The only permanent way to get rid of a bat colony is to exclude them from the building by plugging their entrance holes (bat proofing). Figure 1 shows a bat-proofed building. Locating the entrance way(s) to a bat colony is the most important step before implementing an eviction plan. Time of year is an important factor. Spring, fall and winter are the best times to exclude bats in Florida. Bats will hibernate during winter in cold weather climates. If you live in the northern one-third of the state, wait till after early January to exclude bats and seal openings. The worst time? From the first of April to approximately the third week in July, bats form nursing colonies. Exclusionary measures taken at this time would create major problems. There is a high probability that lactating mothers and their young are present. Young bats, not yet able to fly, remain in the roost. Sealing entrance ways would trap many of the bats, separating mothers from their young and leaving the young bats to die. The odor from dead bats is extremely offensive. It also may attract other bats in the area, increasing bat activity even more. Any adults trapped inside would try to locate other exits increasing the possibility of contact with humans.

To remove a bat colony, locate where the bats are entering or exiting. Since bats leave their roost shortly after sunset, watch the outside of the house from 30 minutes before sunset until 30 minutes after. Bats may enter and exit through an unscreened attic vent, a chimney, and cracks or openings along eaves, window sills, and siding. *Note: Bats do not need an opening they can fly through. A crack only 3/8" wide will admit bats.*

Once all entrances have been located, seal all but the primary entrance. Next install a one-way door over the entrance as shown in Figure 1. Wait three or four nights, and if bats are no longer seen leaving the building, seal the remaining hole. If all the holes have been sealed, there will be no further problems.

Cracks, separations, or other openings should be repaired as soon as they are noticed. Keeping the house weather-tight and energy efficient is the best way to prevent bat problems from recurring.

Methods of habitat manipulation

Artificial Light

Since bats prefer dark spaces, artificial light can be used quite successfully, but only if the light is kept on continuously and moved regularly. Otherwise, the bats will soon find dark corners to avoid the light. This method also may cause bats to move deeper into the house as they avoid the light, making them more likely to enter living areas and come into contact with people.

Repellents

Although a number of methods have been devised to repel bats, this approach is only a temporary solution. Naphthalene (mothball) flakes can be applied to the area of infestation. As long as a strong odor remains, bats may not return. The effects will not last long and repeated applications are required to deter bat re-entry. Ammonia can be used to clean areas infested by bats. Pans of the solution then can be placed in a former roost to act as a repellent. Neither of these methods will be successful as long as bats can reenter the habitat once the odor has begun to fade. The strong odor is also offensive to humans and repeated applications may not be a tolerable long-term solution. Repellents are not as effective as simply waiting for the bat's normal departure at dusk and taking appropriate exclusionary measures.

Fumigants

There are serious disadvantages to the use of fumigants against bats. The results are not permanent, and the building may be recolonized at a later time. Also, poisons used in the extermination of bats may cause an increase in human or pet contact with bats as sickened bats fall to the ground and slowly die. Even if fumigation quickly killed all bats present, it would provide only a very temporary solution at best. Other bats could safely move in within just 2 days unless entry holes are plugged–a solution that would negate the need for fumigation. If fumigation killed a significant number of bats within the walls of a home, a serious odor problem would result. Simple exclusion after the bats' nightly departure is a far preferable solution.

A fumigant can be considered for bat control only in a real public health emergency under the authority of a special permit issued by the Florida Game and Fresh Water Fish Commission and only after all other feasible methods of exclusion and removal have failed.

Ultrasonics

Ultrasonic repellents are ineffective as a deterrent against an animal that uses ultrasound waves in many aspects of its life. They may actually attract bats.

Bat Conservation

Bat populations are on the decline throughout the United States. Loss of habitat due to the disturbance of natural and man-made roosting sites in buildings, old trees, and caves is a major factor in this decline. Another factor is active and persistent persecution by people not aware of the bat's gentle nature and beneficial activities.

Once bats have been excluded from one habitat it is often possible to provide alternative habitats. Uncut woodlots, snags, and viable wetlands with open water are important bat habitats. In particular, cabbage palm left unpruned is tremendously valuable as a home for bats. Also, you can build a bat house (Figure 2).

How to Build a Bat House

This bat house designed by Bat Conservation International (Figure 2) combines relative ease of construction with the varied crevice sizes most often used by American bats, and temperature buffering features. Western red cedar is recommended for its ability to withstand outdoor exposure, though many other woods are suitable. Six feet of 1x12in board and 10ft of 1x10in board are sufficient for construction. (Actual board sizes normally are about 3/4x9-1/4in.)

Dimensions may be varied to allow for slight differences in board widths or personal preferences, but spacing between partitions should remain approximately the same. Use rough lumber and turn all rough sides inward. The rough side of the ceiling should face down. Cut 1/16in horizontal grooves at 1/2in intervals on the smooth sides of all partitions. This enables bat climbing and roosting. Apply a bead of silicon caulk along each exterior joint to prevent heat loss. The estimated cost of materials is less than $20, and a single house may be occupied by 100 or more bats.

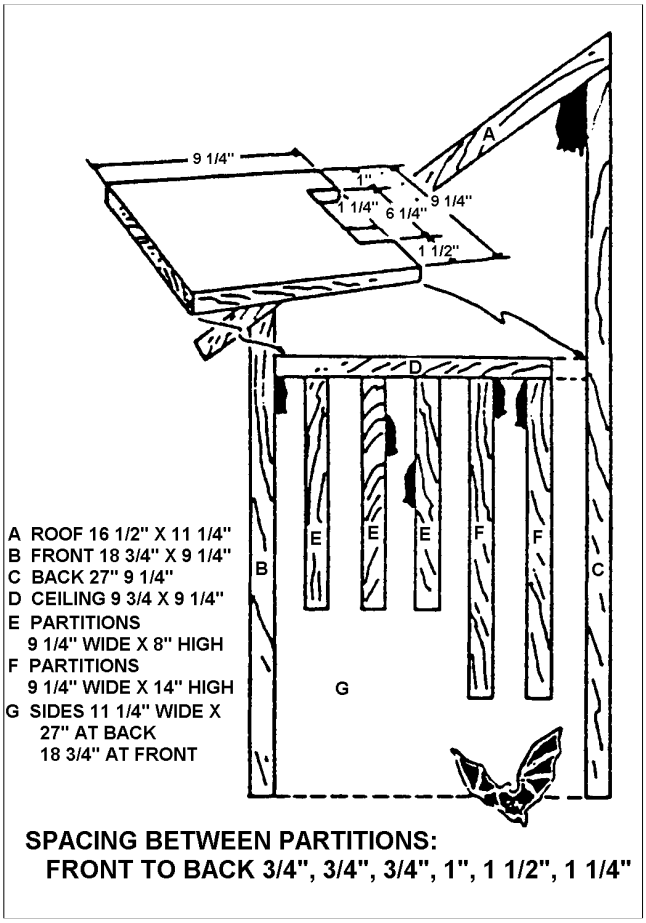


Figure 2. Bat house designed by Bat Conservation Intern'l.

Notes: *Do not let the space between inner partitions exceed 1in.*
When house is completed, hang it 12-15ft above the ground on a tree trunk or side of a building facing south or southeast so it catches the morning sun, but is in the shade during mid-day.
Provide a watering station or locate your bat house near a natural water source to increase your chance of attracting bats.

Suggested Reading

For Bat Problems:

Timm, R.M. (ed.). 1983. Prevention and Control of Wildlife Damage. Nebraska Coop. Exten. Serv., Univ. Nebraska-Lincoln, NE.

French, T.W., J.E. Cardoza, and G.S. Jones. l986. A Homeowner's Guide to Massachusetts Bats and Bat Problems. Div. Fisheries & Wildlife, Commonw. of Massachusetts, Boston, MA.

For Natural History:

Barbour, R.W. and W.H. Davis. 1969. *Bats of America.* Univ. Press of Kentucky, Lexington, KY.

