

Oak wilt



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Staff Forester II*

What is Oak Wilt?

One of the most destructive tree diseases in the United States.

Killing oak trees in central Texas in epidemic proportions.

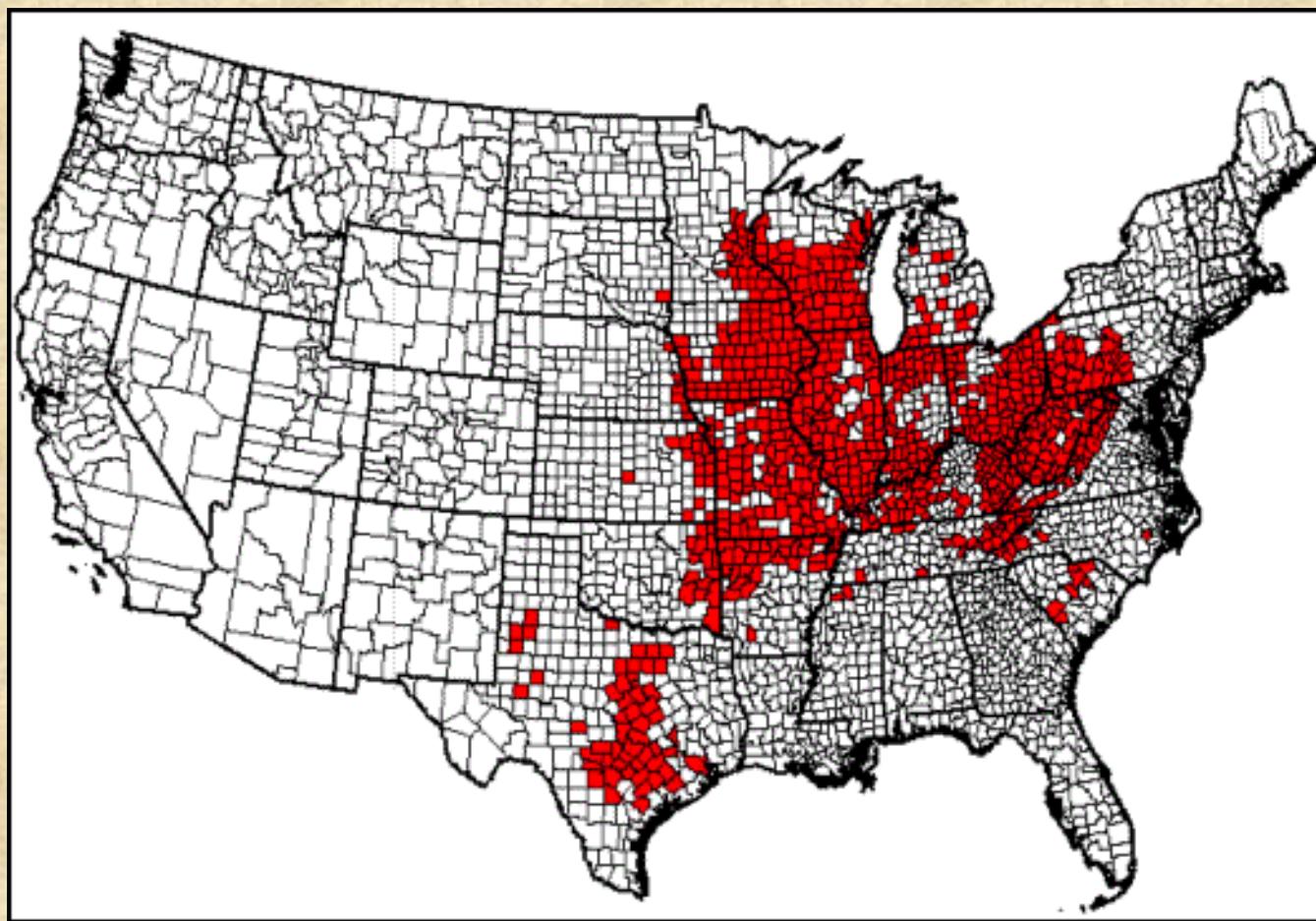
Caused by the fungus *Ceratocystis fagacearum*.

