Drought-Tolerant Plants for North and Central Florida

Gary Knox

UF UNIVERSITY of FLORIDA
IFAS Extension

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

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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>.

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Right: Shirley Denton

What is "Drought" and "Drought Stress?"

In nature, water is usually the most limiting factor for plant growth. This is also the case in home or commercial landscapes. If plants do not receive adequate rainfall or irrigation, the resulting drought stress can reduce growth more than all other environmental stresses combined.

Drought can be defined as the absence of rainfall or irrigation for a period of time sufficient to deplete soil moisture and injure plants.

Drought stress results when water loss from the plant exceeds the ability of the plant's roots to absorb water and when the plant's water content is reduced enough to interfere with normal plant processes.

In Florida, plants may frequently encounter drought stress. Rainfall is very seasonal, and periodic drought occurs regularly. Because Florida's soils are typically sandy and have low water-holding capacity, many plants may experience drought stress after only a few days without water. During drought, local governments may place restrictions on landscape irrigation in order to conserve potable water, and landscape plants may become subject to drought stress. Using drought-tolerant plants in the landscape can reduce the likelihood of plant injury due to drought stress.

How Does Drought Stress Affect Plants?

A plant responds to a lack of water by halting growth and reducing photosynthesis and other plant processes in order to reduce water use. As water loss progresses, leaves of some species may appear to change color — usually to blue-green. Foliage begins to wilt, and if the plant is not irrigated, leaves will fall off and the plant will eventually die.

Drought symptoms resemble salt stress because high concentrations of salts in the root zone cause water loss from roots. Close examination of environmental and cultural conditions should help identify the specific problem.

How Long Before Drought Stress Develops?

The time required for drought injury to occur depends on the water-holding capacity of the soil, environmental conditions, stage of plant growth, and plant species. Plants growing in sandy soils with low water-holding capacity are more susceptible to drought stress than plants growing in clay soils. A limited root system will accelerate the rate at which drought

stress develops. A root system may be limited by the presence of competing root systems, by site conditions such as compacted soils or high water tables, or by container size (if growing in a container). A plant with a large mass of leaves in relation to the root system is prone to drought stress because the leaves may lose water faster than the roots can supply it. Newly installed plants and poorly established plants may be especially susceptible to drought stress because of the limited root system or the large mass of stems and leaves in comparison to roots.

How Does Environment Affect Drought Stress?

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.

The prior environment of a plant also can influence the development of drought stress. A plant that has been drought stressed previously and has recovered may become more drought-resistant. Also, a plant that was well-watered prior to drought will usually survive drought better than a continuously drought-stressed plant.

What Changes Can Be Made to Reduce Effects of Drought in the Landscape?

The landscape environment can be modified to reduce or prevent drought stress by irrigation, mulching, providing shade, and creating windbreaks. 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. For more information, check these resources:

- Florida Yards and Neighborhoods Web site: <http://hort.ufl.edu/fyn/>
- *Landscape Design for Water Conservation*, Florida Extension Fact Sheet ENH-72
- *Coping with Drought in the Landscape*, Florida Extension Fact Sheet ENH-70
- *Managing Your Florida Lawn Under Drought Conditions*, Florida Extension Fact Sheet ENH-157
- *Improving Drought Tolerance in Your Florida Lawn*, Florida Extension Fact Sheet ENH-57
- *Watering Your Florida Lawn*, Florida Extension Fact Sheet ENH-9

Note: Fact sheets are available through the Florida Extension Service Publications Web site: <http://edis.ifas.ufl.edu>.

What are the Characteristics of Drought-Tolerant Plants?

Some species have an inherent tolerance of drought because they have evolved in arid areas, regions with frequent drought, or regions with soils of low water-holding capacity. Some species have anatomical or physiological characteristics that allow them to withstand drought or to acclimate to drought.

All plants have a waxy coating on their leaves called "cuticle," but some species have developed exceptionally thick cuticles that reduce the amount of water lost by evaporation from the leaf surface. Leaf hairs, which reduce air movement at the leaf surface, are another means of reducing evaporation from the leaf. Since the amount of surface area exposed to the atmosphere affects evaporation, leaf size and thickness are other adaptations, with thicker leaves and smaller leaves being more resistant to water loss.

Some species have evolved large surface root systems to quickly absorb rainfall, while other species grow deep root systems to tap deep water tables. Some plants avoid drought by dropping their leaves during droughts, and quickly regrowing new leaves when environmental conditions improve.

