extension
ALABAMA A&M & AUBURN UNIVERSITIES

Drought-Tolerant Landscapes for Alabama

► Learn key issues in planning and implementing a water-efficient landscape and know recommended drought-tolerant landscape plants.

A well-designed and managed landscape can reduce the amount of water needed for home landscape irrigation. This conservation of water becomes increasingly important as municipal governments impose broad watering bans in response to drought situations that create water shortages and strain water supplies. Overhead landscape irrigation is usually the target of these water conservation policies because it is viewed as noncritical consumption.

Thoughtfully planned, attractive landscapes are important because they provide environmental benefits and add value and beauty to homes. The environmental benefits include reducing soil erosion and stormwater runoff, providing wildlife habitats, removing carbon dioxide and pollutants from the atmosphere while adding oxygen, and keeping homes cooler in the summer and protecting them from cold winds in the winter.

Homeowners can ensure a sustainable landscape by planning for water conservation, choosing appropriate plants, improving the soil, establishing plants properly, mulching, fertilizing correctly, and watering efficiently.

Planning for Efficient Use of Water

It is important to plan a design for the landscape. The types of plants used and their location, the condition of the soil, and other factors all affect how much water must be used to maintain the landscape.

Hydrozoning is locating plants according to a landscape's differing levels of shading, soil evaporation rates, and exposure to ambient weather conditions.

Early in the design process, divide the landscape into low, moderate, and high water-use areas, or hydrozones. Walk around the landscape and identify places where the soil stays moist longer; separate them from the areas fully exposed to the sun where the soil tends to dry quickly.

Some plants perform well with only occasional irrigation.

Low water-use hydrozones should comprise as much of the landscape as possible when water conservation is desired. Generally, low water-use hydrozones are located away from the most traveled areas of the landscape, but this is not a requirement. Moderate water-use hydrozones should include established plants that only require irrigation every 2 to 3 weeks in the absence of rainfall or when they show visible signs of stress, such as wilted foliage and off-green color. High water-use hydrozones should be limited and strategically located for high impact and easy access, such as areas around patios, decks, pools, or entryways.

As a starting point, zone 10 percent or less of the total landscape for high water use, 30 percent or less for moderate water use, and 60 percent or more for low water use.

Plants vary tremendously in drought tolerance. Many native plants, once established, require little

supplemental water or maintenance, but don't assume that all native plants are drought tolerant or suitable for home landscapes.

When available, incorporate native wooded areas into the landscape and blend these areas with the planted portions of the landscape. Remove weedy or undesirable understory plants to create more open areas. It may be necessary to remove some canopy trees to reduce competition and improve the health of remaining trees. Strategically place large canopy trees to keep the landscape cooler and reduce water loss while providing a comfortable living environment.

In planted areas, it may be tempting to position young plants close together to be more visually appealing. As plants approach maturity, however, drastic pruning likely will be needed, which increases water use and plant stress. Learn the expected mature size of the plants to be included and provide them with sufficient space.

Windbreaks help keep plants and soil from drying. Use trees, informal hedges, shrubs, or tall ornamental grasses as natural windbreaks.

Decide which plants should be watered first, second, and third, considering plant value, replacement costs, time to grow a comparable plant, and which ones are significant to you. One essential feature of a water-efficient landscape is the gardener's judgment on when irrigation is needed as opposed to relying on an automated timer.

Soil Improvement

Preparing the soil thoroughly helps to ensure good root growth. A plant with deep, extensive roots can withstand periods of drought better than plants with shallow roots. Research has shown that digging a wide planting hole or tilling the soil deeply improves the structure of the soil and results in rapid plant establishment and better root growth.

Organic matter dramatically improves most of the different kinds of soils in Alabama. If the soil is fine clay, choose coarse-textured organic matter, such as aged pine bark, to increase aeration in the soil. This product is available at garden centers in bags, usually labeled as soil conditioner. If the soil is sandy, add fine-textured organic matter for water-holding capacity. Compost, humus, and topsoil are fine-textured products. Peat moss is another alternative that has a high water-holding capacity. It degrades slowly in the soil, but it is expensive. Peat moss is available in bags or compressed bales; compressed bales usually are the best deal. Composted animal manure is also available in bags. Animal manure decomposes rapidly in soil, but it provides plants with nutrients and is inexpensive.

Water-absorbing hydrophilic polymers are designed to be mixed with soil and act as artificial reservoirs that release water to plants as the soil dries. These polymers come in plastic containers and look like small, white crystals. Their soil uptake can be impeded by the addition of high rates of limestone or fertilizer, and the correct application rate and longevity of the polymer in the soil is debated. Considering this in addition to the high cost of polymers currently makes recommending these materials difficult.

The best time of year to prepare previously undisturbed soil is in the fall. This allows time during the winter for incorporated organic matter to decompose and for slowly available amendments, such as limestone, to release. To begin, have a soil test performed and add the recommended slowly available amendments. Do not add recommended water-soluble granular fertilizer until spring.

Soils, particularly clay, should be dry enough to till, but not too dry. To determine if the soil is dry enough, pick up a handful and squeeze. If the ball of soil falls apart when poked, the soil is dry enough. If it stays in a ball, the soil is too wet for tilling.

When planting in a large area, such as a bed or border, improve all the soil at one time. To begin, mark off the area to be tilled. Scoop up the existing vegetation to remove it. Apply a broad-spectrum post-emergent herbicide 7 to 10 days before tilling to make the process easier and to kill aggressive perennial weeds. Apply 4 to 6 inches of organic matter, broadcast soil amendments evenly over the area, and incorporate them uniformly to a 12-inch depth.

Start at one end of the planting area with the tiller and go across the soil, one row at a time, while removing rocks and other debris. If the tiller cannot penetrate deeply into the soil, use a shovel to turn over the soil. The goal is to turn over the soil to a shovel-length depth, not to break up the clumps; the tiller will do that. Next, till the soil in the direction perpendicular to the first direction and go across the soil as before. When the tilling is done, rake the soil smooth and apply a generous layer of mulch.