Bretziella fagacearum



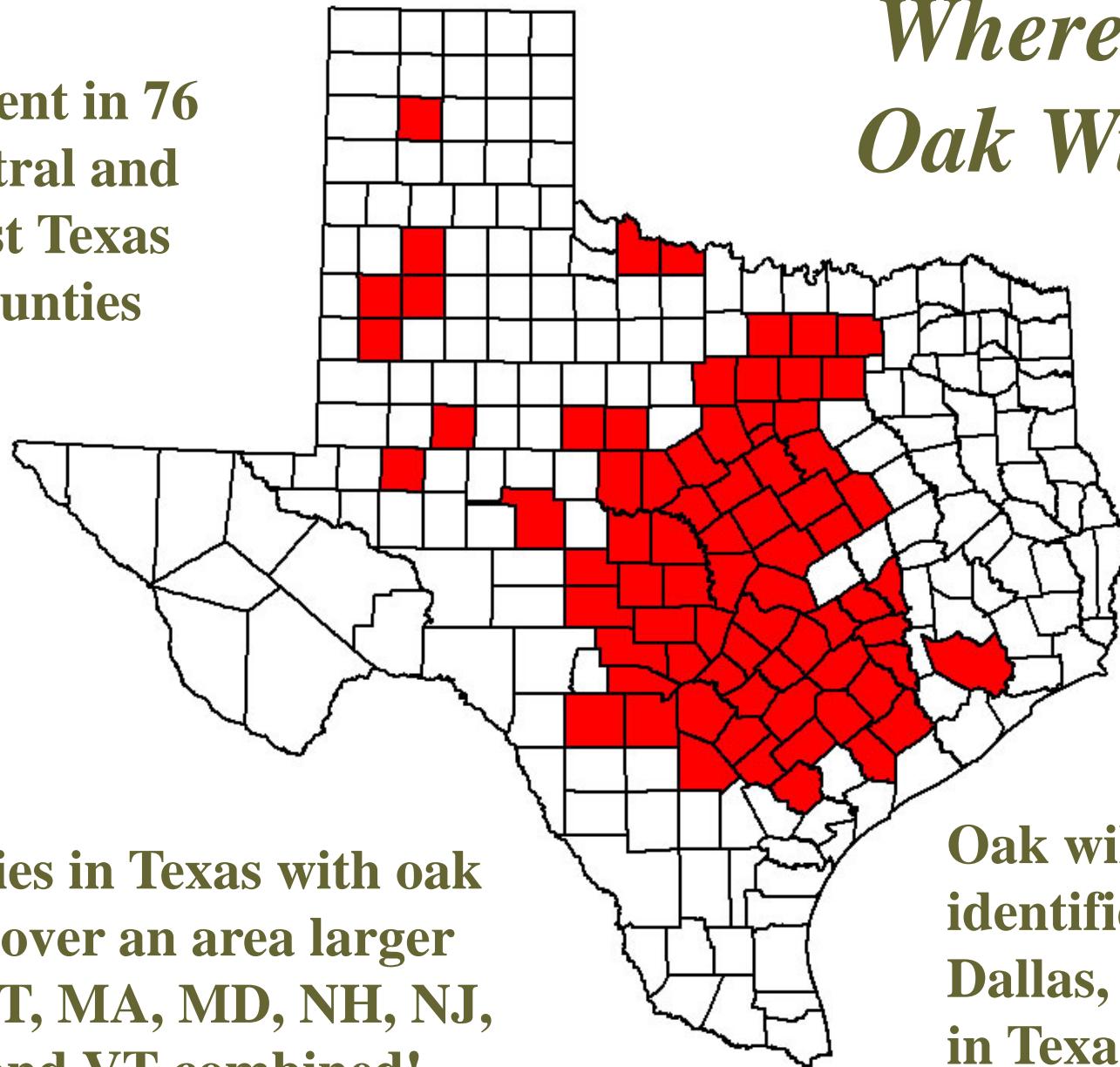
Distribution in U.S.

Present in over 20 eastern and mid-western states



Where Is Oak Wilt?

Present in 76
central and
west Texas
counties



Counties in Texas with oak
wilt cover an area larger
than CT, MA, MD, NH, NJ,
RI and VT combined!

Oak wilt first
identified in
Dallas, in 1961
in Texas

Oak wilt Impact



Urban Areas (< 1 acre)



Oak wilt may reduce urban property values by 15-20%.



Rural Residential Areas



Loss of live oaks to oak wilt has greater economic impact around ranch houses.

Rural Areas



Thousands of acres of live oaks have become victims of oak wilt in rural areas of Central Texas.



Suburban Areas (1-10 acres)



The many new “ranchettes” (<10 ac) in Central Texas have increased incidence and impact of oak wilt.

Ecosystem Impact



Golden cheeked warbler

Also known as gold
finch of Tx

Endangered species
breeds in Central Tx

Range from Palo Pinto
county southwestward
along eastern and
southern edge of
Edwards Plateau

Only species with
breeding range
confined to Tx

Direct threat due to
loss of habitat (oaks
and juniper)

Ecosystem Impact



Ashe Juniper encroachment

Which Oaks are Susceptible to Oak Wilt?

All oaks (*Quercus* spp.) are susceptible to oak wilt!

Red oaks are extremely susceptible and play a unique role in disease spread. Spanish (*Q. buckleyi*), Blackjack (*Q. marilandica*) and Shumard (*Q. shumardii*) are present in central Texas.

White oaks tolerate oak wilt and rarely die from the disease. These include Post (*Q. stellata*), Bur (*Q. macrocarpa*), Chinkapin (*Q. muhlenbergii*), Lacey (*Q. laceyi*) and White Shin or Bigelow (*Q. brevirostra v. sinuata*).

Live oaks (*Q. virginiana* and *Q. fusiformis*) are intermediate in susceptibility but are seriously affected due to their vast, interconnected root systems that allow movement of the fungus between trees.

The Red Oaks



Blackjack



Spanish



Shumard



The White Oaks



Bur



Lacey



Post



Chinkapin



White Shin

The Live Oaks



Escarpm^{ent}



Coastal

How is Oak Wilt Spread?

Above Ground (long distance) via sap-feeding beetles.
Fungal spores are picked up from certain infected Red oaks and carried to fresh wounds on other oak species.
New infection centers are started in this manner.



Sap Beetle



Fungal Mat



Fresh Wound
on Live Oak

Fungal Mats

Contain spores for spread by the beetle

Produced only on red oaks

Mycelial mats form under bark

Multiple mats per tree

Produce a sweet odor like rotting melons



Fungal Mats

Fungal mat production is accelerated by cool, moist weather

In Texas trees killed in late summer may produce mats the following spring.

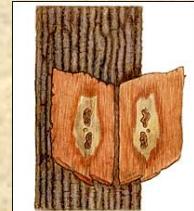


Figure 4. Bark section showing an exposed spore mat on both surfaces.

