

Water, Water, Everywhere?

**A Drought/Water Conservation Program for Homeowners,
Master Gardeners, and Extension Agents**

Helping Landscapes in Drought Section 3 Workbook



**Ed Drannbauer
Gary Knox
Carol Lehtola
Charles Brown**

Water, Water, Everywhere?

Drought/Water Conservation Training for Homeowners, Master Gardeners, and Extension Agents – Participant Workbook for Section Two

Prepared by: Ed Drannbauer, Graduate Student, Agricultural and Biological Engineering Department,
University of Florida, Gainesville, Florida

Gary Knox, Professor, North Florida Research and Education Center, University of Florida,
Quincy, Florida

Carol J. Lehtola, Associate Professor, Agricultural and Biological Engineering Department,
University of Florida, Gainesville

Charles M. Brown, Coordinator: Information/Publication Services, Agricultural and
Biological Engineering Department, University of Florida, Gainesville, Florida

Copyright 2005 by University of Florida Cooperative Extension Service

Published October 2005

Instructional materials for *Water, Water, Everywhere?*, including teacher's guide, participant workbooks, fact sheets, PowerPoint presentations, a video viewer guide, and public service announcements, are available for download from the IFAS Disaster Handbook Web site: <<http://disaster.ifas.ufl.edu>>.

Development of *Water, Water, Everywhere?* was supported by USDA Special Needs Grant 2001-41210-01188.

Contents

About the IFAS Disaster Information Program	4
Introduction: Why Should We Care about Drought?	5
How to Use This Workbook	6
Section 3 — Coping with Drought in the Landscape	
3.1 Helping Landscapes <i>Cope</i> with Drought	7
3.2 Helping Landscapes <i>Recover</i> from Drought	17
3.3 Additional Resources	30
Study Guide for <i>Water's Journey</i>	33
Test Your Knowledge (Answer Key on 36)	35

About the IFAS Disaster Information Program

The IFAS Disaster Information Program is an on-going project with the goal of producing a comprehensive information source for the general public, Extension agents, emergency preparedness and response professionals, and government. *Water, Water, Everywhere?* is the latest addition to this collection, which includes:

- **The Disaster Handbook** – The cornerstone of the IFAS Disaster Information Program is the Disaster Handbook, a two-volume set that contains over 350 publications. **Volume One** contains a wide variety of information that can help people and communities prepare for, survive, and recover from disasters. Special chapters are devoted to Home Recovery and Farm Recovery. **Volume Two** covers many specific disasters, such as hurricanes, tornadoes, extreme heat and cold, lightning, wildland fires, hazardous materials and more. Each chapter has appropriate information for the general public, homeowners, businesses, agricultural producers... in short, for all sorts of groups.

The Disaster Handbook materials are designed so that they can be duplicated locally and distributed. This allows local professionals and community leaders to quickly develop appropriate packets of information customized to immediate local needs. All Disaster Handbook publications are also available for download from the IFAS Disaster Information Web Site. Check the Web site also for updated and new materials.

- **Triumph Over Tragedy Video Series** – The IFAS Disaster Information Program has produced three videos that cover specific disaster topics. For each video, an extensive manual provides additional resources to help in creating your own workshops. **Surviving the Storm: Coordination, Communication, and Cooperation** is an introductory video which will be of interest to general audiences. This video shows the importance of citizens, government and private industry working together to confront disaster situations. **Helping Four-Legged Friends Survive the Storm** covers many important issues concerning small and large animals – and their owners – during a disaster. Much of the footage in this video is based on Florida experiences. **A Community Response to Managing Post-Disaster Stress** talks about the emotional and psychological challenges posed by disasters. This is an overlooked area and one that the general public and service providers should understand more fully.
- **Public Service Announcements** – The Disaster Handbook contains over 70 scripts for public service announcements (PSA) that can be used by local radio stations. Over 40 of these scripts have been recorded and are available for direct download by radio stations on the Internet from **RadioSource.net**. PSAs are available in English and Spanish. The radio spots are available from RadioSource.net in MP3 and WAV formats. Make broadcasters and emergency managers in your vicinity aware of this resource.
- **Agrochemicals and Security: A Training Module for the Safe and Secure Storage of Pesticides and Fertilizers** – The new security environment has prompted the farm community to re-examine how the chemicals that are part of its daily work are handled. Agricultural chemicals have been used in two of the most significant terrorist incidents in the U.S., the World Trade Center Bombing of 1993 and the Oklahoma City Bombing of 1995. Also, another fertilizer, anhydrous ammonia, has become the target of drug manufacturers for the production of methamphetamine, now a significant law enforcement issue throughout the U.S. **Agrochemicals and Security** includes six units that cover the following topics: Introduction: Agrochemicals and Security – Why It Matters; Chemicals and Safety; Homeland Security and Fertilizers; Homeland Security and Pesticides; Security and Anhydrous Ammonia; and, Developing a Hazard Mitigation Plan. Units can be used separately or in combinations depending on audience needs. Each unit consists of a narrative which gives background material, a PowerPoint presentation which parallels the narrative, pre- and post-tests, an evaluation, and table-top exercises for selected units.