Planting

If you're not planting in a large area all at once, but simply adding plants to an existing border or in turf, plant trees and shrubs in individual holes. Dig the hole two to three times wider than the root ball or container and about as deep as the height of the root ball. Roughen the sides and bottom of the hole with a pick or shovel so that roots can penetrate the soil. Water the plant well; it can be difficult to rewet a dry root ball once it is in the ground.

To remove the plant from the container, lay the plant on its side with the container end near the hole. Hit the bottom and sides of the container until the root ball loosens. If roots are growing in a circular pattern around the root ball, loosen them by hand or slice through the roots with a knife. This may appear harmful to the plant, but it encourages new growth while allowing water to move more freely into the root ball.

For root balls wrapped in burlap, remove the string or wire holding the burlap to the root crown. On large trees, it may not be practical to remove all the burlap, but pull away the top one-third. Remove plastic wrapping completely from root balls. Place the root ball in the hole with the top of the root ball (where the roots end and the trunk begins) 1/2 to 1 inch above the surrounding soil. Lay a board across the planting hole to check the depth of the plant.

Plant bare-root plants in early spring after the coldest weather is over but before new growth starts. Whether purchased from a local nursery or by mail order, it is best to establish the plant in the landscape as soon as possible. To start, remove the packing material and soak the roots in tap water for 4 to 6 hours. Make a mound of soil in the middle of the hole and spread the plant's roots out evenly over the mound. Do not set the plant too deeply.

Use the soil removed from the hole to backfill around the root ball. No amendments to the backfill are recommended when planting trees and shrubs in individual holes. When backfill soil is enriched with amendments, the roots of plants tend not to grow beyond the isolated environment of the planting hole into the native soils. This leads to weak and unstable roots. When filling in with soil around the roots, lightly tamp the soil to collapse air pockets or add water to help settle the soil.

Remember, the goal is to provide plants with a moist, well-drained, and well-aerated soil environment so that they develop an extensive root system capable of withstanding periods of drought.

Mulch

Lessons in sustainable landscape practices often can be taken from what occurs in nature. Many forests in Alabama have the same dominant feature: an abundance of accumulated forest-floor litter that conserves soil moisture and recycles nutrients back to the plants.

Applying a 3-to-5–inch layer of an organic mulch to all non-turf planted areas in the landscape helps the soil retain water and reduce losses from evaporation by up to 70 percent when compared to bare soil.

In addition to water retention, mulches have benefits that create an improved soil environment for root growth that improves a plant's drought tolerance. These benefits include impeding germination of aggressive weed seeds that compete with ornamental plants for water, keeping the soil cooler in summer and warmer in winter, preventing soil erosion and compaction, improving soil structure and fertility, encouraging microorganism and earthworm proliferation, and giving an attractive, neat appearance to the landscape. Mulches do absorb water from overhead irrigation, so when you water make sure the water penetrates through the mulch and reaches the soil.

Materials Used for Mulching

Probably the most widely used mulch for home landscaping in Alabama is pine straw and pine bark. These materials are available at garden centers and mass market stores in convenient-to-handle units. Obtaining large quantities may necessitate paying a delivery charge or hiring a trucking company.

An advantage of pine straw is that it looks good in the landscape, but it decomposes fairly quickly and may need reapplication annually. One bale of pine straw generally covers 50 square feet when applied to a 5-inch depth; however, pine straw bales are not always a consistent size in the marketplace. Fine-textured mulches, such as pine straw, retain more moisture than coarse mulches. On sloping sites, pine straw stays in place better than most other mulches and helps to control erosion.

Pine bark should be purchased in a coarse-mulch grade. Fine-grade pine bark does not suppress weeds very well and can float away during heavy rain. Pine bark looks good in the landscape and does not decompose as rapidly as pine straw, but it costs more. One cubic yard (fourteen 2-cubic-foot bags) of bark mulch covers 100 square feet to a 3-inch depth.

Shredded hardwood products are also good mulches because they mat together and are less likely than chips to float away. Occasionally, wood chips are available as a by-product of lumber operations.

Grain straw is the stem of grain crops, typically wheat, gathered and bailed after the grain is harvested; it has many of the same properties as pine straw. Be careful about purchasing bales of hay to use as mulch. Hay often contains grass and weed seed that could create a weed problem in the landscape.

Landscape fabrics can be used under mulch to conserve moisture, discourage weeds, and enhance erosion control. Be aware that all organic mulches decompose, shrink in volume, and need replenishing regularly.

Obtaining sufficient quantities of mulch can actually be an exercise in recycling if you are willing to do a little networking and have access to a pickup truck for hauling. Instead of raking up autumn leaves and disposing of them, use the leaves to mulch non-turf planted beds and around trees in the turf. If leaves are still left over, consider starting a composting program.

Find organic leftovers from the agricultural community to use as mulch. These leftovers, such as peanut hulls, pecan hulls, or even animal bedding, are usually available at no or low cost.

Application of Mulch

Apply at least 3 inches of non-settling material, such as pine bark, or 6 inches of material that settles after a rain, such as pine or grain straw. In the case of a bed or border where all the soil is prepared at one time, cover the entire surface with mulch, except within 8 to 10 inches of the trunk of trees or shrubs. In the case of trees or shrubs located in turf, mulch under the entire canopy of the tree, extending well beyond the drip line, if possible, but do not pile mulch against the trunk or mulch within a few inches of the trunk. This space will allow for air circulation around the base of the plant and help to avoid disease or insect problems.

Efficient Watering

Numerous public awareness surveys have found that homeowners are unaware of the water needs of landscape plants and often overwater them. In addition, overhead sprinkler irrigation systems installed in home landscapes frequently have automated controllers that require little involvement on the part of the homeowner and encourage a set-it-and-forget-it approach. This wastes water, costs money, and may lead to surface water or groundwater contamination by fertilizers or pesticides.

The goal of water-efficient landscapes is to deliver an adequate amount of water to the root zone of plants just before they experience water stress. When irrigation is used, water should be applied efficiently and effectively to make every drop count.

At one extreme, gardeners apply too little water frequently, causing shallow root growth leading to more rapid plant stress under drought or hot conditions. At the other extreme, gardeners deliver water too rapidly or run irrigation for too long, resulting in water runoff and, depending on the soil type, waterlogged soil conditions.

