

## Don't Get Caught With Your Plants Down!: Abiotic Disorders



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### Abiotic Disorders

- ◆ Plant problems (injuries) caused by non-biological agents
  - ✓ Excludes diseases, insects or animals
- ◆ Includes environmental, chemical, structural, physiological, mechanical and cultural issues
- ◆ Disorders often have specific symptoms
- ◆ Weakens plant, become more susceptible to biotic factors (borers, vascular wilts, root rot)

### Abiotic vs. Biotic Disorders

- ◆ **Biotic:** physical signs of insects or diseases (rust spores, mushrooms, conks, powdery mildew)
  - ✓ Spread progressively in plant and nearby plants
  - ✓ May be limited to specific host species: bronze birch borer, EAB
  - ✓ Or have large host range: Japanese beetle, apple scab

### Abiotic vs. Biotic Disorders

- ◆ **Abiotic:** physical signs not found
  - ✓ May develop progressively through plant or population: chronic problems such as construction injury
  - ✓ Or occur instantaneously: gas line leak
  - ✓ Affects numerous plant species: drought stress
  - ✓ Climate, weather and cultural practices primary causes

### Abiotic Disorder Diagnosis

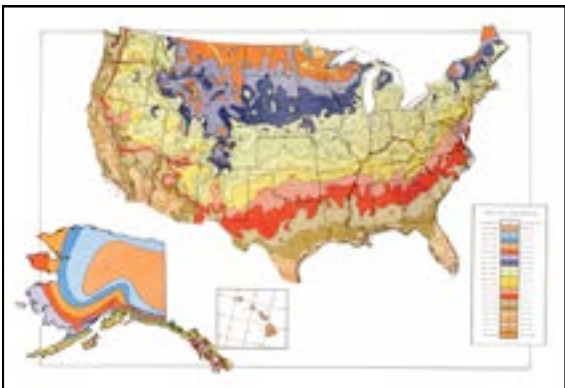
1. Identify the plant
  - ✓ Normal growth characteristics
  - ✓ Specific cultural requirements
2. Identify the symptoms
  - ✓ Chlorosis, necrosis, discolored, abnormal growth and overall size, etc.
3. Inspect entire plant
  - ✓ Include the roots, leaves, fruit, branches, bark, base of trunk
4. Site analysis
  - ✓ Soil and environmental conditions

### Abiotic Disorder Diagnosis

5. Look for patterns
  - ✓ Uniform or scattered symptoms
  - ✓ Single species or multiple species affected
6. Know site history and plant care
7. Identify all potential causes and reasons
8. Verify likely causes
  - ✓ Soil, water or tissue samples sent to lab
  - ✓ Use appropriate resources: books, extension pubs, websites

## Abiotic Disorders: Environmental (climate and weather)

## What is up with our climate?



Previous U.S.D.A. Plant Hardiness Zones 1990



- ### Cold Temperature Injury
- ◆ Cold temperature injury:
    - ✓ Plant must avoid rapid deacclimation during unseasonably warm late winter/early spring weather
      - ✓ Selection of northern provenances, cultivars
    - ✓ Most severe with late winter/early spring or early fall hard freezes or
    - ✓ Warmer winter temperatures causes budbreak followed by very cold
    - ✓ Plants must also rearden following unseasonable warm winter weather or very early spring
    - ✓ If deacclimation progressed too far, cells become "leaky", plant tissue killed

- ### Cold Temperature Injury
- ◆ Symptoms:
    - ✓ Winter kill of buds or twigs
    - ✓ Dieback of branches, death of tender shoots, flowers, fruit
    - ✓ Death of entire plant or roots
    - ✓ Frost damage
    - ✓ Bark splitting, death of cambium
    - ✓ Leaf tatters during leaf expansion
    - ✓ Sunscald, frost crack, bark splitting on trunk
    - ✓ Winterburn of evergreen foliage
    - ✓ Soil heaving of new plants and perennials

Cold Temperature Injury



Cold Temperature Injury



Cold Temperature Injury: Death



Cold Temperature Injury: Drought followed by Freeze



Cold Temperature Injury: Bark Splitting



Can be due to sudden, extreme temperature drops, animal damage, lack of hardiness, stem or root injury, etc.

