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What Does Drought Stress Do to Trees and Landscape Plants?

During times of drought, trees and landscape plants often show the effects of the hot, dry weather. To put into perspective the effect severe drought can have on plants, consider the following facts. Green plants normally have a moisture content of 125–200 percent or more. However, during severe and prolonged drought, the moisture content of live, woody plants can drop below 100 percent.

Water deficits in trees have an adverse effect on many of the tree's growth processes. Severe water stress will injure trees and may kill them. In addition, stressed trees are more vulnerable to insect and disease pests when compared to a healthy tree.

Symptoms of Water Stress

Hardwood trees display numerous symptoms related to water stress. Wilting of leaves is a common indication of water stress. Wilting can be classified as incipient, temporary or permanent. Incipient wilting is not readily noticeable, but it can change to temporary wilting which is characterized by visible drooping of the leaves during the day. At night, the plant will rehydrate and recover from temporary wilting. During prolonged dry periods, temporary wilting can change to permanent wilting where the plant does not recover during the overnight period. Permanently wilted plants may recover when water is added to the soil, but prolonged permanent wilting usually kills most species of plants. Keep in mind there is great variation in wilting among different tree species and different types of soils.

In addition to wilting, leaves

may curl, become crinkly, turn brown along the edges (scorch), turn yellow, turn brown and/or fall from the tree.

Pine trees normally don't "wilt" from drought stress. Pine trees usually retain their needles for about two years. During dry periods, the second year needles (located away from the tips of the branches) will turn yellow and begin to drop from the tree prematurely. It is common to see pine trees with yellow or red second year needles during summer droughts. Landowners and homeowners should not be alarmed if they observe this condition. The tree is definitely drought stressed, but is probably all right considering the dry conditions. During extreme drought the pine may die.

Through a process called transpiration, plants will release considerable amounts of water vapor through tiny leaf openings called stomata. When adequate soil moisture is available, temperatures are not too high, and humidity is not too low, transpiration will occur during most of the day. Under normal conditions, transpiration is lowest during the hottest part of the day, greatest in the morning and late afternoon and ceases at night. When soil water becomes limited, the plant will try to conserve water by closing the stomata in the leaves. But when the stomata are closed for extended periods of time, transpiration ceases and this causes photosynthesis to stop and the plant stops growing. If this goes on long enough, the plant will die. Plants try to protect themselves from water



Drought stressed tree

PHOTO/Patrick Weicherding of University of MN Extension

Location Makes a Difference

The general health of a tree depends a lot on where it is growing. Bottomland areas tend to be one of the most favorable sites for trees. There is usually adequate moisture coupled with deep, fertile soils. Sites that generally are not ideal for good tree health are ridges where shallow, eroded soils usually occur. Rocky soils and soils that may be chemically incorrect (especially pH or soil acidity/alkalinity) for plant growth tend to be stressful to trees. Even the direction a slope or

loss by closing stomata, slowing or stopping growth and by prematurely dropping their leaves. It is common to see leaves falling from trees in mid-summer during dry years.

Delayed Effects of Drought

Immediate effects of drought on hardwood trees are usually obvious, but delayed effects also occur. When unfavorable growth conditions are present now, growth for the coming year is often affected. Plants store food reserves and prepare for the next growing season during the current growing season. For instance, buds for next year's growth will be set during the current summer. The effects of the drought of 2001 and 2002 will carry over to the next growing season, and maybe beyond.

Lack of water also affects radial growth of trees (diameter growth). As a tree grows in diameter, each year it will produce a growth ring that consists of springwood (earlywood) and summerwood (latewood). The width of tree growth rings is greatly affected by the availability of water. During dry years, little radial growth occurs and the annual growth ring will be narrow. Because severe droughts adversely affect trees in many ways, radial growth often will be reduced for the current year and maybe even one or more subsequent years. Scientists can study the growth rings of old trees and determine rainfall patterns for years past. This science is called dendrochronology.

hillside faces can affect tree health. South and west facing slopes tend to be hotter and drier and trees generally do not grow as well as on north and east slopes.

Soils with a high clay content will hold water much better than sandy soils. Trees growing in clay soils tend to be shallow rooted and may be more severely impacted by prolonged drought than trees growing on loamy or sandy soils where roots will grow deeper. Most of a tree's feeder roots that absorb moisture and nutrients are located in the upper 12–14 inches of the soil. When a clay soil dries out, the impact on the tree can be great since the tree is not "accustomed" to sending roots deep into the soil for moisture and nutrients.

Dormant or Dead?

Drought-stressed trees may exhibit signs of dieback or decline. This may be the trees way of coping with a stressful situation. If the roots are unable to supply enough moisture and nutrients to the crown of the tree, the crown will usually begin to die back to bring the trees crown and root system into a more favorable balance. It is often difficult to determine if a tree has died from drought stress or has simply become dormant and appears to be dead. Two simple tests can be done to help determine if a drought-stressed tree is alive or possibly dead. First, collect some small twigs about one-eighth inch in diameter and try to break the individual twigs. If they snap

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Drought may leaves to turn partially or completely brown, such as on this sugar maple.

PHOTO/Robert L. Anderson, USDA Forest Service, image 0014295, www.forestimages.org

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