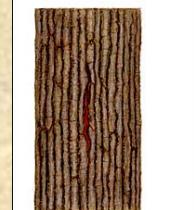
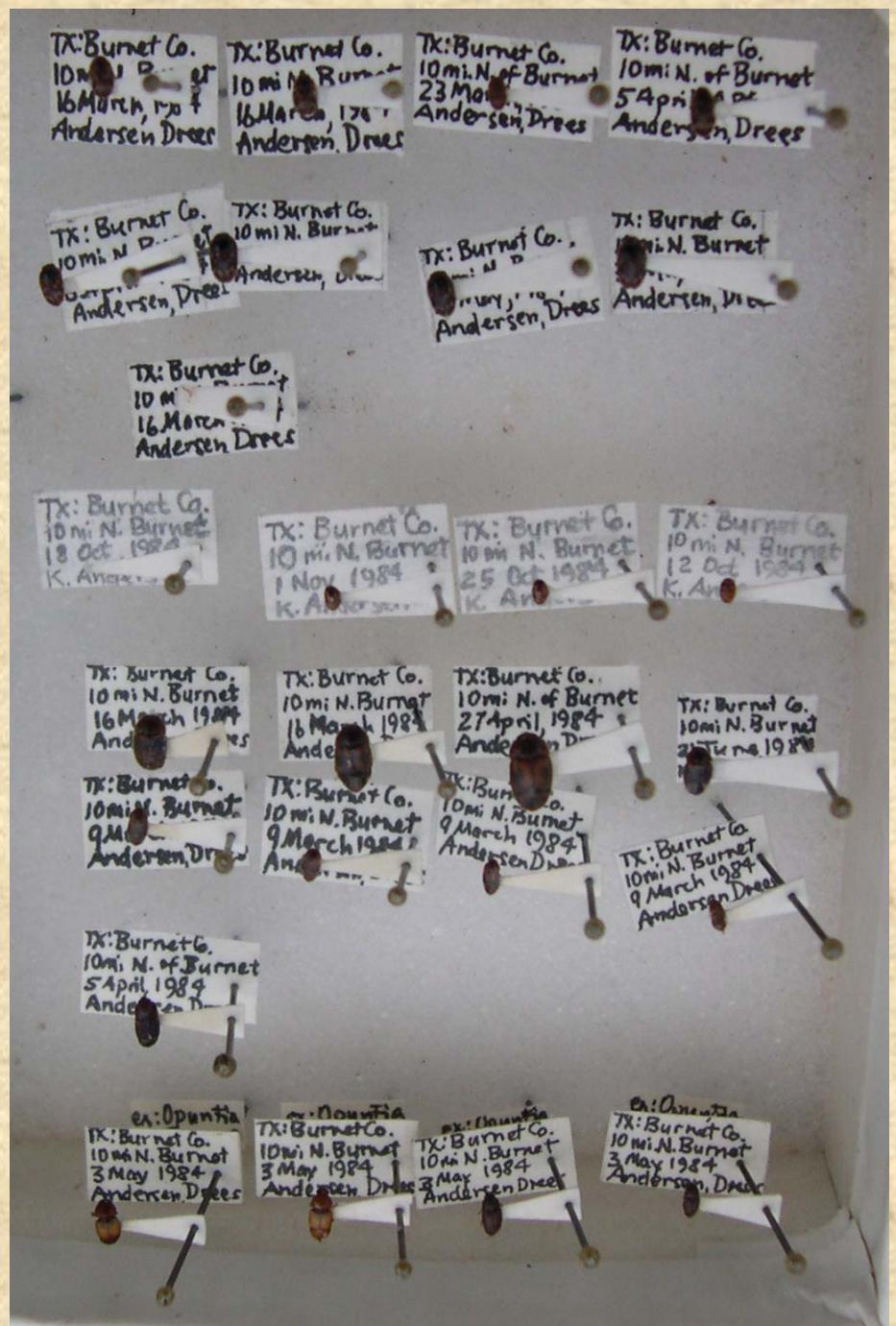


Figure 5. Bark split caused by pressure pad of the oak wilt fungus.

Beetle Spread



Nitidulid Beetle



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

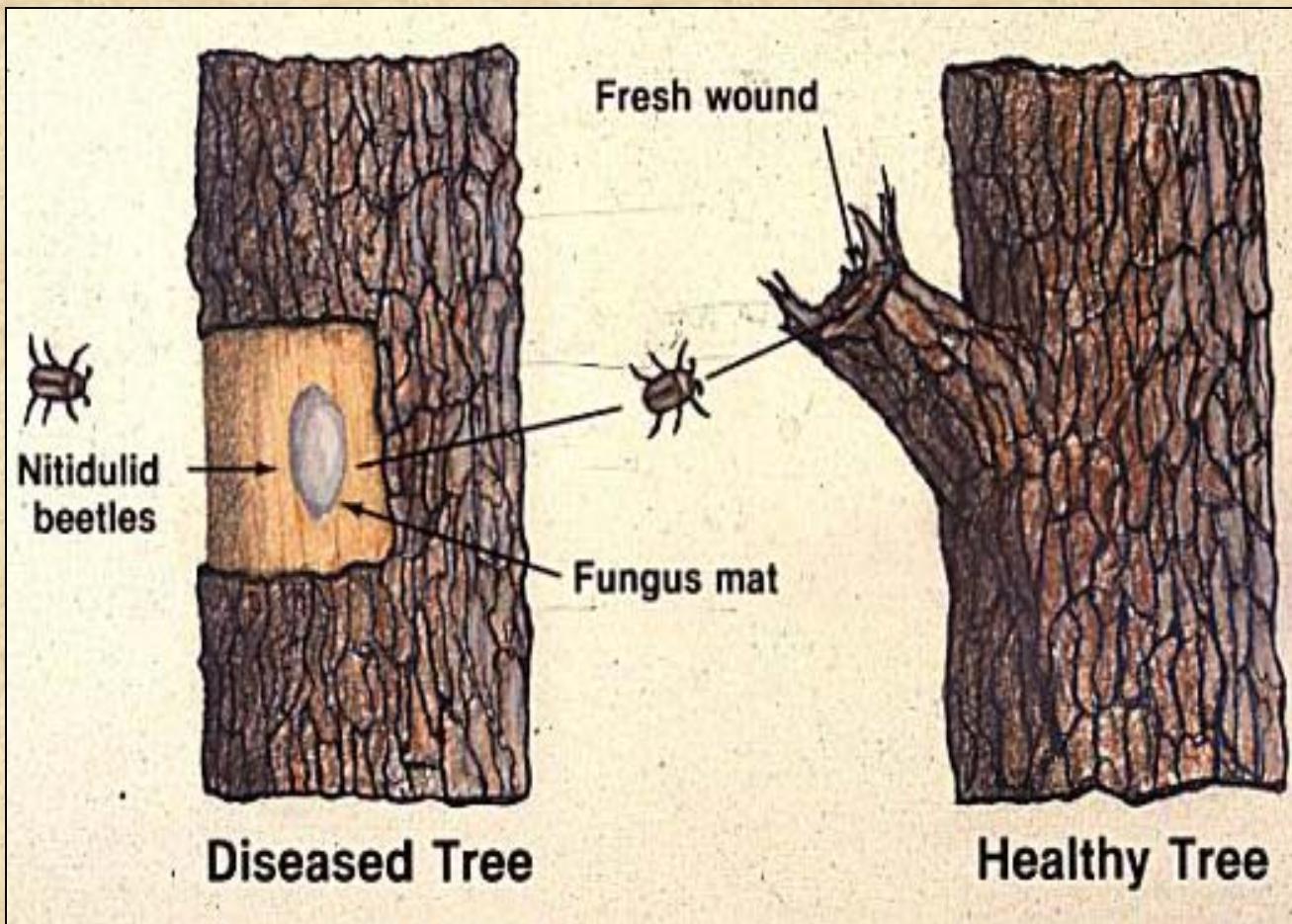
Visit healthy trees rather than dead trees