Cold Temperature Injury: Late Frost

- ◆ As little as 1-2°C can make a huge difference in survival of plant tissues
- ◆ Large bodies of water (Great Lakes) help moderate temperatures
  - ✓ Slow, gradual increase in temperatures in spring, cooler in summer due to winds, slightly warmer in fall and winter
- ◆ Air passing over frozen water is cooled, delaying budbreak in spring
- ◆ Air passing over open water is warmed, helps prevent late frost injury

### Cold Temperature Injury: Late Frost



### Cold Temperature Injury: Late Frost/Freeze

- ◆ Freezes are usually associated with wind, low humidity, and no visible frost deposition on foliage
- ◆ Death of new shoots, even though plant hardy to your hardiness zone
- ◆ Bark splitting of cambium/phloem
- ◆ Scorching of new broad-leaved evergreen foliage
- ◆ Amount of injury depends on temperature extreme, duration of cold temperature, and speed of temperature drop

### Cold Temperature Injury: Leaf Tatters

- ◆ Late spring frosts as buds expand and leaves are developing may cause damage to developing leaves
- ◆ Injured leaves appear sheared, jagged, distorted, lacy in texture and may brown with curled edges
- ◆ Symptoms apparent a day or two after frost
- ◆ Winds dry out and tear or shred leaves further
- ◆ Often seen on oaks: oak tatters
- ◆ Trees growing in low areas or frost pockets are most susceptible
- ◆ Treatments are not needed, will grow out of it

### Cold Temperature Injury: Leaf Tatters



### Cold Temperature Injury: Prevention

- ◆ Select cold hardy plants!
- ◆ Plant in mid to late spring, but fall is good time to plant for some species
- ◆ Use windbreaks to reduce winterburn
- ◆ Plant broad-leaved evergreens and sensitive needle-leaved evergreens out of winter sun and winter winds: partial shade to shade (N.E. or E.)
- ◆ Reduce nitrogen fertilization in late summer so plants harden off properly in fall, stop growing
- ◆ Don't prune heavily in early fall: may encourage flush of new leaves
- ◆ Keep plants healthy, free of insects and diseases
- ◆ Keep new plants watered until ground freezes

### Cold Temperature Injury: Prevention



Rose cones built up heat, cause bud break, must vent





### Cold Temperature Injury: Prevention



Cover reduces radiation heat loss from plants and soil. Plants must be exposed to sun during day to build up heat.

### Cold Temperature Injury: Sunscald or S.W. bark injury



### Cold Temperature Injury: Sunscald or S.W. bark injury

- ◆ **Sunscald Causes:**
  - ✓ Sunny, winter days heat up tree trunk on S.W. side by up to 10°C above air temperatures
  - ✓ Sun sets and bark temperature drops fast causing a shrinking of the bark and sometimes vertical frost cracks also develop
  - ✓ Resulting wounds are invaded by one or more species of fungi that results in continued expansion of cambial kill
  - ✓ Occurs on thin-barked species: mountainash, lindens, honeylocust, cherries, plums, young maples, magnolias

### Cold Temperature Injury: Sunscald or S.W. bark injury

- ◆ **Symptoms in tree:**
  - ✓ Yellowing or browning of the leaves in a part of the crown or on individual branches, mainly on southwest side of the tree
  - ✓ Discoloration moves throughout tree
  - ✓ Lawn mower injury may be apparent at base of tree
  - ✓ S.W. side of trunk has bark cracking with death of cambium
  - ✓ Inner bark is brown rather than green
  - ✓ Canker (discoloration with dead patches or sunken areas) present that may encircle the trunk killing the tree
  - ✓ Borers may move into the tree near sunscald
- ◆ Decline may progress over several years

