



# Oak Wilt

Identification and Management



# Discussion of Oak Wilt in Texas

- History
- Identification
- Biology
- Management

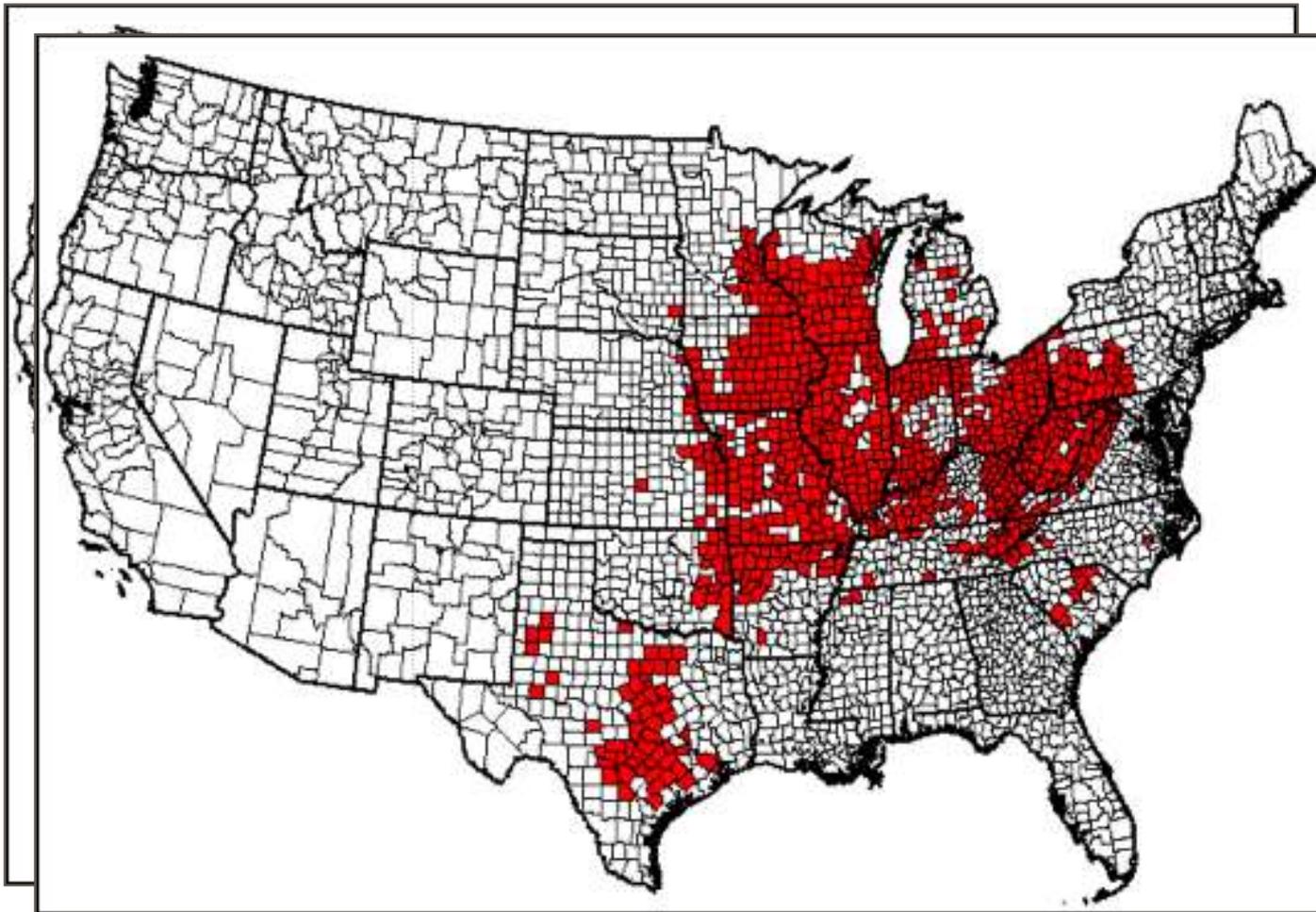




# What is Oak Wilt?

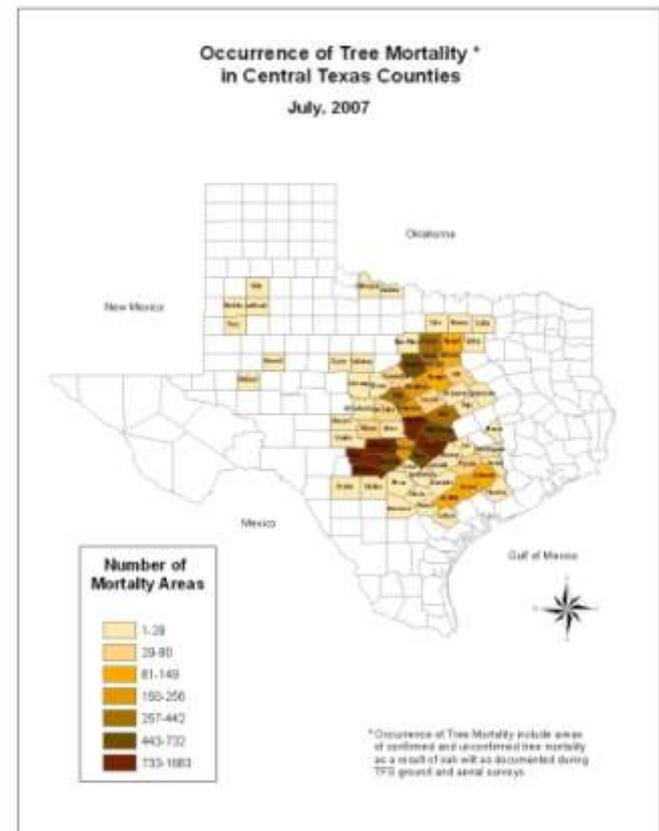
- Oak Wilt is a disease caused by a fungus:  
***Ceratocystis fagacearum***
- This fungus causes a clogging of the water conducting vessels of infected oak trees, causing the trees to wilt and die...

# Range of Oak Wilt in U.S.



# Range of Oak Wilt in Texas

- Oak Wilt was officially identified in Dallas in 1961.
- Since that date, the fungus has been identified in 72 counties of Central and West Texas.





## Oak Wilt Biology, Interacting Factors

# *Ceratocystis fagacearum*

- A fungus (Ascomycete)
- Mostly parasitic, but also saprophytic
- A vascular parasite
- Produces two kinds of spores
- Forms mats of tissue under bark on certain trees
- Heat sensitive
- Origin unknown





# Oak Wilt Symptoms

- Infected trees can display some distinctive symptoms that can indicate oak wilt.
  - Large areas of dead and dying oak trees. This is called a “pattern of mortality”.
  - Live Oaks: Can develop a characteristic leaf pattern called Veinal Necrosis.
  - Red Oaks: Display portions of dead and dying branches that quickly engulf the entire tree. Known as “flagging” or “flaring”. Produce fungal mats under the bark.