Beetle Spread

Attracted to sweet smelling odors- ripe fruit, fresh wounds on trees, fungal mats.



Beetle Spread



How is Oak Wilt Spread?

Underground (localized) via interconnected root systems and root grafts. This occurs primarily in Live oaks and is responsible for the majority of spread and tree deaths in central Texas.



Root Grafts



Live Oak Mott

Root grafts

**live oaks and live oaks
live oaks and red oaks**



Local Spread

Local Spread



How Fast Does Oak Wilt Spread?

Rate of spread via interconnected root systems and root grafts is approximately 50' to 75' per year.



1983



2 years later

How to Identify Oak Wilt

Foliar symptoms in Live oaks



Veinal chlorosis and/or necrosis

How to Identify Oak Wilt

Foliar symptoms in Red oaks



Bronzing or water soaking

How to Identify Oak Wilt

Pattern of mortality in Live oaks



Rapid defoliation.
Death in 3 to 6 months.
Eventual spread to adjacent trees.
No fungal mat formation.
~ 20% survival rate.

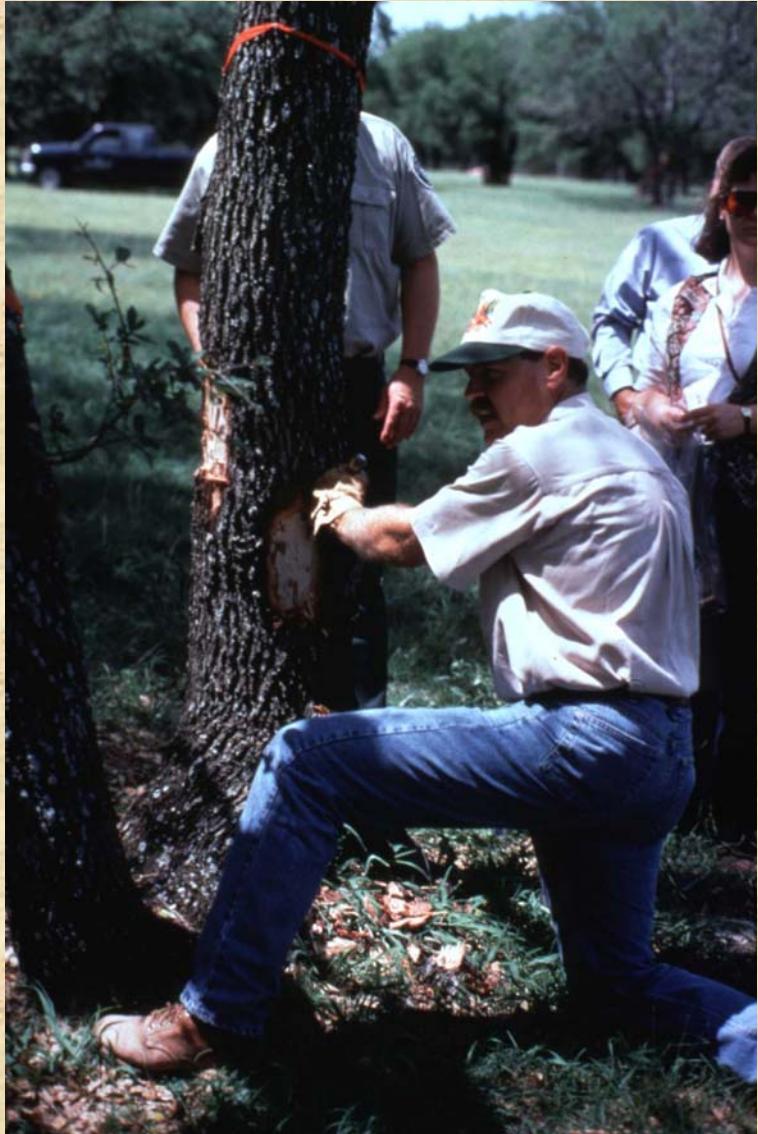
How to Identify Oak Wilt

Pattern of mortality in Red oaks



Maintain dead leaves.
Death in 3 to 4 weeks.
Possible spread to adjacent trees.
Possible formation of fungal mats.
100% mortality (no survivors).