### Cold Temperature Injury: Sunscald or S.W. bark injury

- ◆ Injury occurs in late winter to very early spring
- ◆ **Prevention:**
  - ✓ Limited, if any, prevention with use of tree wrap, **MUST** remove wrap in early spring, do not leave on throughout growing season, heats up underneath, nice place for insects
  - ✓ Use of loose, white, plastic shells are better, have holes in it
  - ✓ Avoid flush cuts, root or trunk injury
  - ✓ Place mulch around base of tree, avoiding touching the trunk, to prevent lawn mower injury
  - ✓ Young trees: maintain lower branches as long as possible that shade trunk
  - ✓ Plant original S.W. side of tree grown in the nursery facing S.W. when planted in landscape
  - ✓ Water trees during drought!
  - ✓ Plant properly, don't bury the root flare or else injury and basal rot can start

### Cold Temperature Injury: Frost Cracks



**Cold Temperature Injury: Frost Cracks**

- ◆ Frost cracks: longitudinal trunk cracks occurring in the bark and wood parallel to the grain that extend to center of trunk
- ◆ Colder the temperatures, the wider the crack
- ◆ Opens in winter, closes in spring, considerable callus formation along edges of crack followed by wood decay
- ◆ Trees 6-18" in diameter more affected than smaller or larger trees
- ◆ Deciduous trees more prone to frost cracks than evergreens
- ◆ Open grown, landscape trees more prone than forest trees
- ◆ Common species affected: honeylocust, linden, London planetree, maples, elms, horsechestnut, oaks, crabs, beech, ash

**Cold Temperature Injury: Frost Cracks**



**Cold Temperature Injury: Frost Cracks**



Deep planting = no root flare, root death, basal rot, large frost crack

**Cold Temperature Injury: Prevention**

- ◆ Limited to no prevention with use of tree wrap
- ◆ Prevention: proper tree planting (depth), avoid flush cuts and root injury, prevent trunk wounds, painting of lower trunk with white latex paint (orchards), proper watering during droughts (avoids root death/injury)



**Cold Temperature Injury: Winterburn**



Desiccation of foliage most severe on winter wind side and side facing winter sun



**Cold Temperature Injury: Winterburn**

- ◆ Winterburn: foliar necrosis (death) of broad-leaved evergreens or narrow-leaved evergreens
- ◆ Water loss from leaves when soil is frozen
- ◆ Either roots unable to absorb moisture or trunk unable to transport it
- ◆ Desiccation most severe on winter wind side and side facing winter sun



**Winterburn Prevention**

- ◆ Anti-transpirant: sprayed on evergreen foliage in fall to reduce evapotranspiration during winter when ground is frozen and plant requires water uptake
- ◆ Must reapply often, washes off
- ◆ Limited success in preventing winterburn, clogs stomates
- ◆ Use of burlap, snow fencing, canvas, etc. placed around plant or in front of plants can help
- ◆ Best to plant evergreens so they are out of winter wind and winter sun (N.E. or eastern side of building)
- ◆ Make sure plants well watered into fall

**Cold Temperature Injury: Soil Heaving**

- ◆ Surface soil with little mulch or snow
- ◆ Leads to soil lifting up and down from alternate freezing and thawing
- ◆ Problem on fall planted or newly planted material and herbaceous perennials without an extensive root system
- ◆ Problem more at beginning and end of winter
- ◆ Breaks roots and exposes roots to cold injury
- ◆ Use mulch cover, evergreen boughs, hay, loose material over newly planted material

**Snow and Ice Damage**

**Ice and Snow Damage**

- ◆ Wet snow, freezing rain, and ice can build up on branches causing excessive loading
  - ✓ Ice-covered twigs can weigh 12-40 times as much than twigs without ice (Pirone, 1978, Semonin, 1978)
  - ✓ 50 tons of ice formed on 50 ft. evergreen tree (Semonin, 1978)
- ◆ Limbs may break, deforming trees, ruining form
- ◆ Some trees and shrubs totally lost due to ice damage, especially if high winds follow icing
- ◆ Snow plow injury becomes evident following spring after melt
- ◆ Trunks of trees can be seriously injured
- ◆ Shrubs suffer damage from being driven over or too much snow plowed over it leading to broken branches