UNIVERSITY OF FLORIDA
Cooperative Extension Service
Institute of Food and Agricultural Sciences

WEC-136

Impacts of Free-ranging Pets on Wildlife[1]

Joe Schaefer[2]

Overview

Cats and dogs are domesticated predators. They have natural prey-chasing, capturing, and killing instincts. As a result of this and the large numbers of them in Florida, cats and dogs have the potential to severely impact local wildlife populations. In addition to reducing populations of species and limiting the number of prey items for native predators, free-ranging pets can cause other problems. For example, they serve as important reservoirs for human and wildlife diseases like ringworm, *toxoplasmosis*, *leptospirosis*, distemper, and rabies. They may be an important factor in introducing these diseases into susceptible wildlife populations.

Dogs kill turtles and other wildlife. My own Australian silky terrier killed a young blue jay, and several frogs and lizards in my backyard. Exotic snakes and other pet predators can also have local impacts if released into the wild. But the pet that is by far the most devastating on wildlife populations is the furry feline. While a few species such as great horned owls and coyotes may think of cats as delicacies, many wildlife populations are threatened by "outside" cats that are allowed to range freely.

The instinctive hunting and killing behavior of cats is extensively documented. Unlike wild predators that kill to eat, cats kill impulsively even when they are not hungry. Animals that nest or feed on or close to the ground such as cardinals, bobwhites, towhees, wrens, rabbits, and lizards are most susceptible. At least part of the population declines experienced by Florida's endangered beach mice are due to domestic cat predation. A Michigan study provided some insight into the impact of a single cat on local prey. During an 18-month period, one well-fed, domestic farm cat killed at least 60 birds and 1,600 small mammals. A study in England estimated that over a million birds are killed each year there by free-ranging cats.

Although it is impossible to determine the extent of this problem in Florida, estimates are astounding. Several thousand stray cats are picked up by county animal control departments in Florida each month (for example, Orange County averages almost 670/month). If each cat killed only one animal each month, tens-of-thousands of animals would be killed each year here. This is a conservative estimate, because studies have shown that cats kill more than one animal per month (almost 100 were killed each month by the cat in the Michigan study), and we really do not know what percentage of all free-ranging cats are picked up by animal control departments.

Solutions

Dr. H.W. Kale, II and David Maehr recommend actions in their book, *Florida's Birds*, that you can take to reduce the chances of cats' sneaking up undetected on wildlife on your property:

- Do not place a bird feeder or bath immediately next to dense shrubbery or other cat hiding places.
- If you own an outside cat, place two bells on its collar--some cats can learn to adjust their moves to silence a single bell.

1. This document is WEC-136, one of a series of the Department of Wildlife Ecology and Conservation], Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Publication: December 1991, as SS-WIS-52. Reviewed, and renumbered, August 1999. Please visit the EDIS Web site at **http://edis.ifas.ufl.edu**.

2. Joe Schaefer, Ph.D., professor, Director, Center for Natural Resources, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611. Agricultural Sciences, University of Florida, Gainesville, 32611.

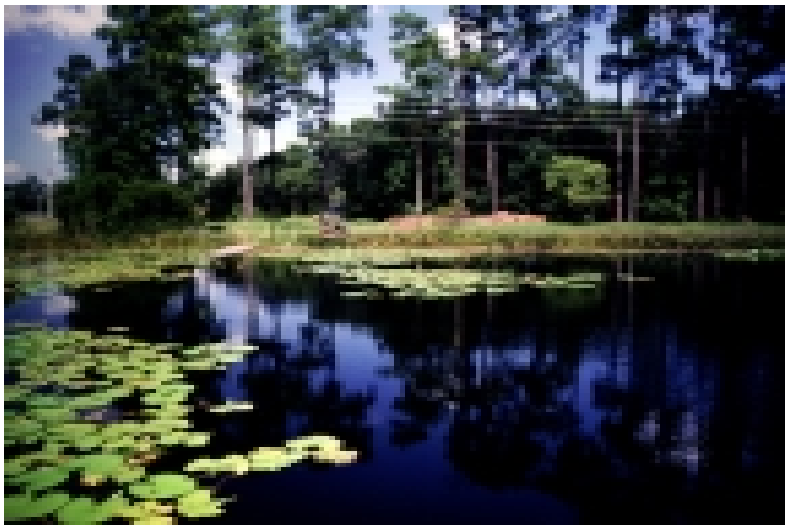
- Do not let your cat roam at night when they can be much more effective predators on sleeping prey.
- If you are having problems with a neighbor's cat, speak to the neighbor about the problem and see what can be worked out.
- Cats hate water, so you may be able to discourage a cat from entering your yard by spraying it several times with a garden hose.
- If the cat is an untagged stray or feral, trap it with a live trap (the raccoon-type trap) then turn it over to the local animal control office or Humane Society.

The best solution to the problem of predatory cats and dogs is responsible pet ownership including: spaying and neutering. as well as confining. Responsible pet owners are also concerned about the potential dangers that their free-ranging pets may encounter: death by vehicles; diseases transmitted by wildlife and other pets; death by wildlife predators; injury from fights with other dogs and cats; and the various animal control practices used by unhappy neighbors.

Suggested Reading

Kale, II, H.W. and D.S. Maehr. 1990. *Florida's Birds*. P. 250. Pineapple Press, Inc. City, FL 288 pp.

TRIPLOID GRASS CARP



Pond owners must be careful to choose a method to selectively manage, rather than eliminate, aquatic vegetation.

For more information contact Aquatic Plant Management Biologists:

Eustis
(352) 742-6438

Lakeland
(941) 648-3202

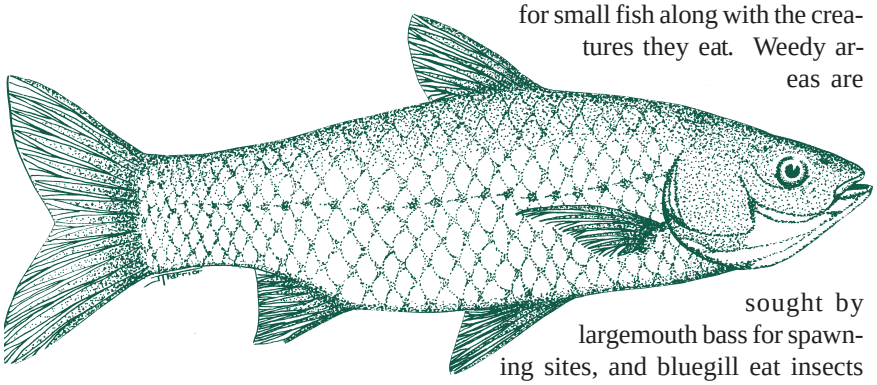
MANY FLORIDA pond owners face problems with nuisance aquatic plants. One of the more publicized solutions is the triploid grass carp, a fish imported from Asia and genetically altered at hatcheries so it will not spawn. One of the few fish species that eats aquatic vegetation, grass carp are effective in controlling **some** species of aquatic plants, particularly in small water bodies. However, this fish is not a magic solution for every pond owner.

This brochure is designed to help you evaluate whether grass carp are the appropriate solution to your problems, and how to properly acquire and stock this fish.

Thirty percent plant coverage is a healthy balance.

Do You Really Have a Plant Problem?

Plants are a natural part of most Florida lakes. Aquatic vegetation provides cover for small fish along with the creatures they eat. Weedy areas are sought by largemouth bass for spawning sites, and bluegill eat insects associated with water plants. Wading birds are common in shoreline vegetation.



Many ponds with weed problems also have desirable aquatic plant species. A pond with dense hydrilla in the middle may have a band of water lilies that the owner would like to maintain. In such cases, pond owners must be careful to choose a method to selectively manage, rather than eliminate, aquatic vegetation.

Although vegetation is not critical for good fishing in small ponds, fisheries biologists recommend up to 30 percent plant coverage as a healthy balance. If your pond or lake falls within these guidelines, you may want to consider whether the cost of treatment is worthwhile.

