Arbor 101
Non-Parasitic Conditions in Landscape Trees

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What is a plant disease?

What is a plant disease?

"A condition of the living plant body
(or one of its parts)
that impairs the performance
of a vital function."

Webster's Dictionary

What is a plant disease?

"An injurious physiological activity
caused by the continued irritation
of a primary causal factor
and expressed in
characteristic physiological conditions called symptoms."

Many plant pathology texts

What is a plant disease?

"An impairment of the normal state of the living plant body (or of any of its components)

that interrupts or modifies the performance of the vital functions,

being a response to:

- environmental factors
- specific infective agents
- inherent defects of the organism
- or to combinations of these factors ."

The <u>really</u> big Webster's Dictionary

What is a plant disease?

An alteration in the normal

- Physiology
- Structure
- Function
- Aesthetic Value
- Economic Value

Types of Plant Disease

Biotic

Infectious diseases caused by living organisms

Abiotic

Non infectious diseases caused by environmental or cultural conditions

Stresses in Plants Can Be

Chronic

Acute

Symptoms vs. Signs

Symptoms are alterations in the appearance of the host due to a disease.

Symptoms vs. Signs

Signs are the physical appearance of a living pathogen.

Anything you see that is primarily made of pathogen tissue can be called a sign.

Disease Symptoms

Symptoms

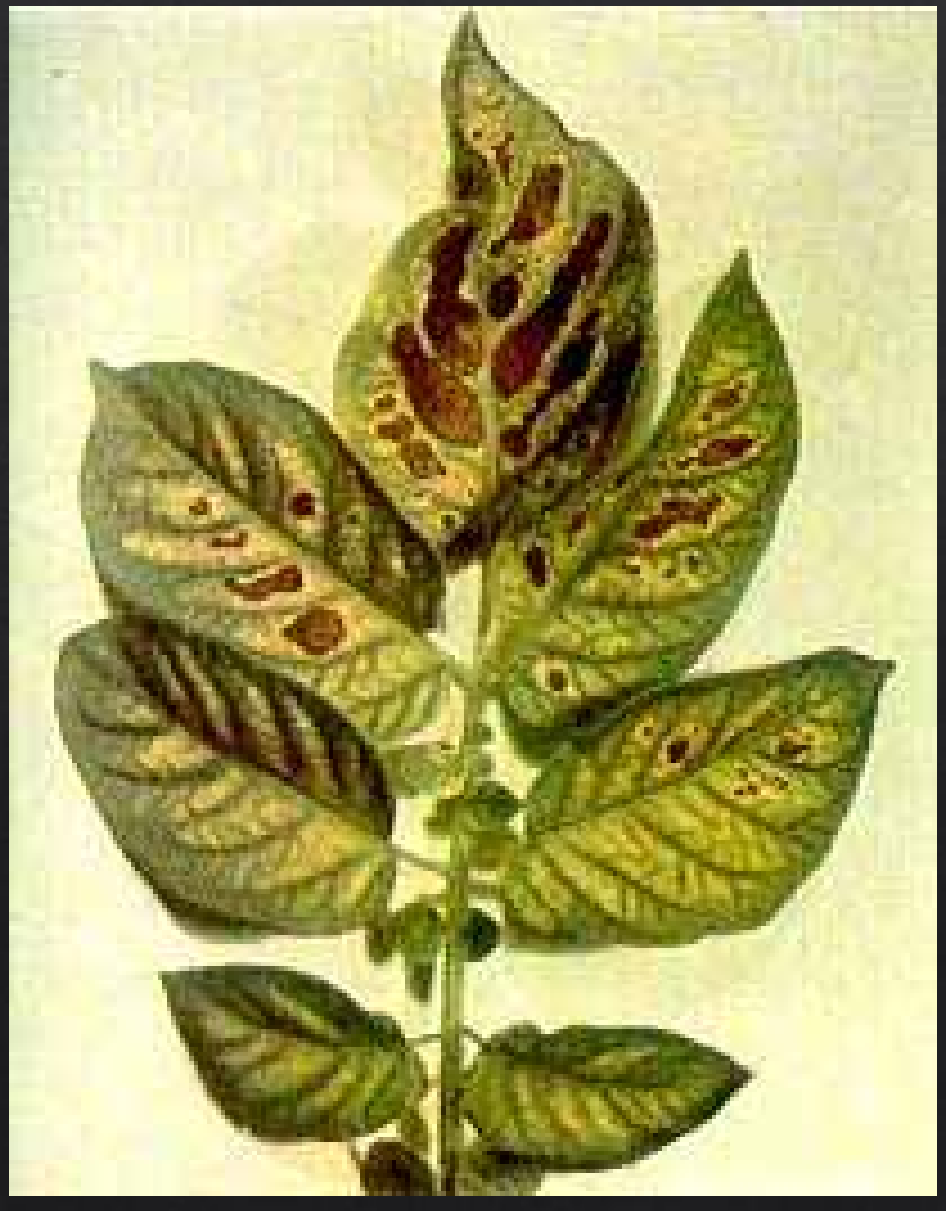
Chlorosis

Symptoms

Chlorosis

Symptoms

Leaf necrosis and scorch



Symptoms

Scorch

Symptoms

Defoliation

Symptoms

Dieback

Symptoms

Epicormic shoots

Symptoms

Decline

What is a plant disease?

An alteration in the

NORMAL

- Physiology
- Structure
- Function
- Aesthetic Value
- Economic Value

Normal vs. Abnormal

Normal vs. Abnormal:

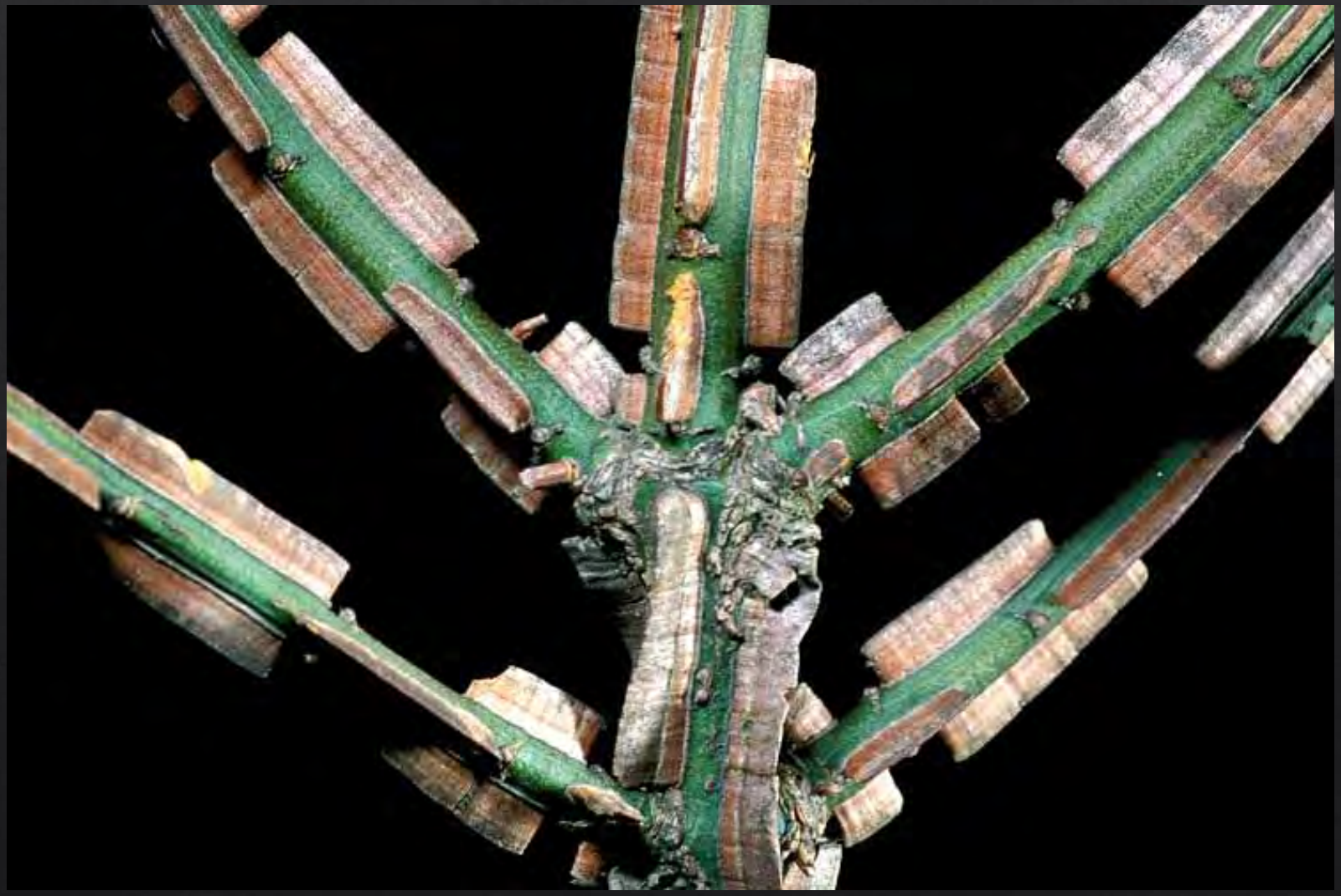
"Pitching" on Pitch pine vs.

Cooley spruce gall aphids on Douglas-fir

Normal vs. Abnormal: Leaf Color

Normal vs. Abnormal:

Bark Characteristics



Normal vs. Abnormal:

Bark Characteristics

Normal vs. Abnormal:

Bark Characteristics

Normal vs. Abnormal: Nematode Damage to Roots

Normal vs. Abnormal: Mycorrhizae on Roots

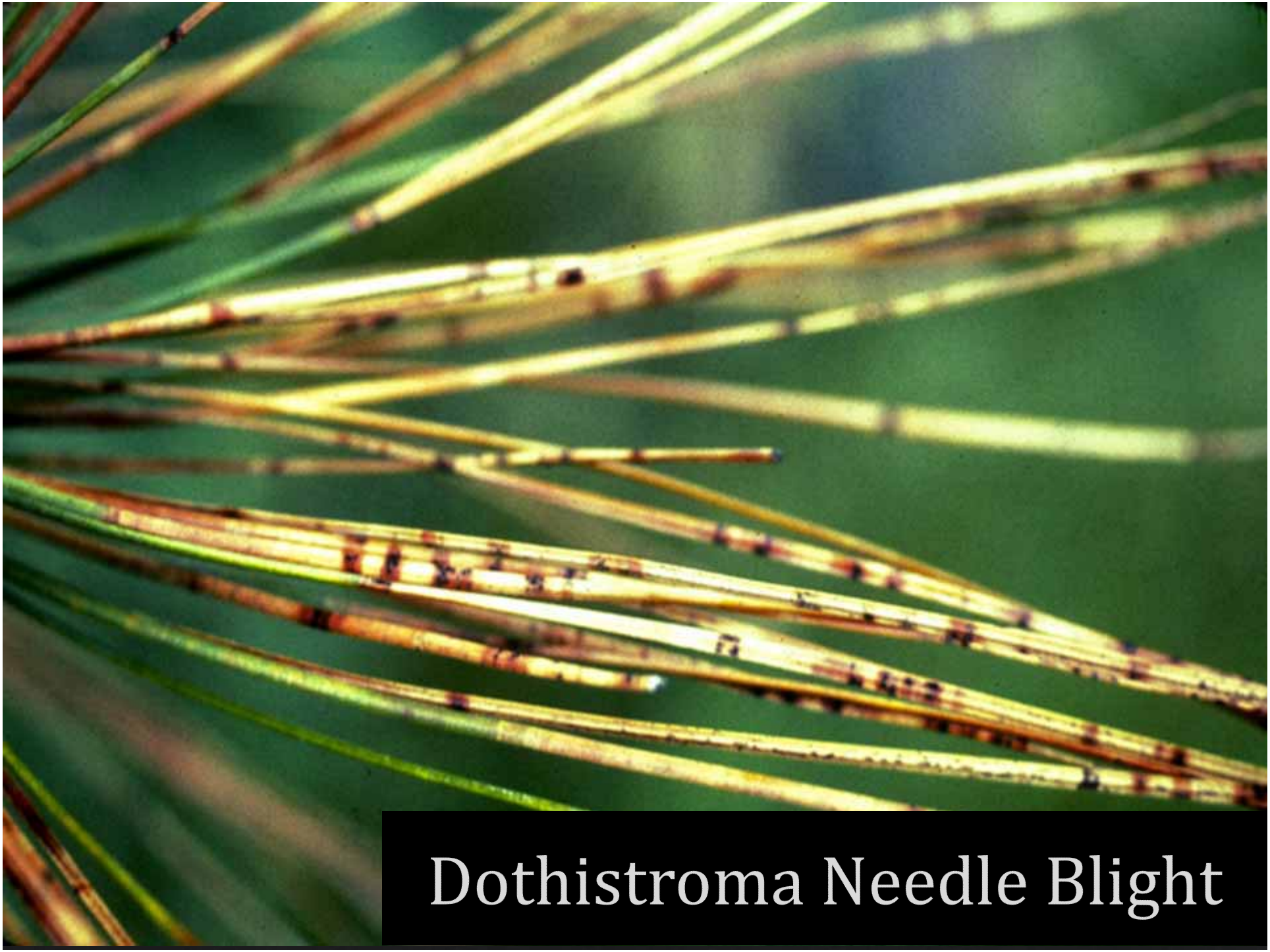
Normal vs. Abnormal: Leaf and Needle Drop

Normal vs. Abnormal

Seasonal Needle Drop


Decline

Normal vs. Abnormal


Dothistroma Needle Blight

Normal vs. Abnormal:

Lichens, moss, algae

Non-Parasitic Conditions

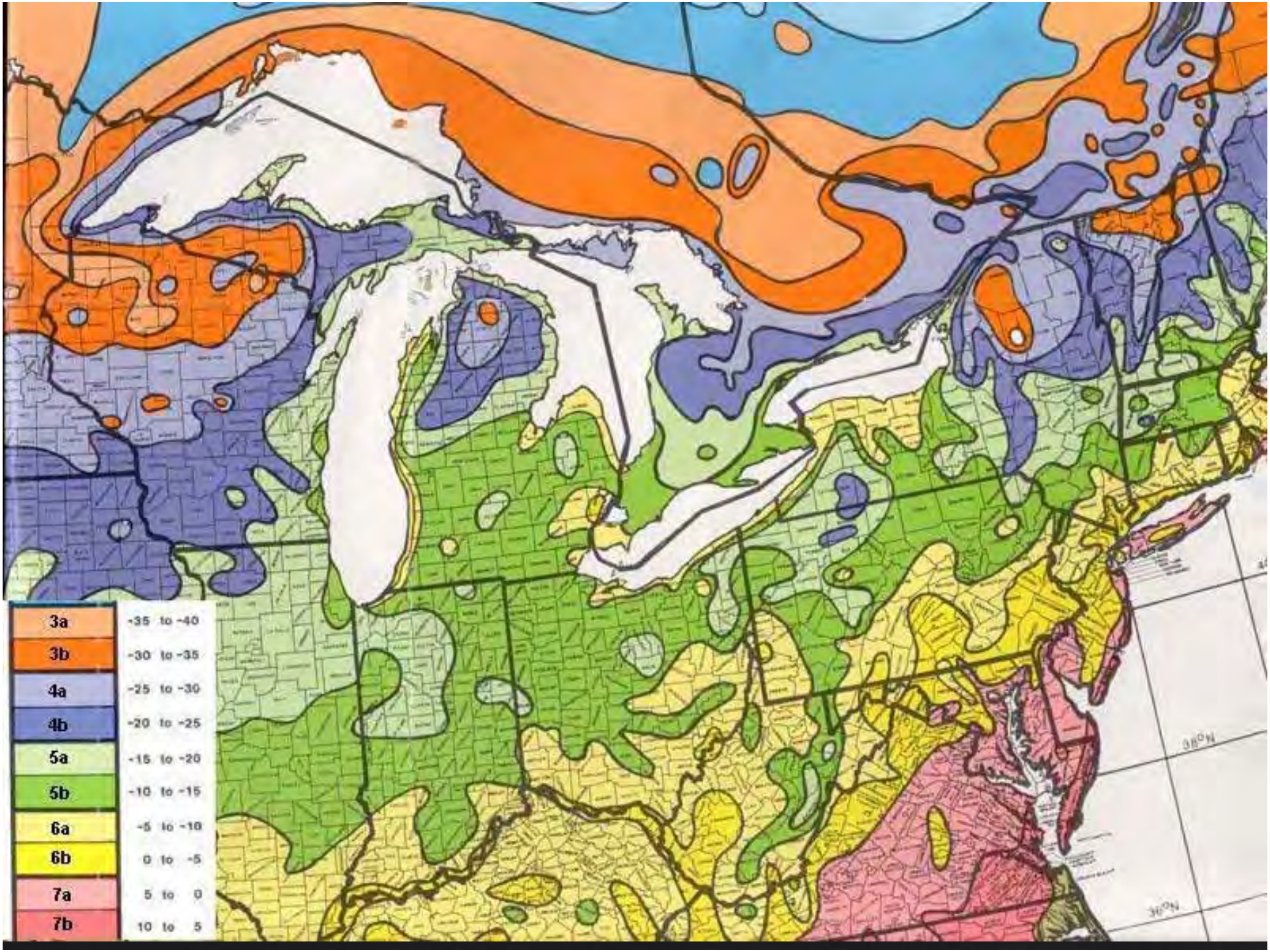
(Abiotic Diseases)

Non-Parasitic Conditions in Trees

- **Environmental (Meteorological)**
  - Climate and Climate Change
  - Drought
  - Sunscald
  - Thermal Injury
    - Heat
    - Cold
  - Ice Damage
  - Hail Damage
  - Salt Injury (natural and manmade)
  - Air Quality
  - Lightning

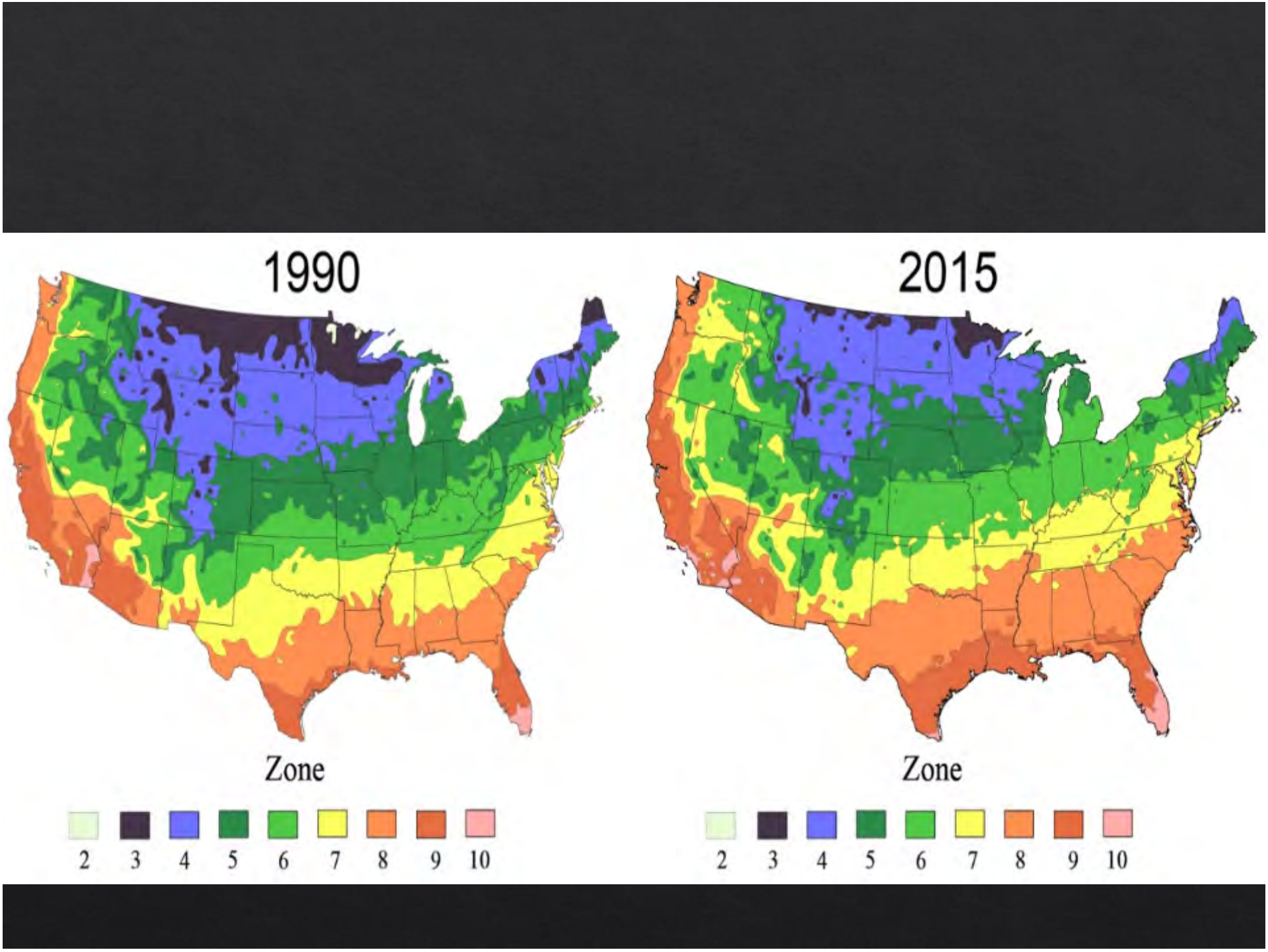
Plant Climates: Temperature


USDA
Plant Hardiness Zone Map


3a -35 to -40
3b -30 to -35
4a -25 to -30
4b -20 to -25
5a -15 to -20
5b -10 to -15
6a -5 to -10
6b 0 to -5
7a 5 to 0
7b 10 to 5


Climate Change
UGA5303093


HOW DOES
climate change
affect trees?


1990
2015
Zone
2 3 4 5 6 7 8 9 10
Zone
2 3 4 5 6 7 8 9 10

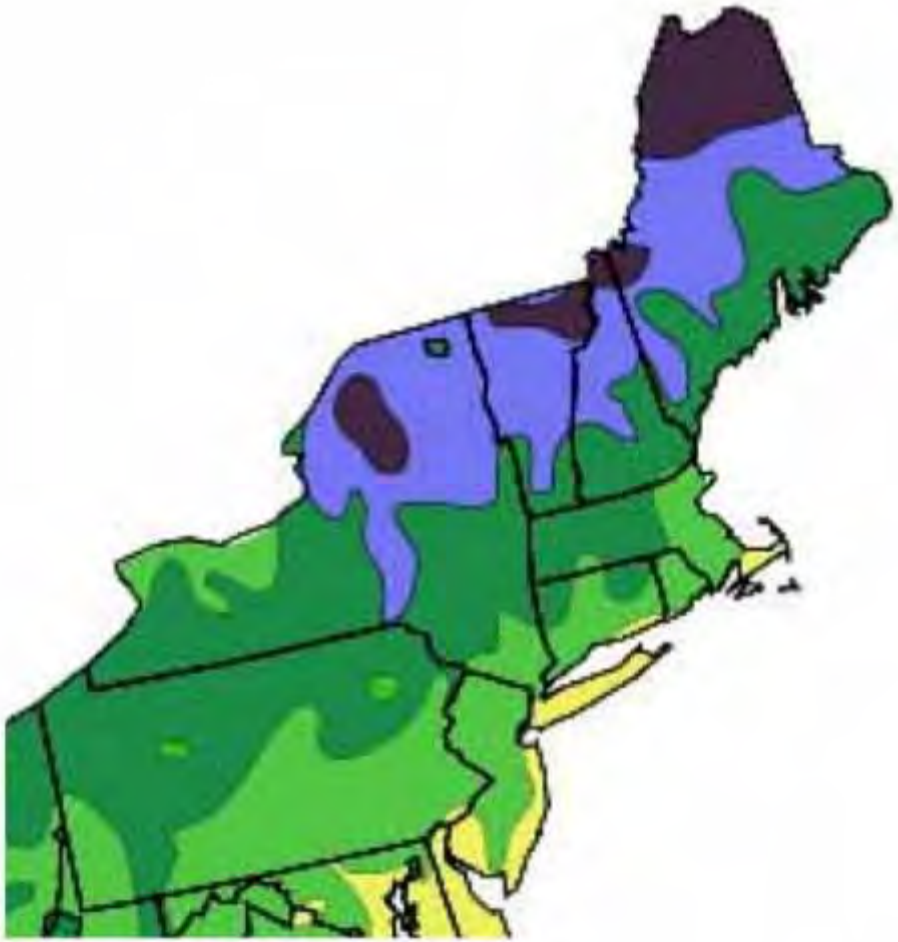
Shift in Plant Hardiness Zones

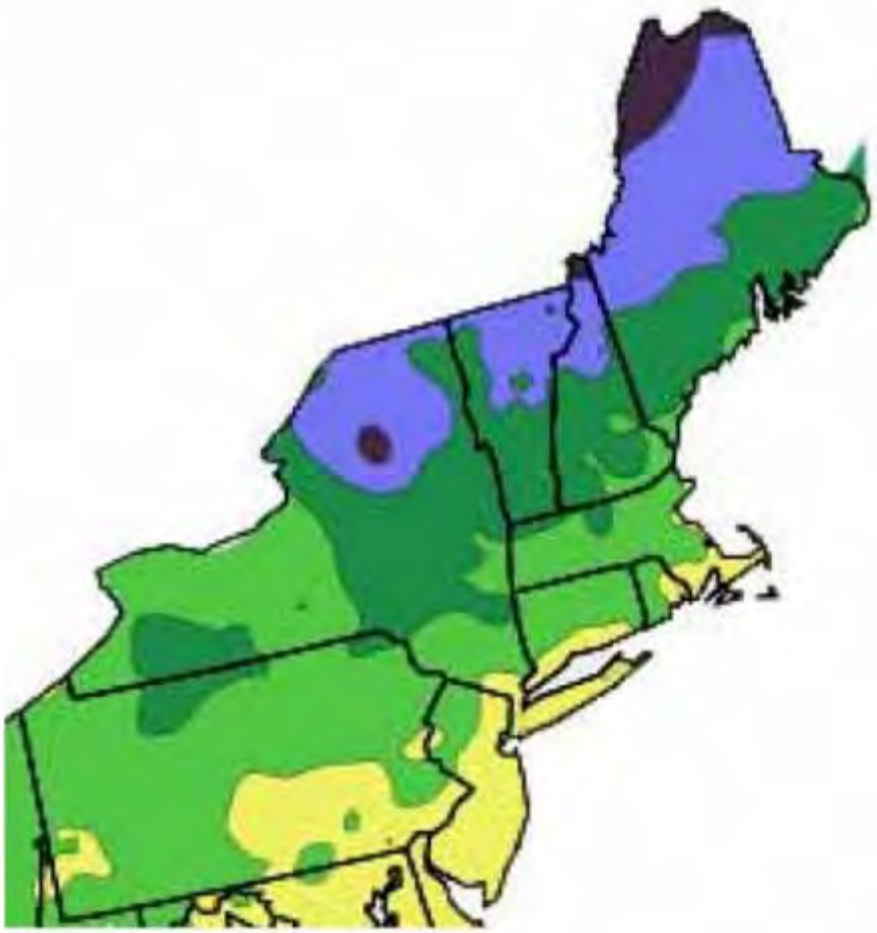
Zone Changes in Past 10 Years
In color of New Planting Zone

Zone Changes in Next 30 Years
In color of New Planting Zone

Average Annual Extreme Minimum Temperature by Climate-Related Planting Zone

- No Change in Zone
- Zone 4 (-29 to -20 °F)
- Zone 5 (-19 to -10 °F)
- Zone 6 (-9 to 0 °F)
- Zone 7 (1 to 10 °F)
- Zone 8 (11 to 20 °F)
- Zone 9 (21 to 30 °F)
- Zone 10 (31 to 40 °F)





1990

2006

Zone

2 3 4 5 6 7 8 9 10

USDA Hardiness Zones

Cold Temperatures

Plants will make
satisfactory vegetative growth
over a wider range of
night temperatures
than is satisfactory for
flower bud formation
and fruit setting


“Fruitless” Olive Trees

Critical Periods

- Spring or Fall – rapid temperature fluctuations, frost
- Coldest winter temperatures
- Low temperatures after a warm spell