**Snow Damage**

Snow plow injury on maple



Excessive snow load bends and breaks limbs



**Ice Damage**



### Ice Damage

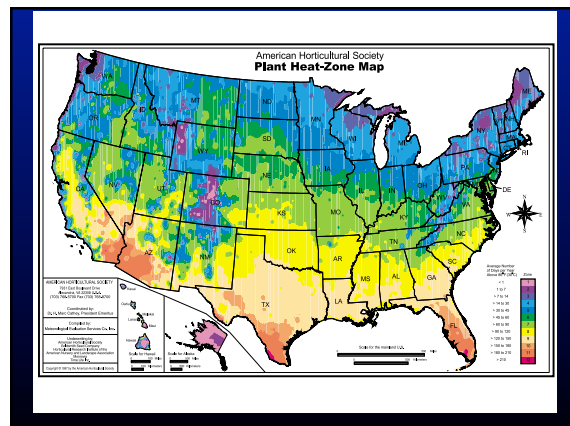


### Heat Tolerance and Injury



### Heat Tolerance

- ◆ American Horticultural Society Heat Zone Map
  - ✓ Based on average, annual days above 86°F
  - ✓ Lower the heat zone, the cooler the climate, ex. Zone 2 vs. 5
  - ✓ Wisconsin has four heat zones:
    - 2: Northeast WI and near UP border
    - 3: North central WI and Door County
    - 4: Eastern, western and central WI
    - 5: Extreme southern and western WI



### Heat Tolerance

- ◆ Heat zones important in southern and western U.S.
- ◆ Becoming a bigger issue with intensely hot and dry summers: 2012
- ◆ Important in northern U.S. in urban areas, particularly with areas of concrete and buildings nearby
  - ✓ Ex. Paper birch prefers heat zones 3 and below



**Native stand of paper birch, cooler**





**Heat Injury**

- ◆ Plants killed or seriously injured above certain maximum temperatures with roots being most sensitive to high temperatures
- ◆ Desiccation of tissues: transpiration exceeds moisture absorption
- ◆ Leaves wilt, death of plant parts or entire plant
- ◆ Membranes become leaky, will not recover
- ◆ Plants with small, thicker leaves more heat tolerant than thin, large leaves (less cuticle development)
- ◆ Burning of shade leaves placed out in sun
- ◆ Dark respiration exceeds photosynthesis at temps. > 86°F leading to burning up of carbohydrates, less for stress tolerance and pest resistance

**Too much sun: Japanese pachysandra**

**Heat Injury**

- ◆ Urban heat island effect in cities:
  - ✓ Warmer due to trapping and radiating heat, reflecting light from buildings
  - ✓ Create shade from tall buildings and have more cloud cover
  - ✓ Tunnel winds next to tall buildings increasing the wind velocity
  - ✓ Soil compaction, dry, "baked" soils
  - ✓ All of this depends on size of city and amount of vegetation cover
  - ✓ Creates microclimates on different sides of buildings

**Heat Injury**

West side of pot facing sun has significant root death: temps. exceed 46°C in nursery containers

### Heat + Drought Injury



### Heat Injury: Treatments

- ◆ Not much we can do as cannot control the temperatures
- ◆ Evaporative cooling with irrigation
- ◆ Can scorch plant as water acts as magnifier
- ◆ Must have continual water on leaves to cool
- ◆ Run risk of overwatering plants
- ◆ Provide shade, impractical
- ◆ Great year for testing plants for heat and drought tolerance!

