



Drought? Don't forget the trees!

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Indiana landscapes are suffering from the worst drought conditions in more than 100 years, and trees in our communities are slowly declining and dying. This seemingly endless pattern of dry weather affects crops and plants of all kinds.

So, now what? Well, with a little care, perhaps we can save some of our trees.

Effects of Drought

Water is the most limiting ecological resource for a tree, and without adequate moisture, decline and death are imminent. Drought can have a major impact on tree health and survival by

- slowing and reducing growth,
- reducing carbohydrate production,
- lowering energy reserves for survival through winter,
- inhibiting production of defense chemicals against pests, and/or
- causing death to portions or even the entire tree.

What is drought? For us, it is an extended period without precipitation. For a tree, it means moisture in the ground is so limited it cannot extract enough for biological processes. There may be some moisture in the ground, however, it is held so tightly by the soil that the plant cannot get it.

In many situations, prolonged drought conditions weaken trees and they become more susceptible to pests that normally may not invade a healthy tree. Insects and diseases enter, weaken, and can kill all or part of the tree, depending on how badly the tree is predisposed to attack in this declining condition. Drought stress promotes diseases through several different mechanisms:

- It may alter the plant's physiology, making trees more susceptible.
- It may reduce the ability of the plant to produce defensive chemicals or to "outgrow" the disease.
- More severe drought stress causes physical injury to tissues through drying; damaged tissues are then easily invaded by otherwise "weak" pathogens.

It is common to see an increase in borer activity, infestation of scale and diseases such as wilt, canker, and root decay during periods of extreme dryness. At this point in the environmentally induced decline, we can expect serious, and often permanent damage to our urban forests.

Long-Term Effects

What can we anticipate in the coming years? How a tree responds to subsequent years of drought depends greatly on health and vitality before the prolonged dry conditions and maintenance inputs during these drier times. The best defense against any environmental or biological challenge is good plant health care.

A biological lag effect is common in trees where environmental conditions are challenging and prolonged. We will notice decreases in the number of new leaves formed in the bud and the new stem segments (internodes) present. Drought influences the number of leaves, leaf surface area, and twig extension the following year when those buds expand. This can mean fewer, smaller leaves and shorter growth between the leaf buds.

The results of prolonged dry conditions might not inhibit the first growth flush, but may decrease the number of stem units formed in the new bud that will expand during the second (or third, etc.) flush of growth. If drought continues, all growth flushes will be affected. Thus, tree growth next year will be atypical and, again, create predisposed conditions to diseases and insects if not monitored and managed.

Dealing with Drought

What to do? Obviously we cannot prevent drought. However, there are some measures we can take to make trees more drought-tolerant and to reduce the long-term effects of prolonged dry conditions.

- Always protect tree trunks, especially young trees, from mechanical damage such as string trimmers, lawn mowers and other equipment. Preventing damage to the bark and wood at the base of the tree maintains a continuous ring of water- and food-transporting tissues.
- Reduce competition for available moisture with other plant materials such as turf, shrubs, and groundcovers, where feasible, by removing plants and adding mulch. Extend the mulch beds and tree rings to the edge of the tree canopy (drip line) to protect those fine “feeder” roots from drying out.

- Mulch trees! Never has there been a more compelling reason to maintain adequate levels of mulch than during periods of drought. Use organic mulch such as clean woodchips and apply to a depth of 2 to 3 inches around the plant root zone. Be sure to replenish throughout the year as the mulch decomposes or is displaced. This will help reduce moisture loss through evaporation and moderate soil temperatures.



Mulch and trunk protection helps with moisture loss and damage.

- Water trees, especially young trees, whenever rainfall is insufficient for extended periods. A proven recommendation is to use the 5 + 5 rule, which says to provide 5 gallons of water plus 5 gallons for every diameter-inch of tree trunk. This should provide plenty of water to help the tree during times of inadequate moisture. Be sure to check soil moisture for adequate drainage. In landscape plantings, the equivalent of ½ gallon of water per square foot of mulched area should be applied at ground level with slow rates to reduce evaporation and runoff.

