BARTLETT TREE EXPERTS
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Abiotic Disorders
Recognition and Treatment

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Landscape plants are exposed to many stresses caused by (non-living) agents including environmental, cultural and site disorders. The impact of these disorders on plant health is influenced by many factors including the type, severity and duration of the stress, species susceptibility to the specific disorder and age and initial condition of the plant. Often decline results from several abiotic agents that work in concert. Stress created by abiotic pathogens frequently predisposes landscape plants to secondary biotic pests such as borers, bark beetles, canker and root disease fungi that contributes to decline and death.

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Diagnosis: Diagnosis of abiotic problems can be difficult because many disorders cause similar symptoms. For instance, wilting in plants can be caused by low soil moisture, excess soil moisture, a root or vascular disease, root damage, certain chemical toxicities as well as soil related problems. Diagnosis is often dependent on a process of elimination where careful evaluation will eliminate specific agents to provide the actual cause or causes. Many factors should be considered in correctly diagnosing plant disorders:

- Correctly identify the plant and understand the culture and growing preferences.
- Look for patterns of damage; abiotic disorders often produce similar symptoms on different plant species. Look for the orientation within the plant. If the entire canopy shows similar symptoms, the disorder is frequently associated with the soil or root system.
- Site evaluation may be necessary to determine soil type, wind patterns and site use patterns.
- Maintenance histories for the plant and site may require evaluation. Considerations include irrigation, fertilization and pest management including weed treatments.

- Assessing weather records especially temperature and precipitation may be necessary. A useful website for historical weather data is operated by the National Climatic Data Center at: http://www.ncdc.noaa.gov/oa/ncdc.html. Accuweather also provides historical weather data at www.accuweather.com .

- Laboratory diagnostic analysis may be needed to confirm possible causal agents. Routine soil analysis should be considered for factors such as pH, mineral nutrient content and salt and sodium levels. Foliar analysis aids in confirmation of specific mineral nutrient deficiencies or toxicities. Chemical residue analysis can confirm the presence of an herbicide or other chemical contaminants from soil and plant tissue. If the suspect chemical is not known, residue analysis can become very expensive due to the trial and error nature of this procedure.

Notes on Specific Abiotic Disorders:

Temperature Extremes: Winter injuries were widespread throughout the northern US in the spring, 2004. This damage was primarily due to below normal January temperatures and lack of snow cover. These conditions caused root mortality as well as bud, branch and foliage (evergreen) injury. Low temperatures combined with wind also lead to desiccation of leaves, buds and twigs on evergreens. Non-native species with marginal hardiness were often damaged although widespread decline occurred on certain hardy natives, most notably eastern redcedar (*Juniperus virginiana*).
Arborists should be patient when considering treatments on plants with winter injuries.

Many plants exhibiting extensive dieback and defoliation following this winter produced new growth from stems and larger branches and were actually very attractive by mid-summer. The decision to remove or severely reduce winter damaged plants should be delayed until new growth resumes in the spring.

Soil Moisture Extremes: Much of the eastern half of the United States has experienced several years of consecutive drought followed by above average rainfall in 2003-04. Many mature trees and recent transplants still show decline as a result of the drought years despite the recent rainfall. Premature fall color and defoliation in some trees has been linked to excessive rainfall in 2004. Phytophthora root rot also appears more prevalent on sensitive species due to high rainfall followed by drought.

Excessive soil moisture is a chronic problem in many irrigated landscapes especially in years of high rainfall. Landscape plants with similar water needs and tolerances should be grouped for specific irrigation zones to prevent over-or- under watering. Rainfall or soil moisture sensors can be installed to prevent irrigation during periods of high rainfall.

Soil Related Disorders:

Soil and root related disorders are probably the most common abiotic problem found in urban landscapes. Insufficient soil volume created by pavement and building conflicts is a major factor limiting the lifespan of urban trees.

Soil compaction on high use sites and new developments physically impedes root growth and lead to root mortality due to low soil oxygen levels from limited pore space. Plants growing in dense soil also are more prone to drought due to lower water holding capacity resulting from the lack of adequate pore space.