Are Triploid Grass Carp The Answer to Your Problems?

Grass carp are not the only way to control nuisance aquatic plants. Chemicals (herbicides) and mechanical harvesting are also used. Although grass carp are very effective in controlling some species such as hydrilla and naiad, they are not recommended for many common plants, including water lilies, bacopa and water hyacinths. See back cover for a description of which aquatic plants are controlled by grass carp.

The Triploid Grass Carp

The grass carp, also known as white amur, is the largest member of the minnow family and is native to eastern Asia. Grass carp were first introduced into the United States in 1963 to test their effectiveness for controlling aquatic plants.

Grass carp were brought to Florida in 1972. Early research found grass carp were effective in controlling hydrilla, a rapidly growing exotic aquatic plant. However, at high stocking rates, virtually all other aquatic plants were eliminated as well.

Because so many of Florida's fish and wildlife species depend on aquatic vegetation at some stage of their lives, controlling distribution of grass carp is a major concern. Spawning requirements are similar to those of striped bass, a species that spawns in a few north Florida river systems. Uncontrolled reproduction could have a long-term impact on desirable aquatic plants, ultimately resulting in degradation of fish and wildlife habitat.

In 1984, a method for producing sterile grass carp was developed. During artificial spawning, hatcheries use a process that results in three sets of chromosomes (triploid) instead of the normal two sets (diploid). This results in a functionally sterile triploid grass carp, greatly reducing the possibility of habitat destruction by escaped fish.

Pros and Cons of Using Triploid Grass Carp

If grass carp will control your problem plant, there are several advantages in using this fish instead of chemical or mechanical methods. Triploid grass carp typically cost $20 to $250 per acre, avoid excess chemical use, and provide long-term control, often 2 to 6 years before restocking is necessary. Chemical treatments range from $200 to $600 per acre, while cost for mechanical control can exceed twice that amount. In addition, chemicals or harvesting may be required twice a year or more.

There are disadvantages in using triploid grass carp. At low stocking rates (generally two to five fish per acre), it often takes six months to a year before plants decrease. Higher rates are more expensive and often lead to elimination of all plants, including desirable species that provide cover for fish and other animals. When plants are removed, fish such as shad and crappie may increase, while bass and bream may become more difficult to locate and catch. Also fewer bird species use the water body if nesting and feeding sites are removed.

If you overstock and later change your mind about aquatic plants, it is difficult to remove grass carp. Triploid grass carp can live more than 10 years, and once vegetation has been eliminated, very few fish can keep a pond plant-free. Triploid grass carp can be caught on hook-and-line using bread, dough balls, dog food and live worms, but the bottom line is that once triploid grass carp have removed all the plants from your pond, it is likely to stay that way for awhile.

To ensure that only triploid grass carp are sold in Florida, each grass carp is tested using scientific equipment that measures red blood cells nuclei. Because of their extra set of chromosomes, triploids have larger blood cells than diploids.

Along with declines in some types of fish and wildlife, pond owners may notice green water, resulting from an increase in microscopic algae. As the problem plants are removed, algae multiplies rapidly. These algae "blooms" can turn the water green, and, in severe cases, the appearance of a "paint scum" may form on the surface. At their worst, blooms lead to fish kills, as algae die and decompose.

In water bodies over five acres, we recommend using triploid grass carp together with chemical or mechanical control. An initial herbicide treatment followed by a low triploid grass carp stocking rate generally results in more effective aquatic plant management at lower long-term cost.

Triploid grass carp grow rapidly,reaching 20 inches and about three pounds in one year from a stocking size of 10-12 inches and one-half pound.

Triploid Grass Carp Checklist

Identify your problem plant.

Triploid grass carp efficiently control some types of plants, such as hydrilla and naiad. Other species are better controlled with other methods. Refer to back cover for common Florida aquatic plants. Applicants may take plant samples to local offices of the Agricultural Extension Service, the Commission, or Department of Environmental Protection for identification.

Do you want to eliminate or selectively manage aquatic plants?

Canals, golf courses, and small ponds may not need vegetation; some aquatic plants are beneficial in larger ponds and lakes where fishing is important. Determine what degree of control is appropriate for your water body.

Contact the Fish and Wildlife Conservation Commission for a permit application.

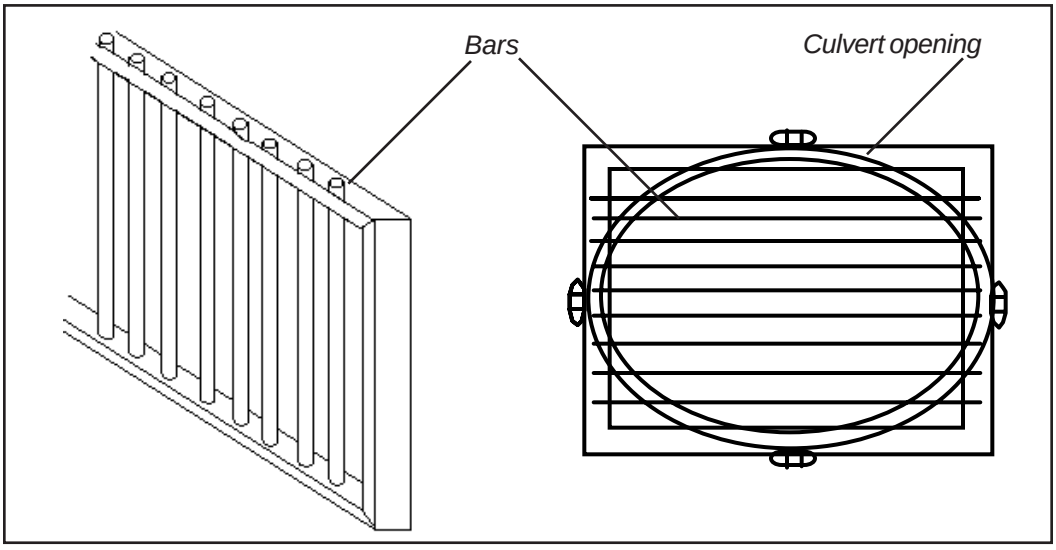
The triploid grass carp is a restricted fish in Florida and can only be possessed by permit issued through the Commission. Your application details the size of the water body, a map showing its location, and its principal use (agriculture, fishing, etc.); what the suspected problem plant is; if your lake or pond has any connection to any other water body; and if you are the sole owner of the pond or lake, or a member of a waterfront property owners' association.

Obtain a permit.

A Commission biologist will evaluate your aquatic plant situation, and check for possible escape routes that may impact other waters. If the permit is approved, the biologist will recommend the number of triploid grass carp to deal with your problem. Generally, two to ten fish per acre are used. Each permit is issued for a specific site and a specified number of fish. If your site has escape routes, you will be required to install an approved barrier before your permit is issued. Consent of all private waterfront property owners or the homeowners association is required prior to permitting.

Find a certified supplier.

The Commission provides a list of suppliers approved to sell triploid grass carp in Florida with each permit. In 1999 there were 34 approved suppliers, 28 of which are in Florida. The cost of triploid grass carp varies depending on the number and size of the fish ordered. As of 1999, for large orders (several hundred) the cost is generally around $5 per fish. The average homeowner with a small pond will probably pay $7 to $10 per fish. **You must use only triploid grass carp obtained from an approved supplier.**



Basic Barrier Designs - A maximum gap of 1.5 inches between bars is allowed.

Grass Carp Barrier Designs

Triploid grass carp are attracted to flowing water and will escape through open connecting streams, marshes, ditches, culverts and drainage structures, particularly if aquatic plants are scarce. Grass carp have been known to leap several feet to leave a water body. In most cases, a fish barrier can be installed at potential escape routes. Such barriers are required to be installed and maintained by the applicant for a permit to be issued by the Commission.