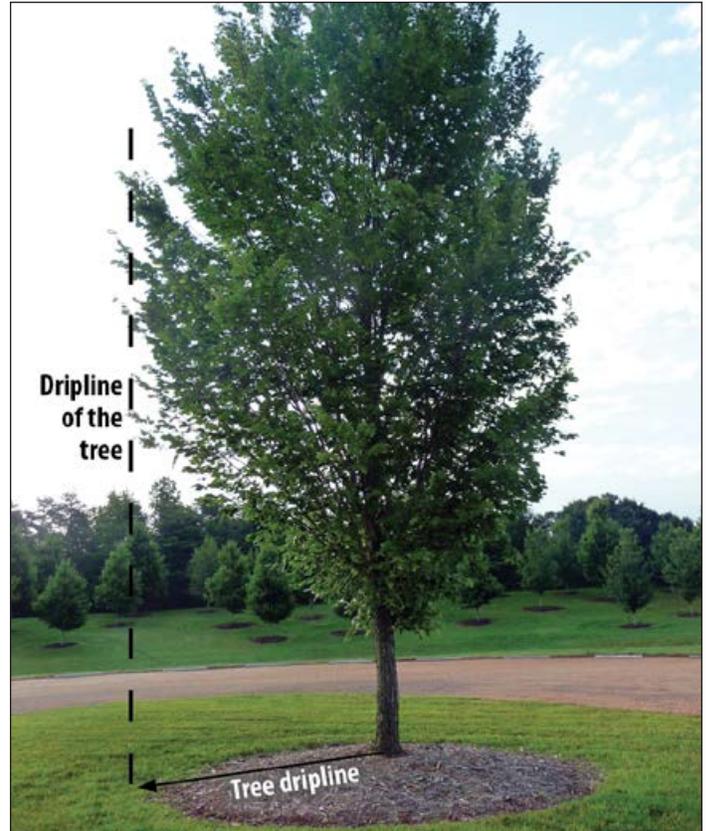
For mature and well-established trees, a good rule is to provide 1 inch of supplemental water every week or so to keep leaf moisture adequate. To determine the amount of irrigation, place a catch device (at least 1 inch deep) in the irrigated area to measure the amount of irrigation provided to the root zone of the tree-planting space. This root zone is located primarily within the drip line of the tree. It is advisable to water plants though the fall until the ground is frozen, so



Water trees whenever rainfall is insufficient.

that trees have adequate moisture to survive the winter months and are ready for spring growth. Nighttime irrigation is optimal, as this is when the tree is physiologically catching up with the water loss during the hot daytime temperatures.

- Reduce or cease certain maintenance activities such as pruning and fertilization. Pruning green wood or live branches is not recommended in a drought, because trees must expend energy to repair pruning wounds. It is not a good practice to fertilize any tree under stress conditions, especially drought. Trees expend additional energy to process the nitrogen, pulling water from the roots, which can worsen tree health.
- Do not disrupt the soil or areas under the drip line or canopy of the tree in drought. This will reduce the capacity of the tree to take up water due to root disturbance and damage. Every viable root is needed to absorb the already scarce water.



Mulch to the drip line of the tree and never disrupt roots in this protected area.

Water Is Critical for Young Trees

It is of even greater importance to remember newly planted landscape plants may need additional help during the drier times. Considering that over 85% of the roots can be removed during the digging process on balled and burlapped plants—and that containerized plants are likely dysfunctional from root restrictions causing circling and girdling roots—there is very little means for the roots to draw much-needed moisture.

Typically, trees should not be considered established for at least two growing seasons after they are planted. The establishment period depends upon species, health, and maintenance. Until the primary root system has begun to reach out into the site soil, supplying adequate amounts of water can be a challenge.

Roots from balled and burlapped or container-grown plants may not grow out of the soil ball and into the surrounding backfill soil for many weeks after installation. The plant must depend on moisture in the original soil ball to sustain it until roots extend into its new soil environment. Since water will generally not move from

the backfill into the soil ball, the moisture content of the surrounding backfill soil is not beneficial to the transplanted tree. The original soil ball must be supplied frequently with the correct amounts of water, although it is a challenge to determine the quantity delivered.

Let's look at a scenario for watering a newly planted tree. According to nursery standards, a 2-inch caliper red maple tree should have a soil ball about 24 inches in diameter with a depth of about 16 inches. The total volume of such a soil ball would be equivalent to the volume of about 20 gallons of water. Assuming that the soil in the ball is a clay loam, the volume of water that could be held by the soil ball is about 25 percent of the total soil volume (about 5 gallons). On a single windy, 95-degree day in the summer, the leaves on a reasonably healthy, newly transplanted red maple tree may lose 2 or 3 gallons of water through their leaves. Considering the limited root growth into the backfill soil outside the root ball, the tree may be suffering from drought stress in only a couple of days. The challenge then becomes how to replenish the moisture in the soil ball without leaving it saturated for an extended period. This prolonged wetness and saturation of soils can lead to disease and is also harmful. Soil type is important and has an impact on moisture levels as well. Sandy soils usually require more frequent irrigation than the heavier clay content soils. Understanding your soils helps in deciding how much to water

There are several methods for watering newly planted trees. More common methods include applying water by hand and hose to the planting pit. Also, there is the trickling hose into the plant pit with the nozzle nestled up to the base of the tree. However, these aren't the most reliable and accurate methods of delivery. First of all, the person watering usually has no idea how much water is being applied. Secondly, there is no guarantee that water applied actually goes into the soil ball as opposed to the surrounding backfill. In these situations, it is possible that much of the water applied may have run off onto non-target areas. In other cases, the planting hole fills with water and the soil ball stays saturated and too wet for an extended time. Drainage is a must! Prolonged saturated soils can be just as detrimental to the tree as prolonged dryness. It's quite a quandary. How do you know when you've got it right?