# Pattern of Mortality

Live Oak Center



Red Oak Center





# Foliar Symptoms

## Live Oak Symptoms



## Red Oak Symptoms





# Veinal Necrosis





# Pattern in Individual Trees

Diseased Live Oak



Diseased Red Oak





# Flagging Red Oak





# What Oaks are Susceptible?

- Live Oaks and oak trees in the RED OAK group are most susceptible to oak wilt.
  - Live Oak
  - Spanish Oak
  - Blackjack Oak
  - Shumard Oak
  - Water Oak
  - Texas Red Oak

# The Red Oaks



**Blackjack**



**Spanish**



**Shumard**





# What Oaks are Less Susceptible?

- Oak Trees in the WHITE OAK group are least susceptible to oak wilt.
  - Bur Oak
  - Post Oak
  - Chinquapin Oak
  - Monterrey Oak
  - Lacey Oak





# Susceptible Live Oak

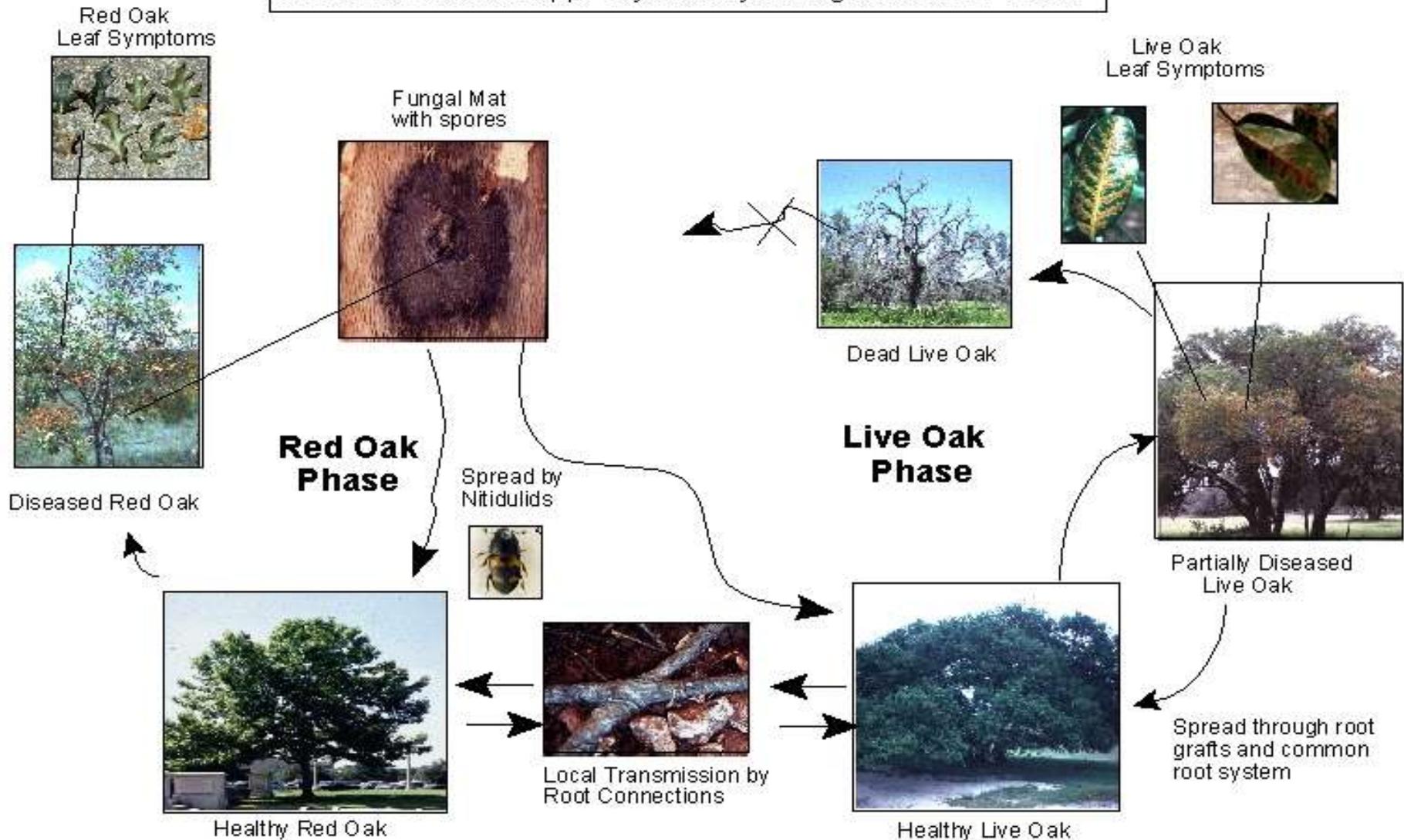
## Post Oak



**AUG 13 2003**

# Oak Wilt Disease Cycle

Infection of *Quercus* spp. By *Ceratostyis fagacearum* in Texas





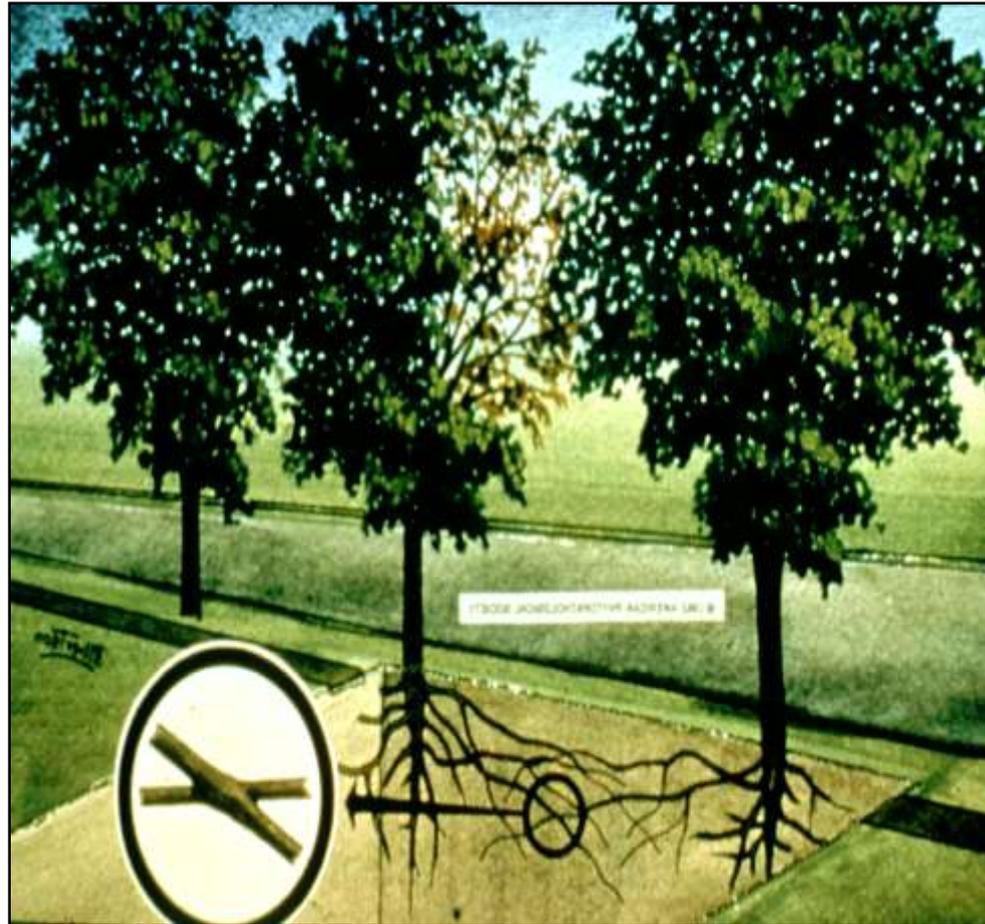
# Oak Wilt Disease Transmission

- The oak wilt fungus can be spread in two primary ways:
  - Above Ground (Long Distance Spread): Certain insects can carry fungal spores from infected red oaks to fresh wounds on healthy oaks, thus forming a new Oak Wilt center.
  - Underground (Local Spread): Through grafted or joined root systems (responsible for the vast majority of tree deaths).