How to Identify Oak Wilt



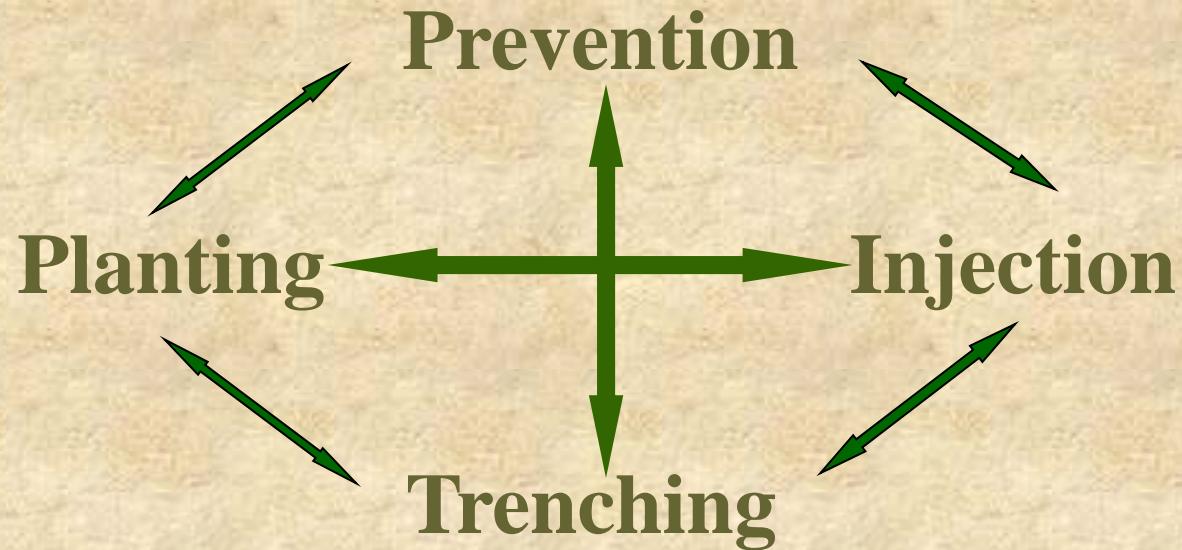
Laboratory Diagnosis (for all oaks)

Oak wilt may be confirmed by isolating the fungus from diseased tissues in the laboratory.

How to Manage Oak Wilt

Early detection and prompt action are essential for successful management of oak wilt.

There are four primary approaches used to manage oak wilt:



These measures will not cure oak wilt but will significantly reduce tree losses.

How to Manage Oak Wilt



Prevention

Avoid wounding oaks from February through June, and regardless of season, paint all pruning cuts and other wounds immediately.



How to Manage Oak Wilt

Destroy infected Red oaks (burn, bury or girdle) to prevent fungal mat formation.



How to Manage Oak Wilt

Transport and use dry, well-seasoned firewood only.

Leave unseasoned wood on site at least one full year before transporting.

Do not store infected firewood near uninfected trees.

Cover wood with clear plastic and bury the edges to prevent insects from leaving the pile.



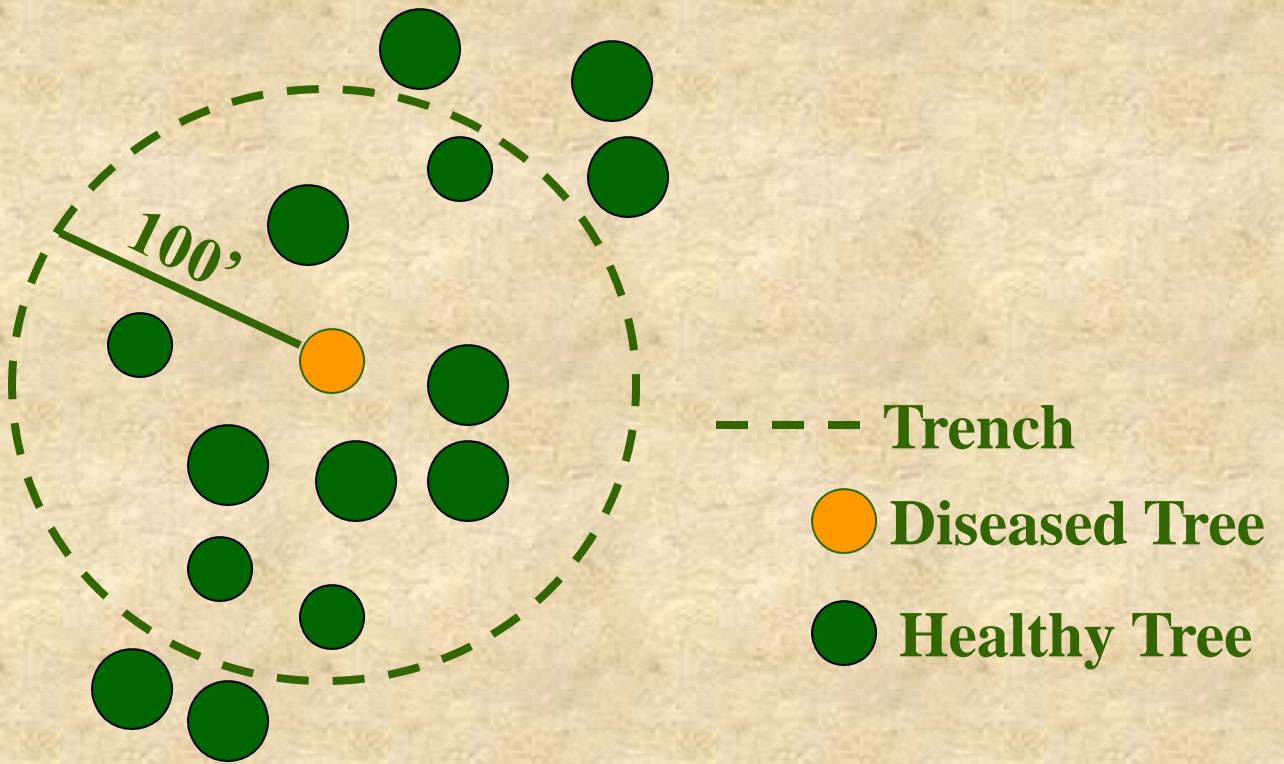
How to Manage Oak Wilt

Trenching

Used to disrupt root connections
and stop the localized spreading
of the disease.