On the Web: <<http://disaster.ifas.ufl.edu>>

Introduction

Why should we care about drought?

We expect that every time we turn a faucet's handle that plenty of fresh, drinkable water will flow out. Whenever we turn on the hose to clean the car, water the plants or wash the dog, we know that water will flow. Most people take for granted the ready availability of water for showers, toilets, and pools, but this is not always the case. Author John Steinbeck wrote in his novel *East of Eden*, "And it never failed that during the dry years the people forgot about the rich years, and during the wet years they lost all memory of the dry years. It was always that way."

Water management in the United States is very efficient, and most water users never really feel the impact of water shortages. Nevertheless, recent years have seen significant droughts in the United States. As populations continue to grow in the U.S. and throughout the world, demand for water is constantly increasing. During the past 50 years, groundwater depletion has spread from isolated pockets to large areas in many countries. One example is in the High Plains of the central U.S., where more than half of the groundwater storage has been depleted in some areas. In South Florida, water management officials have predicted they will run out of groundwater by 2020.

Added to the population increases and the increased demands for groundwater are the effects of drought. In recent years, many areas of the U.S. have suffered severe droughts — periods of years during which rainfall is much less than normal. During such periods, more water must be drawn from the ground to irrigate yards and farms, however, because rainfall is reduced, groundwater is not replenished. This vicious cycle makes the effects of drought more severe.

Drought comes with a high cost. For some, it may mean only minor inconveniences, such as modest water restrictions, but any enterprise that requires water can be severely impacted. Anyone who tends plants, whether on a small scale or large scale, soon feels the impact of drought. Businesses that depend on water must use more water to compensate for dry conditions and also pay more for the water they use. Hay production decreases during drought, and hay must be imported into the drought area to keep livestock alive. Drought is an insidious kind of disaster. You don't know you're in a drought until you are many months into it, and as it continues, it slowly takes a greater and greater toll.

The key is that we must not lose "all memory of the dry years." Even during times of normal precipitation and groundwater levels, citizens should be aware of how to use water wisely. Increased environmental awareness and improved irrigation practices like the ones outlined in this program can make a difference. With proper preparedness, the effects of drought can be minimized.

About *Water, Water, Everywhere?* Workbooks

Workbooks for *Water, Water, Everywhere?* contain information that homeowners and gardeners can use to prepare for, cope with, and respond to a drought. They can be used as part of a lesson plan or used alone for self-study. This program contains information from a wide range of experts in agriculture, horticulture, water management, Extension, climatology, and other areas that is organized and easy-to-follow.

There are three workbooks in the *Water, Water, Everywhere?* module:

- Workbook for Part One contains an introduction to drought and covers ways to conserve water inside and outside the home.
- Workbook for Part Two covers ways you can prepare for drought. This includes selecting drought-tolerant plants, and designing a water-efficient landscape.
- Workbook for Part Three deals with ways to cope with drought. This includes proper plant care and ways to take care of your lawn to minimize the effects of drought. You can use the workbooks in any order you like, but to gain a better understanding of drought, we recommend that you start with Workbook for Part One.

We hope you find the information in this workbook useful. If you have any questions, you can contact your local Extension agent, or find us on the Web at <<http://disaster.ifas.ufl.edu/>>.

Workbook 3 — Coping with and Recovering from Drought*

- 3.1 Helping Landscapes **Cope** with Drought
- 3.2 Helping Landscapes **Recover** from Drought
- 3.3 References

Section 3.1 — Helping Landscapes *Cope* with Drought

Though Florida receives a great deal of rain on average, there are many times when rain showers are few and far between, ranging from days to weeks. As recently as the late 1990s, Florida suffered from a period of years of lower than average rainfall.

In the previous section, we examined how to create an appealing landscape that is also drought-tolerant and which requires less water.

In this section, we will look at how to cope with a drought, and once it has passed, how best to recover from it.

Objectives for Section 3.1

After completing this section, you will be able to:

1. Describe considerations involved when coping with drought.
2. Describe irrigation practices to change during a drought.
3. List practices to cease during a drought.
4. Identify pest problems to look out for during a drought.
5. Describe specific practices for turf, bedding plants, shrubs, and trees during drought periods.
6. Identify drastic measures to implement, should they become necessary.

* Adapted from “Coping with Drought in the Landscape (IFAS Publication ENH 70) by Gary Knox, Professor, Environmental Horticulture Department, University of Florida. Florida Cooperative Extension Service, Gainesville, Florida. 2002.