Be careful when hand watering because water is often delivered too quickly for the soil to absorb, resulting in wasted water as excess runoff and shallow penetration into the soil. Hand watering is an efficient way to water when using a hose-end water breaker or a spray nozzle to deliver water slowly.

Efficient irrigation should deliver water no faster than the rate the soil can absorb it. Soil types and textures play an important role in how much water soil can hold and how quickly soil can be irrigated. For example, 1 inch of water applied to the surface of sandy soil may penetrate 10 inches deep but only penetrate 6 inches deep in a silt loam soil or 4 inches deep in clay loam soil.

Irrigating the entire root zone of plants growing in heavy soil takes longer than for plants growing in lighter soil. Sandy loams may absorb 0.5 to 3 inches of water per hour while clay loams may absorb only 0.1 to 0.5 inch of water in the same amount of time.

Table 1 shows the time required for irrigation water to infiltrate up to 6 inches deep in sandy loam and clay loam soils. Moderately moist clay loam soil requires twice as long to water as sandy loam soil, but when clay loam is severely dry it may require three to four times as long.

Table 1. Time Required for Irrigation Water to Infiltrate Up to 6 Inches Deep in Sandy Loam or Clay Loam Soil		
Inches (soil depth)	**Sandy Loam (hours)**	**Clay Loam (hours)**
1	2	4
2	4	8
3	6	10
4	8	12
5	10	14
6	12	16

The important point is, before you water, dig down and determine if the soil is dry and to what extent. Don't gauge water needs on soil surface appearance. Periodically check the progress of irrigation to determine when sufficient water has been applied.

Water Requirements for Plant Establishment

Container Transplant Requirements

No matter how drought tolerant a plant is reported to be, it will not be unless a sufficient root system develops. For this to occur, plants transplanted from containers require a period of establishment in which water is applied to both the container mix and the surrounding soil.

Roots grow in soil only where there is moisture. Unless both media are moist, the roots may never grow out of the original container mix. Container mixes also dry much faster than the surrounding soil. Both media must be adequately moistened to prevent newly installed plants from being injured or dying of drought. Be careful not to overwater, however; do not water if both soils are moist.

Many gardeners want to water by a timetable that fits their schedule rather than the needs of the plants. By checking soil moisture frequently, you can become in tune with the rate of soil drying and more accurately predict when a plant needs water.

Individual Planting Requirements

For plants installed in individual planting holes, construct a berm 4 to 6 inches high around the perimeter of the planting hole to help funnel water to the roots. Fill the berm with water several times to completely saturate the soil and establish good contact at the interface between the container mix and soil. Mulching newly established plants helps to prevent moisture loss. Check the moisture in both soil types at least once a week during the establishment period to see if water is required. When the soil is dry, watering slowly and deeply encourages a more extensive root system than frequent shallow watering.

Fall Planting Requirements

Fall-planted trees, shrubs, vines, ground covers, and herbaceous perennials demonstrate a greater ability to survive moderately low moisture levels the following growing season compared to those transplanted in the spring or summer. Cool fall temperatures are less stressful to plants than the heat of late spring and summer because the foliage loses less water.

Plants established during fall require less frequent irrigation and are less likely to suffer heat-related stress than those planted in spring and summer. As winter approaches, aboveground portions of the plant stop growing and go dormant soon after planting. This results in less demand on the roots for water. Roots, on the other hand, do not go dormant and continue to grow all winter long. When spring arrives, a healthy, well-developed root system is in place to help the plant adapt better to summer stress.

Establishment Requirements for New Plantings of Shrubs and Trees

Trees and shrubs generally require 9 to 10 weeks of establishment care when planted in late fall or early winter, but those planted in the spring or summer need establishment care for the entire first growing season. There are exceptions, however. For example, camellias, mountain laurel, and many native azaleas are drought tolerant once established, but because their roots grow slowly, they need 2 years of establishment care to achieve drought tolerance. For this reason, they are not listed in the tables.

For those willing to make the extra effort to establish certain plants, options include *Camellia japonica* (Japanese camellia), *Camellia sasanqua* (Sasanqua camellia), *Kalmia latifolia* (mountain laurel), *Rhododendron alabamanse* (Alabama azalea), *Rhododendron austrinum* (Florida flame azalea), *Rhododendron canescens* (Piedmont azalea), *Rhododendron flammeum* (Oconee azalea), *Rhododendron periclymenoides* (Pinxterbloom azalea), *Rhododendron prunifolium* (plumleaf azalea), and *Rhododendron vaseyi* (pinkshell azalea). After the establishment period, gradually reduce watering frequency during dry spells to acclimate plants to drought conditions.

Established Tree and Shrub Irrigation Considerations

Established trees and large shrubs generally have deeper, more extensive roots than other landscape plants and can extract soil moisture even when the soil surface appears dry. The majority of tree and shrub feeder roots (those that take up water and nutrients from the soil) are in the top 10 to 12 inches of soil and extend as much as one and a half to two times the canopy diameter. To be most effective, apply water in this area and to this depth. Trees partly or completely enclosed by large areas of surface concrete or asphalt have more limited access to soil moisture and should be watched closely for signs of water stress.

Very large, old trees are often more prone to loss due to drought because of age and accumulated stresses, but the impact of a drought may not be evident until the next growing season. Be more watchful for the watering needs of older trees.

Trees and large shrubs isolated in turf should be watered inside and just outside the drip line. They may require water only during periods of limited rainfall or when they show signs of stress. A temporary system, such as a soaker hose, may be all that is required for these plants. Individual lengths of soaker hose can be purchased with brass fittings that easily attach to any hose or hose bib. In foundations or borders, however, it is more convenient to water the entire area; therefore, an irrigation system is more efficient.

Bedding Plants, Herbaceous Perennials, and Ground Cover Requirements

Bedding plants, herbaceous perennials, and ground covers are usually small when planted and have small root systems to start with. These plants need 3 to 4 weeks of establishment watering and may have to be watered more often than trees and shrubs to ensure an adequate water supply.