Types of Cold Injury

Winter Kill of
Dormant Buds

Types of Cold Injury

Sunscald

Types of Cold Injury

Preventing Sunscald

Types of Cold Injury

Frost splittin g

Types of Cold Injury

Soil Heaving

Types of Cold Injury

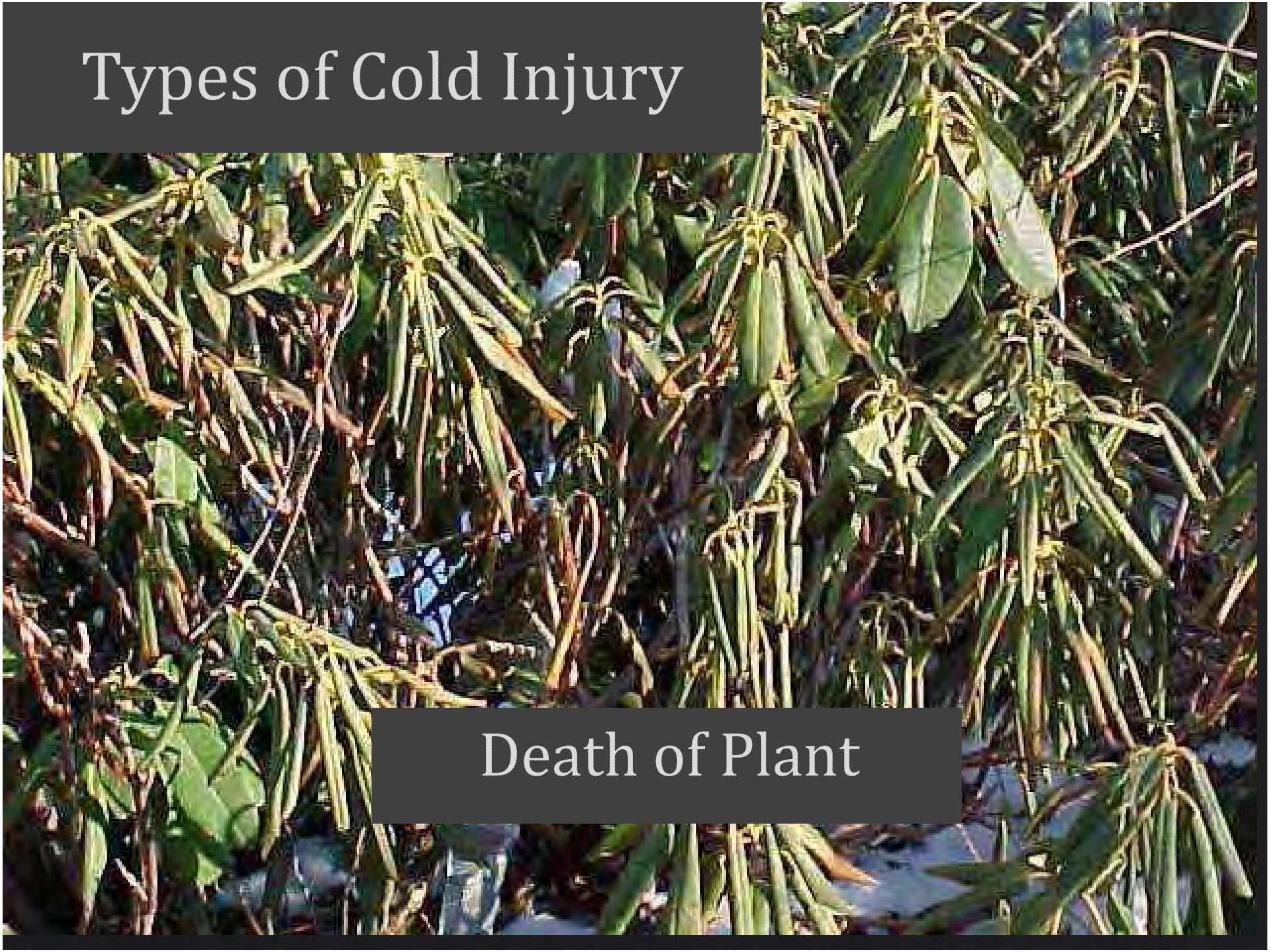
Types of Cold Injury

Spring and Fall frost does damage to tender shoots, flowers, and fruit

Types of Cold Injury

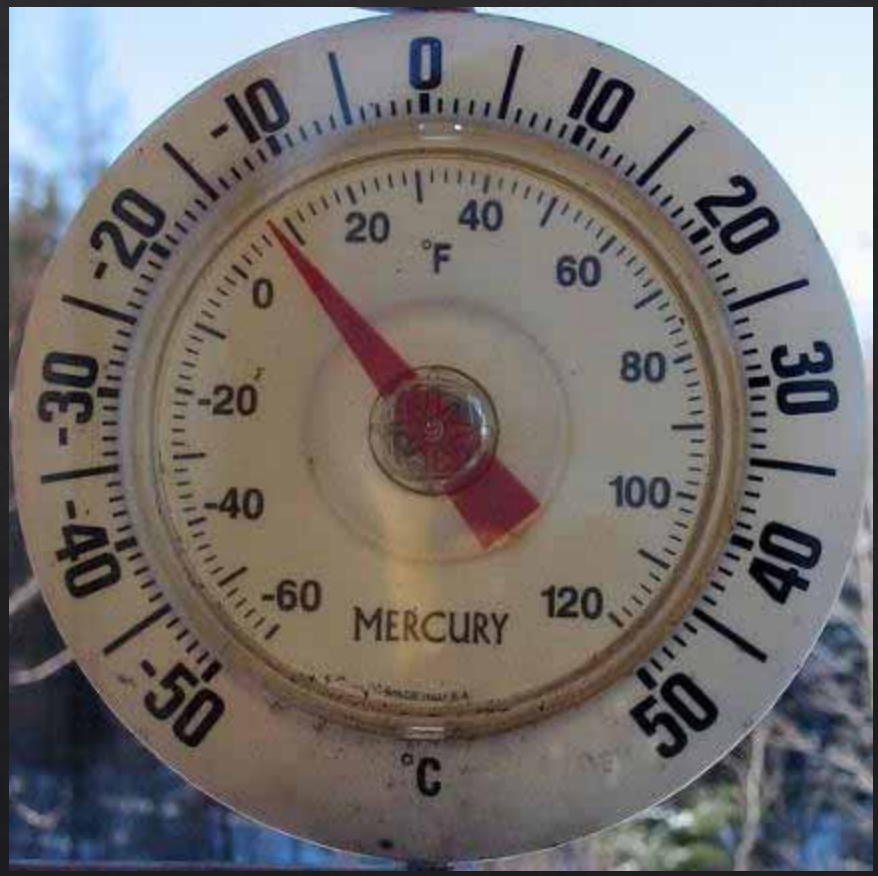
Late season pruning or shearing may elicit a growth response from the plant that doesn't have time to "harden off" before the onset of cold temperatures, causing damage to succulent new growth.

Types of Cold Injury



Death of Plant

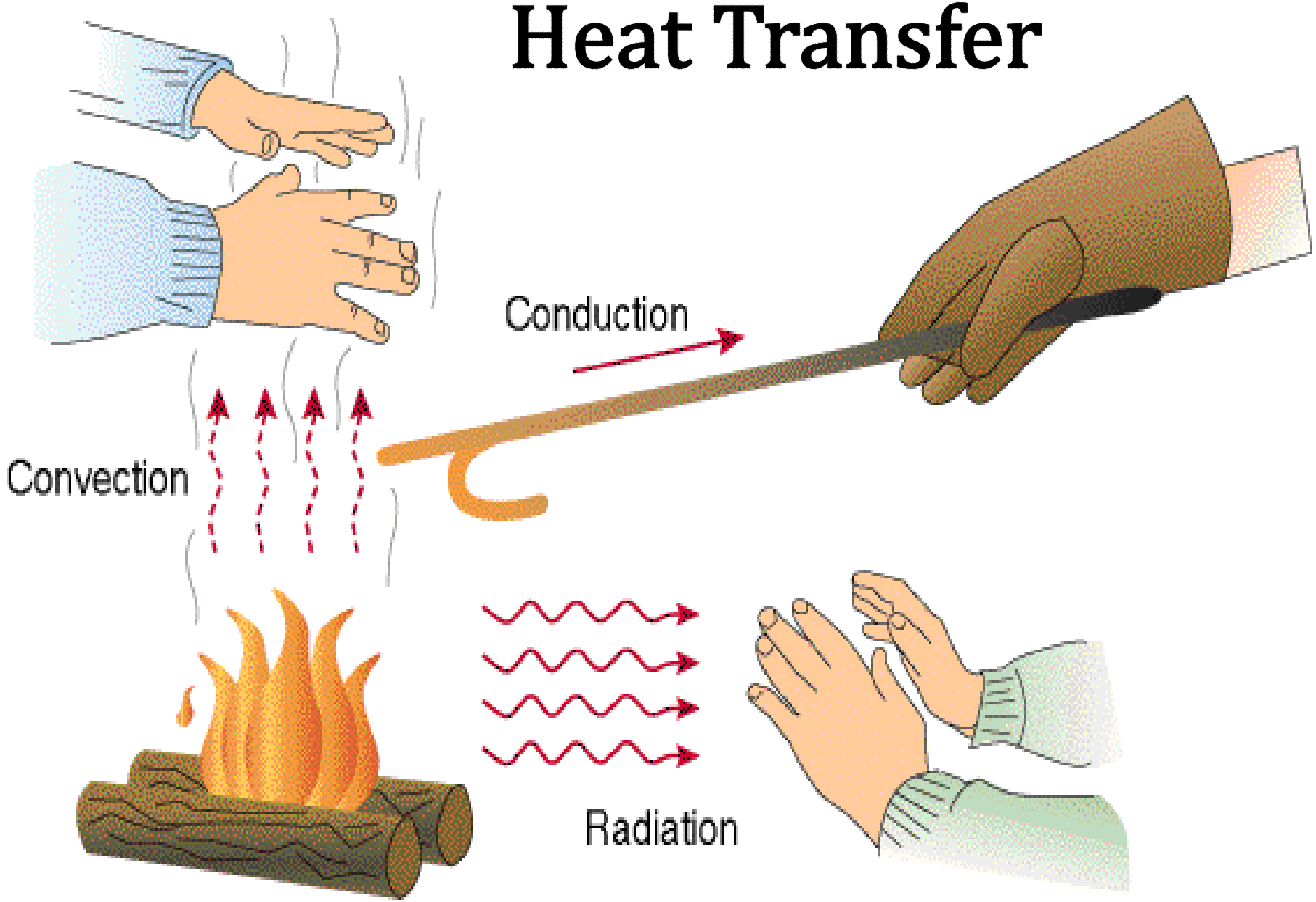
Lowest temperature expectable



Trees are more susceptible to injury when temperatures drop rapidly


Spring
and Fall
Cold

Heat Transfer



Radiation Frost Conditions

- Clear night skies
- Calm winds


Frost Pocket

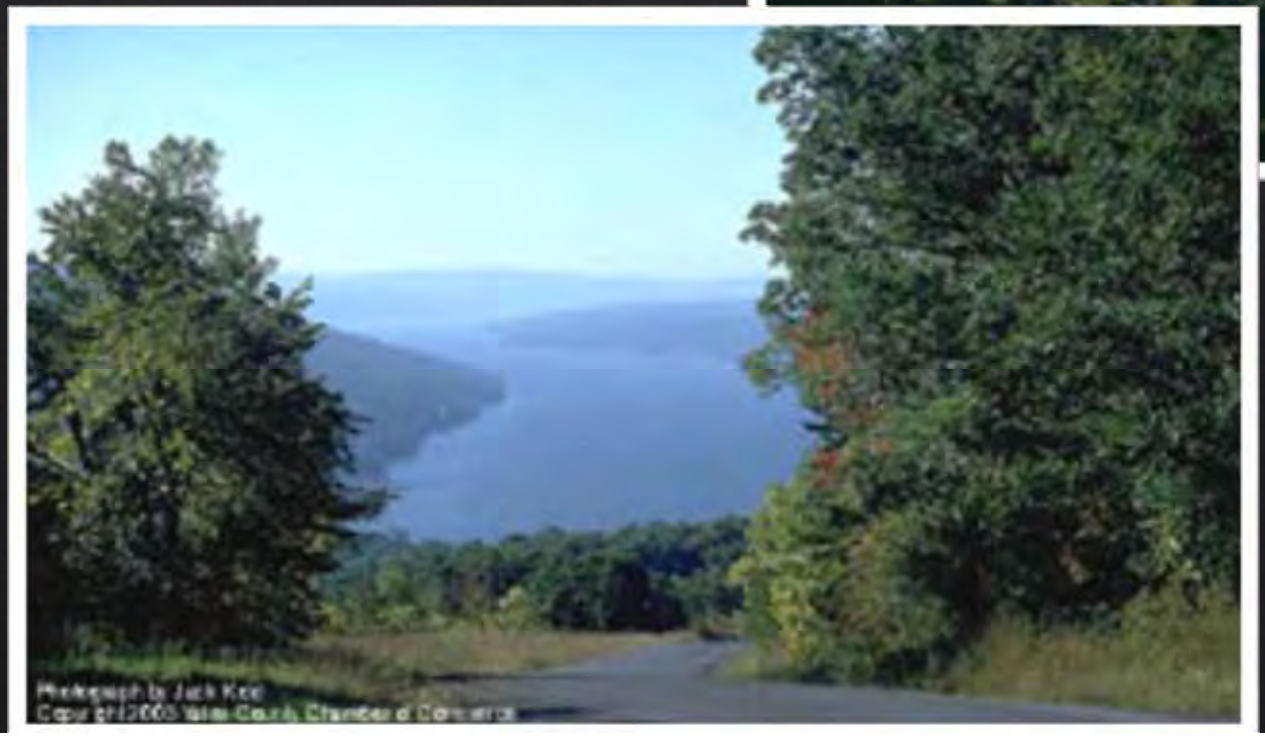
Protecting Against Frosts

Protecting Against Frosts

- Select a site to avoid cold
  - Walled gardens
  - Southern or Western exposures
  - Protect from the wind
  - Plant up on slopes, not at the bottom
- Reduce heat loss
- Use heat from the immediate surroundings
- Add heat

Protecting Against Frosts

Select a site to avoid cold



Protecting Against Frosts

Reduce heat loss

Protecting Against Frosts

Use heat from the immediate surroundings

Protecting Against Frosts

Add heat

Protecting Against Frosts

Add heat

Winter Chilling and Rest

As days begin to shorten, buds enter a condition of rest and will not grow even though all other conditions are favorable.

To overcome rest naturally, buds must be subjected to 4 to 8 weeks of low temperatures (24 – 50 degrees)

Following winters of inadequate chilling, trees are slow to leaf out and bloom is prolonged.

The dormant resting condition is the key to winter survival for many plants in the temperate region.