# Disease Transmission



**10% Insect Vectors**



**90% Root Grafts**

# Local Spread

- Root grafts

- live oaks and live oaks
- live oaks and red oaks





# Local Spread

- Root connections – live oaks



# Beetle Spread



- Beetles are only opportunistic
- Sap feeding beetles
- Attracted to sweet smelling odors- ripe fruit, fresh wounds on trees
- Peak beetle populations is in the spring
- High temperatures limit beetle activity
- Visit healthy trees rather than dead trees

# Insects

- M...  
b...  
s...

ts  
eding





# Insect Vectors and Fungal Mats

- When a red oak dies and does not quickly dry out, fungal mats can form between the bark and the sapwood.
- Fungal mats crack the bark open and attract insects with their fruity odor.
- Beetles feed on the fungal mats and can then transmit the disease via fresh wounds on healthy oaks.



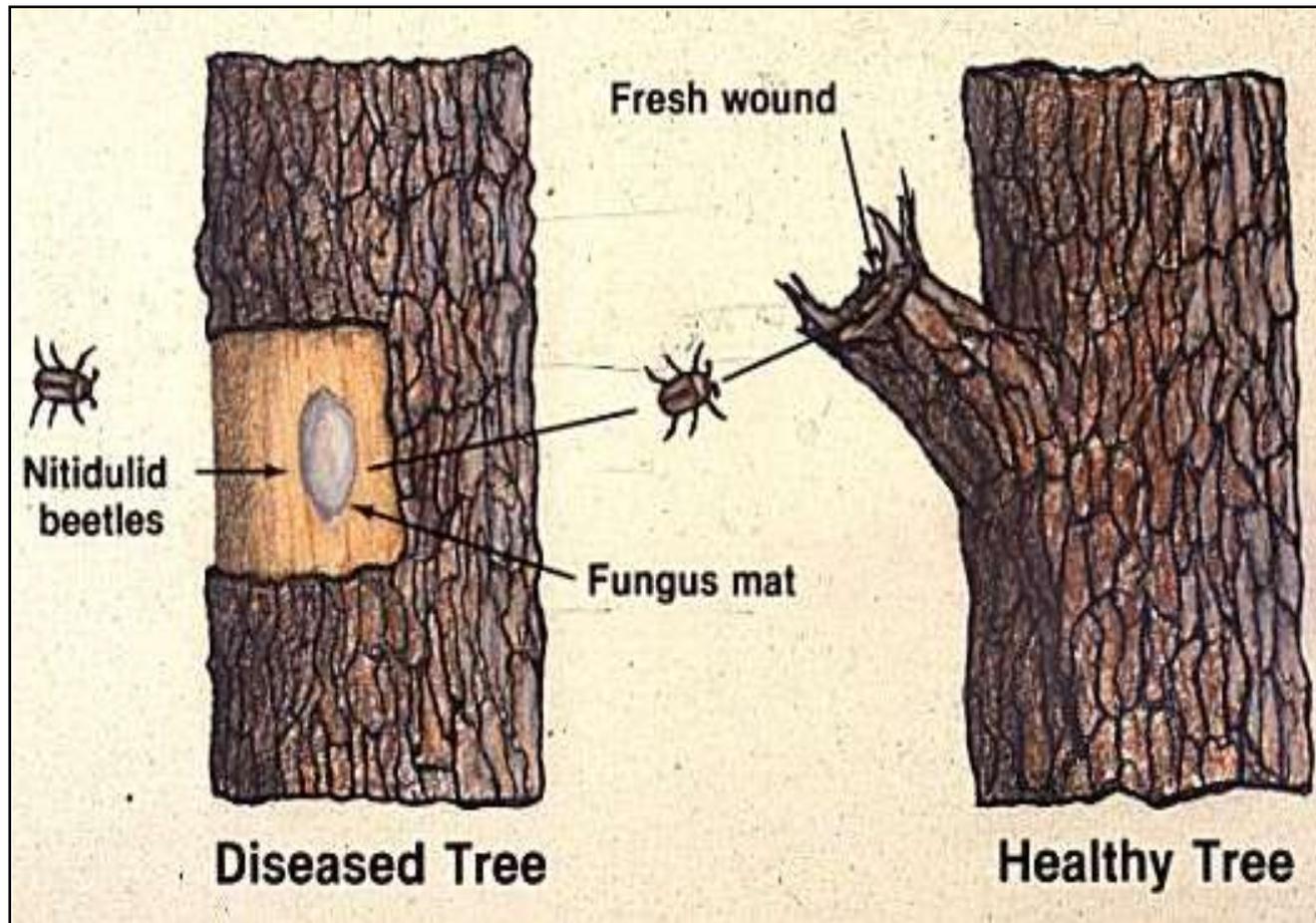


# Red Oak Fungal Mats

- Fungal “spores” or “mats” can form on infected red oaks.
- Their growth and expansion under surface of the bark can be identified by splitting or cracking.



# Insect Spread of Oak Wilt





# Is There a Cure for Oak Wilt?

- No, there is no immediate cure, however, the disease CAN be effectively managed to reduce tree losses.

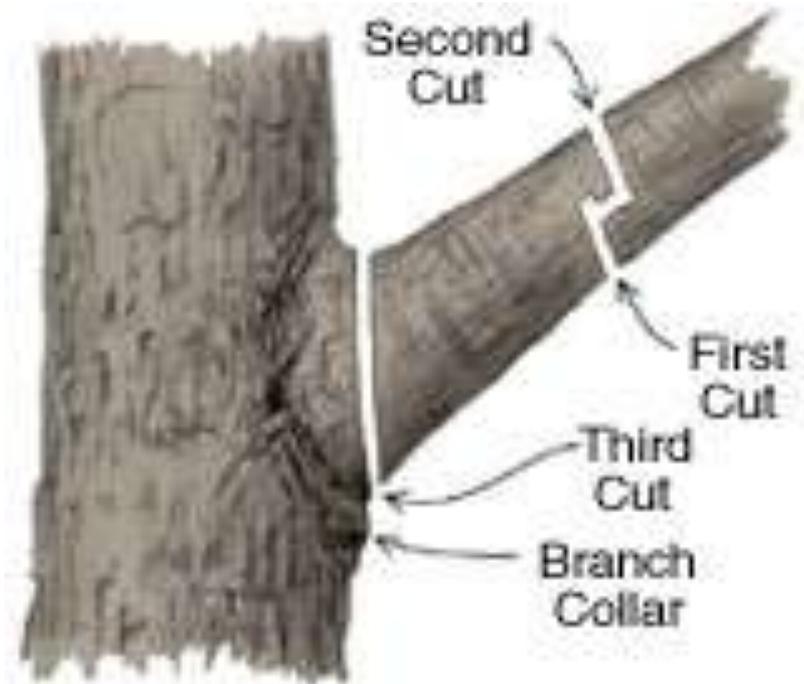


# Treatments & Recommendations

- Utilize proper avoidance precautions. (No Pruning in Spring, Wound Painting, Tool Sterilization, Hire Qualified Arborist)
- Remove & dispose of infected red oaks.
- Trench around expanding centers.
- Inject fungicides into threatened, high value oaks.
- Plant disease resistant trees. Diversify.

# Treatments & Recommendations

- Avoid wounding and pruning oak trees from February through June.
- Make proper pruning cuts.