### Shade Protection of Young Plants



### Drought Stress



### Drought Stress

- ◆ Most of the country was under some level of drought, some extreme
- ◆ One of the driest summers on record, compare to drought of 1988
- ◆ Many, many plants perished, especially newly planted material and drought sensitive plants
- ◆ Provided a good year for evaluation of drought and heat tolerant ornamentals!
- ◆ Required frequent watering on daily basis for newly planted material
- ◆ Dependent on soil type, sandy soil worse
- ◆ Excessive use of road salt exacerbated the problem



### Soil moisture and drainage, too dry, not watered first year



### Drought Stress

- ◆ Water essential for plant growth and development, maintenance of physiological processes
- ◆ Some plants shut down entirely and died
- ◆ Drought sensitive species: Japanese tree lilac, magnolias, pagoda dogwood, Norway spruce and dwarf cultivars, bottlebrush buckeye, hydrangeas, nannyberry, witherod and arrowwood viburnums, burningbush, dwarf Alberta spruce, red osier dogwood, arborvitae
- ◆ Tolerant species were able to slow growth and reduce evapotranspiration by closing stomates, reduce photosynthetic activity

### Drought Stress

- ◆ Drought tolerant species: Palibin lilac, dwarf forsythias, Kalm's St. Johnswort, eastern ninebark, sumac, weigela, black chokeberry, Koreanspice viburnum, New Jersey tea, American hazelnut, Vanhoutte spirea, lilacs, junipers, dwarf bushhoneysuckle, hedge cotoneaster
- ◆ Established plants ONLY, not newly planted
- ◆ Recent research shows plants subject to drought stress form air embolism (air bubble) in xylem vessels, hard to get water up stem (suckers)
- ◆ Plants tolerant to drought, "sip" water slowly over time

### Drought Stress

- ◆ Management:
  - ✓ Proper tree planting
    - ✓ Removal of burlap/basket at time of planting
    - ✓ For container grown stock, bareroot so no interface
    - ✓ Bareroot planting: soak roots in bucket first
  - ✓ Water adequately, at least 1" a week, if it does not rain, check moisture level right in root ball
    - ✓ Soaker hoses, slow flow hose, gator bags
    - ✓ Estimate 5 gal. water per 1" tree caliper
    - ✓ Well watered root system establishes faster
  - ✓ However, with extreme temperatures, this was not enough for many species
    - ✓ Newly planted material needed watering every other day or daily (container grown)
    - ✓ For B&B, water 1-3 times per week, depending on temps

### Drought Stress

- ◆ Management:
  - ✓ Get rid of turf growing directly under tree: competes for water and nutrients
  - ✓ Mulching helped, no more than 2-3" of mulch, over-mulching can prevent water percolation
    - ✓ Wider mulch rings better
    - ✓ Do NOT use weed fabric under mulch as weeds can germinate in mulch and hard to remove from fabric
  - ✓ Keep mulch away from trunk of trees and shrubs
  - ✓ Mulch can be hydrophobic, preventing water from reaching root system, shredded softwood bark (cedar, pine, fir) bark are best

### Soil moisture and drainage, too wet, watered often due to irrigation in turf



### Flooding

- ◆ Toxic effects
  - ✓ Lack of oxygen, respiration stops in roots
  - ✓ Carbon dioxide buildup in soils
  - ✓ Mineral nutrients can become toxic
  - ✓ Fermentation in root cells leads to root rot
  - ✓ Photosynthesis stops in leaves as stomates close
  - ✓ Transpiration slows down, no cooling affect
  - ✓ Soil biology affected, microbes can die
  - ✓ In just a few days, root loss occurs
  - ✓ Prolonged flooding will kill plants

### Flooding: Long Term Affects

- ◆ Plants become more sensitive to future flooding events
- ◆ Unable to defend against pests, more susceptible to root/collar rot and borers
- ◆ Lack of tree stability due to root loss and saturated soil
- ◆ Grade, drainage and erosion changes