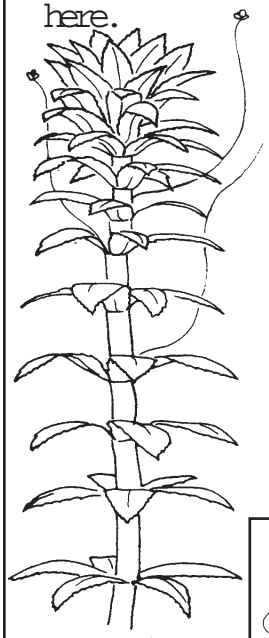
Barrier designs often consist of corrosion-resistant screening placed over a culvert pipe or drain structure. If an area is subject to high flow, a more advanced barrier with a parallel bar design may be necessary to minimize debris build-up which may cause flooding. Barrier requirements must be acceptable to local storm water management agencies. **The permit applicant is responsible for obtaining approval.**

A maximum gap size of one and a half inches will block passage of 10-inch triploid grass carp. If smaller fish are stocked the gap size must be narrower. A leaflet titled "Barriers to Restrict the Movement of Grass Carp for Management of Aquatic Weeds" is available at no cost from Commission offices.

FOR INTERNET ACCESS: http://www.state.fl.us/fwc/fishing/

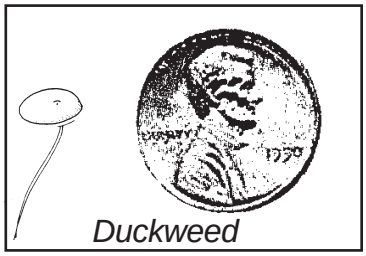
PLANT IDENTIFICATION

Triploid grass carp will control these commonly found plants.
Grass carp also will consume other plants not shown here.

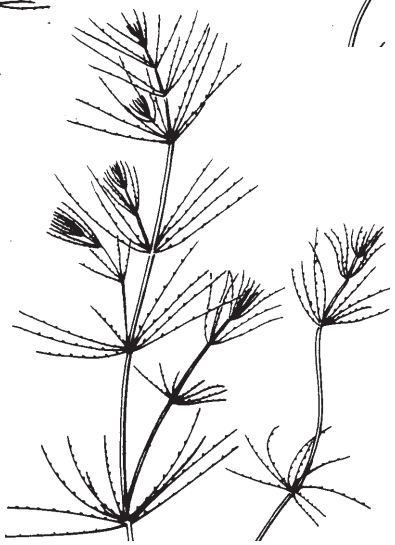


Hydrilla

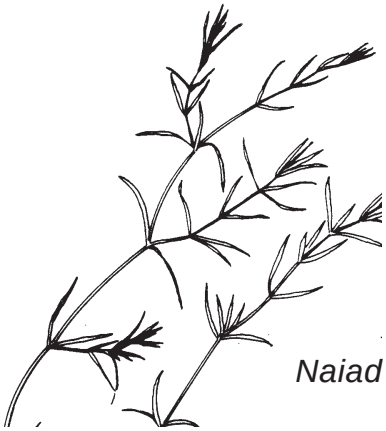
Coontail



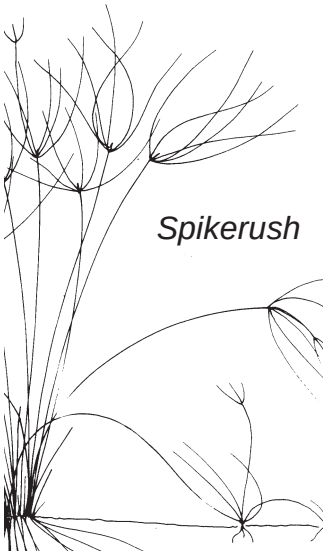
Duckweed



Muskgrass or Chara

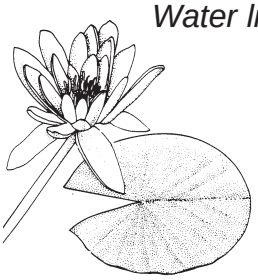


Naiad



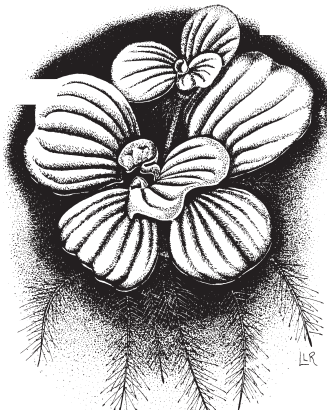
Spikerush

Triploid grass carp will not control these plants.



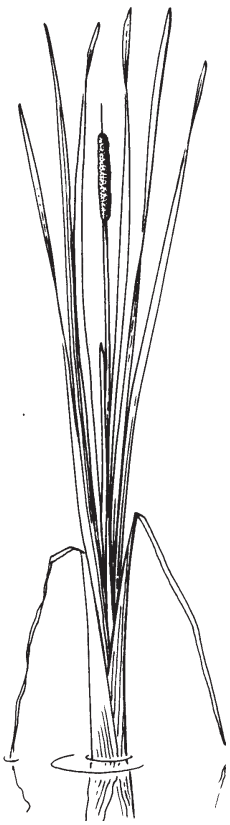
Water lily

Water hyacinth



Water lettuce

Torpedo grass



Cattail

All plant illustrations provided by: IFAS, Center for Aquatic Plants
University of Florida, Gainesville, 1990

WEC220

UF UNIVERSITY of FLORIDA
IFAS Extension

Dealing with Snakes in Florida's Residential Areas - Identifying Commonly Encountered Snakes[1]

Steve A. Johnson and Monica E. McGarrity [2]

Florida's native snake species play important roles in the environment, serving as prey for many native birds and helping to regulate amphibian and rodent populations. Considering the fact that rodents worldwide help to spread 35 known human diseases, we would be well-advised to learn to respect and appreciate snakes for the role they play in our environment. Unfortunately, many snakes are now threatened by habitat loss caused by development of natural habitats to meet the needs of Florida's growing human population. Additionally, large numbers of snakes are killed each year as a result of road mortality and persecution by humans. In the U.S., humans kill thousands of snakes each year, yet only 5-6 people die each year of venomous snakebites. In order for snakes and people to safely coexist, it is important that Floridians learn to identify, understand, and respect snakes.

In residential areas where human-snake encounters are likely to occur, we recommend a three-part proactive approach for coexisting safely with snakes. This document provides information on the first step of this proactive approach – learning to identify Florida's commonly encountered non-venomous and venomous snakes. Please note that, in keeping with the "leave it be" attitude that we advocate, we recommend that you avoid handling snakes if at all possible and NEVER attempt to handle a snake with your bare hands or attempt to handle ANY venomous snake – that is a task best left to professionals.

NON-VENOMOUS SNAKES

Florida is home to 44 species of native snakes, only six of which are venomous. The 13 species described here are commonly encountered snakes that may be found in yards, golf courses, parks, retention ponds, or even in garages and houses. There are certainly other species of snakes that are found in residential areas, but those listed here are the ones most frequently encountered. For each species, we provide information about how to identify it, what it eats, and where it is commonly found in residential settings, as well as insights on behavior and how to deal with each species safely.

1. This document is WEC 220, the second in a 4-part series entitled "Dealing with Snakes in Florida's Residential Areas", of the Department of Wildlife Ecology and Conservation, University of Florida / IFAS. First published July 2007. Accompanying documents by Dr. Johnson related to dealing with snakes in a variety of settings are available through the University of Florida/EDIS at http://edis.ifas.ufl.edu/TOPIC_A23708620. A free PowerPoint presentation (with speaking notes) on the topic of venomous snake safety is available upon request from Steve A. Johnson by email - tadpole@ufl.edu.

2. Steve A. Johnson - Department of Wildlife Ecology and Conservation and Gulf Coast Research and Education Center, University of Florida IFAS/Plant City Campus, 1200 North Park Road, Plant City, FL 33563

Monica E. McGarrity - Gulf Coast Research and Education Center, University of Florida IFAS/Plant City Campus, Plant City, FL

Southern Black Racer

The Southern Black Racer (*Coluber constrictor*), also known as the Eastern Racer, is the “black snake” most commonly found in urban and natural areas throughout all of Florida (Figure 1). These long, slender snakes can grow to 4-5 feet in length, and have smooth gray/black scales on their backs and bellies and white chins and throats.