Supplemental watering of trees can be accomplished in several ways. Drip systems are popular as a slow delivery method that allows the soil ball to become wet. Other options include:

1. Drip irrigation bags are produced under various trade names. These are vinyl bags with perforations allowing a slow delivery of water directly around the trunk and over the root ball.

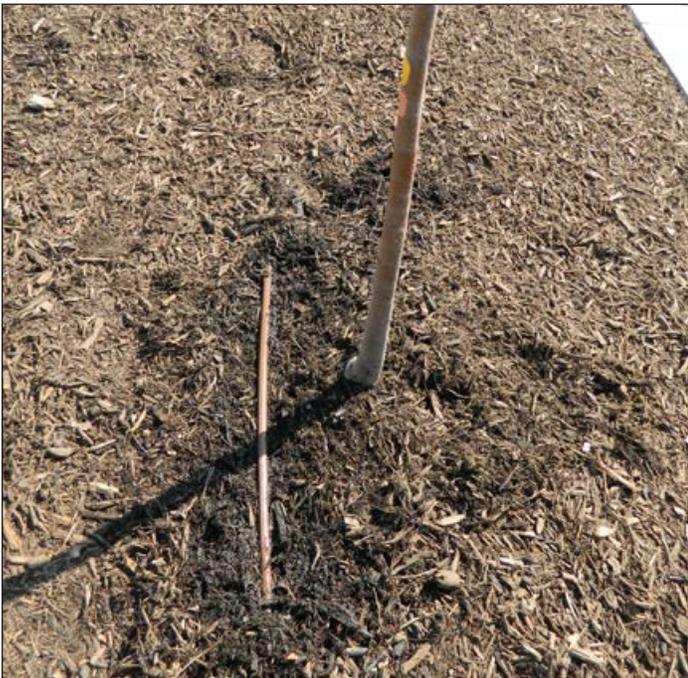


Apply water using a breaker to minimize runoff.



Drip irrigation bags allow slow delivery of water to the soil root ball.

2. An alternative, low-cost method is to puncture the side of a 5-gallon bucket near the bottom in several places, fill it with water, and place it next to the trunk for slow watering and refill as needed. The apparatus may not be as attractive, but accomplishes the objective of keeping the original soil ball moist, but not saturated.
3. A slightly more sophisticated method is using a drip system or emitters that can be connected to the end of a hose. This can be attached to an inexpensive electronic, battery-operated timer programmed that turns the water off after one or two hours of operation.



Drip irrigation delivers water on a timed basis.

Do not operate a drip irrigation system without a timer or without understanding water output. It is not possible to gauge the moisture content of the soil ball by observing the wetting of the soil surface. If the soil ball gets too wet and has inadequate drainage, disease problems will arise.

Other than estimating water needs by observing the plant for wilt, a great way to determine soil moisture is to use a soil probe. Soil probes are great tools for water management decisions, especially when some of the important factors are below ground. The key is to deliver the proper amounts of supplemental water while allowing adequate drainage between deliveries.

Watering Facts

- An inch of water per square foot is equal to 0.62 gallons.
- An inch of water will soak a clay soil about 4 inches deep.
- A cubic foot of water contains 7.5 gallons.
- To determine hose output, measure the time it takes to deliver water into a 5-gallon pail. Then, divide the 5 gallons by the time in minutes to determine the gallons-per-minute output.

Trees have managed to do quite well without us for many centuries, growing to be incredible, biological machines that provide us with life-sustaining benefits. However, in urban and suburban environments, trees often require assistance to overcome the challenging situations of these growing conditions. To maintain a vigorous tree, this translates into proper plant health care, which includes adequate moisture. Regardless of the delivery system or technique, when nature isn't supplying enough water, it is essential to help out with a little care.

Trees and all forestlands are a major asset to our cities, towns, and communities. They are working hard to provide aesthetic, functional, and environmental benefits to improve the quality of life. Preservation and conservation of our urban forests are of critical importance to all of us as professionals and as a society.

Plant a tree, cool the globe!

Credits:

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