Check the soil with a trowel or spade to the depth of the expected root zone. Moisten the entire root zone just before plants show signs of water stress. If plants are allowed to wilt severely a few times, growth can be stunted and flower production reduced. Be careful not to overwater because most bedding plants and herbaceous perennials do not well tolerate constantly wet soils. Porous wall hose or drip irrigation systems can provide adequate water more efficiently than sprinkler systems.

Drip Irrigation Systems

Using irrigation water efficiently requires proper selection of irrigation methods for the plants and for each hydro-zone of the landscape. Drought-tolerant plants should get no more water than they need to look good, and water should be prevented from splashing onto concrete walkways or other areas where it is not needed.

Drip irrigation systems allow slow water penetration into the root zone with minimal evaporation or surface wetting. Compared to sprinkler irrigation, these systems may use 30 to 50 percent less water.

Drip systems may be simple porous wall hoses that can be moved around the landscape or left in place hidden under mulch for small applications. More extensive systems can be installed using perforated flat tubing or emitters for larger areas. A variety of kits and parts to construct a system are readily available, or a system can be installed by a landscape irrigation company.

Drip irrigation applies water from flexible 3/8-to-3/4-inch–diameter polyethylene distribution pipes to emitters at the ends of microtubes (1/8 to 1/4 inch), flat perforated tubing, or round, porous wall hoses (soaker hose).

Several types of drip irrigation systems can be adapted to suit a variety of applications, from watering individual trees and shrubs to beds of annuals, herbaceous perennials, ground covers, or mixed borders. Because so many different types of drip irrigation components are available, choosing the best system for a particular application requires some planning. The best advice is to keep the system as simple as possible and try to wet only those areas where water can be taken up by the roots of desired plants.

Micro-Sprinkler Emitter Advantages

When planning drip irrigation for watering trees and large shrubs, consider using micro-sprinkler emitters that wet the soil over a larger area and provide more even watering. Simple drip emitters restrict the soil wetting pattern and are primarily suitable for small trees and shrubs in borders.

It is generally best to design a system with a few more emitters than you think necessary to allow insertion wherever water is needed. The appropriate number of emitters per plant and flow rate per emitter depends on the size and type of plant. Generally, the larger the plant, the more water and thus emitters it requires.

Drip Irrigation Installation

Drip irrigation systems are usually installed on top of the ground and concealed beneath mulch. This makes the system easy to install and protects the plastic components from ultraviolet light degradation when exposed to sunlight.

The distribution pipes also can be buried 4 to 6 inches beneath the soil surface with the microtubes protruding above the surface. Extend the microtubes at least 6 inches aboveground to allow easy inspection and to prevent dirt from back-siphoning into the emitters and clogging the system.

As a starting point, an emitter system may need to be run about three times per week for 4 hours each time during very dry weather to meet the water needs of the plants. Keep in mind that some species require more water than others. Consider this when planning emitter installation.

For watering annuals, perennials, and ground covers, it is usually necessary to irrigate a solid area. This can be accomplished by spacing emitters 12 to 18 inches apart to achieve a uniform wetting pattern or using perforated tubing or porous wall pipe at the same spacing.

In sandy soils, the lines need to be closer together than in fine-textured clay soils. In bedding plant beds, the drip lines can be laid aside for soil preparation and replaced afterward. Cover perforated tubing or porous pipe under mulch to prevent ultraviolet light degradation from exposure to sunlight.

Micro-Sprinklers Versus Emitters

An alternative method of watering uses small sprinkler heads called micro-sprinklers instead of emitters.

All other components are identical to drip irrigation, including the polyethylene distribution pipes.

Micro-sprinklers cover an area 3 to 12 feet wide and are used for trees and shrubs or beds requiring complete coverage. Do not combine micro-sprinklers with drip emitters in the same irrigation zone. Micro-sprinklers are not as efficient as drip emitters because some water evaporation occurs, but they do provide an economical method of achieving uniform watering.

Fertilization

One goal in a water-efficient landscape is to manage vegetative growth so that plants make reasonable progress toward maturity but grow very little at maturity.

At maturity, plants should be fertilized only enough to maintain plant health. The main concern is to avoid overfertilizing because it encourages rapid, soft growth that is more susceptible to drought. Most established, healthy trees and shrubs only need fertilizer once every 2 to 3 years, while most established herbaceous perennials perform well when fertilized every other year. The exceptions are annual flowers and many roses that require annual fertilization to grow and flower well.

Fertilizers with a high nitrogen percentage (first number in a fertilizer analysis) relative to phosphorus and potassium percentages (second and third numbers in a fertilizer analysis) tend to stimulate excessive vegetative growth. When shoot growth increases, root growth decreases, so the roots are less efficient at extracting moisture from the soil.

Look for a fertilizer with a nitrogen percentage equal to or slightly less than the phosphorus and potassium percentages and then apply it at a low rate. The rate information should be printed on the fertilizer container. Just choose the low end of the prescribed rate range. If the rate is not provided, a low rate would be 1 pound of actual nitrogen per 1,000 square feet. To calculate the application rate, divide the nitrogen percentage (the first number) in the analysis into 100. The application rate using a 12-12-12 garden fertilizer is calculated as follows: 100 ÷ 12 = 8.3 pounds per 1,000 square feet.

The best time to fertilize plants in the landscape is late winter just before spring growth begins. Fall fertilization is not recommended because it may decrease winter hardiness, and high rainfalls during typical Alabama winters wash fertilizer out of the root zone. Lastly, do not fertilize plants during a drought period because fertilizers are composed of nutritive salts that can dehydrate and burn roots in the absence of adequate water.