Soil nutrient deficiencies and low organic matter contents are common in landscape soils. Alkaline soils frequently lead to micronutrient deficiencies in certain species including pin oak, river birch, sweetgum, red maple, rhododendron and other ericaceous plants.

Many of the soil problems associated with urban trees must be addressed during the planning stages prior to planting. Site assessments to determine soil volumes, soil type, pH, nutrient and organic matter content, drainage and bulk densities are considerations prior to planting. If major modifications are needed to the soil, these can be most economically undertaken before planting. Information obtained in the site assessment is essential to choosing trees species that are adapted to the soil conditions.. An excellent publication entitled *Recommended Urban Trees: Site Assessment and Urban Tree Selection for Stress Tolerance* is available from the Urban Horticulture Institute at Cornell University Website at:

http://www.hort.cornell.edu/department/faculty/bassuk/uhi/outreach/recurbtree/index.html

The introduction of soil excavation tools that utilize pressurized air such as the Air-Spade™ and Air-Knife™ has allowed cultivation of compacted soil within the root zone of mature trees without damage to the root system. These tools allow cultivation of large soil volumes which is a significant advantage over vertical mulching and soil replacement by trenching that can effectively disturb only small volumes of soil. Air-tools can incorporate organic amendments such as compost and composted pine bark to greatly enhance soil quality and health.

Chemical Injuries:

Damage from broadleaf herbicides applied to lawns is commonly seen in residential and commercial landscapes where quality turf is maintained. Dicamba and 2,4-D are usually responsible for the damage which is evident as leaf and shoot distortion and browning. Although this damage can be quite striking, trees usually tolerate the damage with no long term effects unless a gross misapplication was made. Damage from broadleaf herbicides can be minimized by making broadcast applications in fall or early spring before trees break bud. Spot-treating weeds within the tree root zone of trees can minimize impact of the damage

Disorders Related to Improper Cultural Practices

Planting Issues: There continues to be debate within the landscape industries over the impact of soil that is placed or left on top of the root collar following planting. In some cases, backfill is placed over the root flare during planting but many nursery trees are being produced with soil covering the root collar. Researchers have attributed increased mortality rates and poor growth with buried root collars. Planting specifications by ISA now specify that root collars must be visible after planting.
http://www.isa-arbor.com/publications/cadDetails/cadContent.asp?cd=landscape%20planting/specs/145-001.htm

Mulching: Mulch placed over the root flares also can lead to plant health problems including increased susceptible to certain infectious diseases and insect pest problems. Mulch placed against the root collar and stem also increases the likelihood of stem girdling roots on many tree species. Arborists must continually emphasize that mulch is intended as a soil and root treatment and there is no benefit from mulching stem tissues.

Pruning: Improper pruning can weaken trees and lead to their eventual decline. Most arborists are well aware of the problems associated with topping trees and this is not a topic that requires discussion with professional arborists. However, improper thinning continues to be practiced and accepted by many arborists. Thinning, by definition, is the removal of live branches to reduce density of the crown or a portion of the crown. When the crown is too dense, interior limbs become shaded die. This is one indication that thinning is necessary. When thinning is performed correctly, most of the cuts are made on the outer portions of the canopy to improve light penetration to interior portions of the crown. A properly pruned mature tree should have live branches on the interior portions of the crown.

Some arborists still thin trees by removing most of the branches on the interior portion of the crown and leave the outer canopy intact ("lion tailing") Often, an excessive amount of live branches are removed. These pruning practices can weaken trees by removing too much energy producing area from the crown. Lion tailing can increase the risk of branch failure by reducing branch taper and by eliminating the dampening effect that interior limbs provide when branches move during storms.

When crown density must be reduced, thinning should be concentrated on the outer portion of the canopy. The goal should be to increase light and air penetration to the interior branches to help maintain their health. A thinned crown should have an even distribution of foliage throughout the crown. (ISA Best Management Practices: Tree Pruning.
https://secure.isa-arbor.com/comersus/store/comersus_viewItem.asp?idProduct=4036

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