Drought and Urban Trees

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Introduction

There are a number of "urban environmental stressors" that urban trees have to combat as compared to their sisters growing in a forested environment: 1) poor urban soils that are compacted, lack adequate organic matter, and have poor drainage; 2) the presence of detrimental contaminants such as salt, oils, and pet waste; 3) heat island effect – phenomenon that traps heat in cities and result in temperatures that can be as much as 10 degrees higher than the surrounding suburbs; 4) tree disease, insects, and pests such as root and trunk rot, beetles, and mistletoe; and 5) construction and mechanical damage to root, trunk, and branches. Severe drought is now added to the list of tree stressors. With the many assaults that the typical urban tree has to fend off, it is amazing that many survive to maturity to provide us the beautiful tree canopy that we enjoy in the city of Atlanta.

Droughts are either short-term or long-term. Droughts also tend to be cyclical. Short-term droughts are usually for a growing season while long-term droughts span a few growing seasons. While a short-term drought may damage trees, especially newly planted ones, long-term droughts are more devastating due to ongoing moisture stress. In addition, droughts cause stress upon trees and make them more susceptible to diseases, insects, and other pests.

The previous year's drought damage may not become evident until spring when weakened limbs break due to strong winds and heavy rains that can cause trees to topple. Many trees will show declined growth for a year or two and that decline, along with the tree's reduced natural defense mechanism, allows for the expansion of pest population such as ambrosia beetles or root-rot fungus, which take advantage of the tree's weakened state. Mistletoe will likely thrive, siphoning much needed water and nutrients from the plant. Drought stress symptoms can persist for several years after the initial drought damage, and trees are at an elevated risk of pest and disease until they can recover.

The symptoms of drought-stressed and construction/mechanical damaged trees can be confusing. Trees with damaged or severed roots often exhibit larger areas of brown, dying foliage, usually on the side where damage occurred as damaged roots aren't

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capable of picking up adequate amounts of moisture. Drought damage manifests itself over the entire tree.

How Much Water is Enough?
Newly transplanted 2 – 2.5" caliper trees should be watered the equivalent of one inch of rain per week (approximately 5 gallons, twice per week). Newly planted trees are more vulnerable to our "urban environmental stressors", coupled with the stress of transplanting, than trees that have become "established" two to three years after transplanting. The effect of drought is particularly acute for newly transplanted trees since they are already devoid of a sizeable portion of their water-absorbing roots – the roots being lost in the digging and transplanting process.

Large mature trees are much easier to be stress-out and damaged than smaller younger established trees. A tree's water demand vary depending on many factors such as ambient air temperature, leaf size, wind speed, etc. Through the process of transpiration, up to 80 gallons or more of water can evaporate through the leaves of a single mature tree on a hot summer day.

Drought Effects/Symptoms on Trees
For a tree, uptake and transport of mineral and nutrients occur in water. Without water, there is no metabolic process, including photosynthesis – the process of manufacturing "food" for the plant. Feeder roots, including root hairs, are critical to the plant's survival. They are located in the upper 6 to 8 inches of the soil, become parched and die due to drought and the associated high temperatures. Root hairs are the first part of the root system affected by hot, dry soil conditions.

Drought effects depend on a tree's health and vigor; symptoms may be sudden or appear within weeks, months, or years after the drought. With the death of root hairs, the water absorbing capacity of the tree is severely reduced. Trees show limited tip/shoot growth, new leaves are often times smaller than normal, and there is decreased growth or no growth, both in girth and in height of trees. Immediate visible effects of drought damage include wilting, defoliation and scorch (deciduous leaves turn yellow/brown from the outside edges inward and in between the veins). Leaves may remain attached to the tree, even though they have become brown or they may drop prematurely. Leaves may roll-up, appear chlorotic (yellow or yellow-green), tree canopy may thin, cracks appear on branches or bark, and there may be a heavier than usual seed production (an indicator that the tree is stressed). Suckers (epicormic branching) sometimes develop on branches and trunk, another indicator that the tree is stressed.

In conifers (evergreen), needles turn yellow, red, brown, or red-purple. Evergreen needles brown from the tip downward.

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As the severity of drought persists, plants become vulnerable to secondary attacks-insects and diseases. If a tree is already stressed prior to the drought, demise is more immediate. Long-term symptoms of drought include dieback of branches and death of the plant as the plant's capacity to absorb water is damaged. The pattern of plant damage or death occurs from the top of the plant down and from the outside of the plant inward. Entire plants may die. Often a tree can recover from drought within a few years of normal rainfall, but sometimes the damage from drought is the beginning of the end, and the tree will continue to decline, even with adequate rain or watering.

Secondary Drought Effects

Among the types of diseases likely to occur in response to drought related stress are root rots, cankers, and wood rots. Spider mites are attracted to and proliferate on drought-stressed plants. An example of delayed secondary effects of drought on trees and shrubs is Armillaria root rot, also called shoestring root rot because the fungus forms shoestring-like structures that invade roots. Ambrosia beetle, pine beetle and other wood boring insects are common causes of death for drought stressed trees.

Do's and Don'ts

Do mulch, preferably with organic mulch. Mulch helps retain moisture at the root level, reduces moisture loss from the soil due to evaporation, and keeps roots and soil cool (root hairs will be preserved. In addition, when the mulch decomposes (breaks down), nutrients will be available to the plant. Install a layer of organic mulch 3 – 4" deep around the base of the tree (for newly planted balled and burlaped trees, spread mulch in an approximately 3' wide diameter; for larger trees, spread as large a diameter as is practical). Do not have mulch touching the bark of the tree as this can lead to the girdling of the tree as a result of decay.

Do remove weeds and grass (replace with mulch, if practical) within the tree's drip line. Weeds/grass compete with plants for moisture, mulching helps to control weeds and make more moisture available for plants.

Do use water from roof runoff and, when possible, harvest gray-water for use during droughts.

Do plant native tree species that are generally adapted to local climate. Whenever possible use Xeriscaping, that is landscaping in ways that do not require supplemental water.

Don'ts

Do not over fertilize plants under severe drought conditions. Although some landscapers may recommend fertilizer (low nitrogen), many fertilizers have a high salt content that makes conditions worse for the tree in that water is being pulled away from the plant at a time when it is needed. Nitrogen encourages growth and increases the plant's demand

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for water at a time when it is not available. Fertilizer should be applied according to a soil test, and should contain low levels of nitrogen (in slow-release form), with a low salt index.

Pruning to reduce the tree's crown to compensate for root hair loss as a result of drought conditions is very controversial. Although pruning will reduce the demand for water, it does place an additional stress on the tree at a time when the tree is already stressed by drought conditions. Pruning is not recommended as a treatment for drought stress. However, careful pruning according to ANSI A300 standards, to reduce branch weight may reduce the risk of branch failures associated with drought stress.