Additional Tips

- Water clay soil before the soil dries out. Once dry, clay soil is extremely difficult to rewet.
- Remove weeds promptly because they compete for valuable water.
- Avoid summer pruning except to remove dead, diseased, or damaged wood because it encourages new vegetative growth and inhibits root growth.
- Prune plants when they wilt during severe drought stress to save them. Remove about one-third of the canopy to reduce the leaves' demand for moisture.
- Consider mature height growth range for both dwarf and full-size shrubs and trees when choosing varieties for your landscape to reduce/eliminate the need for pruning.
- Maintain the irrigation system to prevent leaks that waste water.
- Be conscious of the changing water needs of plants through the season and change irrigation practices accordingly.
- Capture rainwater or recycle water when possible. Rain catchment systems are available.
- Adjust irrigation practices according to sun exposure. North and east exposures need less water than south or west exposures.
- Avoid large areas of light-colored gravel because it reflects heat and can create a microclimate resulting in greater water loss from surrounding plants.
- Consider converting low-traffic turf areas to more drought-tolerant ground covers. Turfgrasses generally require more frequent watering and maintenance than most other landscape plants.
- Terrace steep slopes to reduce runoff erosion and slow water movement so that the soil can absorb it.
- Avoid using narrow strips of turf, hard-to-maintain corners, and isolated islands of grass that need special attention.

Drought Tolerance in Plants

Drought tolerance is a difficult plant characteristic to define because it depends not only on a plant's inherent ability to conserve water internally during times of shortage, but also on how well the plant has established a root system and how well the plant can adapt to environmental stresses other than water availability. Stressors may include adverse soil conditions, high temperature, high light intensity, variable wind speed, and relative humidity.

Drought tolerance does not mean plants prefer hot, dry weather or that they will not be adversely affected by extended dry weather without some supplemental irrigation. Many plants are drought tolerant because they can shut down growth during extended drought; therefore, some decrease in growth and flowering can be expected during periods of limited moisture.

Severe drought can increase insect or disease incidence, decrease leaf size and number, and cause an overall decline in growth rate and plant vigor. High temperatures and wind, heat and light reflection from nearby hard surfaces, or high fertilization can increase the potentially damaging effects of low moisture on plant growth and survival.

Regional differences in drought tolerance in a plant are particularly evident because of varying adaptability to the largely north to south environmental gradient in Alabama. Plants listed in tables 2 to 10 perform well in the landscape with occasional irrigation (every 2 to 3 weeks during drought) or irrigation only during severe drought, but not regular irrigation.

Plants selected for inclusion in the tables are the consensus of horticultural professionals in the Department of Horticulture at Auburn University, curators of the Huntsville and Mobile Botanical Gardens, and select agents in the Alabama Cooperative Extension System from different regions of the state. Most of the plants in the tables are hardy over a wide portion of Alabama; however, plants are included that may only be hardy in the northern or southern one-quarter to one-half of the state.

When making plant selections, consider adaptability to your area of the state. Many of the species are also represented in the trade by numerous cultivars, which may vary in drought tolerance. These lists should not be construed as complete.

Table 2. Large Canopy Trees		
Scientific Name	**Common Name**	**Native***
Deciduous		
Acer barbatum	Florida maple	Y
Acer × *freemanii*	'Autumn Blaze'	N
Acer leucoderme	chalk maple	Y
Carya glabra	pignut hickory	Y
Carya illinoinensis	pecan	Y
Castanea mollissima	Chinese chestnut	N
Catalpa bignonioides	catalpa	Y
Celtis laevigata	sugar hackberry	Y
Celtis occidentalis	common hackberry	Y
Diospyros virginiana	common persimmon	Y
Ginkgo biloba	ginkgo	N
Gleditsia triacanthos	honey locust	Y
Juglans nigra	black walnut	Y
Liriodendron tulipfera	tuliptree	Y
Maclura pomifera	Osage orange	Y
Nyssa sylvatica	black gum	Y
Quercus alba	white oak	Y
Quercus geminata	sand oak	Y
Quercus lyrata	overcup oak	Y
Quercus macrocarpa	bur oak	Y
Quercus marilandica	blackjack oak	Y
Quercus muehlenbergii	chinkapin oak	Y
Quercus nuttallii	Nuttall oak	Y
Quercus prinus	chestnut oak	Y
Quercus stellata	post oak	Y
Quercus velutina	black oak	Y
Sapindus saponaria var. *drummondii*	soapberry	N
Styphnolobium japonicum	Japanese pagodatree	N
Taxodium ascendens	bald cypress	Y
Evergreen		
Calocedrus decurrens	incense cedar	N
Cedrus deodara	Deodar cedar	Y
Cupressus arizonica	Arizona cypress	N
Cupressus sempervirens	Italian cypress	N
Juniperus virginiana	eastern red cedar	Y
Magnolia grandiflora	southern magnolia	Y
Pinus clausa	sand pine	Y
Pinus elliottii	slash pine	Y
Pinus glabra	spruce pine	Y
Pinus palustris	longleaf pine	Y
Pinus taeda	loblolly pine	Y
Pinus virginiana	Virginia pine	Y
Quercus hemisphaerica	Darlington oak	Y

Table 2. Large Canopy Trees (cont.)		
Scientific Name	**Common Name**	**Native***
Quercus laurifolia	laurel oak	Y
Quercus virginiana	live oak	Y
Thuja orientalis	Oriental arborvitae	N

* Native to Alabama: Y = yes or N = no (introduced)

Table 3. Noncanopy Trees		
Scientific Name	**Common Name**	**Native***
	Deciduous	
Acer buergerianum	trident maple	N
Acer truncatum	Shantung maple	N
Amelanchier spp. and cultivars	juneberry	Y
Asimina triloba	pawpaw	Y
Cercis canadensis	eastern redbud	Y
Chilopsis linearis	desert willow	Y
Clethra pringlei	Mexican sweetspire	N
Cotinus coggygria	common smoketree	N
Cotinus obovatus	American smoketree	Y
Crataegus crus-galli	cockspur hawthorn	Y
Crataegus marshallii	parsley hawthorn	Y
Crataegus mollis	downy hawthorn	Y
Cydonia oblonga	fruiting quince	N
Erythrina × *bidwillii*	hybrid fireman's cap	N
Ilex verticillata	winterberry	Y
Lagerstroemia fauriei	Japanese crapemyrtle	N
Lagerstroemia indica	crapemyrtle	N
Magnolia × *soulangeana*	saucer magnolia	N
Nyssa sylvatica	black gum	Y
Oxydendrum arboreum	sourwood	Y
Prunus americana	American plum	Y
Prunus angustifolia	Chickasaw plum	Y
Prunus 'Okame'	Okame cherry	N
Prunus subhirtella	higan cherry	N
Rhamnus caroliniana	Carolina buckthorn	Y
Rhus typhina	staghorn sumac	Y
	Deciduous	
Vitex agnus-castus	lilac chastetree	N
Ziziphus jujuba	jujube	N
	Evergreen	
Caesalpinia spp.	bird of paradise trees	N
Cupressus arizonica 'Carolina Sapphire'	Arizona cypress	N
Eriobotrya japonica	loquat	N
Ilex × *attenuata*	'Savannah', 'Foster' holly	Y
Ilex 'Nellie R. Stevens'	Nellie R. Stevens holly	N
Ilex opaca	American holly	Y