### Hail Injury



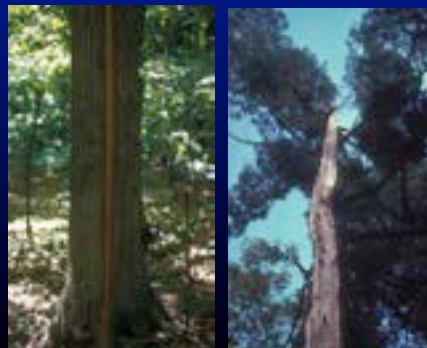
### Hail Injury

- ◆ Damage:
  - ✓ Hail can ruin a plant's form, break small limbs (depending on size of hail stones), defoliate tree as well as flowers and fruit, severely damage trunks
  - ✓ If damage is severe enough, trees can NOT be sold!
  - ✓ No prevention as it is weather related
  - ✓ If growing containers, can put them in lathhouse

### Lightning Injury

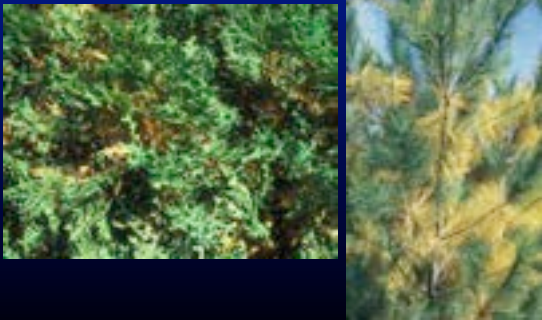


### Lightning Injury





## Fall Defoliation of Conifers



## Fall Defoliation of Conifers

- ♦ Normal part of conifer life cycle:
  - ✓ Normal leaf yellowing and drop of older needles and scale-like leaves can occur on evergreens in fall
  - ✓ Examples: arborvitae, pines, spruce, fir, Douglas-fir, yews, junipers, hemlocks, falsecypress, etc.
  - ✓ Some shed 2-3 year old needles (white pine, arborvitae) versus holding onto leaves for a long time before older ones shed (junipers, bristlecone pine)
  - ✓ Foliage that drops occurs in interior portion of tree/shrub

## Soil and Nutritional Problems



## Urban Soils

- Physical changes (e.g. structure)
- Great vertical and spatial variability
- Compacted (usually macropore loss)
- Over-fertilized
- Often have soil crust or subsoil exposure
- Altered pH, usually elevated
- Restricted aeration and water infiltration
- Interrupted nutrient cycling
- Anthropogenic material
- Modified soil temperature
- Usually decreased SOM



## Compaction

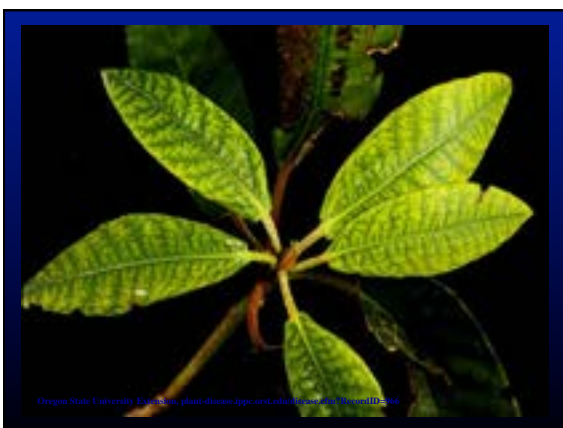
Houses are built using bulldozers, skid steers, backhoes, trucks, gravel, limestone, and asphalt, but why is the oak tree I wanted to save dying?

## Drainage Problems

- ◆ Most plants do not like wet “feet”
- ◆ Plant the right plant in the right location
- ◆ Improve soil drainage **BEFORE** planting
  - ✓ Install French drains or drain tiles
  - ✓ Regrade soil to avoid puddling and low areas
  - ✓ Incorporation of organic matter
- ◆ For existing sites with trees already planted
  - ✓ Vertical mulching
  - ✓ Addition of organic matter
  - ✓ Sand applied to clay will **NOT** work, creates concrete