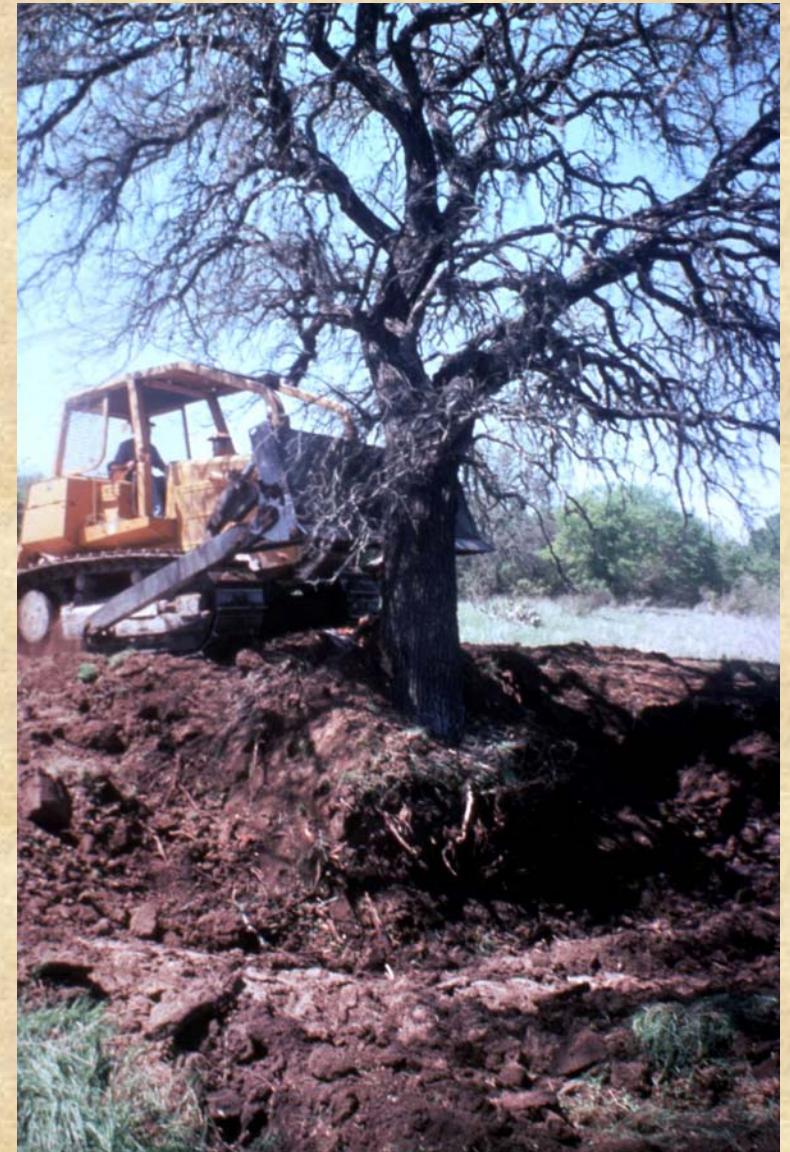
How to Manage Oak Wilt



Trenches must be placed a minimum distance of 100' from the disease and at least 4' deep (sometimes deeper) to halt spread.

How to Manage Oak Wilt

Pushing



Removing all oaks, especially healthy oaks along barrier, can improve trenching effectiveness.

How to Manage Oak Wilt

Used to protect high-value
Live oaks in advance of an
expanding oak wilt center.

Best candidates for treatment
are healthy Live oaks within
75' to 150' from symptomatic
trees.

Injection does not stop root
transmission of the fungus.

Injection



How to Manage Oak Wilt



Injection should only be performed by trained applicators.

Treatment success depends on the health of the tree, application rate, and injection technique.



How to Manage Oak Wilt

Several steps are involved in the injection process from mixing the fungicide solution to connecting the injection harness to the tree.

The services of a professional arborist may be required to assure proper injection.



How to Manage Oak Wilt

Planting

Select trees that are native or adapted to central Texas.

Select trees that are resistant or immune to oak wilt.

Avoid planting monocultures; create diversity in the landscape.

Avoid wounding oaks during planting.



Commonly Confused with...

- *Drought*
- *Hypoxylon canker*

What is Drought?