Section 3 – Part 1

Slides 42-44

Section 3 Coping and Recovering from Drought

Part 1 Helping Landscapes Cope with Drought

Water, Water, Everywhere? - Coping and Recovering from Drought 42

Part 1 – Helping Landscapes Cope with Drought

- Introduction
- Considerations
- Irrigation Priorities/Practices
- Cultural Practices
- Pest Management
- Specific Practices for Turf
- Specific Practices for Bedding Plants, Shrubs and Trees
- Drastic Measures!

Water, Water, Everywhere? - Coping and Recovering from Drought 43

When Will We Run Out Of Water?

Water, Water, Everywhere? - Coping and Recovering from Drought 44

As population increases, demand for water resources also increase. Concern is increasing steadily, as reported in this magazine. But what level of concern will motivate people to start actively conserving water?

Section 3 – Part 1

Slides 45–47

Quest for Water:
Florida battles the drought of 2001




<http://drought.tbo.com/>

Water, Water, Everywhere? – Coping and Recovering from Drought

Drought can happen anywhere, even in a water-rich state such as Florida.

Drought Impacts in the U.S
February 8 – March 8, 2001


<http://enso.unl.edu/ndmc/impacts/us/usimpact.htm#florida>



Water, Water, Everywhere? – Coping and Recovering from Drought

Drought is usually occurring in at least one region of North America at any given time. (For the latest version of this map, refer to the Web site listed in the slide.)

Seasonal U. S. Drought Outlook
Through July 2001
Released April 15, 2001



Likely to Persist

Likely to Persist

Improvement by End of Period; Hydrologic Impacts Likely to Linger

http://www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.html

Water, Water, Everywhere? – Coping and Recovering from Drought

This map from NOAA shows a seasonal outlook for drought, and can show how affects can linger. For more detailed maps (e.g. state or county level maps) consult your state or local water management office.

Section 3 – Part 1

Slides 48–50

Considerations

- Irrigation Priorities/Practices
- Cultural Practices
- Pest Management
- Specific Practices for Turf
- Specific Practices for Bedding Plants, Shrubs and Trees
- DRASTIC MEASURES!

Water, Water, Everywhere? – Coping and Recovering from Drought 48

No two areas are alike, and different plants can have different problems. These are some considerations you should think about.

Irrigation Priorities

- Irrigate highly visible and intensively managed areas first




Water, Water, Everywhere? – Coping and Recovering from Drought 49

Irrigation Priorities

- Drought sensitive plants should have high priority, but turf should have lower priority since turf is less costly to replace




Water, Water, Everywhere? – Coping and Recovering from Drought 50


Drought sensitive plants should have high priority, but turf should have lower priority. Although turf is drought sensitive, it is cheaper to replace turf than to replace trees and shrubs. Sometimes it's better not to water at all.

Section 3 – Part 1

Slides 51–53

Irrigation Practices

- Water when irrigation restrictions allow, or early in the morning
- Irrigate deeply at long intervals (to thoroughly moisten the root zone) rather than frequent, shallow waterings

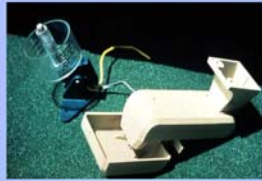


Water, Water, Everywhere? – Coping and Recovering from Drought 51

Deep watering improves drought resistance by promoting deeper, more extensive root systems. Depth of watering should be 6 to 12 inches for turf and bedding plants, and 12 inches for perennials, shrubs, and trees. One inch of irrigation wets a sandy soil to a depth of about 12 inches.

Irrigation Practices

- Install a rain shut-off device on permanent irrigation systems, or check to make sure the existing device works properly and is not blocked by vegetation or structures



Water, Water, Everywhere? – Coping and Recovering from Drought 52

The law in Florida and other states require a device like this one.

Irrigation Practices

- Examine the irrigation system to check for clogging and repair leaks



Water, Water, Everywhere? – Coping and Recovering from Drought 53

It is important to check for leaks regularly. A leak of 60 drips per minute will waste about 9 gallons of water a day, 260 gallons a month, and 3154 gallons a year!

Section 3 – Part 1

Slides 54–56

Cultural Practices

- Avoid practices that stimulate growth
 - Don't fertilize
 - Avoid routine pruning




Water, Water, Everywhere? – Coping and Recovering from Drought 54

Don't fertilize or, if you do, do so with a low nitrogen fertilizer. Fertilization stimulates growth and increases water needs.

Pest Management

- Keep weeds under control (weeds compete for water!)
- Watch for insect and disease problems (spider mites, borers, powdery mildew, vascular wilts)




Water, Water, Everywhere? – Coping and Recovering from Drought 55

Avoid unnecessary applications of pesticides that require “watering in.”