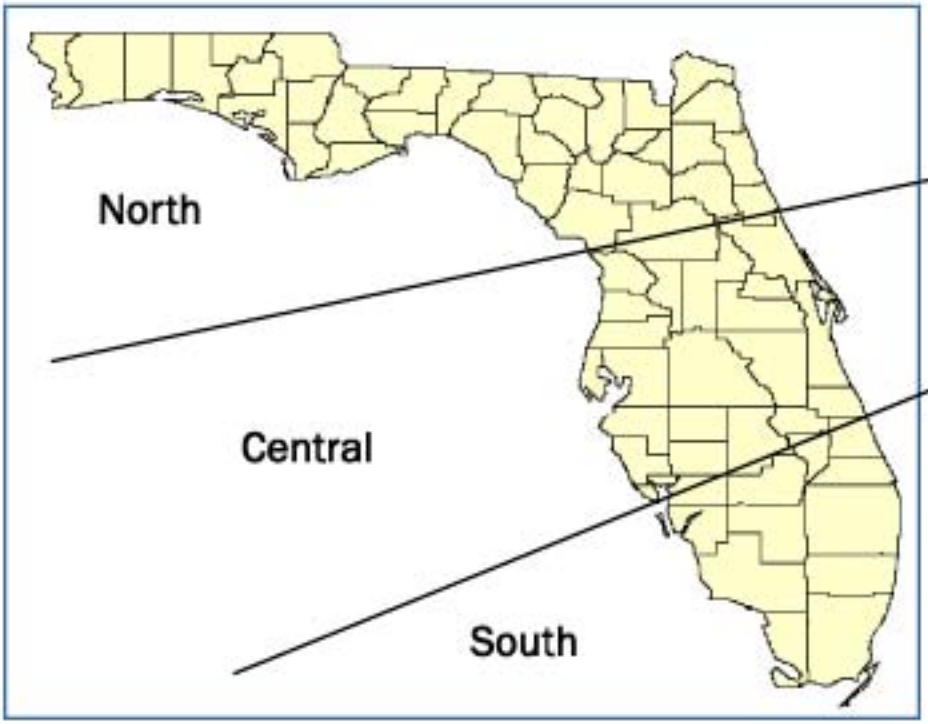
Lists of Drought-Tolerant Plants

The plants listed in the following tables have been reported to tolerate drought stress better than most landscape plants. Although these plants are considered drought-tolerant, new plantings will require regular irrigation for 6 weeks to 6 months or more before they become established well enough to be effectively drought-tolerant. Trees larger than two inches caliper (two inches in diameter) will take longer to establish.

Plants are listed in one of five categories:

- Trees
- Palms
- Shrubs
- Groundcovers
- Vines

Within each list, plants are listed in alphabetical order according to scientific name. Common names are also given. Plants native to Florida are indicated, and the region of adaptation within north and central Florida is given for each plant. North Florida (N) extends from Pensacola to Jacksonville and south to Ocala; central Florida (C) consists of the area from Ocala south to Punta Gorda and Fort Pierce.



Trees

Common Name	Scientific Name	Native?	Region of Adaptation
Box elder	*Acer negundo*	Yes	N
Bauhinia, Orchid tree	*Bauhinia blakeana, B. purpurea, B. monandra*	—	C
Bottlebrush	*Calistemon* spp.	—	C
Pignut hickory	*Carya glabra*	Yes	N, C
Catalpa	*Catalpa* spp.	Some	N
Cedar	*Cedrus* spp.	—	N, C
Hackberry, Sugarberry	*Celtis* spp.	Some	N, C
Redbud	*Cercis canadensis*	Yes	N, C
Citrus	*Citrus* spp.	—	N, C
Smoke tree	*Cotinus* spp.	Some	N
Hawthorn	*Crataegus* spp.	Some	N, C
Cypress	*Cupressus* spp.	—	N
Coral tree, Cockspur coral tree	*Erythrina crista-galli*	Yes	C
Eucalyptus, Gum tree	*Eucalyptus* spp.	Some	C
Evodia	*Evodia* spp.	—	N, C
Fig	*Ficus carica*	—	N, C
Honeylocust	*Gleditsia triacanthos*	Yes	N
Silk oak	*Grevillea robusta*	—	C
American holly	*Ilex opaca*	Yes	N, C
Yaupon, Yaupon holly	*Ilex vomitoria*	Yes	N, C
Jacaranda	*Jacaranda mimosifolia*	—	C
Southern red cedar	*Juniperus silicicola*	Yes	N, C