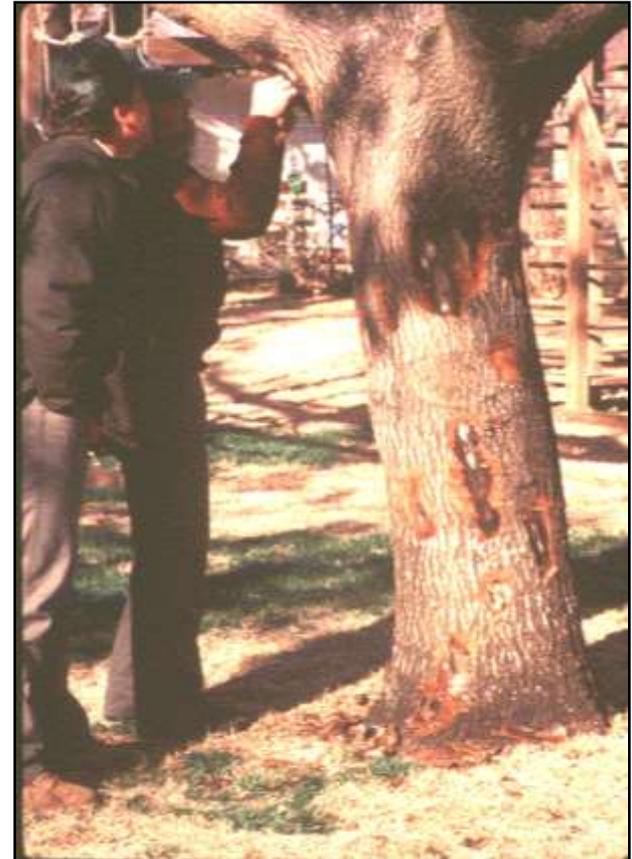
# Paint Wounds and Pruning Cuts on Oaks All Year!





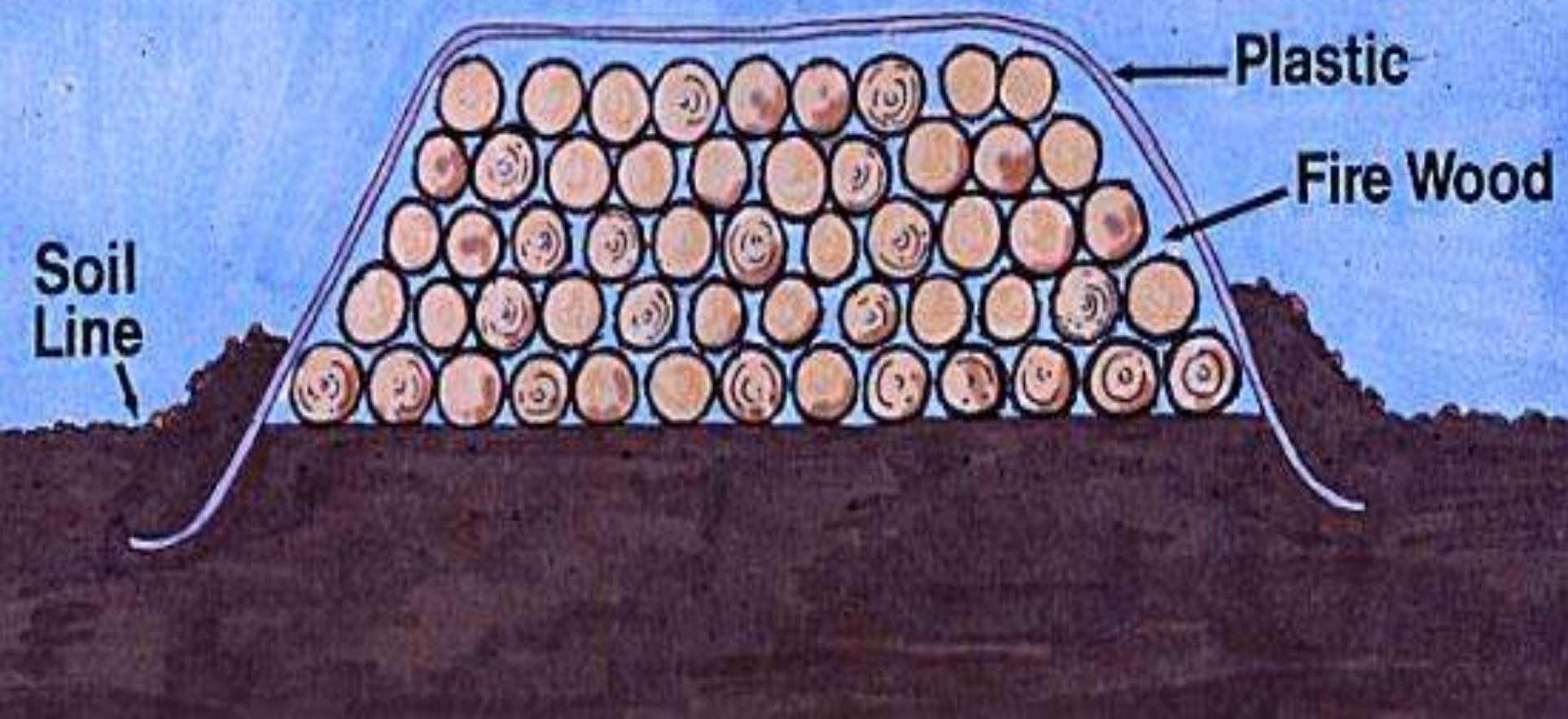
# Dispose of Red Oaks

- Infected red oaks should be identified and removed from the environment immediately by **Burning, Burying in a Landfill, or Chipping/Composting.**
- This practice will help reduce the potential aerial spread where the fungal spores are transported to healthy trees by insects.



## HANDLING FIREWOOD

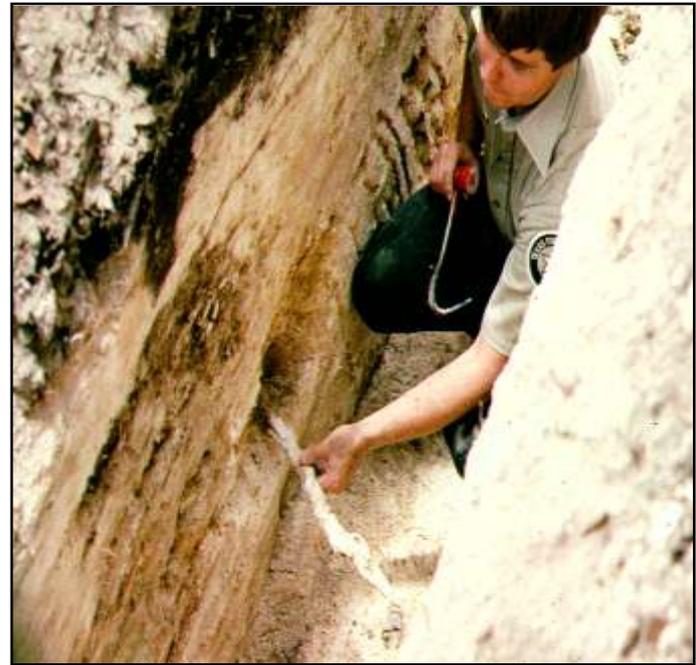
- DO NOT USE DISEASED RED OAKS
- SELECT WELL-SEASONED WOOD
- TAKE PRECAUTIONS W/UNKNOWN





# Oak Wilt Management

- Root Graft Disruption (Trenching)
  - Physically isolate healthy trees from infected trees to prevent the disease from spreading.



# Trenching

- Trenches are used to disrupt root connections and stop the localized spreading of the disease.