## Nitrogen Deficiency

- ✓ Slow growth, small leaves, reduced growth from year to year
- ✓ **Symptoms:** yellowing of leaves, especially older leaves due to mobility of N in xylem
- ✓ Whole plant looks stunted and off color
- ✓ Difficult to measure in soil, many forms available
- ✓ Foliar analysis and visual assessments are better



## Chlorosis

- ◆ Cause: Micronutrient (Fe or Mn deficiency from alkaline soil pH, Fe and Mn are probably sufficient in soil, but with high pH, their forms become unavailable for root uptake)
- ◆ Problem trees:
  - ✓ Oaks (especially pin and white oak)
  - ✓ River birch
  - ✓ Red Maples (Mn deficiency)
  - ✓ Rhododendrons
  - ✓ Other woody plants can also be affected

Soil pH, fertility,  
and texture:  
healthy pin oak



Soil pH, fertility,  
and texture:  
chlorotic pin oak  
due to iron  
deficiency, high pH





**Chlorosis on rugosa rose**

**Micronutrient Deficiencies: Manganese (Mn)**



Manganese Deficiency  
Symptom Progression  
on Red Maple

Addition of iron will make this problem worse!  
Similar symptoms as Fe deficiency  
Do foliar analysis to determine which ion  
Common in some maples

**Chlorosis**

- ◆ Management:
  - ✓ Plant the right plant in the right location
  - ✓ Monitor soil pH and soil nutrients
  - ✓ Decrease pH using sulfur or aluminum sulfate
  - ✓ Add chelated Fe and/or Mn as needed
  - ✓ Make sure trees are adequately watered
  - ✓ Minimize damage to trees' root systems

**City Tree Planting: Terraces, Boulevards**



**Urban Tree Planting: Tree Tombs**



**Urban Tree Planting: Think Planting Area, Not Planting Hole**



**Deicing Salt Impacts of Ornamental Plants**



**Salt Spray Injury On Maple**



**Salt Spray Injury: Witches Brooming**



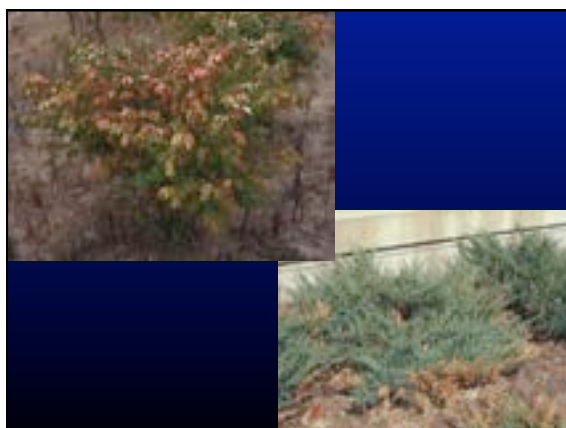
**Needle Tip Burn From Salt Spray**

**Herbicide Injury**



### Herbicide Injury

- ◆ **Causes:**
  - ✓ Growth regulator herbicides
    - ✓ 2,4-D
    - ✓ Dicamba
    - ✓ Atrazine
    - ✓ Imprelis
  - ✓ Other herbicides
- ◆ All plants are susceptible to injury



### Imprelis® Injury on Conifers

Two photographs of conifer trees showing Imprelis injury. The top image is a close-up of a branch with brown, damaged needles. The bottom image shows a whole conifer tree with significant brown, damaged foliage.

### Imprelis® Injury on Conifers

Two photographs of conifer branches showing Imprelis injury. The top image is a close-up of a branch with brown, damaged needles. The bottom image shows a branch with brown, damaged needles, likely a result of herbicide application.

### Imprelis® Injury on Honeylocust

Two photographs of a Honeylocust tree showing Imprelis injury. The top image is a close-up of a hand touching a branch with distorted growth. The bottom image shows a Honeylocust tree with distorted growth, likely a result of herbicide application.