Figure 1. Southern Black Racer (Adult). Credits: Steve A. Johnson, University of Florida

Adult Black Racers are commonly found sunning themselves on lawns, shrubbery, walkways and fences, and are occasionally found in houses (particularly after rains). Racers are harmless to people and are swift and agile (as their name implies), fleeing rapidly when approached. However, if they are cornered and feel threatened, they may vigorously shake their tail (making a rattling sound on the floor or dry leaves) and may release a foul smelling 'musk' on their captor or even strike if handled. Black Racers use their speed to catch a variety of prey, including frogs, lizards, small snakes, birds, and rodents.

Due to their dark coloration, harmless Black Racers are sometimes incorrectly identified as venomous Cottonmouth Water Moccasins (Figure 16), which have rather thick, heavy bodies with rough-looking keeled scales (with longitudinal ridges) and blocky heads. Young Black Racers (Figure 2) are also long and slender, but bear little resemblance to adults. They have a series of reddish-brown blotches down the middle of their backs on a gray background and abundant small, dark specks on their sides and bellies.

Figure 2. Southern Black Racer (Juvenile) - note the slender body and reddish colored blotches. Credits: Steve A. Johnson, University of Florida

There are several other “Black Snakes” found throughout the southeastern U.S. that are often difficult to identify. Of these, only the Black Racer and Southern Ring-necked Snake (also described here) are commonly found in residential areas. Additional information about “Black Snakes” and tips on identification can be found in the document "Black Snakes": Identification and Ecology, available online through the University of Florida's Electronic Data Information Source (EDIS) at http://edis.ifas.ufl.edu/UW251.

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"Flower Pot Snake" - Brahminy Blind Snake

Brahminy Blind Snakes (*Ramphotyphlops braminus)* are tiny (2-6 inches), brownish-black, earthworm-like snakes with nearly invisible eyes and no distinct head or tail (Figure 3).

Unlike earthworms, these non-native snakes are smooth and are not segmented. They were introduced to Florida through the ornamental plant trade (hence the name “Flower Pot Snake”) and are one of the most commonly found snakes in urban areas throughout peninsular Florida. Notably, the prevalence of this non-native species can be attributed in part to the fact that all Brahminy Blind Snakes are female, meaning that a single individual can reproduce asexually by a process called 'parthenogenesis'. These tiny snakes burrow in potted plants or flower beds, feeding on larval ants and

Figure 3. "Flower Pot Snake" or Brahminy Blind Snake, shown next to a dime for size comparison (Adult). Credits: Jason Butler, 2007

termites, and are occasionally found in houses, as their small size allows them to slip in under doors. These snakes are completely harmless to humans, and may be removed from the house by sweeping them into a bucket or small garbage can.

Southern Ring-necked Snake

Southern Ring-necked Snakes (*Diadophis punctatus*) are one of the most commonly found snake species in urban areas throughout all of Florida, where they are found in leaf litter or mulch, on walkways, and sometimes in houses. They occasionally fall into pools and end up in the skimmer basket. These small, grayish-black snakes rarely grow longer than 12 inches, and can be easily identified by the obvious ring of orange or yellow around the neck and a matching brightly colored belly with a row of black spots down the center (Figures 4 & 5). When alarmed or threatened, Ring-necked Snakes coil their tail like a corkscrew and may emit a foul scent, although they rarely attempt to bite.

These shy snakes are harmless, preferring to spend their time under logs and rocks, where they eat earthworms, slugs, salamanders, lizards, and small snakes. Due to their small size, these snakes may be unable to climb out of pools and may inadvertently slip into a house under doors. They can easily be removed from the pool using a leaf skimmer or from the house by sweeping them into a bucket or small garbage can. Release them in nearby shrubs, so that these harmless snakes can continue to eat your garden slugs!

Figure 4. A Southern Ring-necked Snake (Adult) showing typical defensive posture—note the coiled tail. Credits: Steve A. Johnson, University of Florida

Figure 5. Southern Ring-necked Snake (Adult) showing yellow belly coloration. Credits: Kenneth Krysko, FLMNH, University of Florida, 1996

Rat Snakes

Red Rat Snakes, also known as Corn Snakes (*Elaphe guttata*, Figure 6) are frequently found in urban areas throughout Florida. These beautiful snakes have reddish-orange blotches (outlined in black) on their backs and sides on a highly variable background of tan, gray, or yellow-orange, and a distinctive black and white “checkerboard” pattern on their bellies.

Due to their reddish coloration, these snakes are occasionally confused with coral snakes (Figure 17). However, non-venomous Red Rat Snakes are generally larger (3-5 feet), and lack the distinct black nose and red, yellow and black bands of coral snakes.

Yellow Rat Snakes (*Elaphe obsoleta*, Figure 7) are closely related to Red Rat Snakes, and are frequently found in urban areas throughout peninsular Florida (not found in the Panhandle). This is a large

Figure 6. Red Rat Snake (Adult), demonstrating its superior climbing skills. Credits: Steve A. Johnson, University of Florida

(4-6 feet), distinctive golden yellow snake with four dark longitudinal lines running down its back.

Figure 7. Yellow Rat Snake (Adult). Credits: Steve A. Johnson, University of Florida, 2004

Juvenile Red Rat and Yellow Rat Snakes look similar and resemble Red Rat Snake adults, albeit a dull, brownish version. As Yellow Rat Snakes grow, the blotches will fuse to form the longitudinal lines seen in adults, and the gray-brown background coloration turns to yellow-orange. Typical juvenile rat snake markings are shown in Figure 8 below.

Both Yellow and Red Rat Snakes are excellent climbers and are frequently found in residential areas on shrubs or fences. They are also found on occasion

Figure 8. Juvenile Yellow Rat Snake - Markings are typical of juvenile rat snakes. Credits: Kenneth Krysko, FLMNH, University of Florida

in garages and even in bathrooms inside the home, where they gain entrance by way of holes in walls or uncovered roof vent-pipes. These are harmless non-venomous snakes, but can be quite defensive and may emit a foul smelling musk and strike when cornered. If found in the house, you may be able to remove these snakes by using a broom to gently guide them into a large outdoor garbage can, which can then be covered and used to relocate the snake outdoors. In the garage, you may be able to gently guide the snake through an open door using a broom. If this is not possible, remember that Rat Snakes feed primarily on rodents – after they rid you of your rodent pests, they will likely move on in search of food and water. In addition, there are many preventative methods, detailed in the next document of this series, which will greatly reduce your chances of an indoor encounter with a snake.

Garter Snakes

Eastern Garter Snakes (*Thamnophis sirtalis*, Figure 9) are frequently encountered in urban areas throughout Florida. Eastern Garter Snakes are small-medium sized snakes (2-3 feet long) with keeled scales marked with three light-colored longitudinal lines, one down the middle of the back and one along each side of the body. There is also a "checkerboard" pattern of black splotches down the back between the stripes.

Due to this splotched pattern, Eastern Garter Snakes are occasionally misidentified as Pygmy Rattlesnakes (Figure 15), which have large, irregular blotches, much thicker bodies, blocky heads, vertical

Figure 9. Eastern Garter Snake (Adult). Credits: Steve A. Johnson, University of Florida

pupils, and a dark stripe through the eye to the corner of the jaw.

Eastern Garter Snakes feed primarily on small prey such as earthworms, frogs, and salamanders. In urban areas, they are often found among shrubbery near houses, along the edges of ditches or ponds, and may even get into bathrooms inside a home, gaining entrance by way of holes in walls. These snakes are generally docile, but when cornered may release a foul smelling musk and flatten their heads and bodies to appear more imposing. These harmless snakes may be removed from the house by sweeping them into a bucket or small garbage can. Preventive methods, detailed in the next document in this series, can help to eliminate unwanted indoor encounters with snakes.