Specific Practices for Turf

- Irrigate turf only after signs of wilting
- Stop irrigating Bahiagrass and allow it to go dormant



Water, Water, Everywhere? – Coping and Recovering from Drought 56

Irrigate turf only after about 30% of your lawn starts to wilt. Signs of wilting include footprints that remain in the grass long after being made, a bluish-grey appearance to the lawn, and a large proportion of leaf blades that are folded in half length-wise.

Section 3 – Part 1

Slides 57–59

Specific Practices for Turf

- Raise the cutting height of turf
- Mow less frequently
- Keep the mower blade *sharp!*



Water, Water, Everywhere? – Coping and Recovering from Drought 57

A sharp mower blade produces a cleaner cut that heals more quickly and loses less water than a cut made by a dull blade.

Specific Practices for Bedding Plants, Shrubs and Trees

- Add mulch to beds so that the final depth is 2 to 3 inches after settling



Water, Water, Everywhere? – Coping and Recovering from Drought 58

Adding mulch to beds reduces evaporation from soil and moderates soil temperature, reducing stress on roots

Specific Practices for Bedding Plants, Shrubs and Trees

- Enlarge beds to reduce tree/shrub root competition from grass



Water, Water, Everywhere? – Coping and Recovering from Drought 59

Section 3 – Part 1

Slides 60–62

Specific Practices for Bedding Plants, Shrubs and Trees

- Avoid using overhead sprinklers for shrub and flower beds
(about 65% of overhead irrigation can be wasted by evaporation and wind dispersal)



Water, Water, Everywhere? – Coping and Recovering from Drought 60

Hand water, flood irrigate, or use trickle irrigation instead.

Specific Practices for Bedding Plants, Shrubs and Trees

- Consider installing a micro-irrigation system
(these are often exempt from irrigation restrictions)



Water, Water, Everywhere? – Coping and Recovering from Drought 61

Micro-irrigation is the most water efficient.

Specific Practices for Bedding Plants, Shrubs and Trees

- Irrigate trees and shrubs **ONLY** after they start to wilt
- Watch “Indicator Plants” for signs of wilting:
 - Azalea
 - Gardenia
 - Hydrangea
 - Dogwood
 - Hibiscus
 - Impatiens
 - Japanese maple
 - Trumpet tree (*Datura*)

Water, Water, Everywhere? – Coping and Recovering from Drought 62

Many trees and shrubs can survive drought without irrigation, providing they are well-established and were irrigated prior to the drought.

Section 3 – Part 1

Slides 63–65

DRASTIC MEASURES!

- Only irrigate plants upon severe wilting
- Remove weak or less desirable plants



Water, Water, Everywhere? - Coping and Recovering from Drought 63

Drooping leaves and a change in leaf color are signs of wilting. Also move container plants to shaded areas so their water needs will be reduced.

DRASTIC MEASURES!

- Thin dense beds of plants (i.e., remove every other plant)
- Prune woody plants severely to reduce leaf area



Water, Water, Everywhere? - Coping and Recovering from Drought 64

The following recommendations should be followed when drought is so severe and water use is so restricted that landscape plant survival is in question.

DRASTIC MEASURES!

- Apply chemical wetting agents to areas of the landscape where the soil has become hydrophobic (water runs off rather than is absorbed by soil)


Water, Water, Everywhere? - Coping and Recovering from Drought 65

Section 3 – Part 1

Slides 66–68

Summary


- Irrigate highly visible areas and drought-sensitive plants first
- Water when legal but irrigate deeply
- Use a rain shut-off device and check/repair the irrigation system
- Avoid practices that stimulate growth
- Keep weeds under control and watch for pests



Water, Water, Everywhere? – Coping and Recovering from Drought 66

Summary


- Irrigate turf, shrubs and trees only after wilting (watch indicator plants)
- Raise the mowing height
- Mow less frequently with a sharp blade
- Stop irrigating bahiagrass
- Enlarge beds and add mulch
- Avoid using overhead sprinklers
- Install a micro-irrigation system



Water, Water, Everywhere? – Coping and Recovering from Drought 67

DRASTIC MEASURES! – Summary

- Only irrigate plants upon severe wilting
- Remove weak plants
- Thin dense beds of plants
- Prune severely to reduce leaf area
- Apply chemical wetting agents



Water, Water, Everywhere? – Coping and Recovering from Drought 68

Section 3.2 — Helping Landscapes Recover with Drought

Let's assume that, using the principles in this workbook, you've created a drought-tolerant landscape. In spite of these efforts, a recent drought has impacted your landscape, and now that the rain has started again, you need to know what to do to recover from the drought.

In this section, we'll cover many issues about recovery. The procedure outlined here has two phases: Assessment and Action. First, we'll work through how to assess your landscape. What should you be looking for? What plants did well? What plants suffered?

Then, we'll look at the actions you can take to repair damage your landscape suffered during the drought and what changes you can make to improve your landscape's drought-tolerance.