# Most Common Trenching Equipment in Texas

**Ripper Bar**



**Rock Saw**



**Back Hoe**

# Trenching

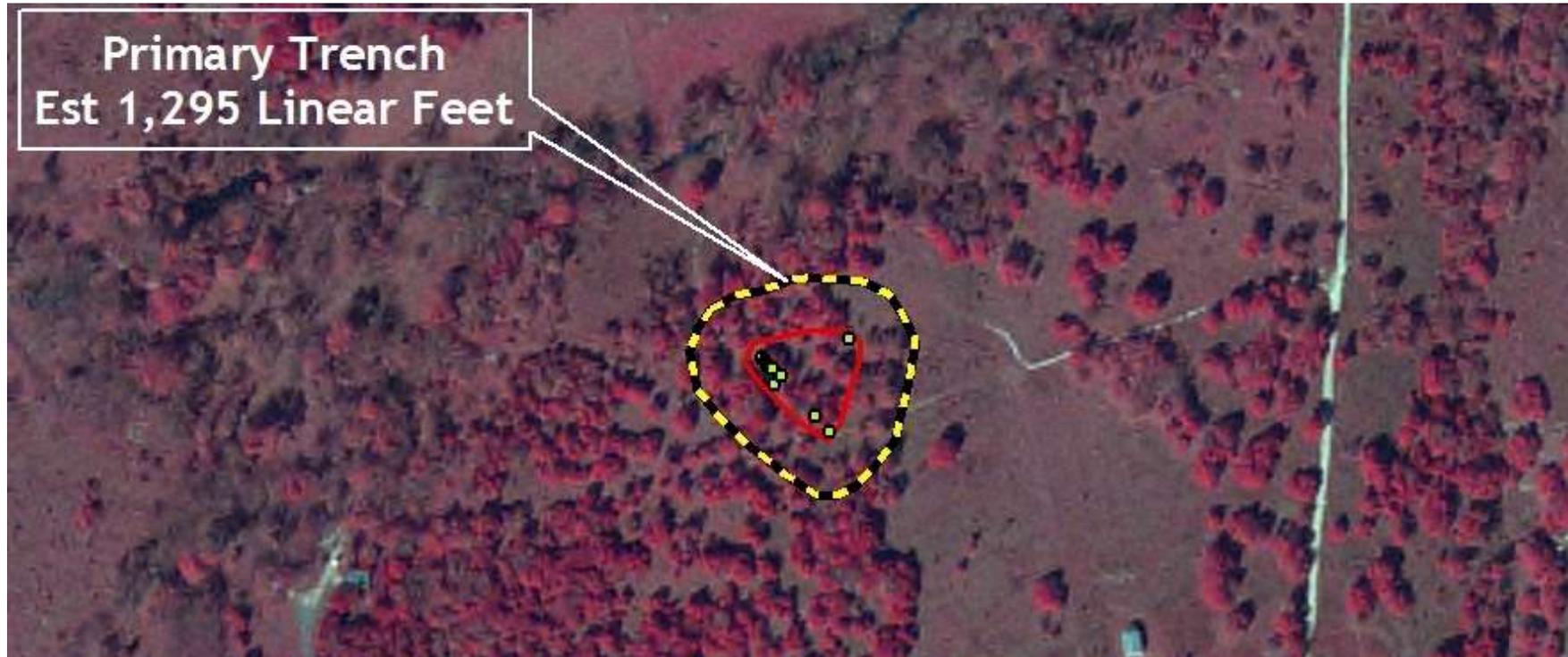
- Rock Saw
- 60" depth





# Treatment Protocol

- Place trench line at least 100 feet from nearest diseased tree and at least 48” deep.



# Total Trench Accomplishments 1988 - 2008

Centers trenched = 2,531

Feet of trench = 3,512,893 (665 miles)

Total cost shares = \$ 2,526,790

Total costs = \$ 6,228,285

Average cost/foot = \$1.85

Success of trenches: 78%



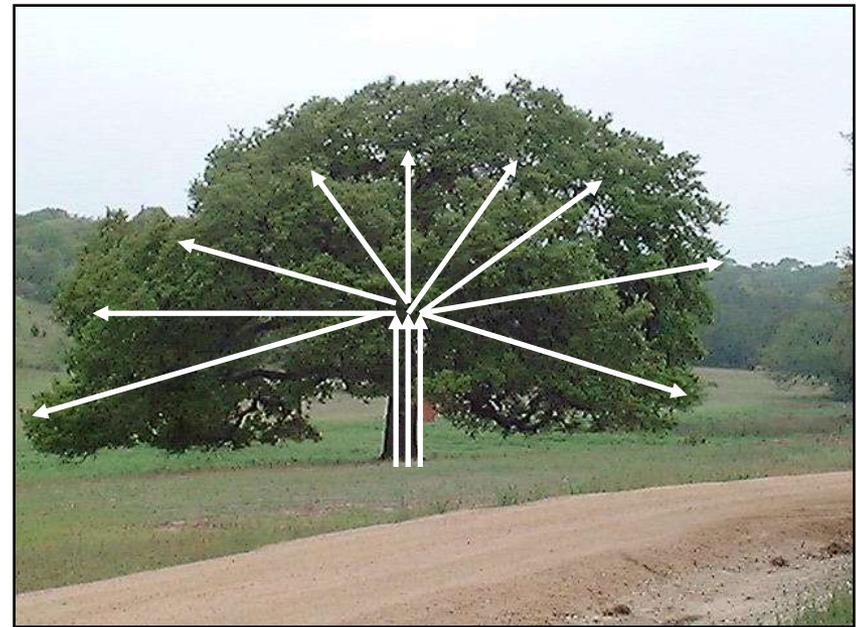
# Injection: Macro-Infusion

- The rapid introduction of large volumes of solution directly into a tree's vascular system.



# Injection: Macro-Infusion

- The purpose of macro-infusion is even and complete coverage of entire crown.
- All the small twigs and branches get enough chemical to keep the disease from growing.





# Macro-Infusion

- NOTE: Injection of trees DOES NOT PREVENT LOCAL SPREAD OF DISEASE. The injection May or May Not save that particular tree. The tree should be injected with little or no symptoms in order for the tree to have the best chance of survival.