Rough Green Snake

The Rough Green Snake (*Opheodrys aestivus*) was once among the most commonly encountered snakes in Florida, and may still be encountered in urban settings. This small, slender snake grows to only 2-3 feet in length, and can be easily recognized by its bright green, keeled scales, which give it a rough appearance (Figure 10). The belly is generally a cream or pale yellow color.

This snake is often seen sunning itself on bushes or in trees but is seldom (if ever) encountered in houses. These snakes are docile, and will generally attempt to stay still, relying on their green camouflage to keep them hidden when approached by people. If camouflage does not work they will quickly flee through the branches of shrubs and small trees. Rough Green Snakes specialize in eating insects they

Figure 10. Rough Green Snake (Adult). Credits: Steve A. Johnson, University of Florida

find on bushes or trees, and should be left in place to play their role in the environment.

Southern "Banded" Water Snakes

Southern Water Snakes (*Nerodia fasciata*), are perhaps the most commonly misidentified non-venomous snake species—people often confuse them with the venomous Cottonmouth. Southern Water Snakes have rough-looking, keeled scales, and can reach up to 5 feet in length (typical size ranges from 2-4 feet). The Banded Water Snake (*N. f. fasciata*) has dark crossbands on a lighter colored background (Figure 11).

The crossbands are quite variable in color, and may be black, brown, or even red. The background color of these snakes may be brown, gray, dull yellow, or reddish brown.

The closely related Florida Banded Water Snake (*N. f. pictiventris*) has similar crossband markings, and a distinctly marked belly. The Latin name “pictiventris” means “painted belly” and refers to the conspicuous dark markings on the belly of these snakes (Figure 12).

In both subspecies the crossbands tend to darken as the snakes age, and large snakes may be a nearly uniform dark-color (Figure 13).

These large, dark-colored snakes also have dark “eye stripes” through the eye to the corner of the jaw, and large individuals are easily (and frequently)

Figure 11. Banded Water Snake (Adult) showing typical banded pattern. This snake feels threatened and has flattened its head and puffed up its body to look more intimidating. Credits: Kenneth Krysko, FLMNH, University of Florida

Figure 12. Florida Banded Water Snake (Adult), showing markings on belly scales. Credits: Photo courtesy of USGS

confused with the venomous Cottonmouth Water Moccasin (Figure 16). When threatened, water snakes will flatten their heads and bodies in an attempt to look larger and more intimidating. These snakes prey upon salamanders, frogs, fish and crayfish, and are often encountered along the edges of ditches and ponds, in the same habitats where Cottonmouths are found. If you encounter a large, dark snake that you cannot confidently identify, particularly near water, "leave it be!" Even the non-venomous water snakes should not be handled unless absolutely necessary, as they release an especially foul-smelling musk and sometimes bite

Figure 13. Banded Water Snake (not a Cottonmouth), showing nearly uniform dark coloration. This snake feels threatened and has flattened its head and puffed up its body to look more intimidating. Credits: Photo courtesy of USGS

when they feel threatened. If necessary, these snakes can be relocated using a broom to guide them into a large garbage can – although they will likely attempt to escape to the safety of any nearby water.

FLORIDA'S VENOMOUS SNAKES

Of the approximately twenty species of venomous snakes found in the United States, only six are found in Florida, and only four are found in central and southern Florida. Florida's venomous snakes belong to two families – the Viperidae or "Pit Vipers" (5 species) and the Elapidae, represented in Florida by the Coral Snake. The four species described here are the most commonly encountered venomous snakes in Florida. More information on identifying all six of Florida's venomous snake species can be found in "Recognizing Florida's Venomous Snakes", an educational document available online through the University of Florida's Electronic Data Information Source (EDIS) at http://edis.ifas.ufl.edu/UW229.

Learning to identify Florida's most commonly encountered venomous snakes is essential, not only for safety reasons but also to alleviate the fears that lead to needless persecution of snakes. As you learn more about snakes and begin to understand them, you will see that all snakes – even venomous species – are beneficial and play important roles in our environment. Negative encounters with venomous

snakes are rare and several precautions, described in the next document in this series, will help prevent such unwanted encounters in residential areas.

PIT VIPERS - VIPERIDAE

The pit vipers found in Florida all share certain characteristics that can help you to learn to identify them. They all have bodies that are rather thick and heavy for their length, heat sensing pits on the side of the face, vertical pupils, and they usually have a dark stripe through the eye to the corner of the jaw (as do some non-venomous water snakes). Pit vipers also have rough-looking, keeled scales (with longitudinal ridges) and wide, somewhat triangular heads with obvious thin necks. However, many non-venomous species also have keeled scales and triangular heads, and should not be mistaken for venomous snakes. If you arent sure, be safe – give the snake its space!

Eastern Diamondback Rattlesnake

The Eastern Diamondback Rattlesnake (*Crotalus adamanteus*, Figure 14) is Florida's largest venomous snake, typically ranging in size from 3-6 feet (record length 8 feet!), and is found throughout the state of Florida. This snake can easily be identified by the large black diamonds with beige borders, which are repeated down the back.

Figure 14. Eastern Diamondback Rattlesnake (Adult). Credits: Steve A. Johnson, University of Florida

These snakes have large, blocky heads with a distinctive dark band from the eye to the corner of the jaw, rough-looking keeled scales, and may have large rattles at the tip of the tail that *usually* make a loud buzzing sound when the snake feels threatened. Juvenile Eastern Diamondback Rattlesnakes are similar in appearance to adults, and can also be easily identified.

The Eastern Diamondback Rattlesnake is rarely found in urban areas, preferring more natural scrub or wooded areas, where it preys on mice, rats, and rabbits. However, they occasionally wander onto golf courses and into suburban neighborhoods that are near pine forests. Eastern Diamondback Rattlesnakes have declined severely in numbers due to habitat loss, road mortality, and indiscriminate killing by people. The Eastern Diamondback Rattlesnake should be respected and admired from a safe distance. It can strike up to two-thirds its body length and possesses the largest quantity of the most toxic venom (at least to mice) of any species in the United States. If you encounter this snake, "leave it be" -- DO NOT attempt to approach, handle or kill it!

Pygmy Rattlesnake

The Pygmy Rattlesnake (*Sistrurus miliarius*, Figure 15) is the smallest venomous snake in Florida, averaging one foot in length, and feeds primarily on frogs, toads, and mice. Found throughout the state, this is the most commonly encountered venomous snake in Florida, and can be found in a variety of urban settings.

Figure 15. Pygmy Rattlesnake (Adult). Credits: Steve A. Johnson, University of Florida

Although small, the Pygmy Rattlesnake has a stout body and blocky head. The body is gray with irregular dark blotches down the back and sides and a broken reddish-brown line down the center of the back between blotches. There is also a distinctive dark line through the eye to the corner of the jaw. Juveniles are similar in appearance, but the tip of the tail is a bright yellowish color.

Although Pygmy Rattlesnakes do have a rattle, it is so small it is barely audible and makes an insect-like buzzing noise. These small rattlesnakes are quite defensive – if approached, they may hold their ground and strike at their perceived attacker. It is a good idea to wear leather gloves at all times while gardening, as these venomous snakes are often encountered in flower beds and gardens.

Cottonmouth

The Cottonmouth (*Agkistrodon piscivorus*, Figure 16), also known as the Water Moccasin, is the most aquatic venomous snake in Florida. It is occasionally seen in urban areas throughout Florida near the edges of ditches, ponds, lakes, and wetlands, where it feeds on fishes, frogs, mice, and rats.

Figure 16. Cottonmouth (Adult), showing banded markings and the namesake defensive posture. Credits: Steve A. Johnson, University of Florida

These heavy-bodied snakes can grow to 6 feet in length (typical size ranges from 2-4 feet), and have rough-looking, keeled scales. Young Cottonmouths resemble the closely related Copperhead, and have bright reddish-brown, splotched crossbands, a dark stripe through the eye to the corner of the jaw, and a bright yellow-tipped tail. The crossbands darken with age, and older snakes may be nearly uniformly dark-colored.