Objectives for Section 3.2

After completing this section, you will be able to:


1. Identify what to look for when assessing your landscape.
2. Describe what to look for which you might not otherwise expect.
3. Describe what considerations to make after a drought.
4. Describe how to properly replace plants.
5. Know how to care for plants after a drought.
6. Identify what signs of plant stress to look for.

Section 3 – Part 2

Slides 69–71

Section 3 **Coping and Recovering from Drought**

Part 2
Helping Landscapes Recover from Drought



Water, Water, Everywhere? – Coping and Recovering from Drought 69

Part 2 – Helping Landscapes Recover from Drought

- **Assess the Landscape**
 - What to look for
 - Where to look for damage
 - The right plant in the right place
 - Surprises!
- **What to Do**
 - Changing your landscape
 - Plant care after a drought
 - Long-term effects of drought
 - Review your maintenance practices





Water, Water, Everywhere? – Coping and Recovering from Drought 70

This presentation explains how to assess a landscape for drought damage and offers advice for short-term care and long-term maintenance and prevention to minimize the harmful effects of drought on the landscape.

What to Look for: General

- Plants and turf
- Irrigation system
- Note the locations and characteristics of problem areas





Water, Water, Everywhere? – Coping and Recovering from Drought 71

Section 3 – Part 2

Slides 72–74

What to Look for: Specific



- Dead patches of grass
- Wilted or off-color foliage
- Poor or uneven growth
- Dead branches or plants
- Sudden death of an entire tree or shrub

Water, Water, Everywhere? - Coping and Recovering from Drought 72

These signs could give you a clue on how to improve your irrigation plan or landscape design.

Where to Look for Damage



- Marginal species
- Plants improperly sited
- Areas where plants were particularly stressed

Water, Water, Everywhere? - Coping and Recovering from Drought 73

The prior environment of a plant can also influence the development of drought stress.

The Right Plant in the Right Place

- Pay close attention to “marginal” plants for your area of the state



Water, Water, Everywhere? - Coping and Recovering from Drought 74


Marginal plants are those which may not be best suited for your location.

Section 3 – Part 2

Slides 75–77

The Right Plant in the Right Place
Marginal Plants for North Florida


- Plants too far south
 - Some Cherries (*Prunus* species)
- Plants too far north
 - Bottlebrush
 - Queen palm
 - Bougainvillea
 - Tropicals




 Water, Water, Everywhere? – Coping and Recovering from Drought 75

The Right Plant in the Right Place
Marginal Plants for Central Florida

- Plants too far south
 - Dogwood
 - Saucer magnolia
 - Redbud
 - Fringe tree
- Plants too far north
 - Tibouchina
 - Tropicals



 Water, Water, Everywhere? – Coping and Recovering from Drought 76

The Right Plant in the Right Place
Marginal Plants for South Florida

- Plants too far south
 - Camellias
 - Azaleas
 - Temperate deciduous fruits (apples, pears, and most peaches, blueberries, raspberries, and blackberries)



 Water, Water, Everywhere? – Coping and Recovering from Drought 77

Section 3 – Part 2

Slides 78–80

The Right Plant in the Right Place
Plants in the Wrong Places

Pay close attention to plants that were improperly sited in the landscape

- Too dry
 - Azaleas
- Too wet
 - Pittosporum
- Too sunny
 - Dogwood
 - Azaleas
- Too shady
 - Turf
- Improper soil pH – Azaleas, blueberries, bahiagrass, and centipedegrass on alkaline soil



Water, Water, Everywhere? - Coping and Recovering from Drought 78

The Right Plant in the Right Place
Plants in Stressful Sites

- Pay close attention to plants located in “stressful” sites
 - Turf and plantings close to sidewalks, roads, etc.





Water, Water, Everywhere? - Coping and Recovering from Drought 79

The Right Plant in the Right Place
Plants in Stressful Sites

Plantings where roots were confined or restricted

- Raised beds
- Sidewalk cutouts
- Dense plantings
- Compacted soil
- Parking lot islands

Water, Water, Everywhere? - Coping and Recovering from Drought 80

Compacted soils result when man and machinery break down the natural soil structure. This can be so extensive that water may remain on the soil surface for several days after irrigating or rainfall.

Section 3 – Part 2

Slides 81–83

The Right Plant in the Right Place
Plants that Suffered Stress


- Pay close attention to plants that were particularly stressed
 - Drought-sensitive plants
 - Plants with shallow roots



Water, Water, Everywhere? – Coping and Recovering from Drought 81

The Right Plant in the Right Place
Plants that Suffered Stress


- Recently-planted trees, shrubs and sod
- Plants that were overwatered prior to drought and water restrictions



Water, Water, Everywhere? – Coping and Recovering from Drought 82

The Right Plant in the Right Place
Plants that Suffered Stress

Irrigation zones with poor uniformity



Water, Water, Everywhere? – Coping and Recovering from Drought 83

Section 3 – Part 2

Slides 84–86

Surprises!