Roots will grow at lower temperatures than will the shoots

High Temperatures

High Temperature Tolerance

- Species
- Stage of development
- Previous environmental history

Drought

Moisture

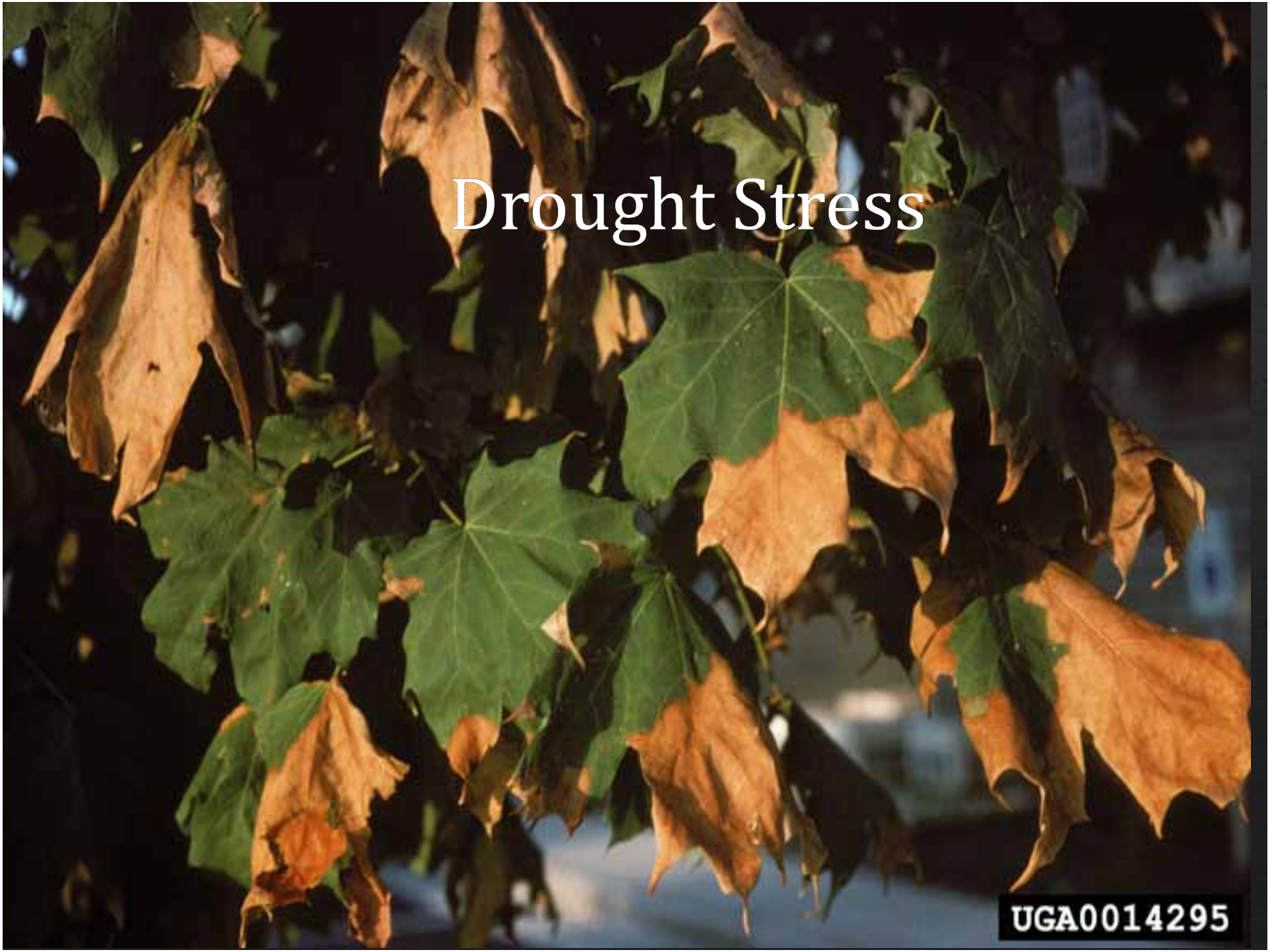

Rain


Fog


Dew

Drought

Drought Stress


Drought Stress
UGA0014295

Excess Moisture

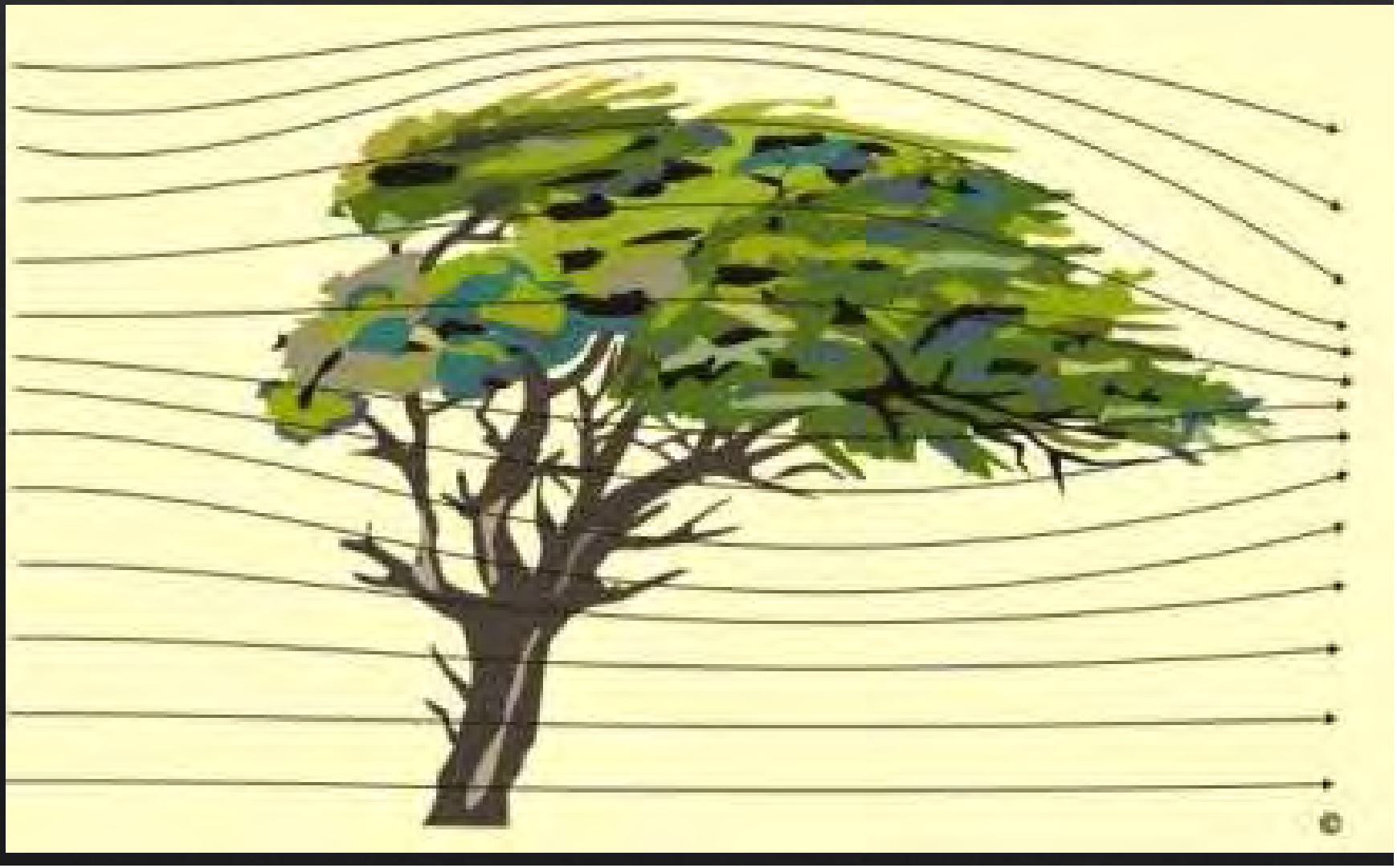

Hail

Hail


Hail

Snow and Glaze Ice

Wind



Wind

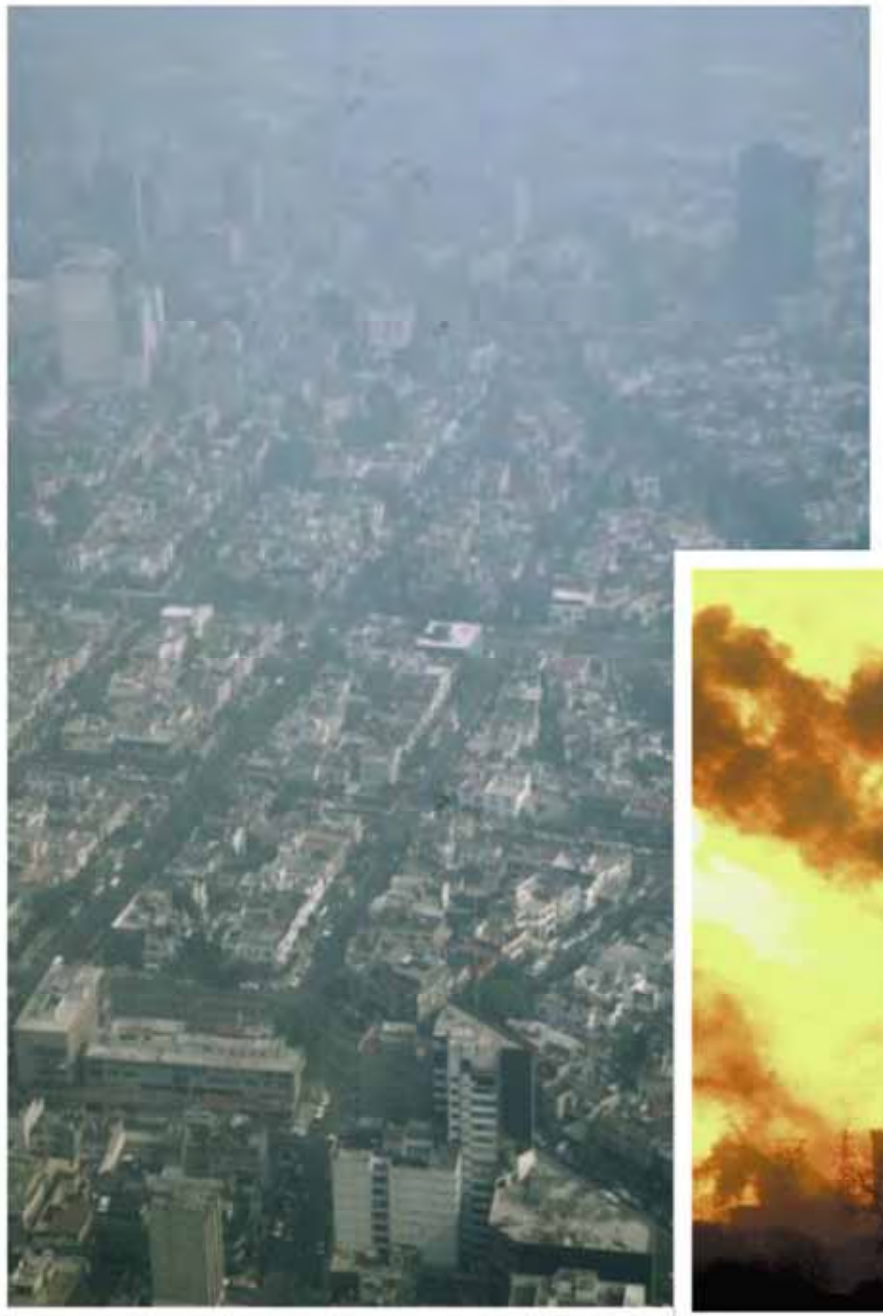
Light: Radiation

- Quality
  - wavelength
  - Color
- Intensity
  - Irradiance
- Duration
- Source
  - sunlight
  - artificial

Phototropism

Air Quality

Air Pollution Damage



Air pollution

ozone damage on maple

Urban Climate

- Temperature – Heat Islands
- Precipitation
- Humidity
- Wind

LIGHTNING

Lightning Protection

- Provides a path to ground
- Usually used in high value trees.

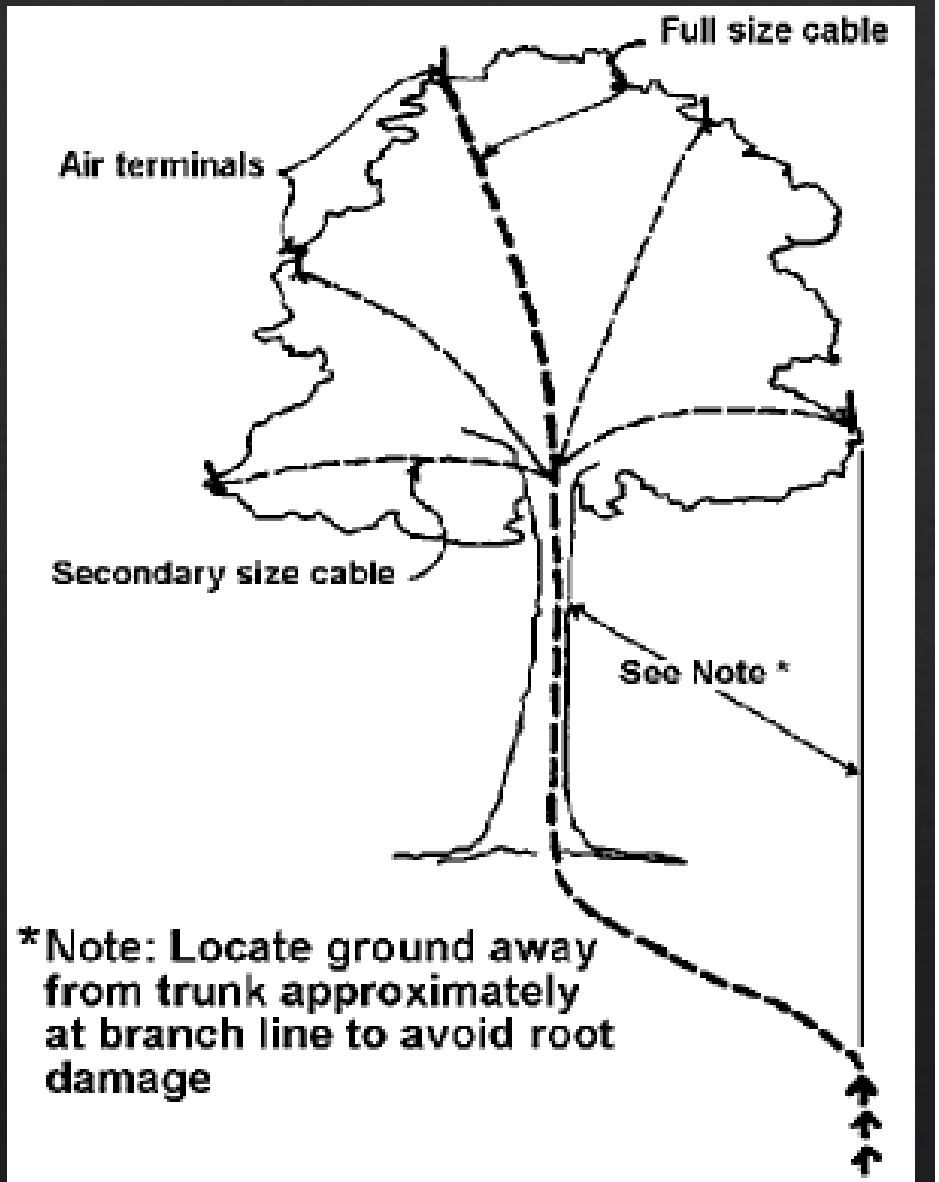
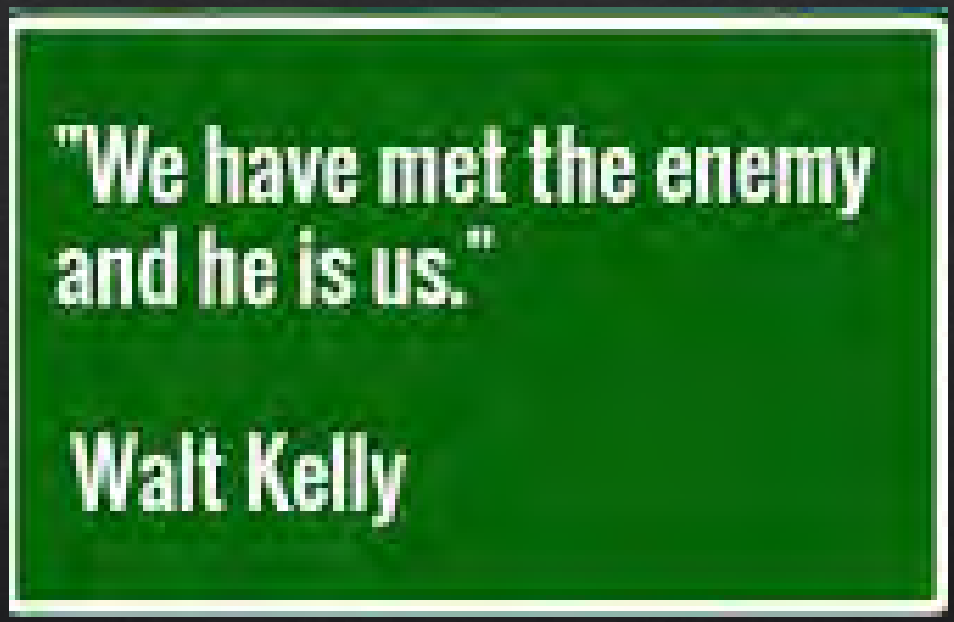