# Urban Forest Renewal

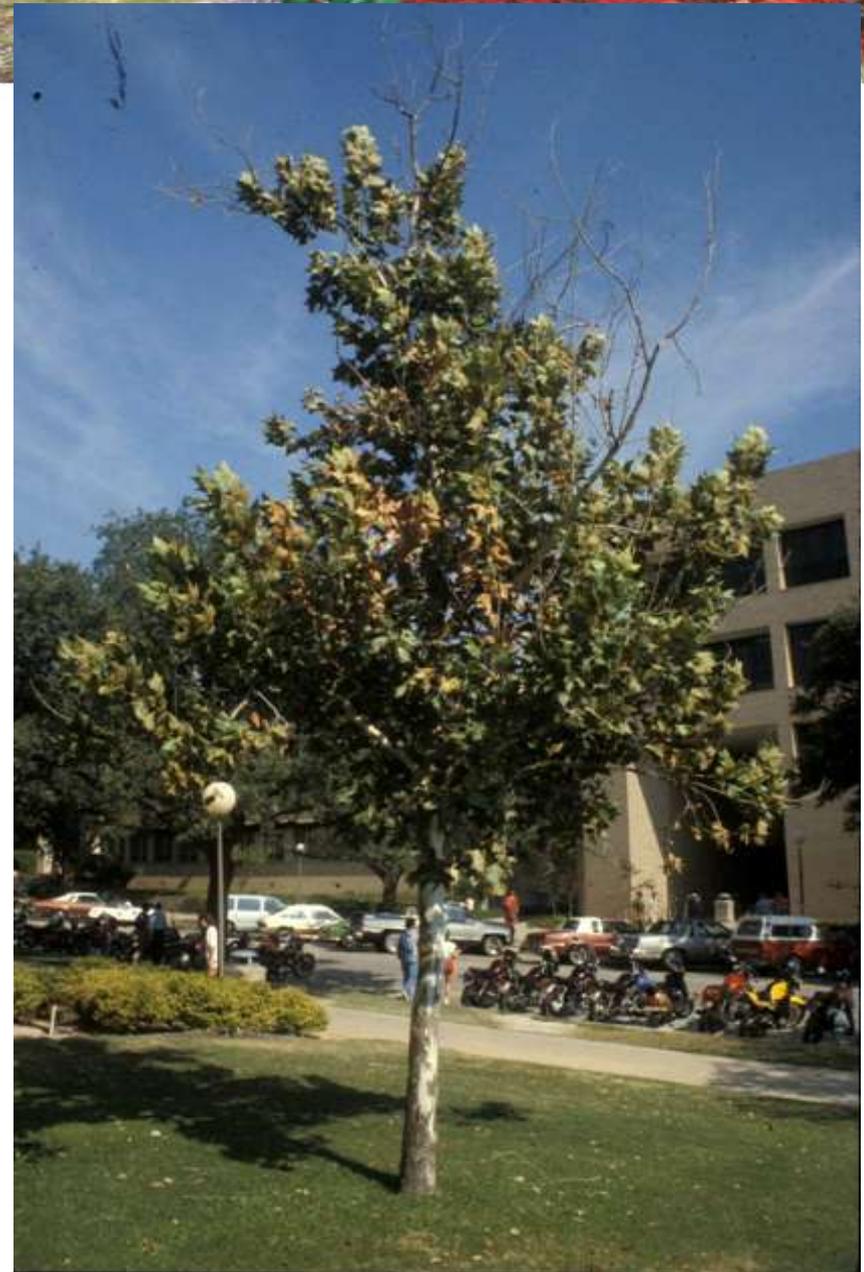




# Declines in Texas

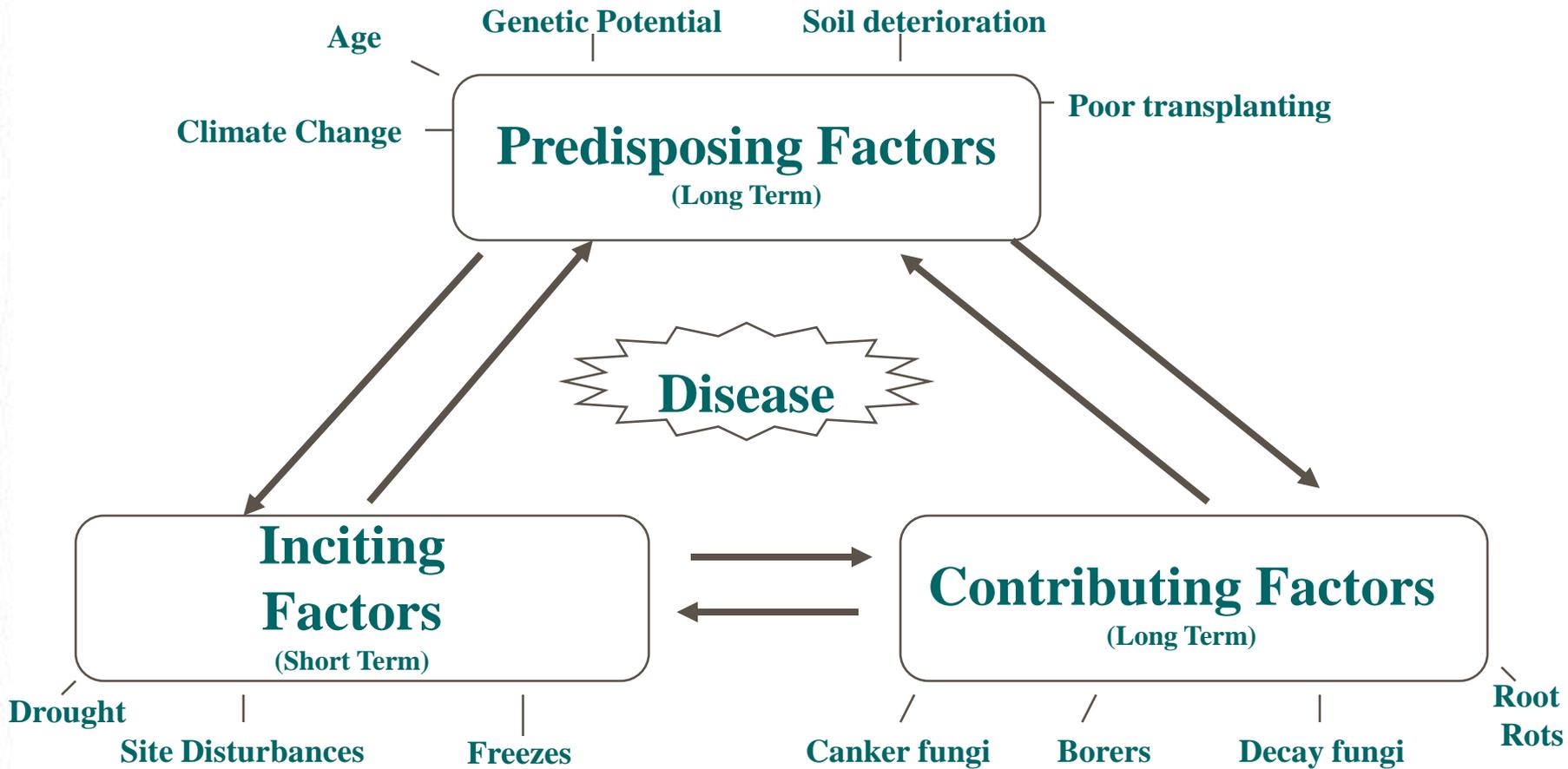
Sycamore  
decline

Post oak decline



# Interacting Factors in Tree Disease

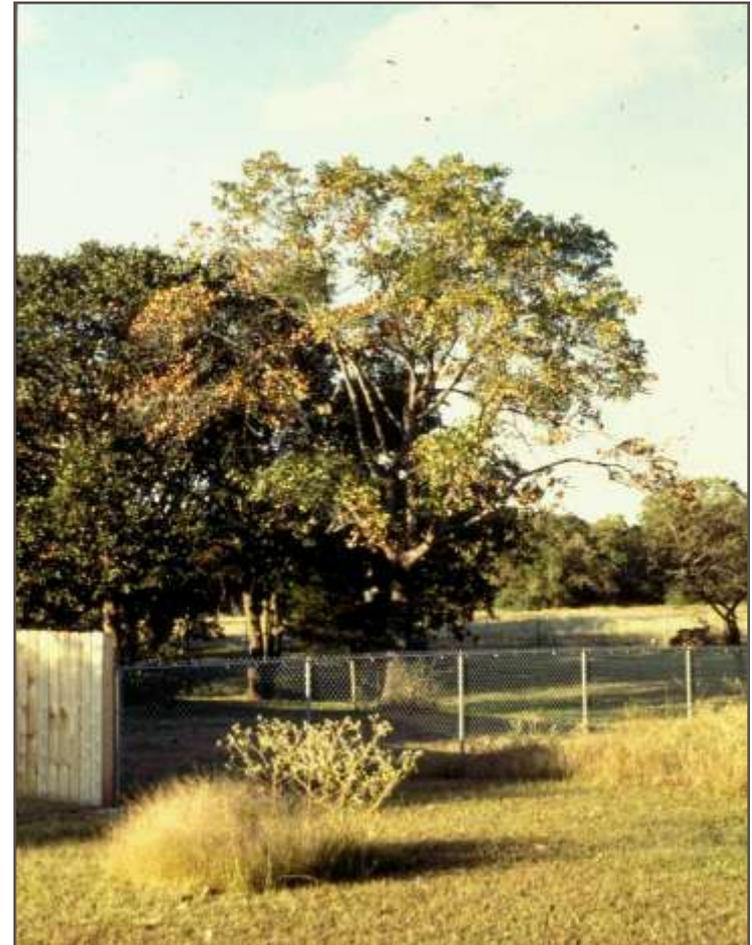
Diseases of complex etiology = Declines



# DECLINES

## Post Oak Mortality in the Brazos Valley Observations

- Has been a problem for the past 35 years
- Trees in newer developments begin to die in late spring, early summer
- Rates of death variable – may not show up for years after construction
- Symptoms are fairly consistent





# Post Oak Mortality in the Brazos Valley

## Observations, cont'd.

- Trees often die in patches
  - Hypoxylon is a constant contributing factor
  - Phytophthora has been implicated as an additional factor
- 
- Difficult to predict which trees will die
  - Eventually the mortality will stabilize