The absence of precipitation for a periods of time sufficient to deplete soil moisture and injure plants

Drought stress results when water loss exceeds the ability of the plant's roots to absorb water and begins to interfere with normal plant processes

Symptoms of Drought Injury

- *Loss of turgidity – wilting*
- *Chlorotic leaves - yellowing*
- *Leaves may appear dull*
- *Leaves become misshapen*
- *Browning and/or loss of leaves*
- *Loss of fine feeder roots*
- *Branch dieback from top down and from outer to inner branches*
- *Decreased defenses against insects and disease*

Leaf symptoms from drought

Interveinal chlorosis



Tip burn



Branch dieback



Other drought related problems

- *Increased plant susceptibility to pests:*
Spider mites, Borers, Twig beetles, aphids
- *Increased susceptibility to diseases:*
Armallaria root rot, Ganoderma root rot,
Hypoxylon canker, Bacterial wetwood,
and a host of other wood rot fungi

Hypoxylon canker







Disease spread

- *Spores are produced from fruiting structures and spread by wind.*
- *Spores enter tree through injuries to limbs and trunk*
- *Disease commonly remains dormant until the tree experiences stress sufficient enough to reduce tree defense mechanisms and allow the disease to colonize the tree*

Hypoxylon Canker Symptoms

- *Change of foliage color in early summer or spring*
- *Branch dieback, initially in one branch, then spreading to the whole crown*
- *Bark sloughs off exposing large masses of brown dusty spores that transition to a grayish surface with black fruiting structures*
- *Infected wood has black streaks or patterns throughout the wood*

Any significant stress, including infection from other diseases, can trigger hypoxylon canker

Post oaks are particularly vulnerable due to their low tolerance to any form of root disturbance

Soil compaction, root damage, and poor water relationships are most often associated with post oaks that develop hypoxylon canker

Control Options

- *Prevention is achieved by maintaining tree health*
- *Avoid injury to trunk, limbs and roots*
- *Never apply fill soil around the trees*
- *Avoid compaction of soil in root zone*
- *Do not alter drainage around trees*
- *Avoid injury to root systems*

Proper Pruning



C.O.D.I.T

Pruning - Proper pruning can reduce future problems

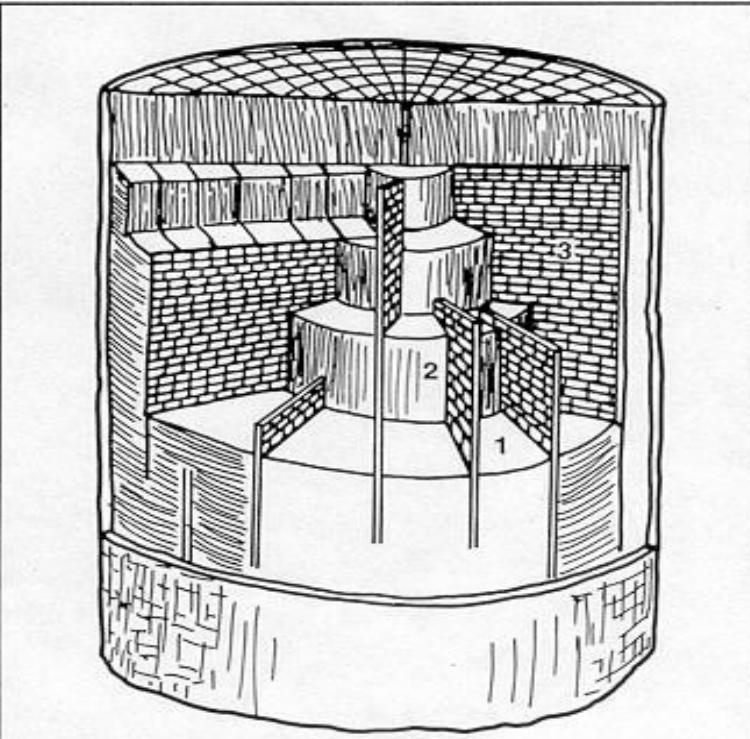


Fig. 1.16 CODIT. Wall 1 is formed when the tree responds to wounding by “plugging” the upper and lower vascular elements to limit vertical spread of decay. Wall 2 is formed by the last cells of the growth ring limiting inward spread. Wall 3 is the ray cells that compartmentalize decay by limiting lateral spread. Wall 4 (not shown), the strongest wall, is the new growth ring that forms

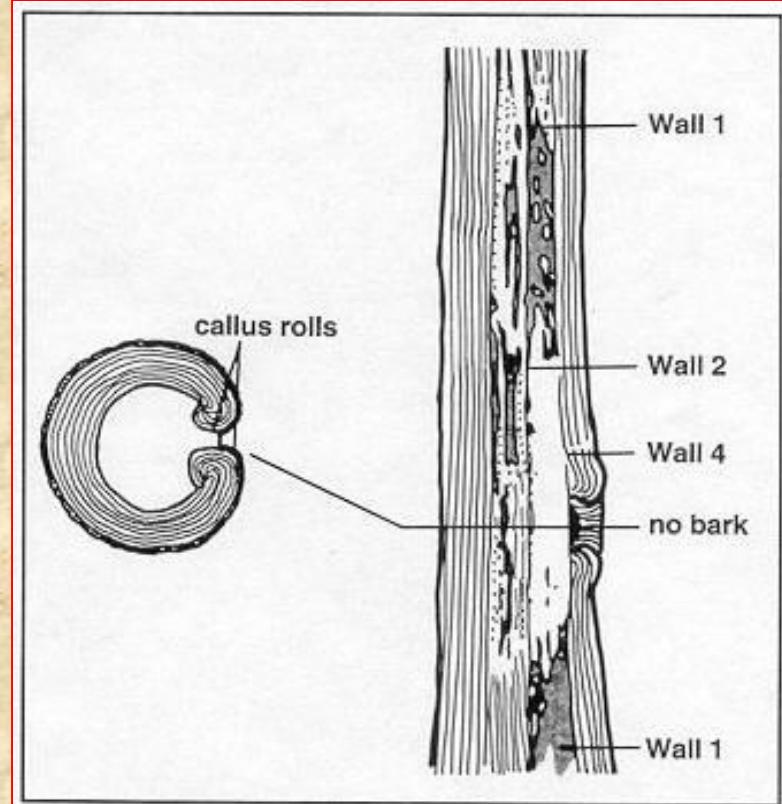


Fig. 1.17 Compartmentalization of decay. Wall 4 prevents decay from entering new wood. Wall 3, not shown, and Wall 2 have failed to prevent the decay from spreading laterally and internally.