Figure 3. Lightning protection system for lone trees

Lightning Protection

- Provides a path to ground
- Usually used in high value trees.

Non-Parasitic Conditions in Trees: Environmental (Manmade)



Non Parasitic Conditions in Trees

- Environmental (Manmade)
  - Construction Damage
  - Soil Compaction
  - Grade Changes
  - Root Damage
  - Chemical Injury
    - Pesticide
    - De-icing salts
  - Improper planting/mulching
  - Gas Injury

Mechanical Injury

- Equipment
- Vehicles
- Vandalism
- Storm Damage
  - Wind
  - Ice
  - Hail

Lawn Mower Injury

Lawn Mower Injury

Lawn Mower Injury

Chemical Injury

- Herbicides
- Pesticide Phytotoxicity
- Salt
  - De-icing salts
  - Fertilizers

Herbicide Damage

Herbicide Damage

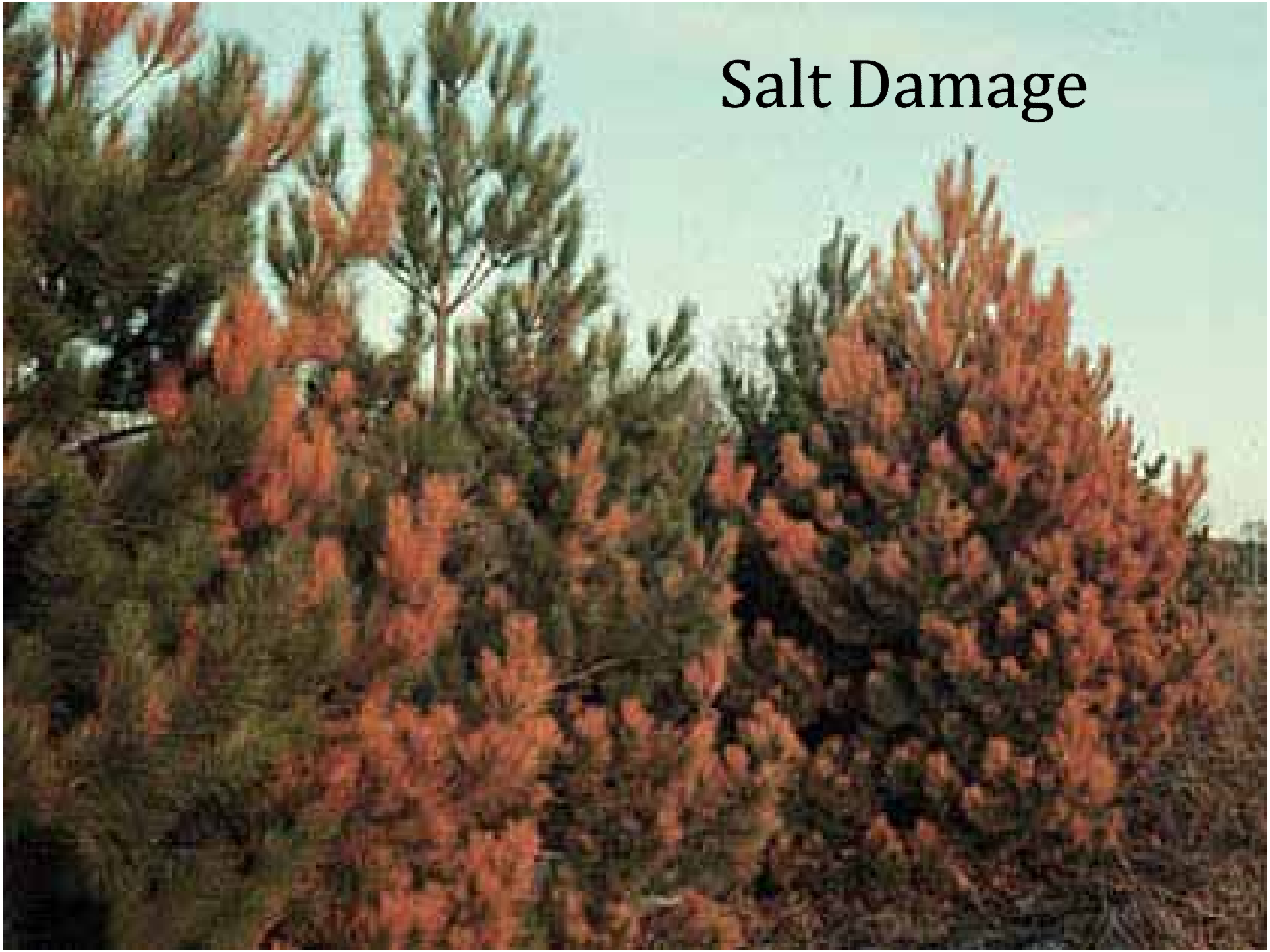
- Selective broadleaf lawn herbicides are commonly used.
- Our landscape trees are broadleaf plants
- Imprelis

Pesticide Phytotoxicity

- Read the Label!
- Phytotoxicity
- Too hot to spray

Pesticide Phytotoxicity

- Pressure damage


Salt Damage


Salt Damage
after Sandy

Salt Damage from Road De-icing Salts

Thermal Injury

- Low Temperatures
- High Temperatures
- Fire
- Other sources:
  - Exhaust
  - Paving


NATURAL
FIRE
DO NOT
REPORT

Soil Compaction

- Often associated with construction but not he only cause

Soil Compaction

- Often associated with construction but not he only cause,
- Vehicle traffic…

Soil Compaction

- Often associated with construction but not he only cause,
- Vehicle traffic…
- …even foot traffic can cause significant soil compaction

Construction Damage

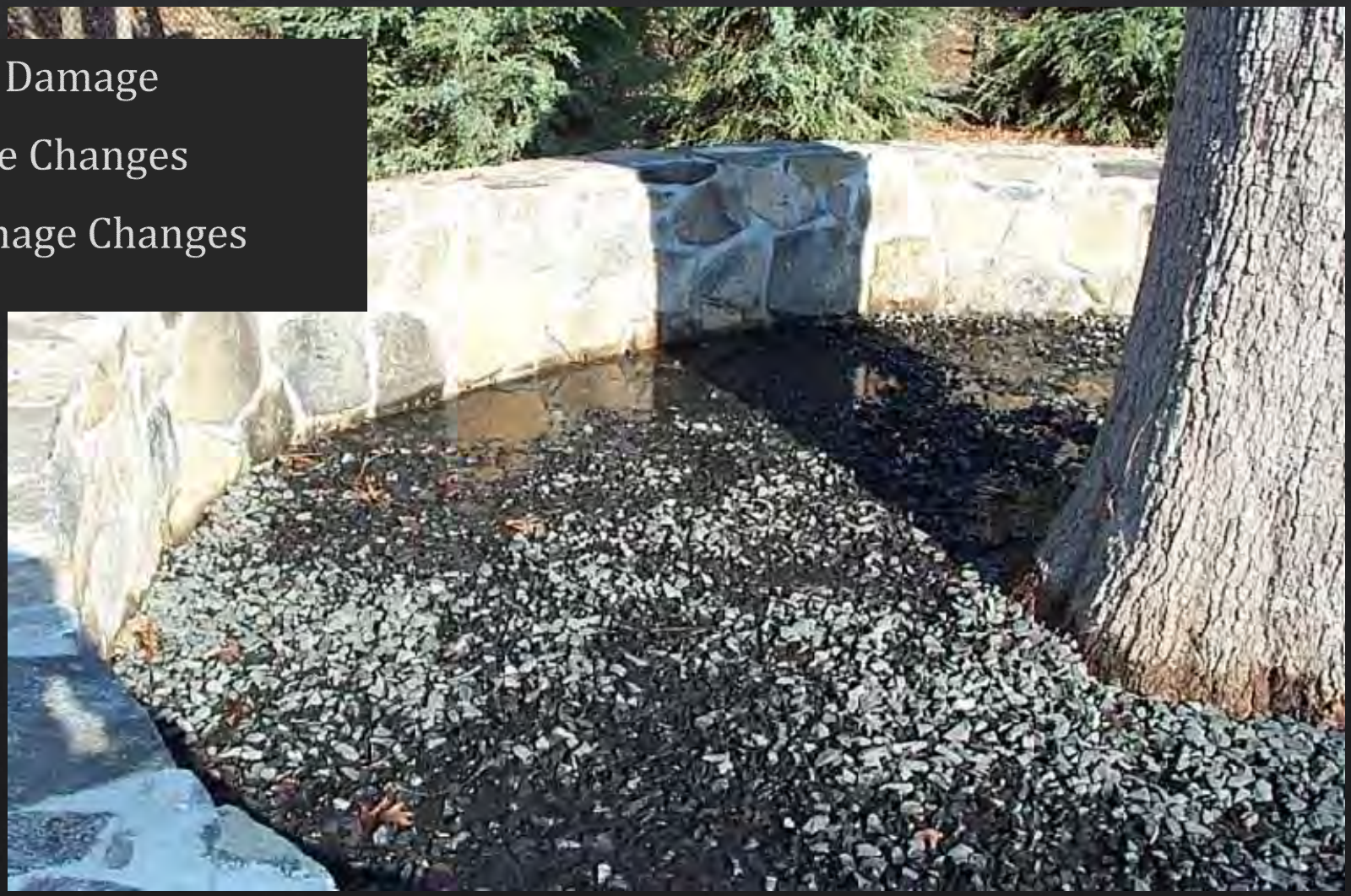
- Root Damage

Construction Damage

- Root Damage
- Grade Changes

Construction Damage

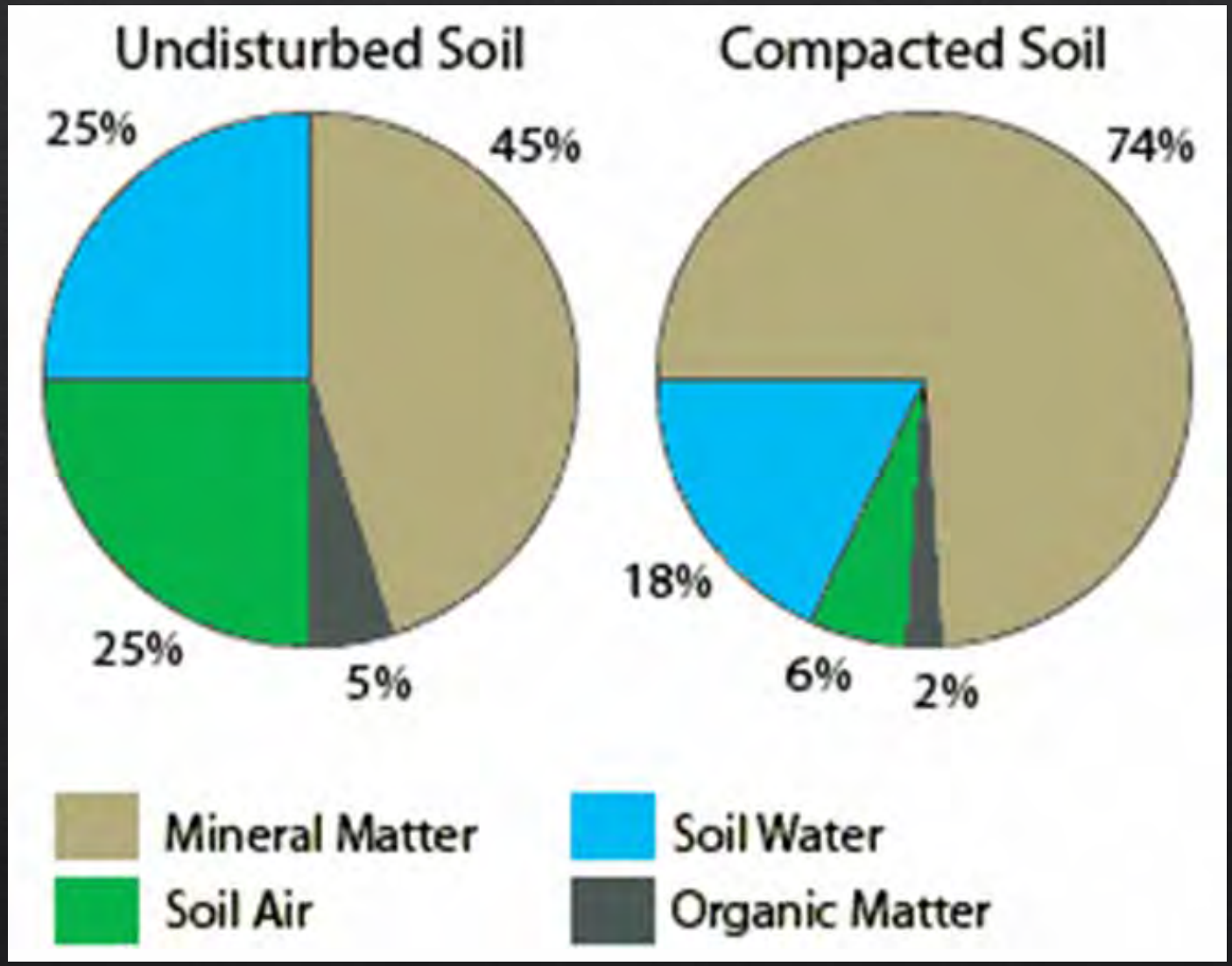
- Root Damage
- Grade Changes
- Drainage Changes



