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SOLVING ABIOTIC TREE PROBLEMS

While tree problems attributed to **cultural and environmental factors** are common, they are becoming increasingly more common as populations increase and urbanization continues. In many cases there is little that can be done about these problems once they are observed so **prevention** is usually the best approach.

I. STRESS PROMOTING ELEMENTS:

A. Acute-

these are stresses that occur suddenly and cause damage soon after;
examples: improper pesticide sprays, frosts, freezes, injuries during transport

B. Chronic-

these are stresses that occur gradually and appear as a general decline;
examples: nutritional imbalances, improper pH of the soil, too low light

II. COMMON ENVIRONMENTAL PROBLEMS:

A. Meteorological Effects:

1. Frost-

a. Symptoms:

quite variable, depending upon time of damage; includes twig and branch dieback, bark cracking or splitting, leaf distortion; frozen tissues can turn blackish brown

b. Causal Factors:

damage can occur in late spring, early fall, and during dormancy; dormant frost damage can result in failure to leaf out

2. Sunscald/Sunscorch-

a. Symptoms:

variable, including bark splitting and leaf scorch; new growth of ornamentals may be affected under extremely high temperatures; often occurs on the southwest side of the tree during winter or early spring ("southwest injury")

b. Causal Factors:

periods of extremely high temperature combined with windy conditions; often a combination of above freezing temperatures during the day and freezing temperatures at night

3. Light-

a. Symptoms:

poor growth and vigor; undersized, off-colored leaves or needles; lower branch dieback is common

b. Causal Factors:

incorrect light level for tree species

4. Lightning-

a. Symptoms:

trunk shattering, splitting of bark and canopy dieback; a long slash up the cambium spiralling down the tree where a 1-4 inch wide strip of bark has been ripped off; long splinters of wood at base of tree

b. Causal Factors

lightning charge follows the most conductive path between top and roots, sometimes along the surface but often in outer sapwood

5. Winter Injury-

a. Symptoms:

dieback, foliar browning, sunscald, and bark splitting

b. Causal Factors:

late spring frosts (after growth has started), cool summer followed by a warm fall and drop in temperature, excessive or late season nitrogen fertilization, dry soil or root injury, frost cracking, excessive temperature fluctuations and drying winds, lack of snowcover

c. Commonly Affected Plants:

wide range of plants including broadleaved evergreens (rhododendron and mountain laurel), narrowleaved evergreens (arborvitae, yew, juniper, pine, and hemlock), deciduous trees and shrubs (weeping cherry, rose), and ground covers (pachysandra and ivy)

d. Control Measures:

1. select appropriate site for planting
2. have sufficient moisture in root zone before soil freezes
3. avoid late summer and early fall fertilization
4. mulch to increase moisture retention in winter
5. prune out dead branches or twigs in spring and fertilize to stimulate new growth
6. use of anti-transpirants or anti-desiccants

B. Air Pollution:

1. Symptoms:

highly variable, depending upon type of pollutant and plant host; typically classified as **acute** or **chronic**; **acute injury** normally involves the death of cells and develops within a few hours or days following exposure to high levels of pollutants; symptoms include stippling or altered pigmentation, flecking, bleaching, chlorosis, interveinal and marginal necrosis, and tip necrosis; **chronic injury** typically develops more slowly, within days or weeks following exposure; this type of injury usually appears in response to long-term, low-concentration exposure; in some

cases, visible symptoms are not present but exposure results in suppressed photosynthesis rates, stimulated respiration, and suppressed growth; symptoms are often subtle and easily confused with other problems such as normal senescence, nutritional disorders or other environmental stresses

2. *Causal Factors:*

major classes of phytotoxic air pollutants, in descending order of direct damage are: oxidants (ozone O₃, PAN), sulfur dioxide (SO₂), and fluorides (hydrogen fluorides HF)

3. *Commonly Affected Plants:*

significant differences in sensitivity of plant species to specific pollutants occur; particularly sensitive tree species to specific pollutants are:

O₃-- white ash, eastern white pine, black cherry, catalpa, honey locust

SO₂-- larch, birch, American elm, eastern white pine

HF-- young, expanding needles of pines and spruces, paulownia, Douglas fir, serviceberry

4. *Control Measures*

- a. plant resistant or tolerant species where pollutants are known problems
- b. maintain good plant vigor by proper cultural practices