- Some “drought tolerant” plants suddenly die or show injury after rain resumes (often in July/Aug)
 - These plants usually have root damage/disease that was not evident during the drought
 - High temperatures and “full” growth flushes increase transpirational water loss, and damaged root systems can’t keep up

Water, Water, Everywhere? - Coping and Recovering from Drought 84

Aside from the moisture content of the soil, environmental conditions of high light intensity, high temperature, low relative humidity and high wind speed will significantly increase plant water loss.

What to Do

- *Change your landscape*
- *Care for drought-affected plants*
- *Know long-term effects of drought*
- *Review your maintenance practices*

Water, Water, Everywhere? - Coping and Recovering from Drought 85

Reducing the overall water requirements of the landscape is best achieved by initially designing the landscapes for water conservation, including efficient irrigation systems, proper watering and the use of drought tolerant plants where appropriate.

Decisions, Decisions!

- Change the landscape design?
- Change the irrigation system?
- Replace plants/turf?
- Cut back plants?
- Maintain landscape as usual?


Water, Water, Everywhere? - Coping and Recovering from Drought 86

Section 3 – Part 2

Slides 87–89

Changing the Landscape Design

- Consider changing the landscape design to incorporate more water-efficient features



Water, Water, Everywhere? – Coping and Recovering from Drought 87

Refer to the resources section for information on landscape design.

Changing the Irrigation System

- To correct problems
- To incorporate more water-efficient features



Water, Water, Everywhere? – Coping and Recovering from Drought 88

Plant Replacement

Turf — Replace the entire lawn if more than 40% of the turfgrass is dead or severely damaged

Landscape Beds — Consider replacing:

- Dead plants
- Significantly damaged plants
- Living, but “aesthetically-challenged,” plants

Water, Water, Everywhere? – Coping and Recovering from Drought 89


Section 3 – Part 2

Slides 90–92

Plant Replacement

Replacement may not be necessary in:

- Beds that were “overplanted” at installation
 - ☒ Removal of dead plants provides space needed for the canopies and roots of remaining plants
- Damaged turf areas where turf is no longer appropriate due to shade or other factors that prevent proper growth



Water, Water, Everywhere? - Coping and Recovering from Drought 90

Plant Replacement

If replacing plants...


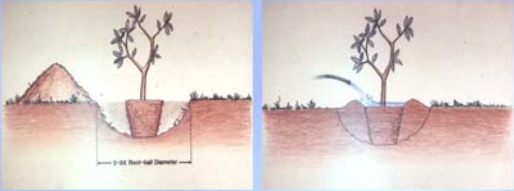
- Follow the “Right Plant/Right Place” rule
- Consider plants with greater drought tolerance
- Don’t replace disease-killed plants with other susceptible plants



Water, Water, Everywhere? - Coping and Recovering from Drought 91

Plant Replacement

If replacing plants, install them properly!



Water, Water, Everywhere? - Coping and Recovering from Drought 92

Section 3 – Part 2

Slides 93–95

Plant Care after a Drought

Pruning

- Remove dead branches from trees and shrubs
- Prune as needed for safety, plant health and aesthetics

— POSITION OF CUT
— BOUNDARY BETWEEN TRUNK TISSUE AND BRANCH TISSUE

BRANCH STUB
BRANCH COLLAR

RIGHT **WRONG**

Water, Water, Everywhere? – Coping and Recovering from Drought 93

Plant Care after a Drought

Fertilization Considerations

- Most established trees and shrubs don't need fertilizer
- Use iron instead of nitrogen fertilizer to green up a lawn
- If you fertilize, remember nitrogen fertilizers will stimulate growth; avoid fertilizing until plants have fully recovered and root systems have regenerated

Water, Water, Everywhere? – Coping and Recovering from Drought 94

Plant Care after a Drought

Fertilization Considerations

- Fertilizer can be applied to plants needing to replace a significant portion of their canopy or to new plants that need a growth "boost" to catch up in size to older plants
- Micronutrients may be applied to palms, tropical fruits and other plants showing these nutrient deficiencies

Water, Water, Everywhere? – Coping and Recovering from Drought 95

Section 3 – Part 2

Slides 96–98

Long-Term Effects of Drought
Signs of Residual Plant Stress


- Water sprouts and uneven growth




 Water, Water, Everywhere? - Coping and Recovering from Drought 96

Long-Term Effects of Drought
Signs of Residual Plant Stress


- Water sprouts/uneven growth
- Pests that move in on stressed plants
 - Borers! →
 - Azalea leafminer
 - Botryosphaeria and Hypoxylon cankers
 - Armillaria and some other root rots