# Pathology of Post Oak Hypoxylon Canker = Contributing Factor





# Hypoxylon Canker

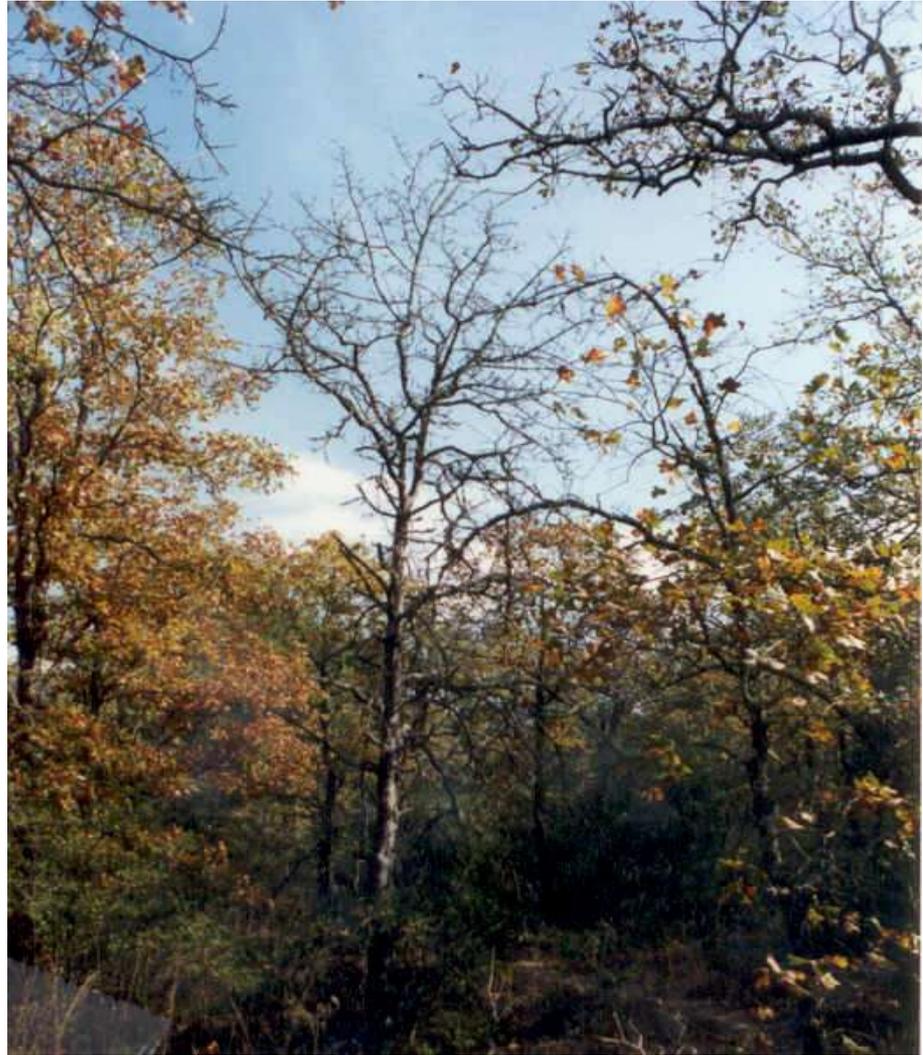
- *Hypoxylon atropunctatum*
- Non aggressive, facultative saprophyte
- Contributing factor in decline
- Cosmopolitan resident of inner bark
- Causes a white rot of sapwood
- Nearly a universal presence on dying post oaks



# Post Oak Mortality in Woodlands

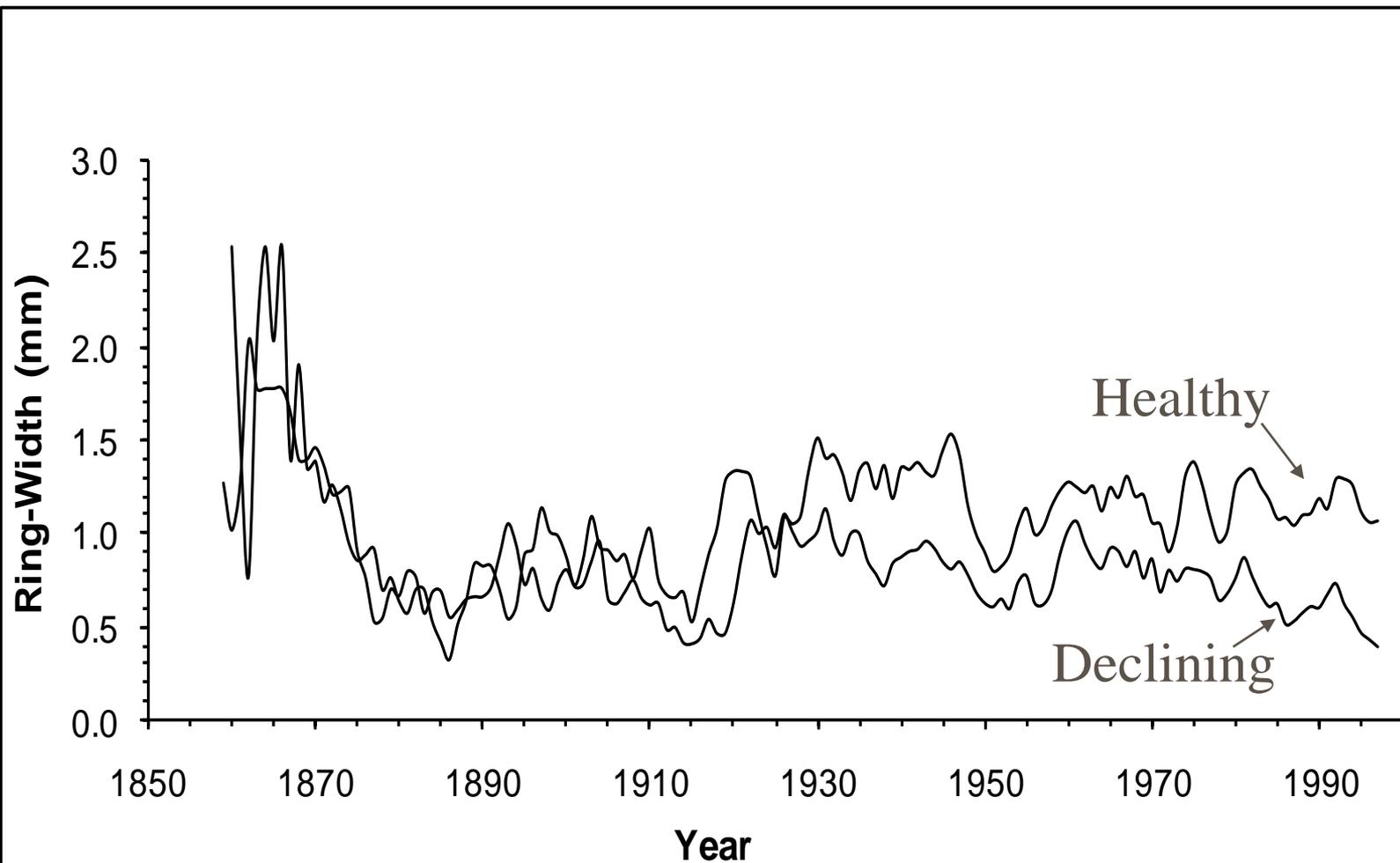
## Observations

- Occurs in patches
- Associated with Hypoxylon
- No obvious spatial relationships
- Appears to have been increasing in recent years