C. Water Problems:

1. Drought-

a. *Symptoms:*

loss of turgor in needles or leaves, drooping, wilting, yellowing, premature leaf or needle drop, dieback, poor growth, stunting, plant death; predisposes plant to secondary problems and cultural injuries; symptoms often not evident until the year after drought occurs

b. *Causal Factors:*

soil water becomes deficient and results in feeder root damage and death; plant unable to take up water

c. *Commonly Affected Plants:*

broad range of deciduous and evergreen trees and shrubs; effects are particularly severe on seedlings or recent transplants but established plants are also affected; especially affected this year were maple, ash, hemlock, juniper, dogwood, rhododendron

d. *Control Measures:*

1. water in periods of low soil moisture
2. select appropriate site and use proper planting practices
3. select native plants adapted to local seasonal and annual variations in the water supply; drought sensitive (e.g., dogwood, many oaks, arborvitae, many *Viburnum*) vs drought tolerant species (e.g., most pines, many *Prunus*, eastern larch, some junipers)
4. prune out dead branches or twigs in spring

2. Excess Water-

a. *Symptoms:*

highly variable, including epinasty (downward bending of petioles), stem swelling, chlorosis, edema, reduced and stunted growth, twig dieback, wilting, leaf drop, root and plant death

b. Causal Factors:

root damage in flooded or waterlogged soils is associated with oxygen deficiency; damaged fibrous roots die, decay, and plants are unable to take up water; predisposed plants are subject to secondary invaders and opportunistic pests

c. Commonly Affected Plants:

seedlings and new transplants are more sensitive than established ones; dormant plants tolerate flooding longer than those in active growth; angiosperms are generally thought to be more tolerant than gymnosperms; particularly affected are yews, hemlocks, maples, rhododendrons

d. Control Measures:

1. avoid plant stress by appropriate site selection and proper planting practices
2. maintain vigor by fertilization to stimulate good growth
3. select appropriate species for site and soil conditions, water-tolerant species (e.g., red maple, eastern larch, forsythia, green ash) vs water-intolerant species (e.g., gray and paper birch, crabapple, dogwood, eastern hemlock)
4. prune dead or dying tissues to minimize problems from secondary invaders

D. Soil Modification:

Trees are affected by many types of mechanical and chemical injuries and symptoms often do not show up until considerably after the damage has been done and often not until it is too late to save the tree; these injuries can result in significant damage the root system;

1. Mechanical-

a. Construction Injuries:

- "Bulldozer Blight" often damaging the base of the trunk

b. Soil Compaction (Root Smothering):

- roots are crushed by driving heavy construction equipment or trucks over roots

c. Root Cutting:

- roots are cut when excavating for foundation walls, sidewalks, or streets

2. Chemical-

a. Salt:

- salt damage results from both direct sprays and from absorption through roots; one type of damage results from coastal flooding with salt water; a second type is associated with de-icing salts which cause damage to roots when they buildup and leach into soil and damage foliage and branches when salt-containing water form the "spray zone" comes in direct contact with plant tissues

b. Excess Fertilizer:

- often results from over-application of lawn fertilizers and can cause excessive levels of soluble salts and subsequent root damage

c. *Natural Gas:*

- gas leaking into the soil induces anaerobic conditions; microorganisms in the soil transform sulphates to hydrogen sulfide which inhibits respiration by the roots and nutrient uptake

d. *Herbicide:*

- careless or misapplied herbicides, most frequently associated with lawn applications of broadleaf weed killers such as 2,4-D or dicamba in root zones of woody ornamentals

E. Mechanical Injuries:

These types of injuries result in direct physical damage to the tree and cause a variety of symptoms from canopy thinning to tree death.

1. *Lawnmower, String Trimmer*
2. *Storm / Wind Damage*
3. *Snow and Ice Damage*
4. *"Human" Damage*

V. NUTRITIONAL PROBLEMS:

Although considerable research has been conducted in order to understand nutrient imbalances associated with toxicities and deficiencies, the effects of either extreme are *very* difficult to diagnose. In many cases, soil and plant tissue analyses are necessary for accurate diagnosis. Symptoms of imbalance may appear on all or any parts of the tree but are most common on foliage. In some cases, nutrients may be present in the soil but are unavailable for uptake by the tree due to many factors including soil pH problems, competition with other ions, and root damage.

- A. **Deficiencies**
- B. **Toxicities**

VI. ANIMAL DAMAGE:

Animals can cause significant damage to woody ornamentals in urban, suburban, and rural settings; damage results in a variety of symptoms from decline to sudden death.

- A. **Squirrels**
- B. **Voles / Meadow Mice**
- C. **Deer**

VII. OTHER PROBLEMS:

Trees are subject to so many other problems they are too numerous to mention. However, two common cultural problems are worth mentioning.

- A. **Girdling Roots**
- B. **"Flower Disease"**