 Water, Water, Everywhere? - Coping and Recovering from Drought 97

Long-Term Effects of Drought
Signs of Residual Plant Stress

- Water sprouts and uneven growth
- Pests that move in on stressed plants
- Nutrient deficiencies




 Water, Water, Everywhere? - Coping and Recovering from Drought 98

Section 3 – Part 2

Slides 99–101

Long-Term Effects of Drought
Signs of Residual Plant Stress

- Water sprouts and uneven growth
- Pests that move in on stressed plants
- Nutrient deficiencies
- “Early” fall color
- Heavy flowering and/or fruiting



Water, Water, Everywhere? – Coping and Recovering from Drought 99

Long-Term Effects of Drought
Signs of Residual Plant Stress

- Water sprouts and uneven growth
- Pests that move in on stressed plants
- Nutrient deficiencies
- “Early” fall color
- Heavy flowering and/or fruiting

What do do if plants exhibit these symptoms


- Play “detective” to determine the cause and decide on a course of action (if the condition can be remedied)

Water, Water, Everywhere? – Coping and Recovering from Drought 100

Review Maintenance Practices

- Review and revise maintenance practices according to UF guidelines for plant health and water efficiency






Water, Water, Everywhere? – Coping and Recovering from Drought 101

Section 3 – Part 2

Slides 102–104

Review Maintenance Practices

- Review and revise maintenance practices according to UF guidelines for plant health and water efficiency
 - Mulch
 - Irrigate and fertilize “as needed”
 - Use slow-release fertilizers
 - Practice IPM
 - Mow high
 - Recycle yard waste

 Water, Water, Everywhere? - Coping and Recovering from Drought 102


Helping Landscapes Recover from Drought

- Assess the Landscape
 - Know what to look for
 - Know where to look
 - The right plant in the right place
 - Surprises!
- What to Do
 - Changing your landscape
 - Plant care after a drought
 - Long-term effects of drought
 - Review your maintenance practices


 Water, Water, Everywhere? - Coping and Recovering from Drought 103

Water, Water, Everywhere?
A Drought/Water Conservation Program

Ed Drannbauer
Gary Knox
Carol Lehtola
Charles Brown



Water, Water, Everywhere? was produced in part with support from the United States Department of Agriculture (Award 2002-41210-01440).

 Water, Water, Everywhere? - Coping and Recovering from Drought 104

Section 3.3 – Additional Resources

Print materials for “Water, Water, Everywhere?” can be downloaded from the Disaster Handbook Web site: <<http://disaster.ifas.ufl.edu>>.

Copies of the video “Water’s Journey: The Hidden Rivers of Florida” can be ordered on the Web at: <<http://www.karstproductions.com>>.

Additional Materials

Florida AgSafe – The Florida Agricultural Safety Program

Web site: <http://www.flagsafe.ufl.edu>

National Agricultural Safety Database

Web site: <http://www.cdc.gov/nasd>

EDIS: The Florida Cooperative Extension’s Electronic Data Information Source

Web site: <http://edis.ifas.ufl.edu>

Water Resources of the United States

Web site: <http://water.usgs.gov>

USGS Publications: Circulars

<http://pubs.usgs.gov/products/books/circular.html>

USGS Earthshots: Satellite Images of Environmental Change

Web site: <http://edcwww.cr.usgs.gov/earthshots/slow/tableofcontents>

Global International Waters Assessment

Web site: <http://www.giwa.net>

Worldwatch Institute

Web site: <http://www.worldwatch.org/topics/water.html>

World Resources Institute

Web site: <http://www.wri.org>

The World’s Water

Web site: <http://www.worldwater.org>

Surf Your Watershed

Web site: <http://www.epa.gov/surf>

National Drought Mitigation Center

Web site: <http://www.drought.unl.edu/index.htm>

Videos

“Water’s Journey, The Hidden Rivers of Florida”

Wes Skiles, Karst Productions: Gainesville, 2004

Order on the Web at: <<http://www.karstproductions.com>>.

Greenworks TV - Online videos concerning water conservation and drought

Website: <http://www.greenworks.tv/waterquality/droughtinfo.htm>

University of Nebraska-Lincoln – Drought Management Strategies

Website: <http://www.panhandle.unl.edu/videos.htm>

Recommended Reading

Cadillac Desert

Marc Reisner

Penguin Books, New York, 1986

ISBN: 0140104321

The River Dragon Has Come!

John G. Thibodeau and Phillip Williams, editors

M. E. Sharpe, Armonk, New York, 1997

ISBN: 0765602067

Study Guide for *Water's Journey: The Hidden Rivers of Florida*

To understand drought, it is also important to understand where we get our water and how it moves through the environment. *Water's Journey: The Hidden Rivers of Florida* explains in an interesting way about our groundwater resources. This video also shows why it's important to conserve our water resources.