Construction Damage

- Root Damage
- Grade Changes
- Drainage Changes
- Soil Compaction

Soil Compaction



Soil Compaction

Introduction:

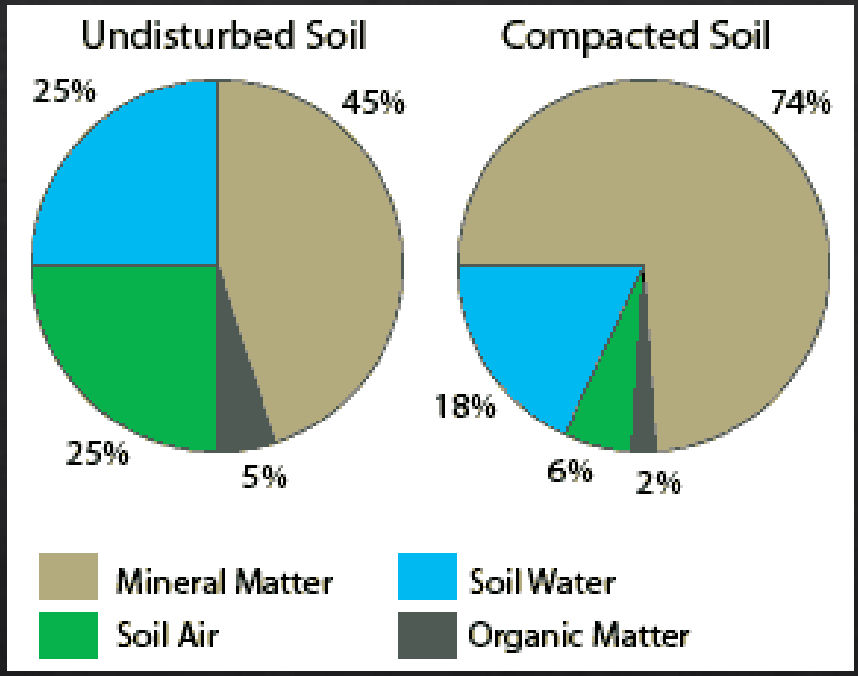
What are we trying to do in employing a pneumatic tool?

- The AirSpade uses pneumatic air to move and loosen compacted soil around a tree.
- Benefits can include:
  - Decreased soil density
  - Increased soil porosity
  - Increased soil porosity
  - Increased gas exchange
  - Improved rooting environment
- Moving the soil away from the base of the tree can also assist an arborist in assessing the overall health of the tree.
- This method can also be used for trenching within root zones and for incorporating soil mixes into beds within tree root zones.
- It is also used to correct girdling roots, or perform a root collar excavation (RCX).

Properties of Soil:

Undisturbed Soil vs. Compacted Soil

- Roots must work harder to grow into compacted soil, which means that there will be less roots, which means that the plant takes up fewer nutrients and water. All this translates to poor plant growth.
- When soil is too compact, it can make it difficult for water to percolate through the soil profile. Saturated soils have little oxygen, anaerobic conditions can cause root death.



Source: www.nrcs.usda.gov

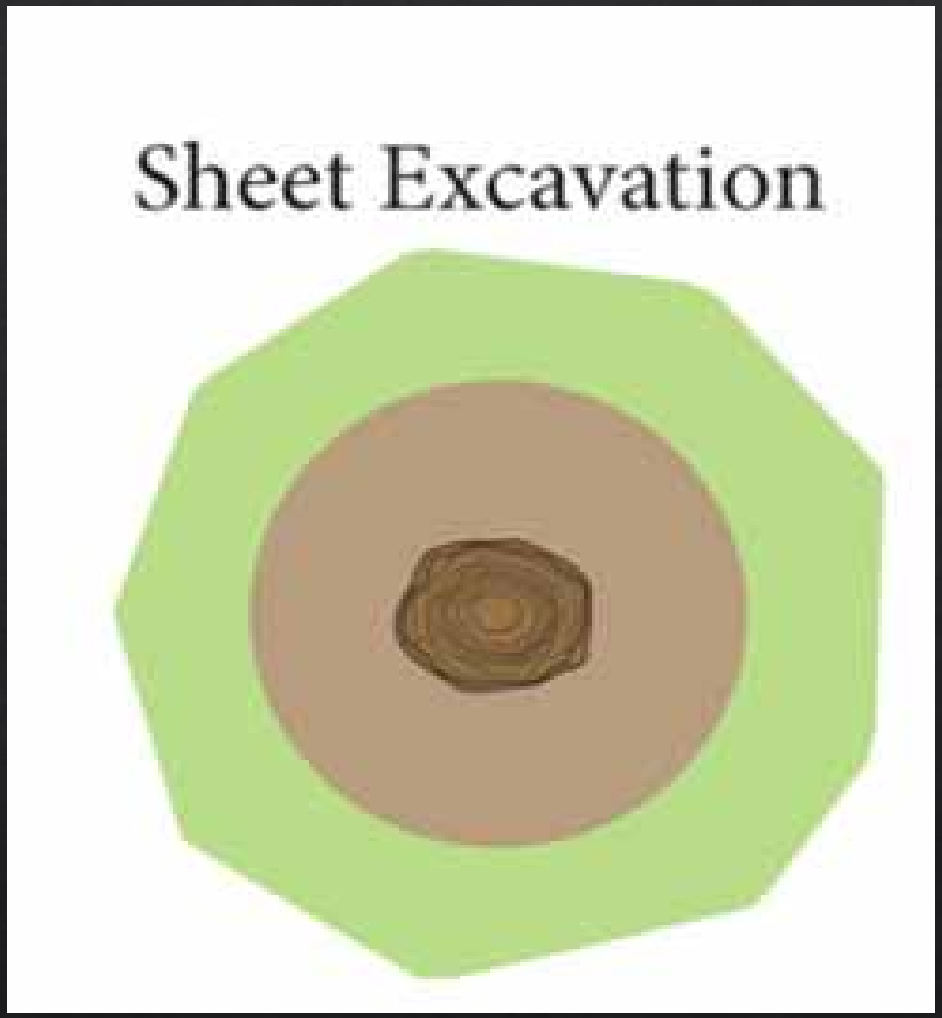
What are we trying to achieve:

Increased Organic Matter & Air

- Organic matter and air are two soil properties we can manipulate.
- Compacted soil prevents the flow of oxygen and nutrients. Most of a tree's roots proliferate near the surface where they have the best access to oxygen and nutrients. Loosening the soil with an AirSpade is excellent for promoting root growth.
- Increasing organic matter in the soil improves the soil biology. After loosening the soil with an AirSpade, mix in several inches of well-decomposed organic matter.

Strategies For Soil Aeration:

There are 4 types of AirSpade protocols



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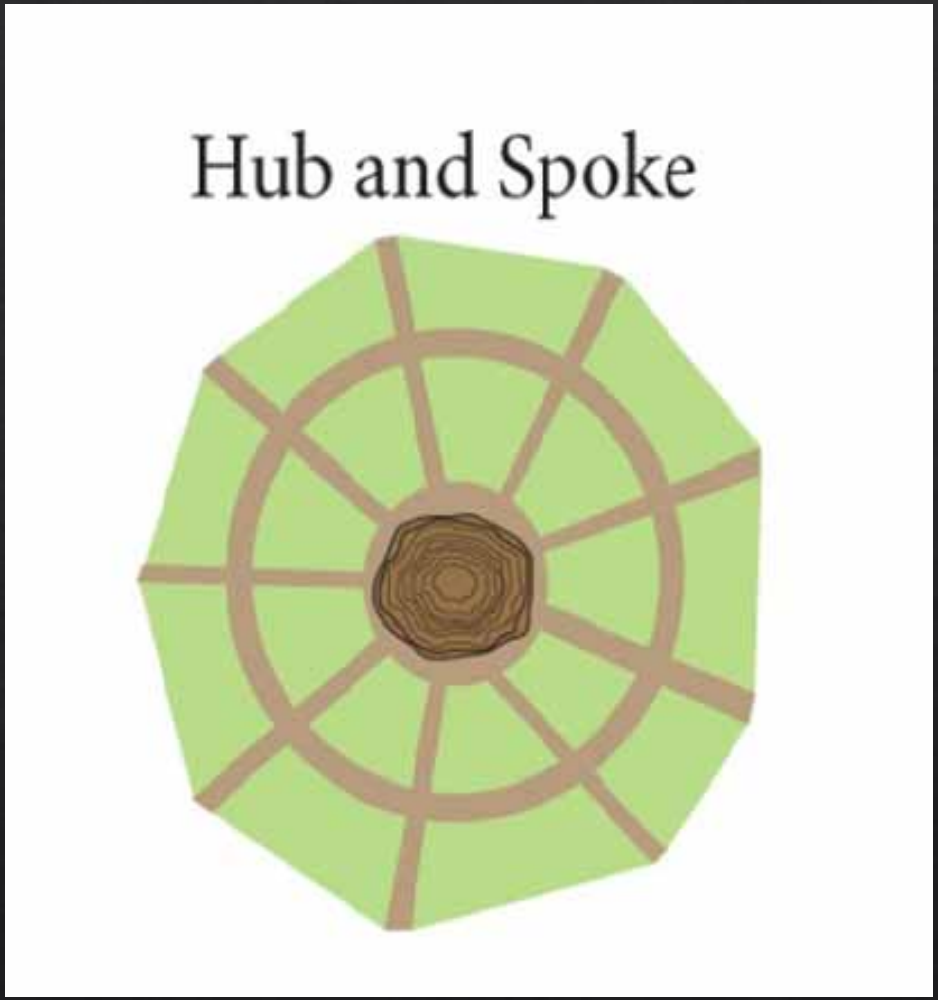

Strategies For Soil Aeration:

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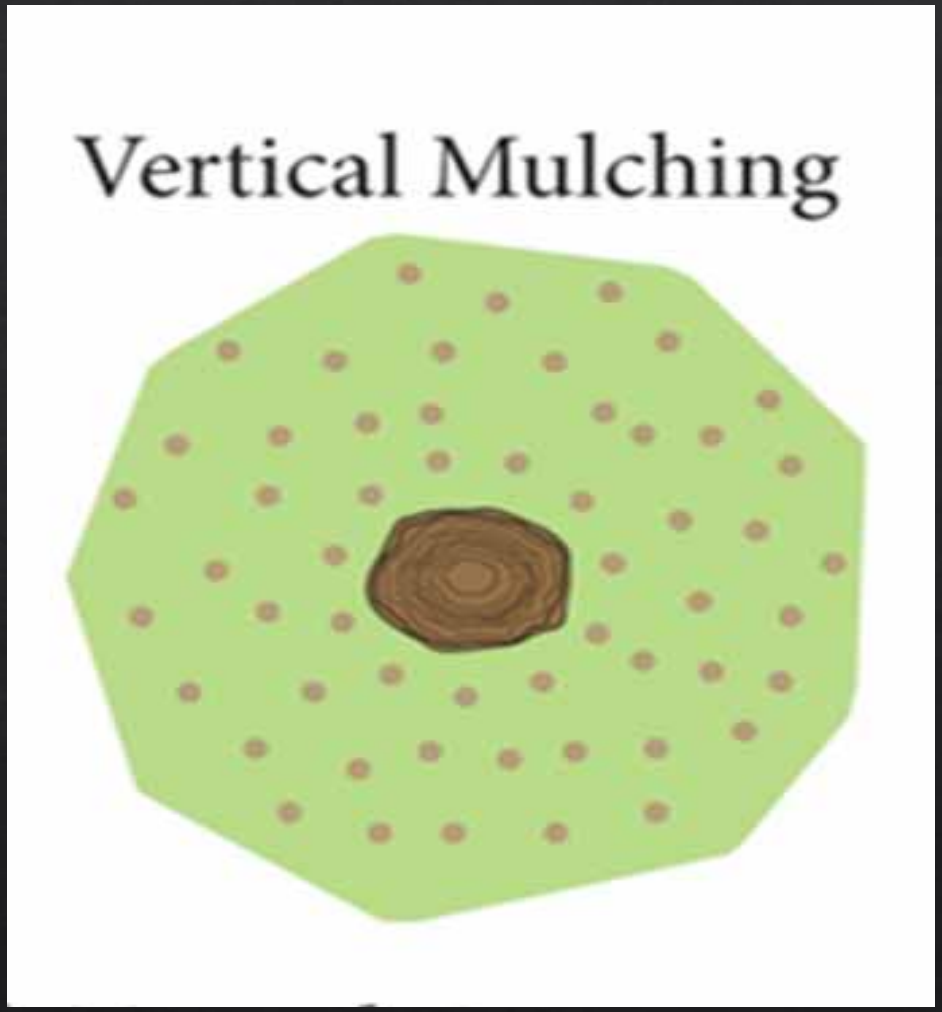


Strategies For Soil Aeration:

There are 4 types of AirSpade protocols

Soil Decompaction Strategies Using The AirSpade

Air Tilling

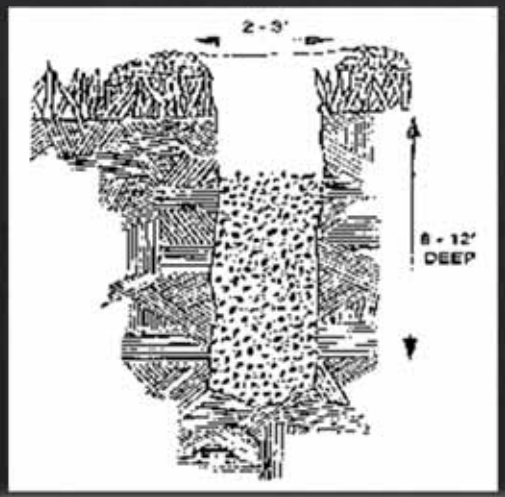
Also known as

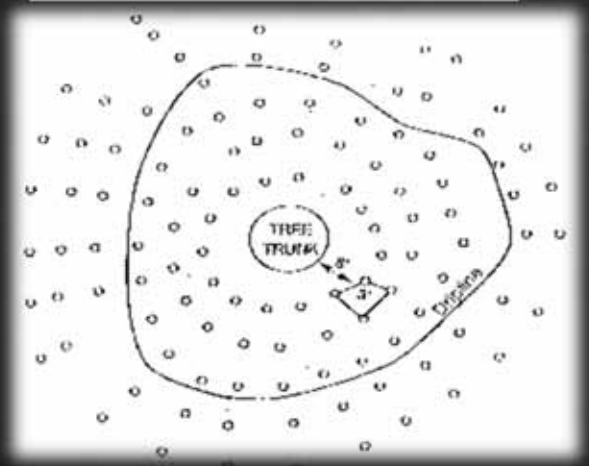
Sheet Excavation

or Root Invigoration

Radial Trenching (Hub and Spoke)