As mentioned in the previous section, several species of non-venomous water snakes are often misidentified as Cottonmouths. In order to avoid being bitten, it is best to never attempt to handle any aquatic snake. Cottonmouths do not have rattles, but may vigorously shake their tail when threatened (like many non-venomous snakes), making a rattling sound in dry leaves. As a defensive behavior, Cottonmouths may coil their body and open their mouth widely, showing the namesake cotton-white interior. These behaviors are defensive, rather than aggressive, and, despite their infamous reputation as being aggressive, Cottonmouths will generally flee from threat unless harassed.

CORALSNAKES - ELAPIDAE

Harlequin Coral Snake

The Harlequin Coral Snake (*Micrurus fulvius*, Figure 17), is a small (1 - 2.5 feet in length), slender, secretive snake that spends most of its life underground. This snake feeds on lizards and other snakes. Coral Snakes occur in residential areas, where they may be encountered under brush piles, firewood, or other objects under which they hide. You may also encounter a Coral Snake while you are digging in your yard to plant shrubs or a garden. Coral Snakes stay in hiding most of the time, and if you see one in the open it will likely be moving rapidly across your lawn to a new hiding place.

Coral Snakes have smooth, glossy scales and are brightly colored with red, yellow, and black rings. Their snout is blunt and black, followed by a band of yellow, and their body is marked with wide red and black rings separated by narrow yellow rings (the colored rings go all the way around the snake), and the tail is black and yellow.

There are two non-venomous Coral Snake “look-alikes” (Scarlet Kingsnake and Scarlet Snake) that can be confused with the Coral Snake at first glance, but they can easily be identified as non-venomous by the order of their colored bands (red touching black). Remember the "stoplight

Figure 17. Harlequin Coralsnake (Adult) - Note the black nose and the touching red and yellow bands. Credits: Steve A. Johnson, University of Florida

phrase" -- when you see a snake with bright red, yellow & black bands, remember “yellow, red, STOP!” In the venomous Coral Snake, the yellow and red bands touch. In the two non-venomous species the black and red bands touch—these snakes also have red, rather than black, snouts.

Interestingly, all of the pit vipers give birth to live young, and the Harlequin Coral Snake is the only venomous egg-laying species in Florida. Therefore, when snake eggs are encountered, they almost certainly belong to a non-venomous species and can be left in place unharmed without fear for your safety.

ADDITIONAL RESOURCES

This document is the second in a series of four documents by Dr. Steve Johnson and Monica McGarrity that provide information to Florida's residents on how to identify snakes that are commonly encountered in residential settings, how to prevent encounters from occurring in the first place, and how to respond in the unlikely event that someone is bitten by a snake. Anyone living in Florida, especially people new to the state, will find these documents useful. These documents are available online through UF/IFAS Extension Electronic Data Information Source.

1. Dealing With Snakes in Florida's Residential Areas – Introduction (http://edis.ifas.ufl.edu/UW257)
2. Dealing With Snakes in Florida's Residential Areas - Identifying Commonly Encountered Snakes (http://edis.ifas.ufl.edu/UW258)
3. Dealing With Snakes in Florida's Residential Areas – Preventing Encounters (http://edis.ifas.ufl.edu/UW260)
4. Dealing With Snakes in Florida's Residential Areas – Emergency Planning (http://edis.ifas.ufl.edu/UW261)

Hotline Numbers:

Poison Control Hotline: 1-800-222-1222

American Society for the Prevention of Cruelty to Animals (ASPCA) Poisoning Hotline: 1-888-426-4435 (charges may apply)

Good Books on Florida Snakes:

Conant, R., and J. Collins. 1998. Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America, 3rd edition. Boston: Houghton Mifflin Company.

Carmichael, P., and W. Williams. 2004. Florida's Fabulous Reptiles and Amphibians. Tampa: World Publications.

Tennant, A. 2003. Snakes of North America: Eastern and Central Regions. revised edition. Houston: Lone Star Books.

Snake Resources on the World Wide Web:

Johnson, S.A. 2005. **Dealing with Venomous Snakes in Florida Schoolyards Series.** WEC199-202. Gainesville: Institute of Food and Agricultural Services. http://edis.ifas.ufl.edu/TOPIC_SERIES_Dealing_with_Venomous_Snakes_in_Florida_School_Yards

Johnson, S.A., and M.E. McGarrity. **“Black Snakes”: Identification and Ecology.** WEC214. Gainesville: Institute of Food and Agricultural Services. 2006. http://edis.ifas.ufl.edu/UW251

Florida Museum of Natural History—Online guide to Florida snakes:
http://www.flmnh.ufl.edu/herpetology/FLGUIDE/onlineguide.htm

Florida Fish and Wildlife Conservation Commission snake page:http://www.myfwc.com/critters/snakes.asp

Partners in Amphibians and Reptile Conservation (PARC) site:
http://www.parcplace.org/index.html

Snake Handling Equipment:

Midwest Tongs - http://www.tongs.com (we recommend their Gentle Giant tongs)

Tomahawk Live Trap - http://www.tomahawklivetrap.com (we recommend their 60” Super Tube tongs with rubber cushions)

WEC 202

UF UNIVERSITY of FLORIDA
IFAS Extension

Recognizing Florida's Venomous Snakes[1]

Steve A. Johnson and Martin B. Main[2]

Florida is home to 45 species of native snakes, six of which are venomous (poisonous). The venomous species include five pit vipers (Eastern Diamond-backed Rattlesnake, Timber Rattlesnake, Pygmy Rattlesnake, Copperhead, and Cottonmouth) and the Coral Snake. Copperheads and Timber Rattlesnakes have a limited range in Florida. Copperheads only occur in a small area of Florida's Panhandle just west of Tallahassee, and Timber Rattlesnakes are only found in northern Florida as far south as Gainesville and in limited portions of the Panhandle. The other four venomous species are found throughout the state. Florida's venomous snakes occur in a variety of natural habitats, ranging from swamps to dry woods.

The five species of pit vipers all share several characteristics. The pupils of their eyes are vertical (cat-like) and they have a deep facial pit between each eye and nostril. These characteristics can be difficult to see unless a snake is examined closely, so do not rely on them to differentiate venomous from non-venomous species. Florida's pit vipers have blocky, triangular-shaped heads that are distinctly broader than their necks. Relative to their length, these species are heavy-bodied snakes.

Although each of the six venomous species in Florida have unique characteristics that allow them to be readily identified by experts, there are many non-venomous species with which the venomous species may be confused. Therefore it is best not to attempt to capture, harass, or harm any snake. To do so may put you at risk of being bitten by a venomous species.

Cottonmouth/Water Moccasin

The Cottonmouth is the most aquatic of Florida's venomous snakes and occurs throughout the state (Figure 1). Although they may exceed five feet in length, most adult Cottonmouths observed in Florida are about three feet long. This species prefers the margins of lakes, rivers, and wetlands. Adults are dark-colored and may have a faint crossband pattern or be a uniform black. The eye is camouflaged by a broad, dark facial stripe that runs from the eye to the back of the head.

1. This document is WEC 202, one portion of a 4-part package of the Department of Wildlife Ecology and Conservation entitled "***Dealing with Venomous Snakes in Florida School Yards.***" Institute of Food and Agricultural Sciences (IFAS), University of Florida. First published: September 2005. Please visit the EDIS Web site at http://edis.ifas.ufl.edu. Accompanying documents are available by contacting Steve A. Johnson (johnsons@wec.ufl.edu) or Martin B. Main (mbma@mail.ifas.ufl.edu). A free PowerPoint presentation (with speaking notes) about venomous snakes in Florida is available upon request from Steve A. Johnson.