Table 3. Noncanopy Trees (cont.)		
Scientific Name	**Common Name**	**Native***
Ilex vomitoria	yaupon	Y
Lithocarpus henryi	Henry tanbark oak	N
Loropetalum chinense	Chinese fringetree	N
Myrica cerifera	southern wax myrtle	Y
Prunus caroliniana	Carolina cherry laurel	Y

* Native to Alabama: Y = yes or N = no (introduced)

Table 4. Deciduous Shrubs		
Scientific Name	**Common Name**	**Native***
Aesculus parviflora	bottlebrush buckeye	Y
Aesculus pavia	red buckeye	Y
Anisicanthus wrightii var. *aurea*	desert honeysuckle	N
Aronia arbutifolia	red chokeberry	Y
Asimina parviflora	smallflower pawpaw	Y
Callicarpa americana	American beautyberry	Y
Calycanthus floridus	sweetshrub	Y
Caryopteris × *clandonensis*	bluebeard	N
Castanea pumila	Allegheny chinkapin	Y
Chaenomeles speciosa	flowering quince	N
Deutzia gracilis	slender deutzia	N
Deutzia scabra	fuzzy deutzia	N
Diervilla rivularis	Georgia bush honeysuckle	Y
Diervilla sessilifolia	southern bush honeysuckle	Y
Exochorda racemosa	common pearlbush	N
Ficus carica	fig	N
Forsythia × *intermedia*	border forsythia	N
Fothergilla gardenii	dwarf fothergilla	Y
Hamamelis vernalis	vernal witchhazel	Y
Hamelia patens	hummingbird bush	N
Hibiscus syriacus	shrub althea	N
Hydrangea quercifolia	oakleaf hydrangea	Y
Ilex decidua	possumhaw	Y
Jasminum floridum	Florida jasmine	N
Jasminum mesnyi	primrose jasmine	N
Jasminum nudiflorum	winter jasmine	N
Kerria japonica	Japanese kerria	N
Leucothoe racemosa	sweetbells leucothoe	Y
Magnolia stellata	star magnolia	N
Phildelphus coronarius	sweet mock orange	N
Physocarpus opulifolius	ninebark	N
Punica granatum	pomegranate	N
Rhus glabra	smooth sumac	Y
Rosa 'Knockout'	Knockout rose	N
Rosa 'Nearly Wild'	Nearly Wild rose	N

Table 4. Deciduous Shrubs (cont.)		
Scientific Name	**Common Name**	**Native***
Russelia equisetiformis	coral fountain plant	N
Spiraea × *arguta*	garland spirea	N
Spiraea × *bumalda* 'Anthony Waterer'	Anthony Waterer spirea	N
Spiraea cantoniensis	Reeves spirea	N
Spiraea prunifolia	bridalwreath spirea	N
Spiraea thunbergii	Thunberg's spirea	N
Spiraea × *vanhouttei*	Vanhoutte spirea	N
Symphoricarpos orbiculatus	coralberry	Y
Ungnadia speciosa	Mexican buckeye	N
Vaccinium arboreum	sparkleberry	Y
Vaccinium ashei	rabbiteye blueberry	Y
Vaccinium elliottii	Elliott's blueberry	Y
Viburnum × *burkwoodii*	Burkwood viburnum	N
Viburnum dentatum	arrowwood	Y
Viburnum prunifolium	blackhaw viburnum	Y
Viburnum rufidulum	rusty blackhaw viburnum	Y

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Table 5. Evergreen Shrubs		
Scientific Name	**Common Name**	**Native***
Abelia chinensis	Chinese abelia	N
Abelia × *grandiflora*	glossy abelia	N
Acca (Feijoa) sellowiana	pineapple guava	N
Agarista populifolia	Florida leucothoe	Y
Aloysia virgata	almond verbena	Y
Buxus microphylla var. *japonica*	Japanese boxwood	N
Buxus microphylla var. *koreana*	Korean boxwood	N
Buxus sempervirens	common boxwood	N
Cassia corymbosa	Argentine senna	N
Cassia splendida	fall-blooming senna	N
Cephalotaxus harringtonia	Japanese plum yew	N
Cotoneaster dammeri	bearberry cotoneaster	N
Cotoneaster horizontalis	rockspray cotoneaster	N
Cotoneaster lacteus	brightbead cotoneaster	N
Cotoneaster microphyllus	littleleaf cotoneaster	N
Ilex × *aquipernyi*	brilliant holly	N
Ilex × *attenuata*	many cultivars	Y
Ilex cornuta cvs.	Chinese holly	N
Ilex crenata	'Compacta' and 'Convexa' only	N
Ilex glabra	inkberry holly	Y
Ilex × *hybrids*	many cultivars	N

