



Drought Stress in Trees

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Recently, I told one of my Town Managers that we should be holding bonds on landscaping for the first two years, requiring developers/builders to water trees for the first two summers after planting so that the new trees can establish. I also said that turf irrigation shouldn't be relied on to establish new trees. The Town Manager replied, "What kind of trees should we be planting that aren't so thirsty. And what about 'zero-scaping'?"

Oh, boy ... This response perfectly encapsulates the uphill struggle of public education that is our job as tree professionals. I had erroneously assumed he knew that any species we planted would need at least some supplemental water to establish, and that the species is probably less important than the growing conditions.

The same can be said for drought stress in urban trees. Growing conditions are usually the biggest contributing factor to drought stress, specifically soil type/quality and the amount of impervious surface nearby. Drought stress is a simple concept. The amount of water in the soil surrounding a tree gets so low that the tree's roots cannot absorb enough moisture. This results in tissue death, first of fine hair-like roots followed by the large, fibrous roots. Root loss leads to system-wide stress in the tree, making the tree more susceptible to insect and disease and escalating its spiral of decline.

Signs of short-term drought stress are wilting, yellowing, scorching, and dropping leaves. **Signs of long-term drought stress** (commonly seen in newly planted trees that aren't being watered) are dead top branches and outer tips, thinning foliage, stunted leaf size, slowed or halted growth, increase prevalence of secondary pests, and poor response growth (callus tissue).

Urban soils are often of poor quality, meaning they suffer from compaction, top soil loss, low organic content, pollution picked up by stormwater or deposited from the air,

interrupted nutrient cycling, and a lack of soil microbes. Compaction of clay soils is especially detrimental because it reduces the ease of root penetration, decreases the ready movement of water through the soil, and decreases the soil's water holding capacity. This is one of the big reasons to improve your development ordinance by requiring the removal of at least 300 cubic feet per tree of clay/fill soil and replacing it with 'garden soil', or something similar, before planting.

Newly planted urban trees in North Carolina should be watered 1 year per 1-inch caliper, though this can vary depending on soil and other growing conditions, such as the amount of impervious cover nearby. Impervious surfaces prevent rain from permeating the soil and radiate heat upwards into the tree canopy. Such conditions artificially worsen the tree's hyper-local climate (e.g., each tree in a parking lot island). A lot of tree death can be prevented by improving soil before planting. This is especially true for trees in and near parking lots.

During extreme drought, even mature trees that haven't lost roots to construction can suffer. Mature trees can use hundreds of gallons of water a day, which may translate to hundreds of dollars per month if you were to provide the tree with its necessary moisture amount. But providing just *some* supplemental water during the worst period of a drought can be enough to keep a tree from entering the spiral of decline.

I lived in Austin, Texas, through a mega-drought that lasted about three years from autumn 2010 to late summer 2013. The Texas A&M Forest Service estimated that the drought killed about 10% of all the trees in the entire state (urban and rural communities). I remember leaving a garden hose on a trickle overnight at the base of mature pecans that were very valuable to me because they shaded my backyard and patio.

In sum, drought stress can largely be prevented through prior planning to improve soil health. Maintaining hardwood chips as mulch, adding organic compost, and reducing competition from turf grass are three treatments that can significantly boost soil health. To alleviate soil compaction, excellent treatments include vertical mulching, air spading, and the deep injection of water/fertilizer near existing trees.

Additional Resources

[Simple Steps to Aid Stressed Trees](#), *Kelby Fite of Bartlett Tree Research Laboratories*

[Drought and Landscape Trees](#), *Alabama Cooperative Extension*

[Drought Stress, Tree Health & Management Implications](#), *Connecticut Ag Experiment Station*