2. Steve A. Johnson, Assistant Professor and Extension Specialist, Department of Wildlife Ecology and Conservation, Mid-Florida Research and Education Center, University of Florida's Plant City Campus, 33563; Martin B. Main, Associate Professor and Extension Wildlife Specialist, Department of Wildlife Ecology and Conservation, Southwest Florida Research and Education Center, Institute of Food and Agricultural Sciences, University of Florida, Immokalee, FL 34142.

Figure 1. Florida distribution of the Cottonmouth: Entire state

Figure 2. Adult Cottonmouth exhibiting mouth-gaping behavior. Credits: Steve A. Johnson, University of Florida

Figure 3. Juvenile Cottonmouth. Credits: Steve A. Johnson, U.S. Geological Survey

As a defensive response when threatened, Cottonmouths often will open their mouths wide, revealing the cotton-white interior (Figure 2). Young Cottonmouths (Figure 3) are brightly colored with reddish-brown crossbands and a yellow-colored tail. When young they look very similar to the Copperhead.

Several species of harmless water snakes are often mistaken as Cottonmouths. Water snakes are not venomous but they tend to be aggressive and quick to bite. To avoid confusion and the potential for being bitten, it is best to leave all water snakes alone.

Copperhead

In Florida, Copperheads only occur in a small area of Florida's Panhandle just west of Tallahassee, primarily along the Apalachicola River and its tributaries (Figure 4).

Figure 4. Florida distribution of the Copperhead: Small part of the Panhandle

Figure 5. Copperhead. Credits: William J. Barichivich, U.S. Geological Survey

Copperheads prefer to remain near streams and wet areas. A full grown Copperhead is usually less than three feet long. Copperheads are relatively thick-bodied with bold markings (Figure 5). The general body color of these snakes is light brown to gray, and there are large bands of darker brown along their backs. Because of constrictions in the darker bands along the center of the back of this species, the darker bands have an hourglass shape. The alternating pattern of lighter and darker bands provides Copperheads with exceptional camouflage in the forested areas where they live. Young Copperheads look very similar to adults except the tips of their tails are yellowish in color.

Eastern Diamond-backed Rattlesnake

This is a very dangerous snake and should not be approached. The Eastern Diamond-backed Rattlesnake is Florida's largest venomous snake and may exceed six feet in length. It occurs throughout Florida in a variety of dry habitats, such as pinelands, scrub, and golf courses (Figure 6).

Figure 6. Florida distribution of the Eastern Diamond-backed Rattlesnake: Entire state

Eastern Diamond-backed Rattlesnakes have bold markings down their backs that include a row of large, dark diamonds with brown centers and cream-colored borders (Figure 7). The tail ends in a rattle that is used to make a loud buzzing sound when the snake feels threatened. Some individuals may not rattle, even when they are poised to strike. The large, thick head has a light-bordered, dark stripe running diagonally through the eye to the rear of the jaw. The scales of this species are strongly keeled (i.e., there is

Figure 7. Eastern-diamondbacked Rattlesnake. Credits: Steve A. Johnson, U.S. Geological Survey

a ridge along the center of each scale), giving these snakes a rough appearance. The young are similar to adults in color pattern.

Timber Rattlesnake

The Timber Rattlesnake (a.k.a. Canebrake Rattlesnake) has a relatively small range in the state; it is only found in northern Florida as far south as Gainesville and in limited portions of the Panhandle (Figure 8).

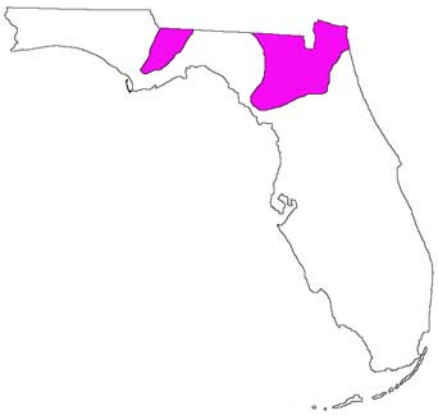

Figure 8. Florida distribution of the Timber Rattlesnake: Small part of the Panhandle and northern Florida

This species prefers moist pinelands, river bottomlands, and hammocks. Timber Rattlesnakes can grow to five feet or longer. These snakes have a pinkish-gray to tan body color with prominent, irregularly-shaped, dark marks and bands (Figure 9). A reddish-brown stripe runs along the middle of the back of Timber Rattlesnakes.

The tail of the species is dark brown or black and ends with a large rattle. Timber Rattlesnakes have large, thick heads and there may be a band running

Figure 9. Timber Rattlesnake. Credits: John Jensen, Georgia Department of Natural Resources

from each eye to the rear of the head. The scales of this species are strongly keeled, giving these snakes a rough appearance. The young are similar to adults in color pattern.

Pygmy Rattlesnake

Pygmy Rattlesnakes are the smallest of Florida's venomous snake species. Adults rarely exceed 20 inches in length. Pygmy Rattlesnakes range throughout the state and occur in many different habitats that include pine flatwoods, oak scrub, open pinelands, and palm hammocks (Figure 10).

Figure 10. Florida distribution of the Pygmy Rattlesnake: Entire state except for the Keys

This is one of the most commonly encountered venomous snakes that occasionally is found in residential neighborhoods. Pygmy Rattlesnakes have a dark band that runs from each eye to the rear of the jaw (Figure 11). Their bodies are covered with numerous dark blotches with a row of darker blotches running down the middle of the snake's back. Usually a series of reddish-brown marks can be seen between the blotches on the back.

Figure 11. Pygmy Rattlesnake. Credits: Steve A. Johnson, U.S. Geological Survey

The rattle on the tip of the tail of this species is so small that it cannot be heard even when shaken vigorously by the snake. Pygmy Rattlesnakes are bold and will often hold their ground if approached. They will bob their head and strike into the air if they feel threatened.

Coral Snake

Coral Snakes occur in many types of habitats throughout the state (Figure 12) but are seldom encountered because they are quite secretive and spend much of their lives underground.

Figure 12. Florida distribution of the Coral Snake: Entire state except for the Keys

They are rarely longer than 30 inches and are usually no bigger around than a quarter. Coral Snakes are identified by the alternating bands of black, yellow, and red that give this species its bold appearance (Figure 13).

Two non-venomous species (Figures 14 and 15) look very similar to Coral Snakes because they also have bands of red, black, and yellow (or orange or white). However, the arrangement of the bands differs between the non-venomous species (Scarlet Kingsnake and Scarlet Snake) and the Coral Snake. In the two non-venomous species the red bands touch only black bands, but in Coral Snakes the red bands only touch yellow bands. Remember the stoplight phrase "yellow, red, STOP!" If the red and yellow bands are next to each other, like the colors of a stoplight, it is a Coral Snake. Another feature of the Coral Snake is its blunt, black snout, which is followed by a band of yellow on the head. Neither the Scarlet Kingsnake nor the Scarlet Snake have black snouts.

Figure 13. Coral Snake (venomous). Credits: Steve A. Johnson, University of Florida

Figure 14. Scarlet Kingsnake (non-venomous). Credits: William J. Barichivich, U.S. Geological Survey

Figure 15. Scarlet Snake (non-venomous). Credits: Jennifer S. Staiger, U.S. Geological Survey

Additional Resources

Poison Control Hotline: 1-800-222-1222

Good Books on Florida Snakes

A Field Guide to Reptiles and Amphibians of Eastern and Central North America by Roger Conant and Joseph Collins, Houghton Mifflin Company, 3rd edition, 1998 (Peterson Field Guide Series).

Florida's Fabulous Reptiles and Amphibians by Pete Carmichael and Winston Williams, World Publications, 2004.

Snakes of North America, Revised Edition: Eastern and Central Regions by Alan Tennant, Lone Star Books, 2003.

Snake Information on the Internet

Florida Museum of Natural History's Online guide to Florida snakes: www.flmnh.ufl.edu/natsci/herpetology/FL-GUIDE/onlineguide.htm

Florida Fish and Wildlife Conservation Commission snake page: www.myfwc.com/critters/snakes.asp

Partners in Amphibians and Reptile Conservation (PARC): www.parcplace.org/index.html