Table 5. Evergreen Shrubs (cont.)		
Scientific Name	**Common Name**	**Native***
Ilex latifolia	lusterleaf holly	N
Ilex opaca	American holly	Y
Ilex vomitoria	Yaupon holly	Y
Illicium parviflorum	small anise-tree	N
Juniperus spp.	many juniper species and cultivars	N & Y
Michelia figo	banana shrub	N
Nerium oleander	oleandar	N
Osmanthus americanus	devilwood	Y
Osmanthus × *fortunei*	Fortune's osmanthus	N
Osmanthus fragrans	sweet olive	N
Osmanthus heterophyllus	holly osmanthus	N
Philadelphus coronarius	sweet mock orange	N
Pittosporum tobira	pittosporum	N
Podocarpus macrophyllus	Chinese podocarpus	N
Pyracantha angustifolia 'Yukon Belle'	Yukon Belle firethorn	N
Pyracantha coccinea	scarlet firethorn	N
Pyracantha crenatoserrata	Chinese firethorn	N
Pyracantha koidzumii	Formosa firethorn	N
Rhaphiolepis indica	Indian hawthorn	N
Rhapidophyllum hystrix	needle palm	Y
Rhododendron indicum	southern Indian azalea	N
Rhododendron obtusum	Kurume azalea	N
Sabal palmetto	palmetto palm	Y
Serissa foetida 'Kowloon'	Kowloon serissa	N
Sophora secundiflora	Texas mountain laurel	N
Trachycarpus fortunei	windmill palm	N
Viburnum awabuki	mirror leaf viburnum	N
Viburnum luzonicum	Luzon viburnum	N
Viburnum obovatum	Walter's viburnum and 'Densa'	Y
Viburnum odoratissimum	sweet viburnum	N
Viburnum 'Pragense'	Prague viburnum	N
Viburnum × *rhytidophylloides*	lantanaphyllum viburnum	N
Viburnum suspensum	Sandankwa viburnum	N
Viburnum tinus	laurustinus	N
Yucca aloifolia	Spanish bayonet	N
Yucca filamentosa	Adam's needle	Y
Yucca gloriosa	mound lily yucca	Y
Yucca recurvifolia	soft leaf yucca	Y

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Table 6. Vines and Ground Covers		
Scientific Name	**Common Name**	**Native***
Bauhinia yunnanensis	pink orchid vine	N
Bignonia capreolata	crossvine	Y
Campsis radicans	trumpet creeper	Y
Campsis × tagliabuana	hybrid trumpet creeper	N
Clitoria mariana	butterfly pea	Y
Clitoria ternatea	blue pea vine	N
Gelsemium sempervirens	Carolina jessamine	Y
Juniperus conferta	shore juniper	N
Juniperus davurica	Parson's juniper	N
Juniperus horizontalis	creeping juniper	N
Juniperus procumbens	Japanese garden juniper	N
Lathyrus latifolius	everlasting pea	N
Lonicera × heckrottii	goldflame honeysuckle	N
Lonicera sempervirens	coral honeysuckle	Y
Ophiopogon japonicus	mondograss	N
Parthenocissus quinquefolia	Virginia creeper	Y
Parthenocissus tricuspidata	Boston ivy	N
Passiflora incarnata	maypop	Y
Quisqualis indica	Rangoon creeper vine	N
Rosa banksiae	Lady Banks rose	N
Senecio confusus	Mexican flame vine	N
Smilax smallii	Jackson vine	Y
Thunbergia alata	black-eyed Susan vine	N
Trachelospermum asiaticum	Asiatic jasmine	N
Trachelospermum jasminoides	confederate jasmine	N
Vitis rotundifolia	muscadine	Y
Wisteria frutescens	American wisteria	Y

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Table 7. Annuals or Biennials	
Scientific Name	**Common Name**
Angelonia angustifolia	summer snapdragon
Arctotis × hybrida	blue-eyed African daisy
Argemone grandiflora	showy pricklypoppy
Argemone mexicana	Mexican poppy
Asclepias curassavica	bloodflower
Begonia × semperflorens cultorum	wax begonia (not in full sun)
Berlandiera lyrata	chocolate daisy
Calandrinia umbellata	rock purslane
Carthamus tinctorius	safflower
Castilleja indivisa	Indian paintbrush
Catharanthus roseus	annual vinca
Celosia argentea var. *plumosa* or *cristata*	plumed or crested cock's comb

Table 7. Annuals or Biennials (cont.)	
Scientific Name	**Common Name**
Celosia spicata	wheat cock's comb
Coreopsis tinctoria	calliopsis
Cosmos bipinnatus	tall cosmos
Cosmos sulphureus	sulphur cosmos
Dianthus barbatus	sweet william
Dracopis amplexicaulis	clasping coneflower
Euphorbia marginata	snow-on-the-mountain
Eustoma grandiflorum	lisianthus, prairie gentian
Gaillardia × *grandiflora*	blanket flower
Gazania rigens	treasure flower
Gomphrena globosa	globe amaranth
Helianthus annuus	annual sunflower
Helichrysum bracteatum	strawflower
Leonotis nepetifolia	lion's ear
Limonium sinuatum	annual statice
Melampodium divaricatum	medallion flower
Mirabilis jalapa	four o'clock flower
Nolana paradoxa	Chilean bellflower
Sanvitalia procumbens	Mexican creeping zinnia
Scaevola aemula	fan flower
Senecio cineraria	dusty miller
Verbascum bombyciferum	nettle-leaved mullein
Zinnia angustifolia	narrowleaf zinnia
Zinnia haageana	Mexican zinnia
Zinnia marylandica	'Profusion' series zinnia

Table 8. Herbaceous Perennials	
Scientific Name	**Common Name**
Achillea × 'Coronation Gold'	Coronation Gold yarrow
Achillea filipenadulina	fernleaf yarrow
Achillea × 'Moonshine'	Moonshine yarrow
Agapanthus africanus	agapanthus
Alyssum montanum	creeping basket-of-gold
Amsonia tabernaemontana	eastern bluestar
Armeria maritima	common thrift
Artemisia spp.	wormwood
Asclepias tuberosa	butterfly weed
Aspidistra elatior	cast-iron plant
Aster spp.	fall asters (numerous)
Aurina saxatilis	basket-of-gold
Baptisia alba	white false indigo
Baptisia australis	false blue indigo