Trees

Common Name	Scientific Name	Native?	Region of Adaptation
Juniper	*Juniperus* spp.	Some	N, C
Crape myrtle	*Lagerstroemia indica, L. fauriei, L. (indica x fauriei)*	—	N, C
Laurel	*Laurus nobilis*	—	C
Macadamia nut	*Macadamia integrifolia*	—	C
Osage orange	*Maclura pomifera*	—	N
Southern magnolia	*Magnolia grandiflora*	Yes	N, C
Mulberry	*Morus* spp.	Some	N,C
Wax myrtle	*Myrica cerifera*	Yes	N,C
Jerusalem thorn	*Parkinsonia aculeata*	—	N, C
Bay	*Persea* spp.	Some	N, C
Sand pine	*Pinus clausa*	Yes	N, C
Slash pine	*Pinus elliottii*	Yes	N, C
Japanese black pine	*Pinus thunbergiana*	—	N
Pistachio	*Pistacia* spp.	—	N, C
Oriental arborvitae	*Platycladus orientalis*	—	N, C
Podocarpus, Yew podocarpus	*Podocarpus macrophyllus*	—	N, C
Nagi podocarpus	*Podocarpus nagi*	—	C
White poplar	*Populus alba*	—	N
Chickasaw plum	*Prunus angustifolia*	Yes	N, C
Cherry laurel	*Prunus caroliniana*	Yes	N, C
Cherry plum	*Prunus cerasifera*	—	N
Hoptree	*Ptelea trifoliata*	Yes	N, C
Chapman oak	*Quercus chapmanii*	Yes	C

Trees

Common Name	Scientific Name	Native?	Region of Adaptation
Holly oak	*Quercus ilex*	—	N, C
Bluejack oak	*Quercus incana*	Yes	N, C
Turkey oak	*Quercus laevis*	Yes	N, C
Laurel oak	*Quercus laurifolia*	Yes	N, C
Bur oak	*Quercus macrocarpa*	Yes	N, C
Myrtle oak	*Quercus myrtifolia*	Yes	C
Water oak	*Quercus nigra*	Yes	N, C
Pin oak	*Quercus palustris*	—	N,C
Chestnut oak	*Quercus prinus*	Yes	N,C
Shumard oak	*Quercus shumardii*	Yes	N, C
Post oak	*Quercus stellata*	Yes	N, C
Cork oak	*Quercus suber*	—	N, C
Black oak	*Quercus velutina*	Yes	N, C
Live oak	*Quercus virginiana*	Yes	N
Sumac	*Rhus* spp.	Some	N, C
Locust	*Robinia* spp.	Some	N
Soapberry	*Sapindus* spp.	Some	N, C
Japanese pagoda tree, Necklace pod	*Sophora* spp.	Some	N, C
Tamarisk	*Tamarix* spp.	—	N, C
Pond cypress	*Taxodium ascendens*	Yes	N, C
Baldcypress	*Taxodium distichum*	Yes	N, C
Elm	*Ulmus* spp.	Some	N, C
Zelkova	*Zelkova serrata*	—	N, C
Jujube	*Ziziphus* spp.	—	N, C

Palms

Common Name	Scientific Name	Native?	Region of Adaptation
Paurotis palm	*Acoelorrhaphe wrightii*	Yes	C
Queen palm	*Arecastrum romanzoffianum*	—	C
Pindo palm	*Butia capitata*	—	N, C
European fan palm	*Chamaerops humilis*	—	N, C
Sago palm	*Cycas revoluta*	—	N, C
Canary Island date palm	*Phoenix canariensis*	—	N, C
Pygmy date palm	*Phoenix roebelenii*	—	C
Needle palm	*Rhapidophyllum hystrix*	Yes	N, C
Lady palm	*Rhapis excelsa*	—	N, C
Dwarf palmetto	*Sabal minor*	Yes	N, C
Cabbage palm	*Sabal palmetto*	Yes	N, C
Saw palmetto	*Serenoa repens*	Yes	N, C
Windmill palm	*Trachycarpus fortunei*	—	N
California fan palm, Desert fan palm	*Washingtonia filifera*	—	N, C