Review these questions before you view *Water's Journey* to focus your attention on key points. After the video, answer these questions to reinforce what you have learned.

1. Water above and below the ground is _____.
2. Currently, how does the demand for water compare to the supply? _____
3. What percent of the world's available freshwater supply comes from groundwater? _____
4. Water is constantly being reused. However, it's not always available in the _____ and _____ that we need it in.
5. What is the one way that pollution from the surface can make its way down to the groundwater?
6. What is the largest use of freshwater in Florida, and how has this affected the availability of water?
7. What are BMPs?
8. If water is clear, that means it is not polluted. True or False?
9. What makes up an aquifer?
10. What are some ways "to use a little less water" that were mentioned in the film?
11. What are some ways to save water in your lawn?
12. When is the best time to water?
13. What are some examples of drought-tolerant landscaping?

Study Guide for Water's Journey: The Hidden Rivers of Florida — Answer Key

1. Water above and below the ground is **interconnected**.
2. Currently, how does the demand for water compare to the supply? **Demand exceeds supply**
3. What percentage of the world's available freshwater supply comes from groundwater? **90%**
4. Water is constantly being reused. However, it's not always available in the **quality** and **quantity** that we need it in.
5. What is the one way that pollution from the surface can make its way down to the groundwater? **Runoff from roads and other sources of pollution that eventually make their way into the aquifer.**
6. What is the largest use of freshwater in Florida, and how has this affected the availability of water? **Agriculture is the largest use of fresh water. The use of pesticides and fertilizers has affected water quality and reduced the availability of groundwater.**
7. What are BMPs? **Best Management Practices. These are new practices used by agriculture to reduce the amounts of fertilizers and pesticides they use, and to conserve water.**
8. If water is clear, that means it is not polluted. True or False? **False! Some important pollutants, such as nitrates and mercury, can not be seen by the naked eye.**
9. What makes up an aquifer? **An aquifer is basically an underground formation (could be limestone, sand, or gravel) with porous spaces that hold water.**
10. What are some ways "to use a little less water" that were mentioned in the film? **Some are: shorter showers, more efficient toilets and showerheads, and making sure your home is leak-free.**
11. What are some ways to save water in your lawn? **Some are: using a rain sensor on your irrigation system, checking to make sure your sprinklers are aimed properly, or not even watering your lawn at all.**
12. When is the best time to water? **Evenings or early morning are the best times to water, when chances for evaporation are at their lowest.**
13. What are some examples of drought-tolerant landscaping? **Drought-tolerant landscaping includes cutting weeds and allowing native plants, which would have grown there anyway, to take their place.**

Test Your Knowledge

1. Which areas should be given a priority during drought conditions?
2. How deeply should plants and turf be watered during drought?
3. What device is required by Florida law on irrigation systems?
4. How often should fertilizer be applied during drought?
5. How should turf be cut during a drought?
6. How should shrubs and flower beds be watered, especially during a drought?
7. What are some things you can do in severe droughts to increase the chances of survival of your landscape?
8. What signs in your landscape can help you improve your irrigation plan or improve your landscape design?
9. At what point is it advisable to replace your lawn after a severe drought?
10. What are some long-term effects of drought on plants?

Test Your Knowledge -- Answer Key

1. Which areas should be given a priority during drought conditions? — Highly visible and intensively managed areas should be given priority, as well as the most drought-sensitive plants.
2. How deeply should plants and turf be watered during drought? — Deep watering improves drought resistance by promoting deeper, more extensive root systems. Depth of watering should be six to twelve inches for turf and bedding plants, and twelve inches for perennials, shrubs, and trees.
3. What device is required by Florida law on irrigation systems? — A rain shut-off device.
4. How often should fertilizer be applied during drought? — Fertilization stimulates growth and increases water needs, so it is best not to use fertilizer at all.
5. How should turf be cut during a drought? — Turf should be mowed less frequently, with a higher cutting height and a sharp blade.
6. How should shrubs and flower beds be watered, especially during a drought? — These areas should be hand-watered, flood-irrigated, or trickle-irrigated.
7. What are some things you can do in severe droughts to increase the chances of survival of your landscape? — Thin your dense plant beds by removing every other plant. Prune woody plants severely to reduce leaf area.
8. What signs in your landscape can help you improve your irrigation plan or improve your landscape design? — Signs include dead patches of grass, wilted or off-color foliage, poor or uneven growth, dead branches or plants, and sudden death of an entire tree or shrub.
9. At what point is it advisable to replace your lawn after a severe drought? — Replace the entire lawn if 40% of the turfgrass is dead or severely damaged.
10. What are some long-term effects of drought on plants? — Effects include water sprouts and uneven growth, pests that invade stressed plants, nutrient deficiencies, early fall color, heavy flowering and/or fruiting.