Table 8. Herbaceous Perennials (cont.)	
Scientific Name	**Common Name**
Baptisia carolina	false indigo
Baptisia tinctoria	wild indigo
Belamcanda chinensis	blackberry lily
Ceratostigma plumbaginoides	plumbago
Chrysopsis villosa	golden aster
Coreopsis auriculata 'Nana'	mouse ear coreopsis
Coreopsis grandiflora	tickseed
Coreopsis lanceolata	lance coreopsis
Crocosmia × *crocosmiiflora*	montbretia
Cuphea llavea	bat face cuphea
Delosperma ashtonii	Ashton's ice plant
Delosperma cooperi	hardy ice plant
Delosperma nubigenum	orange-yellow hardy ice plant
Dianthus deltoides	maiden pink
Dianthus gratianopolitanus	cheddar pink
Dianthus plumarius	cottage pink
Echinacea augustifolia	prairie coneflower
Echinacea paradoxa	yellow coneflower
Echinacea purpurea	purple coneflower
Echinacea tennesseensis	Tennessee coneflower
Epimedium spp.	epimedium
Erythrina herbacea	coralbean
Eupatorium havanense	white mist flower
Guara lindheimeri	guara
Heliopsis helianthoides	false sunflowers
Helleborus foetidus	bear's foot hellebore
Helleborus orientalis	Lenten rose
Hemerocallis spp.	daylily
Iris cristata	crested iris
Iris hybrids	bearded irises
Iris pallida	dalmatian iris
Iris sibiricia	Siberian iris
Kniphofia hirsuta	dwarf red hot poker
Kniphofia uvaria	red hot poker
Lantana montevidensis	trailing lantana
Liatris spicata	spike blazing star
Linum spp.	flax
Lychnis coronaria	rose campion
Oenothera fruiticosa	sundrop
Oenothera macrocarpa	Missouri evening primrose
Opuntia compressa	eastern pricklypear cactus
Perovskia atriplicifolia	Russian sage
Phlomis 'Edward Bowles'	hybrid Jerusalem sage
Phlomis fruticosa	Jerusalem sage

Table 8. Herbaceous Perennials (cont.)	
Scientific Name	**Common Name**
Phlomis russeliana	Jerusalem sage
Phlomis tuberosa	tuberous Jerusalem sage
Phlox subulata	creeping phlox
Pycnanthemum virginianum	mountain mint
Rudbeckia fulgida	black-eyed susan
Rudbeckia laciniata	cutleaf coneflower
Rudbeckia maxima	great coneflower
Rudbeckia nitida	shining coneflower
Ruellia brittoniana	Mexican petunia
Salvia greggii	Texas sage
Salvia guaranitica	blue anise sage
Salvia leucantha	Mexican sage
Salvia microphylla	baby sage
Salvia reptans	cobalt sage
Salvia texana	blue Texas sage
Santolina chamaecyparissus	lavender cotton
Santolina rosmarinifolia	green santolina
Sedum spp.	stonecrop
Silene caroliniana	wild pink
Solidago hybrids	'Cloth of Gold', 'Crown of Rays' goldenrod
Solidago canadensis	Canada goldenrod
Solidago rugosa	wrinkle-leaf goldenrod
Spigelia marilandica	Indian pink
Stachys byzantina	lamb's ears
Symphyotrichom georgianum	Georgia aster
Verbascum phoeniceum	purple mullein
Verbena canadensis	rose verbena
Verbena rigida	sandpaper verbena
Verbena tenuisecta	moss verbena
Veronica altissima	tall ironweed
Veronica prostrata	prostrate speedwell
Veronica repens	creeping speedwell

Table 9. Herbs		
Scientific Name	**Common Name**	*
Agastache foeniculum	anise hyssop	P
Allium schoenoprasum	chives	P
Allium tuberosum	garlic chives	P
Artemisia abrotanum	southernwood	P
Borago officinalis	borage	A
Calamintha nepeta	calamint	P
Eucalyptus cinerae	silver dollar tree	A/P
Laurus nobilis	bay	A/P
Lavandula augustifolia	English lavender	P

Table 9. Herbs (cont.)		
Scientific Name	**Common Name**	*****
Lavandula stoechas	Spanish lavender	P
Marrubium vulgare	horehound	P
Matricaria recutita	false camomile	A
Nepeta x faassenii	catmint	P
Nepeta racemosa	Persian catmint	P
Origanum laevigatum	ornamental oregano	P
Origanum marjorana	sweet marjoram	A
Origanum onites	pot oregano	P
Origanum vulgare	wild oregano	P
Rosemarinus officinalis	rosemary	P
Ruta graveolens	rue	P
Saponaria officinalis	soapwort	P
Satureja montana	winter savory	P
Tagetes lucida	Mexican tarragon	P
Tanacetum parthenium	feverfew	P
Teucrium chamaedrys	wall germander	P
Thymus camphoratus	camphor thyme	P
Thymus × citriodorus	lemon thyme	P
Thymus herba-barona	caraway-scented thyme	P
Thymus praecox ssp. *arcticus*	mother-of-thyme	P
Thymus psuedolanuginosus	wooly thyme	P
Thymus vulgaris	garden thyme	P
Tulbaghia violacea	society garlic	P

*A = annual, P = perennial, or A/P = perennial treated as an annual depending on hardiness zone

Table 10. Ornamental Grasses		
Scientific Name	**Common Name**	**Native***
Andropogon gerardii	big bluestem	Y
Andropogon ternarius	splitbeard bluestem	Y
Andropogon virginicus	broom sedge	Y
Bouteloua gracilis	blue gammagrass	Y
Briza media	quaking grass	N
Chasmanthium latifolium	upland sea oats	Y
Cortaderia sellowiana	pampas grass	N
Eragrostis elliottii	Elliott's love grass	Y
Eragrostis spectabilis	purple love grass	Y
Hystrix patula	bottlebrush grass	Y
Leymus arenarius	blue lyme grass	N
Muhlenbergia filipes	gulf muhly	Y
Muhlenbergia lindheimeri	muhly grass	Y
Muhlenbergia rigens	deer grass	Y
Muhlenbergia capillaris	pink muhly grass	Y
Nassela tenuissima	Mexican feather grass	Y
Panicum virgatum	switchgrass	Y
Saccharum ravennae	Ravenna grass	N
Schizachyrium scoparium	little bluestem	Y
Stipa gigantea	giant feather grass	N

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