Shrubs

Common Name	Scientific Name	Native?	Region of Adaptation
Glossy abelia	*Abelia x grandiflora*	—	N
Sweet acacia	*Acacia farnesiana*	—	N, C
Century plant	*Agave americana*	—	N, C
Aloe	*Aloe*	—	C
Lead plant	*Amorpha canescens*	Yes	N, C
Chokeberry	*Aronia* spp.	Some	N, C
Sage, Sagebrush	*Artemisia* spp.	—	N, C
Eastern baccharis, Groundsel bush, Salt bush	*Baccharis halimifolia*	Yes	N,C
Mentor barberry	*Berberis x mentorensis*	—	N
Japanese barberry	*Berberis thunbergii*	—	N
Silver sea oxeye	*Borrichia arborescens*	Yes	C
Butterfly bush	*Buddleia* spp.	—	N
Cactus	Cactaceae family	Some	N, C
Beauty berry	*Calicarpa americana*	Yes	N, C
Bottlebrush	*Callistemon* spp.	—	N, C
Dwarf natal palm	*Carissa grandiflora* 'Prostata'	—	C
Senna, Cassia	*Cassia alata (Senna alata)*	—	N, C
Rosemary	*Ceratiola ericoides*	Yes	N, C
Hedge cactus	*Cereus peruvianus*	—	N, C
Quince	*Chaenomeles* spp.	—	N
Sweet fern	*Comptonia peregrina*	Yes	N
Pampas grass	*Cortaderia selloana*	—	N, C
Cotoneaster	*Cotoneaster* spp.	—	N
Southern bush honeysuckle	*Diervilla sessifolia*	Yes	N, C
Coral bean, Cherokee bean	*Erythrina herbacea*	Yes	N, C

Shrubs

Common Name	Scientific Name	Native?	Region of Adaptation
Pascuita, Crown of thorns, Pencil tree	*Euphorbia* spp.	—	C
Pineapple guava	*Feijoa sellowiana*	—	N, C
Fig	*Ficus carica*	—	N, C
Kumquat	*Fortunella japonica*	—	C
African daisy	*Gamolepis chrysanthemoides*	—	C
Broom, Woadwaxen	*Genista* spp.	—	N,C
Sea buckthorn	*Hippophae rhamnoides*	—	N,C
St. John's-wort	*Hypericum* spp.	Some	N, C
Gallberry	*Ilex glabra*	Yes	N, C
Yaupon, Yaupon holly	*Ilex vomitoria*	Yes	N, C
Juniper	*Juniperus* spp.	Some	N, C
English lavender	*Lavandula angustifolia*	—	N
Bush clover	*Lespedeza* spp.	Some	N, C
Texas sage	*Leucophyllum frutescens*	—	N, C
Matrimony vine, Christmas berry	*Lycium* spp.	Some	N, C
Rusty lyonia	*Lyonia ferruginia*	Yes	N, C
Wax myrtle	*Myrica cerifera*	Yes	N, C
Myrsine	*Myrsine guianensis*	Yes	C
Myrtle	*Myrtus communis*	—	N, C
Oleander	*Nerium oleander*	—	N, C
Indian fig, Prickly pear	*Opuntia ficus-indica*	Yes	N, C
Devils-backbone	*Pedilanthus tithymaloides*	Yes	C
Photinia, Redtop		—	N, C

Shurbs

Common Name	Scientific Name	Native?	Region of Adaptation
Pittosporum	*Pittosporum* spp.	—	N, C
Oriental arborvitae	*Platycladus orientalis*	—	N, C
Cape leadwort, Plumbago	*Plumbago auriculata*	—	C
Podocarpus, Yew podocarpus	*Podocarpus macrophyllus*	—	N, C
Nagi podocarpus	*Podocarpus nagi*	—	N, C
Cherry laurel	*Prunus caroliniana*	Yes	N,C
Pomegranate	*Punica granatum*	—	N,C
Firethorn	*Pyracantha* spp.	—	N, C
Indian hawthorn	*Raphilepis* spp.	—	N, C
Buckthorn, Indian cherry	*Rhamnus* spp.	Some	N, C
Sumac	*Rhus* spp.	Some	N
Rose	*Rosa* spp.	—	N, C
Rosemary	*Rosemarinus officinalis*	—	N, C
Butchersbroom	*Ruscus aculeatus*	—	N, C
Inkberry	*Scaevola plumieri*	Yes	C
Boxthorn	*Severina buxifolia*	—	N, C
Buffalo-berry	*Shepherdia* spp.	—	N, C
Japanese pagoda tree, Necklace pod	*Sophora* spp.	Some	N, C
Spiraea	*Spiraea* spp.	—	N
Bay cedar	*Suriana maritima*	Yes	C
Yellowbells, Yellow elder	*Tecoma stans*	Yes	C
Blueberry, Sparkleberry	*Vaccinium* spp.	Some	N, C
Viburnum	*Viburnum* spp.	Some	N, C
Chaste tree	*Vitex agnus-castus*	—	N, C
Yucca	*Yucca* spp.	Some	N, C
Coontie	*Zamia floridana*	Yes	N, C

