MISSISSIPPI STATE UNIVERSITY EXTENSION

# Effects of Long-Term Drought on Landscape Trees

**Figure 1. Leaf scorch on dogwood (*Cornus* spp.) Source: Robert L. Anderson, USDA Forest Service, Bugwood.org**

Unlike forest-grown trees, trees in urban and landscape settings must adapt to an increased number of environmental stressors. These include compacted soils, contaminants, diseases, higher temperatures, mechanical damage, restricted root systems, and more. In cases where water stress occurs over a short period of time (such as a single growing season), homeowners will observe wilted leaves, leaf scorch, or leaves prematurely dropping from the tree. The effects of long-term (more than a growing season) drought on plant health are less obvious but more serious. Mississippi has experienced frequent periods of drought in the past several years. Consequently, it is important for homeowners to learn how to identify symptoms of drought stress and how to keep trees healthy.

## Signs of Drought Stress

Droughts stress trees and cause them to be more susceptible to diseases, pests, and structural damage than they would be under normal, healthy conditions. Without water, trees are unable to absorb and transport minerals or nutrients. Metabolic processes, including photosynthesis, decrease or cease as drought conditions become severe. During a drought, fine root hairs die, reducing the capacity to absorb water. Drought effects can vary, depending on tree species, health, vigor, and location. Drought symptoms include browning across the entire tree, but trees with damage to the root system will have large areas of dying foliage on the side of the crown. Immediate visible effects include wilting, scorch, and defoliation (loss of leaves).

**Scorch.** Leaf scorch occurs when leaves turn yellow-brown starting from the outside edges (Figure 1). Leaves can also become chlorotic (yellow or yellow-green).

**Defoliation.** In the event of damage to the root system, trees often lose their canopy, starting at the top and middle of the crown (Figure 2).

Similarly to broadleafess species, conifers respond to drought inwardly from the outside portions of the crown, starting with the tip and moving downward as fine feeder roots die. Needles turn shades of yellow, red, and brown (Figure 3).

**Producing seeds and suckers.** Other indicators of stress include heavy seed production and suckers (Figure 4) on the side of the trunk (also known as epicormic branching). However, these symptoms are not conclusive of drought stress.

**Insects, parasites, and diseases.** Additional indicators of drought include boring insects (Figure 5), root rot (Figure 6), spider mites (Figure 7), and mistletoe (Figure 8). A common observation in drought-stressed Mississippi pine trees is the Ips beetle. Hypoxylon canker (and other cankers) is more likely to develop in stressed trees due to reduced capacity to isolate small wounds, which allows invasion of a variety of pathogens (Figure 9). Close inspection may reveal small, poorly formed buds.

**Branch dieback and breakage.** The effects of drought may not become evident for several years until weakened branches break in spring storms. Decline can continue for the next few years as trees use up their energy reserves and try to resist diseases and pests. As drought persists, branch dieback continues in the same pattern, starting at the middle top and spreading into the interior of the crown.

**Death of the tree.** After several years of water stress, the entire plant may eventually die, even if rain or irrigation becomes available. Armillaria root rot, for example, may take years to kill the tree, even after drought has ended.

**Figure 2. Long-term drought stress and crown dieback on a Japanese tree lilac (*Syringa reticulata*). Source: William Fountain, Univ. of KY, Bugwood.org**