## Average annual ring-width chronologies of health vs. severely declining post oaks





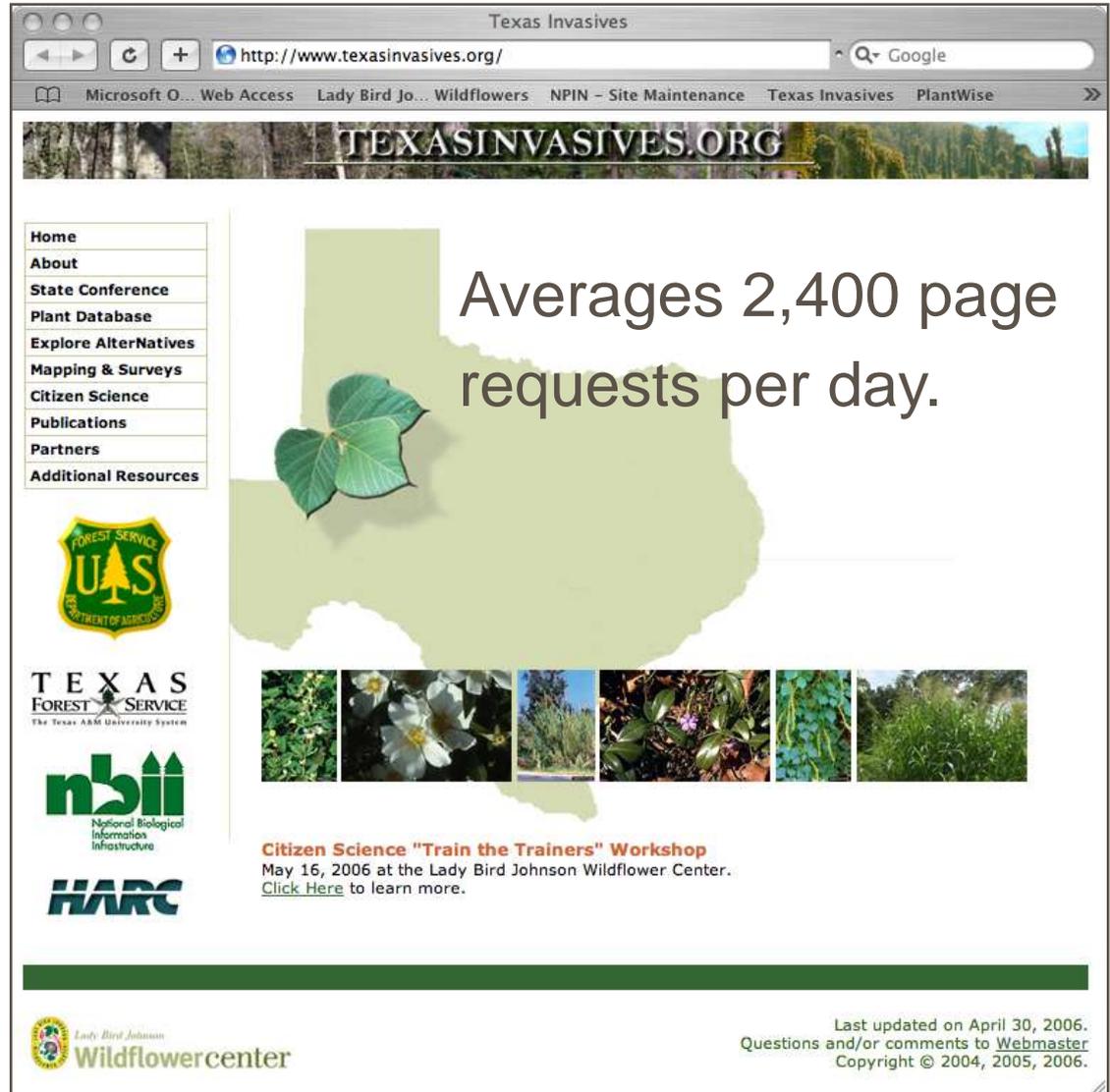
# Conclusions

- Declining trees have been growing slower than healthy trees for about 70 yrs.
- Competition not a factor in decline
- All ages affected, ruling out cohort senescence
- Lower water holding capacity in soil and droughts predispose post oak to decline
- These results have implications for oak mortality in urban environments

# www.texasinvasives.org

**Purpose:** Distribute scientifically accurate invasive plant information to the general public and land management professionals via the World Wide Web.

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# Texas Invasive Plant & Pest Council

- TIPPC was established in Texas in 2008. It is an educational and professional group organized to promote awareness of invasive plants and pests in Texas.
- Membership is open to all individuals and corporate and institutional entities.
- For more information: [www.texasinvasives.org](http://www.texasinvasives.org) and click on 'TIPPC'.

# TEXAS BEWARE!

The emerald ash borer (**EAB**) may already be here.

This non-native beetle kills ash trees and is well established in the Midwest. It has recently been detected in Missouri. Help protect ash trees in forested and urban areas of Texas.



- The insects may be transported long distances in firewood, so do not bring firewood into the state.
- Watch for symptoms of EAB infestation:
  - ash trees with dying or dead branches in upper crown
  - shoots or suckering along the trunk
  - bark splits with winding galleries and white larvae beneath the bark; heavy feeding by woodpeckers
  - "D"-shaped exit holes in bark
- Report dead and dying ash trees with these symptoms to your nearest Texas Forest Service or county extension office, or contact Joe Pase (936) 639-8170 in Lufkin.
- For more information, visit [www.emeraldashborer.info](http://www.emeraldashborer.info) or [www.texasinvasives.org](http://www.texasinvasives.org).



# Soapberry Borer, *Agrilus prionurus* (Coleoptera: Buprestidae) An Exotic Pest Recently Detected in Texas

Ronald F. Billings and Herbert A. Pase III  
Texas Forest Service



A new insect pest of western soapberry (*Sapindus drummondii*) has recently been detected in several counties in Texas. The soapberry borer (*Agrilus prionurus*), a native of Mexico, was first reported in Bastrop County, TX in 2003. Since then, it has been detected in several additional counties, including near or within the cities of Dallas, Fort Worth, Waco, Austin, Houston and Corpus Christi.

As its populations expand rapidly in Texas, this buprestid is killing soapberry trees of all ages. It may eventually threaten western soapberry populations throughout the tree's range, which extends from northern Mexico to Missouri, and west to Arizona.

Leaves of western soapberry, a medium-sized, drought-hardy tree, resemble those of the invasive Chinaberry, but are not double compound and the leaflets do not have serrated (toothed) margins. Infestations of soapberry borer are similar to those of emerald ash borer, *Agrilus planipennis*, a close relative not yet found in Texas.

Infested trees can be easily recognized by the exposed sapwood that results when birds and squirrels chip off the bark to feed on the larvae. Bark chips accumulate at the base of the tree. A heavily-infested tree will be completely girdled by white larvae feeding beneath the bark.

The adult beetle is about ½ inch-long, shining black and distinctively marked with four small white spots on the wing covers. Larvae are flat-headed wood borers that may attain an inch or more in length as they mature. After feeding beneath the bark, the larvae bore into the wood to complete development and to pupate. The adult leaves a D-shaped exit hole as it emerges.

Western soapberry appears to be this insect's sole host in Texas and the tree exhibits little resistance to this introduced pest. Little else is known about the insect's biology or methods of control. For more information or to report new infestations, contact the authors: [rbillings@tfs.tamu.edu](mailto:rbillings@tfs.tamu.edu) or [jpase@tfs.tamu.edu](mailto:jpase@tfs.tamu.edu).



Characteristic symptoms of *A. prionurus* infestations



D-shaped exit hole



Adults of *A. prionurus* (note 4 white spots)



Desirable landscape soapberry tree killed near Houston



Western Soapberry



# For More Information

**Texas Oak Wilt Website:**

**[www.texasoakwilt.org](http://www.texasoakwilt.org)**

**Texas Forest Service Website:**

**[www.texasforestsERVICE.tamu.edu](http://www.texasforestsERVICE.tamu.edu)**

**Invasive Plants & Pests**

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