Groundcovers

Common Name	Scientific Name	Native?	Region of Adaptation
Aloe	*Aloe* spp.	—	C
Bromeliads	Bromeliaceae family	Some	C
Beach bean	*Canavalia maritima*	Yes	C
Hottentot fig	*Carpobrotus edulis*	—	C
Bearberry cotoneaster	*Cotoneaster dammeri*	—	N
Golden creeper	*Ernodea littoralis*	Yes	C
Purpleleaf wintercreeper	*Euonymus fortunei* 'Coloratus'	—	N
Creeping fig	*Ficus pumila*	—	N, C
Trailing fig	*Ficus sagittata*	—	C
Sunrose	*Helianthemum nummularium*	—	N, C
Beach sunflower	*Helianthus debilis*	Yes	N, C
Daylily	*Hemerocallis* spp.	—	N, C
St. John's-wort	*Hypericum* spp.	Some	N, C
Morning glory	*Ipomoea* spp.	Some	N, C
Juniper	*Juniperus* spp.	Some	N, C
Gopher apple	*Licania michauxii*	Yes	C
Matchweed	*Lippia nodiflora*	Yes	N, C
Liriope	*Liriope* spp.	—	N, C
Cinquefoil	*Potentilla* spp.	—	N, C
Rosemary	*Rosemarinus officinalis*	—	N,C
Sea purslane	*Sesuvium portulacastrum*	Yes	N, C

Groundcovers

Common Name	Scientific Name	Native?	Region of Adaptation
Purple heart	*Setcreasea pallida*	—	N, C
Cape honeysuckle	*Tecoma capensis*	—	C
Rice-paper plant	*Tetrapanax papyriferus*	—	N, C
Asiatic jasmine	*Trachelospermum asiaticum*	—	N, C
Puncture vine	*Tribulus terrestris*	—	N, C
Society garlic	*Tulbaghia violacea*	—	N, C
Sea oats	*Uniola paniculata*	Yes	N, C
Zoysiagrass	*Zysoia* spp.	—	N, C

Vines

Common Name	Scientific Name	Native?	Region of Adaptation
Crossvine	*Anisostichus capreolata*	Yes	N, C
Bouganvillea	*Bouganvillea* spp.	—	C
Trumpet creeper	*Campsis* spp.	Some	N, C
Marine ivy	*Cissus incisa*	Yes	N, C
Drummond clematis	*Clematis drummondii*	—	N, C
Texas clematis	*Cematis texensis*	—	N, C
Purpleleaf wintercreeper	*Euonymus fortunei* 'Coloratus'	—	N
Creeping fig	*Ficus pumila*	—	N, C
Carolina yellow jasmine	*Gelsemium sempervirens*	Yes	N, C
Morning glory	*Ipomoea* spp.	Some	N, C
Honeysuckle	*Lonicera sempervirens*	Yes	N, C
'Dropmore Scarlet' honeysuckle	*Lonicera (hirsuta x sempervirens 'Dropmore Scarlet'*	—	N, C
'Golden Flame' honeysuckle	*Lonicera x heckrotti 'Gold Flame'*	—	N, C
Matrimony vine, Christmas berry	*Lycium* spp.	Some	N, C
Virginia creeper	*Parthenocissus quinquefolia*	Yes	N, C
Flame vine	*Pyrostegia venusta*	—	C
Cape honeysuckle	*Tecoma capensis*	—	C
Confederate jasmine	*Trachelospermum jasminoides*	—	N, C
Grape	*Vitis* spp.	Some	N, C
Japanese wisteria	*Wisteria floribunda*	—	N
Native wisteria	*Wisteria frutescens*	Yes	N,C

Afterword

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 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 avaiable 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>