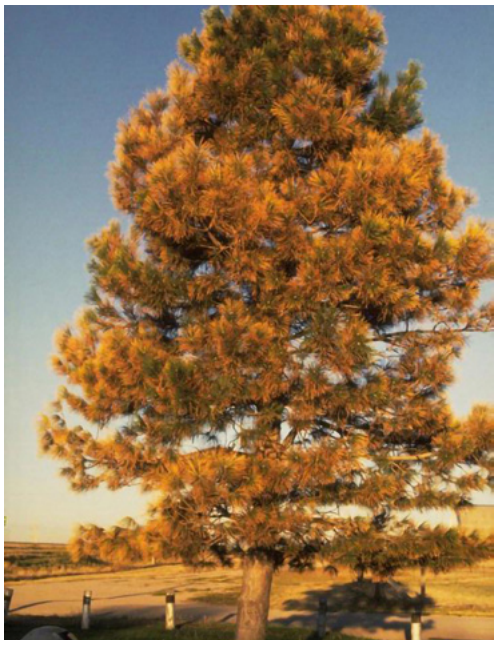

**Figure 3. Long-term drought effects on *Pinus* spp. Source: William M. Brown Jr., Bugwood.org**

**Figure 4. Epicormic branching. Source: Joseph O'Brien, USDA Forest Service, Bugwood.org**

**Figure 5. Ips beetle damage.**

**Figure 6. Armillaria root rot. Source: USDA Forest Service – Northeastern Area, USDA Forest Service, Bugwood.org**

**Figure 7. Spider mites. Source: John A. Weidhass, Virginia Polytechnic Institute and State University, Bugwood.org**

**Figure 8. Mistletoe. Source: Joseph O'Brien, USDA Forest Service, Bugwood.org**

**Figure 9. Hypoxylon canker. Source: USDA Forest Service, Region 8, Southern, Bugwood.org**

## Alleviating Drought Effects

Large trees can transpire (lose water) at a rate of over 100 gallons per day. An inch of rainfall equates to over 27,000 gallons (113 tons) of water per acre. Thus, the task for the homeowner is not supplementing rainfall, but helping the tree survive until it rains again.

Soil should be moist to a depth of 12 inches below the surface. Slow, deep watering is preferred over fast, shallow watering. Water for a long time to saturate the soil to a great depth and encourage deep root growth for better adaptation to the site. Newly planted, 2- to 2.5-inch-diameter trees need at least 1 inch of rain per week, but they do not have enough water-absorbing roots when freshly planted.

**Soaker hoses.** Whether you have an established or new tree, a good approach is to place a soaker hose around the trunk base for a half-day of watering once a week. You want to water when there is dew formation (just before daylight) to minimize evaporation. Watering before daylight does not alter the natural cycle of wetting and drying, and it is more economical.

**Sprinkler system.** One way of measuring water irrigation using a sprinkler system is to place a can next to the tree and stop watering when 2 inches of water accumulate in the can. In contrast to slow watering systems (such as soaker hoses, drip emitters, and watering bags), sprinkler systems are designed for turf rather than trees. These systems are not ideal for trees and can lead to excessive watering and root rot. The goal is to apply moisture to the soil without exceeding the infiltration rate.

**Mulch.** Mulching helps keep moisture around tree roots and encourages microbial and insect life underneath as organic matter decomposes. Apply 2 to 4 inches of mulch at the drip line (the imaginary ring constituting the edge of the tree crown). Do not pile mulch against the trunk itself; stop the mulch 5 or 6 inches from the trunk.

There are several types of mulch. Pine straw is effective, pleasing to the eye, and does not attract wood-boring insects or float away during heavy rain like bark or wood chips. The downside to pine straw is that it breaks down faster than woody material. Stone or chopped-up tires can also be used; however, these are expensive and don't add nutrients to the soil as they decompose. It can also be difficult to weed in artificial mulch. If yard leaves are used, they should not be piled against the trunk, and the pile should not be over 4 inches deep after settling.

## Other Considerations for Planting and Managing Trees

- **Plant tree species suited to your site.** In other words, do not plant a water-loving tree in a dry location. Consider using plants adapted to dry climates in landscaping.
- **Do not fertilize trees that are water-stressed.** Artificial fertilizers are made of salt and can make conditions worse. Nitrogen encourages growth, which only serves to increase demand for water.

- **Do not prune a drought-stressed tree except to reduce risk of branch failure.** Pruning to compensate for root loss is rarely effective and can be detrimental to the tree.
- **Be aware of any restrictions on water use that may apply in your community.**
- **Trees on a slope or on sandy soils may need more watering than trees in soils that hold more water.** Trees on a slope may also need a soaker hose or drip emitter.
- **Never transplant a tree during a drought.** It will unlikely survive because it can't establish its root system.

Trees are readily adaptable to water stress, but long-term drought conditions can lead to decreased overall tree health and increased likelihood of tree death. Signs of prolonged drought stress include leaf scorch, dieback, and root problems. Homeowners can lessen effects of drought by planting the right tree in the right place and using slow, systematic irrigation and mulch.

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