## Herbicide Injury

- ◆ **Control:**
  - ✓ Apply herbicides only when needed
  - ✓ Follow application directions exactly
  - ✓ Apply herbicides only when wind speed is low (< 5 mph)
  - ✓ DO NOT apply herbicides too close to non-target plants
  - ✓ Apply herbicides at low pressure
  - ✓ Use amine rather than ester forms of herbicides as they are less volatile

## Cultural Problems: Human Activities

## Things to Consider Before Planting

- ◆ **Where to Plant**
  - ✓ Look out for above ground and below ground utility lines or septic fields
  - ✓ Is location big enough, both height and width, to support tree/shrub growth
  - ✓ Call Digger's Hotline BEFORE you dig!
- ◆ **Plant the right plant in the right location**
  - ✓ Do a soil test first to determine what can grow in your soil environment
  - ✓ Choose plants adaptable to your soil conditions
  - ✓ Choose cold hardy plants that are pest resistant
- ◆ **Buy only quality nursery stock**
  - ✓ Look at the roots, not just the top

## Why are our trees dying so young?



## Deep Planting and Girdling Roots



## Deep Planting and Girdling Roots







## Staking Trees

- ◆ When to do it?
  - ✓ All bareroot and container grown trees, some B&B
  - ✓ Windy locations
  - ✓ Area subject to vandalism
  - ✓ Prevents lawn mower damage: keeps them away
- ◆ How to stake?
  - ✓ Do NOT use rubber hose, wire, or other constricting material; will girdle trunk within one year!
  - ✓ Use loose, flexible material: 2-3" wide, canvas or seat belt webbing material either with metal grommets or not
  - ✓ If have metal grommets, place heavy gauge wire through grommets and around tree stakes, not around tree
  - ✓ If no grommets, place flexible material around stake and staple it onto itself to tighten, but not too tight

## Improper Staking of Trees



## Improper Staking of Trees: Effects



## Staking and Wrapping Trees

- ◆ Tree wrap, is it needed?
  - ✓ Used mainly to protect trunk during shipping
  - ✓ Must remove packing material; additional tree wrap is not recommended
  - ✓ Wrapping material placed tightly against trunk increases relative humidity underneath: can increase canker fungi
  - ✓ Raises temperatures next to trunk: sunscald
  - ✓ Wrap can hide wounds created at nursery
  - ✓ Frost crack/sunscald on trunks often due to too deep of planting, drought stress, flush cuts of branches, and root injury

## Trees Wraps: Not Recommended



## Mulch Volcano: Bad for Trees








**Establishment Period:  
Is planting a bigger tree better?**

**Establishment Period after Planting**

- ◆ Establishment Period = 3 – 12 months depending on USDA Hardiness Zone per diameter inch of tree
- ◆ 2" Tree in Zone 9 = 3 months/inch caliper tree
- ◆ \*2" Tree in Zone 4 = 12 months/inch caliper tree

Gilman and Watson

**Root and Top Growth of a 1" Caliper Tree**  
A 1" caliper tree would have a normal root diameter of 4.5 feet in the wild. Less than 5% of the root system is transplanted when dug from field.




Based on 18" of root growth/year

Watson, G.

First Year. The tree is under severe water stress soon after transplanting. With good care the stress diminishes, and the root system diameter should increase to 4.5 feet, 100% of the original, by the end of the first year. Roots and top are now balanced and tree should grow with normal vigor

**Root and Top Growth of a 4" Caliper Tree**  
A 4" caliper tree would have a normal root diameter of 18 ft. in the wild. Less than 5% of the root system is transplanted in the root ball when dug from field.



Based on 18" of root growth/year

First Year. Root system diameter increases to 6 feet, 9% of original volume. With less than 10% of the absorbing roots to support a full crown (top), the tree is often under severe water stress, inhibiting top growth, including bud formation

Smaller trees have a shorter establishment period, get bigger faster



Figure 31 — When planted at the same time, a smaller tree can establish more quickly. The tree on the right, which was smaller in diameter when planted (indicated by circles), grew larger in 3 years.

Have a Great Day and Think Spring!



Questions?

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