Vertical Mulching





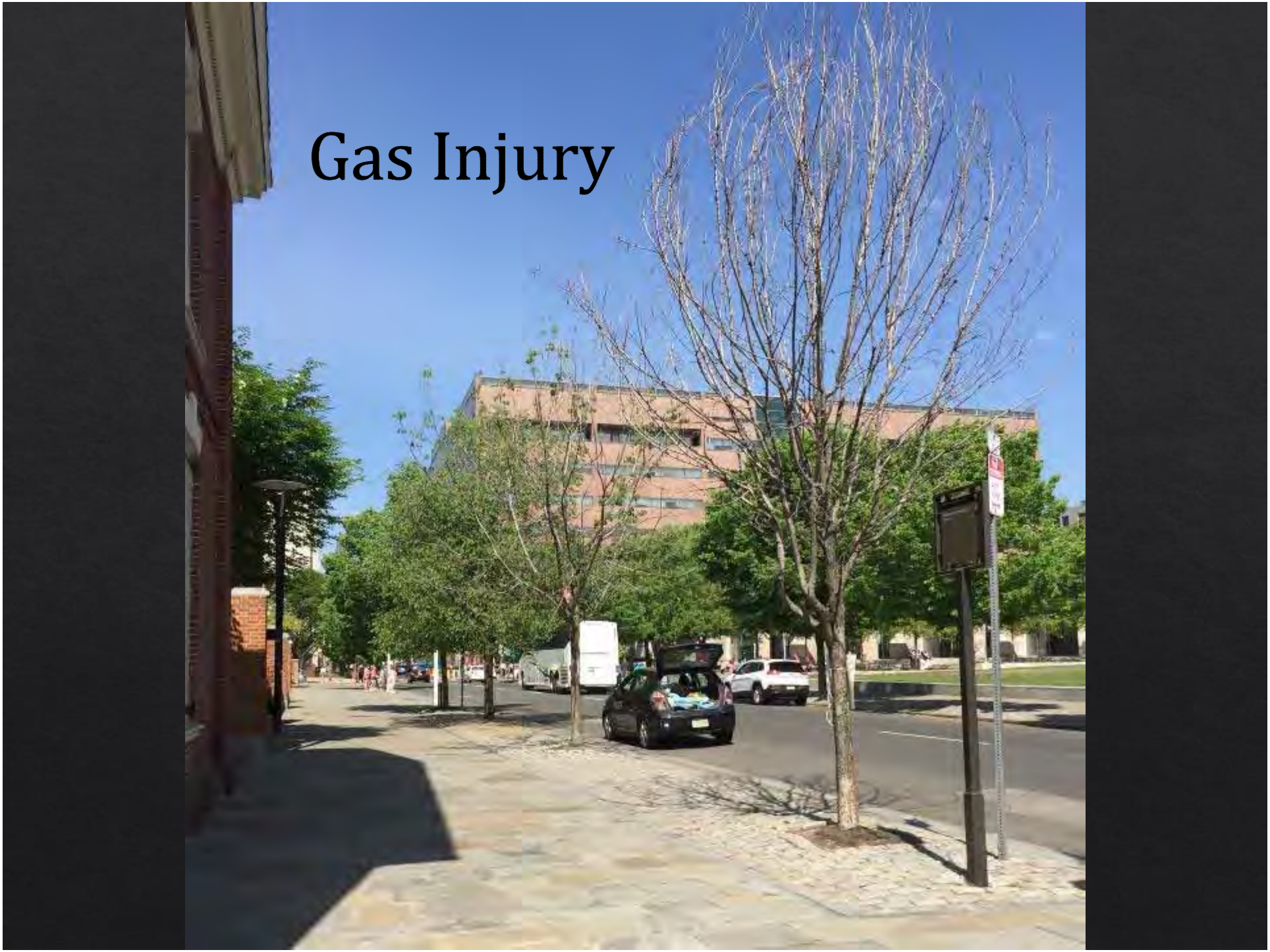
Root Collar Excavation

- A Root Collar Excavation (RCX) is the process of removing excess soil from the top of trunk flares and around the trunks of trees. We use an Air Spade to move excess soil from around the root collar and then evaluate the structure of the root system.
- Plants are commonly too deep, or have excess soil or mulch covering the root flare. This can be caused by:
  - Improper planting
  - Settling or shifting
  - Over mulching
- Root decay, which is common in mature trees, is difficult to see and diagnose without uncovering and inspecting the buttress roots of the tree.
- These conditions can result in the formation of girdling or restrictive roots, which can lead to decline and death of the tree.

Benefits Of Compost

- When compost is incorporated into the soil, microbes continue consuming tiny bits of organic matter and releasing nutrients that plants can use.
- The improvement to soil structure, in combination with increased beneficial soil biology activity, lead to more sustainable landscapes that require less fertilizer and less irrigation to maintain healthy and strong plants.

Gas Injury

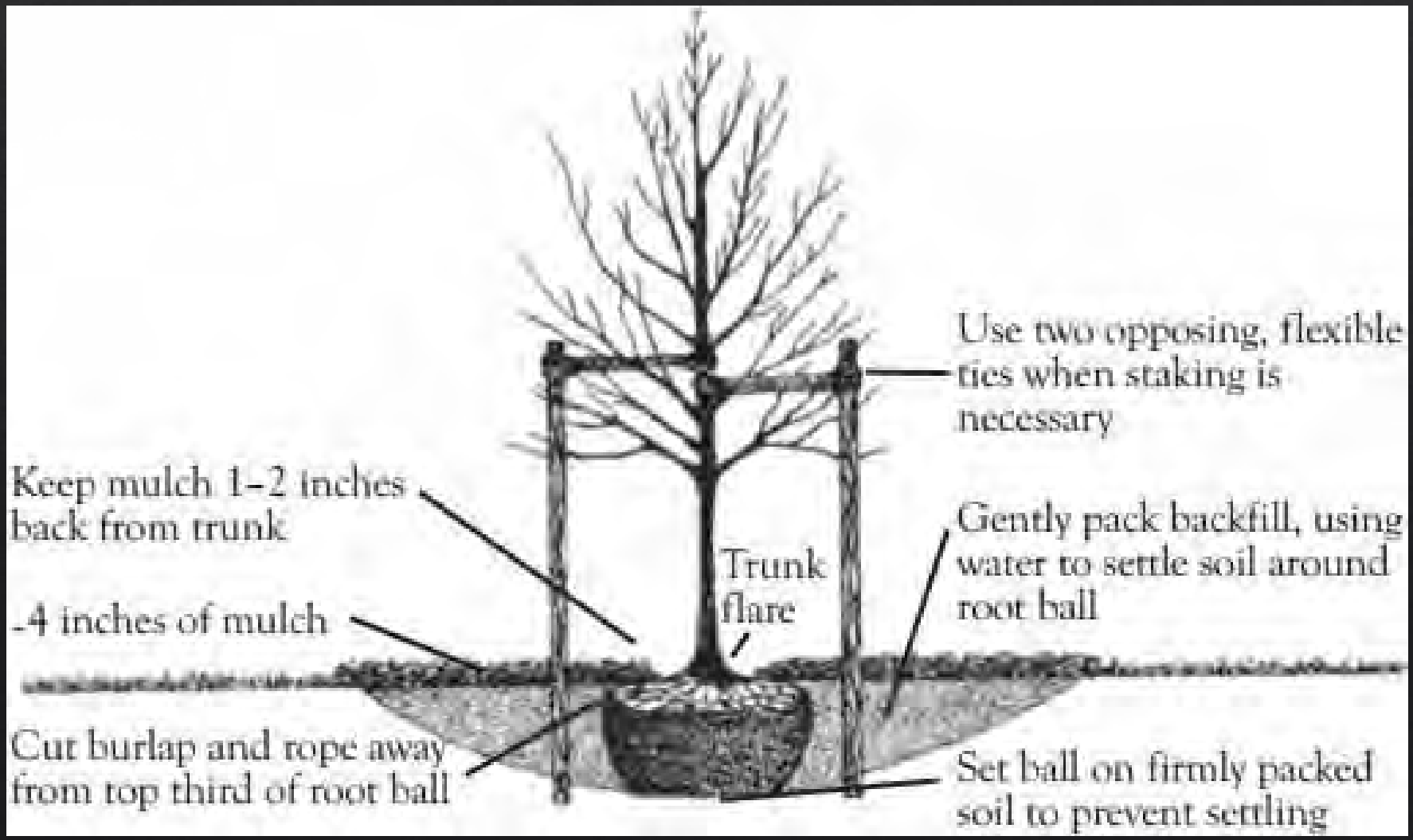

Gas Injury


Improper Planting

Improper Mulching

I shouldn't have to say this…

Improper Planting



Non Parasitic Conditions in Trees

- **Physiological**
  - Girdling Roots
  - Low Light
  - Allelopathy
- **Nutritional**
  - Micronutrient deficiencies

Girdling roots

Girdling roots

Inadequate Sunlight

Photosynthesis

Sun light

I I I

I I I

V V V

$CO_2 + H_20$ ----------> $C_6H_{12}O_6 + O_2$

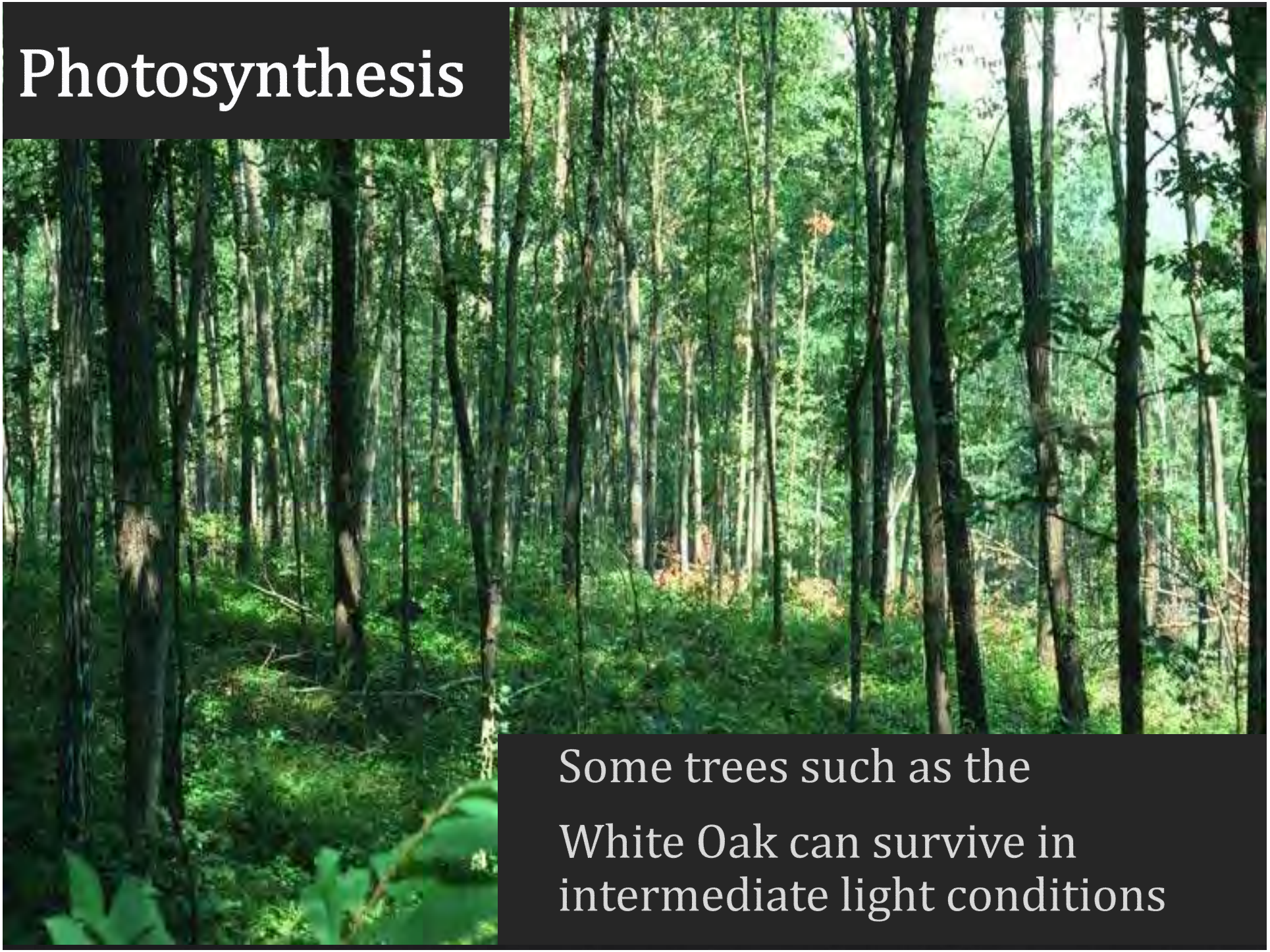
(carbon dioxide) + (water) ----------> (sugar) + (oxygen)

Photosynthesis

Some trees such as the American Beech

can survive in very low light conditions

Photosynthesis



Some trees such as the

White Oak can survive in intermediate light conditions

Photosynthesis

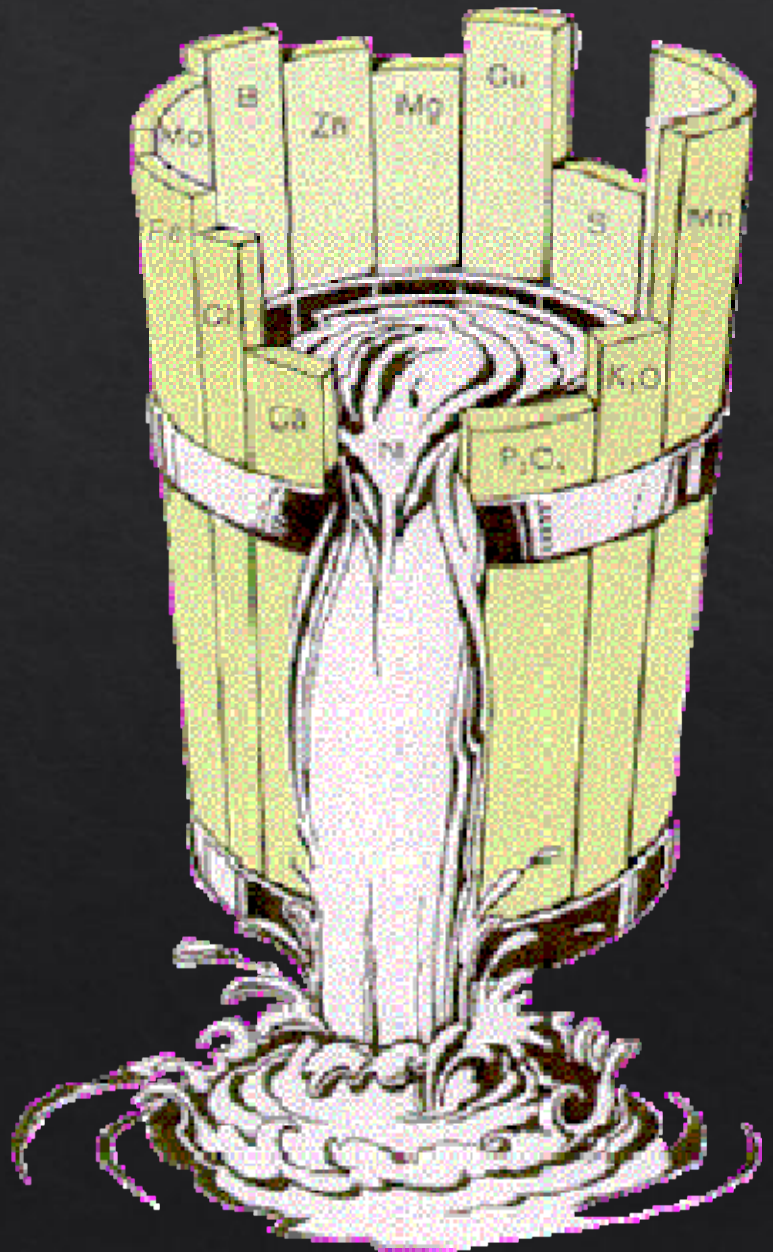
Other trees such as the Loblolly Pine require large amounts of light.

Nutrient Deficiency

Nutrients and Sources

- Air
  - Carbon
  - Oxygen
- Water
  - Hydrogen
- Soil
  - Macronutrients
    - Nitrogen
    - Phosphorus
    - Potassium
    - Sulfur
    - Calcium
    - Magnesium
  - Micronutrients
    - Iron
    - Boron
    - Manganese
    - Copper
    - Zinc
    - Molybdenum
    - Chlorine

Liebig's Law of the Minimum



Nutrient imbalance

Iron deficiency in oak

Nutrient Imbalance

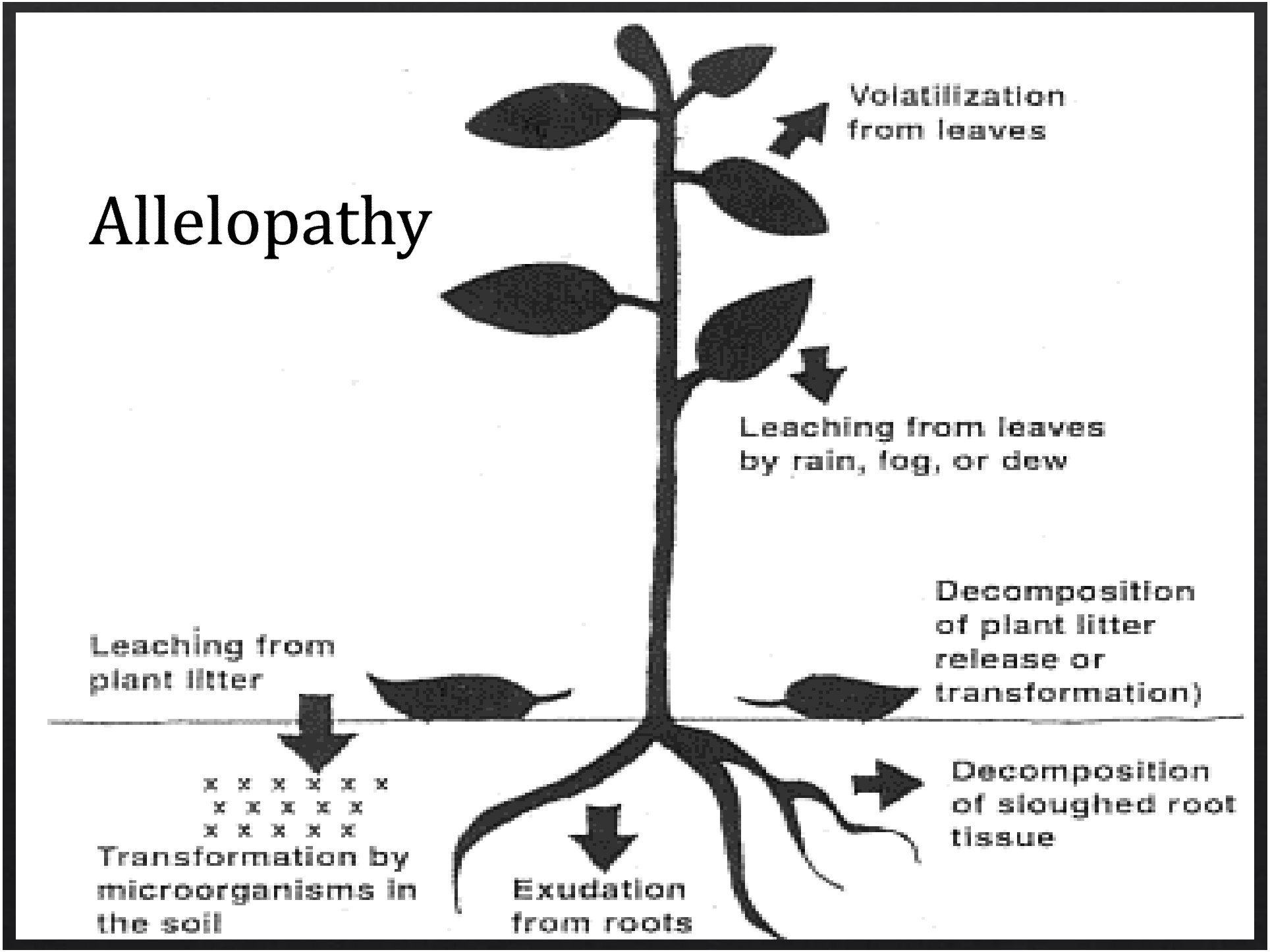
Magnesium deficiency

Nutrient imbalance

Manganese deficiency

Allelopathy

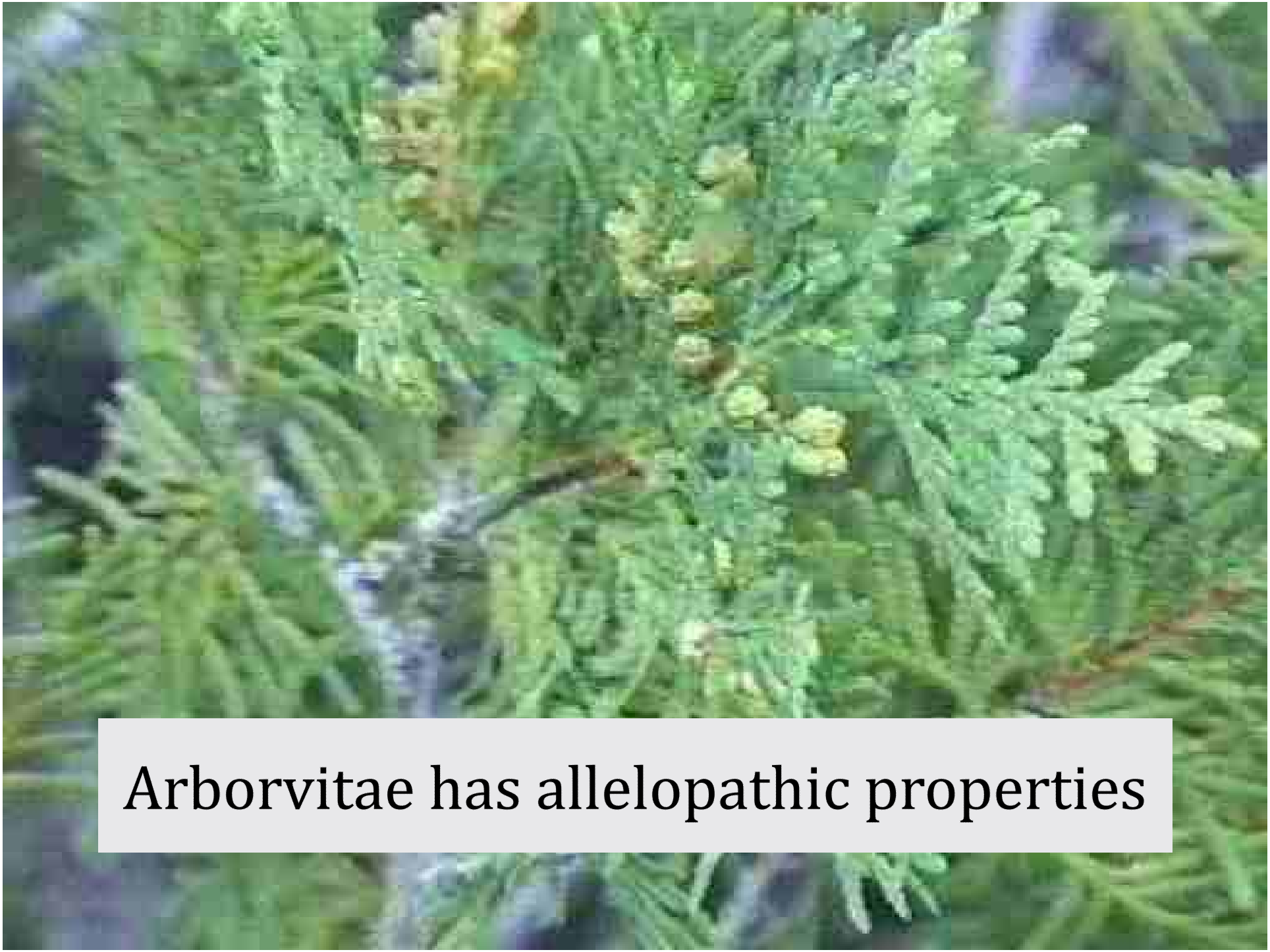
Allelopathy



Garlic Mustard

- Invasive
- Exhibits allelopathy by killing beneficial michorrizae needed by desirable plants

Sunflowers are allelopathic to weeds

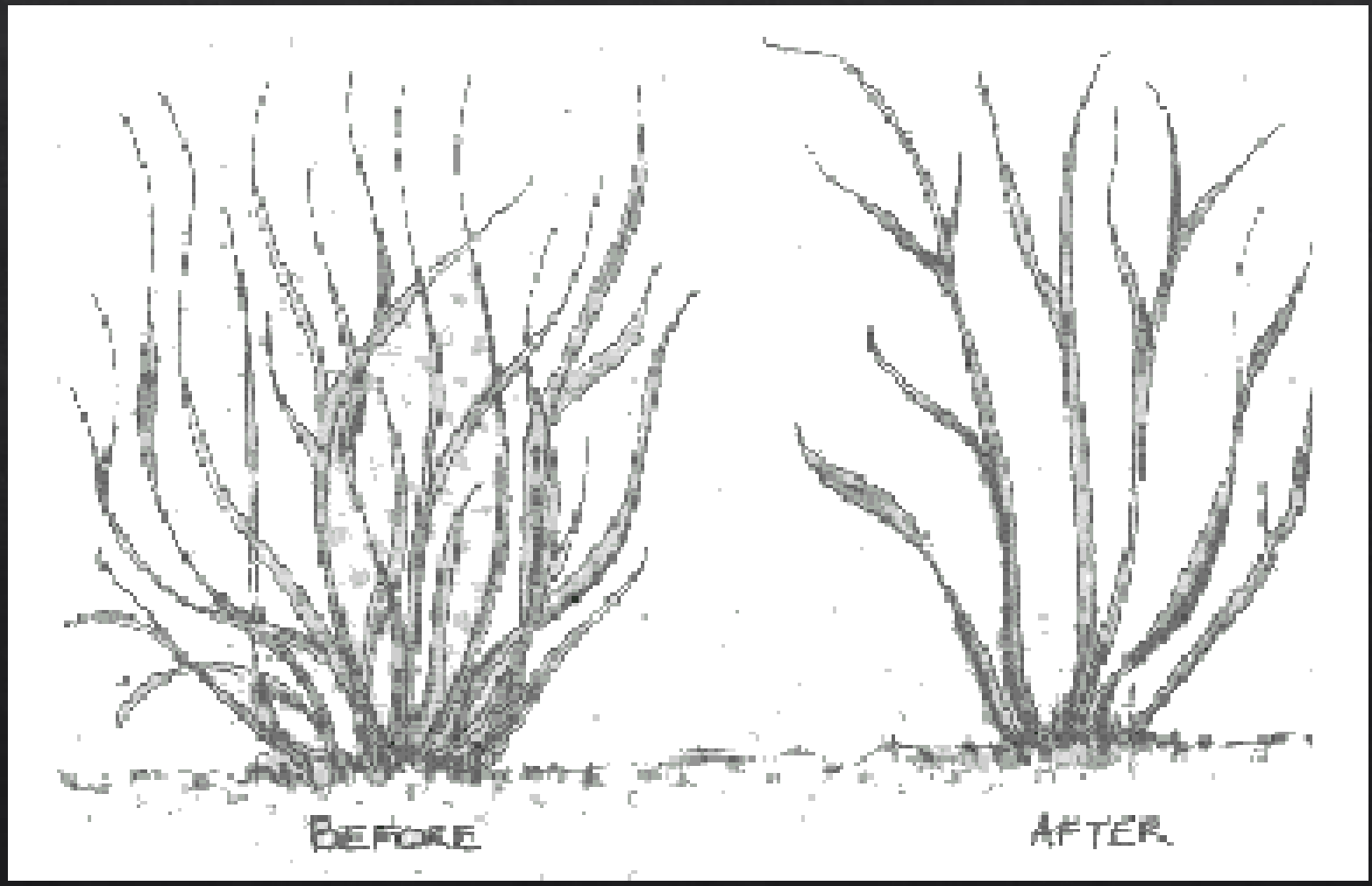

Arborvitae has allelopathic properties

Reducing the effects of non parsitic disease

Right Plant, Right Place

Sanitation

Proper Pruning



Water Management

Nutrient Management


Contact information
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The End