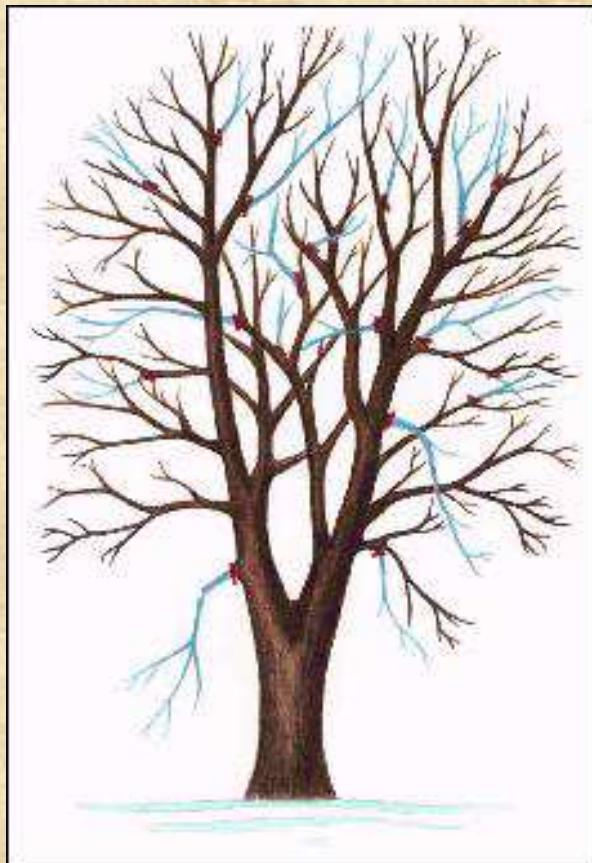
Compartmentalization of Decay in Trees

Compartmentalization



Helps contain the spread of decay within a tree

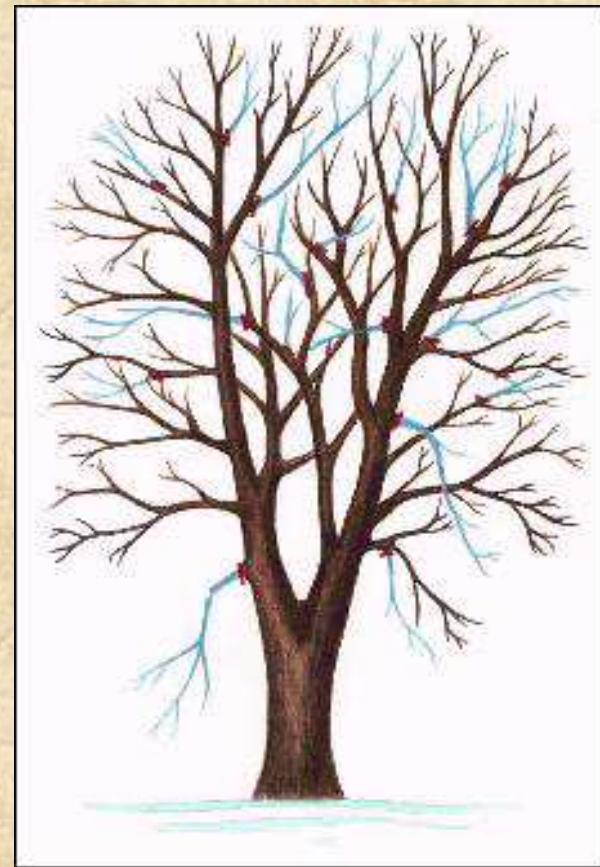
Crown Thinning



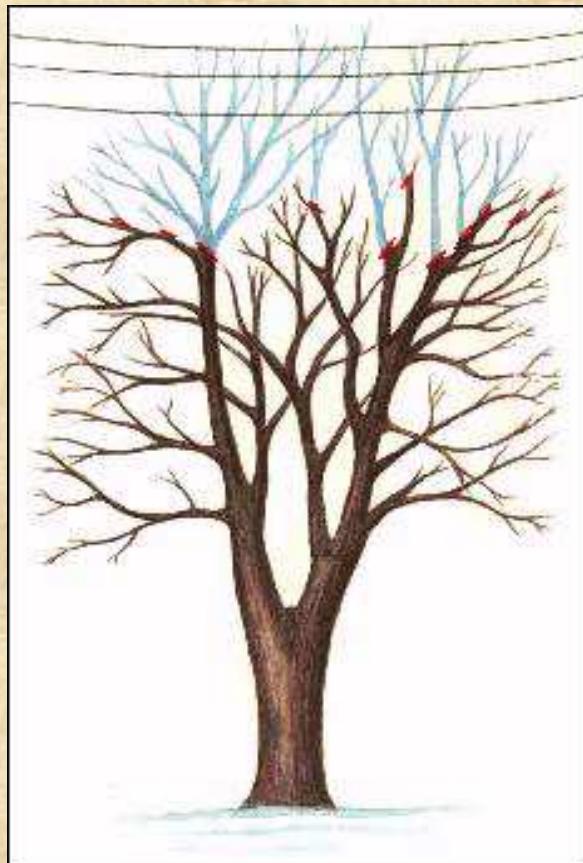
- **Favor branches with strong, U-shaped angles of attachment.**
- **Remove branches with weak, V-shaped angles of attachment and/or included bark.**
- **Lateral branches should be evenly spaced on the main stem of young trees.**

Crown Thinning (cont.)

- Remove any branches that rub or cross another branch
- Insure lateral branches are less than $\frac{1}{2}$ to $\frac{3}{4}$ of the stem diameter to discourage co-dominant stems.
- Do not remove more than $\frac{1}{4}$ of the living crown at one time. If it is necessary to remove more, do it over successive years.



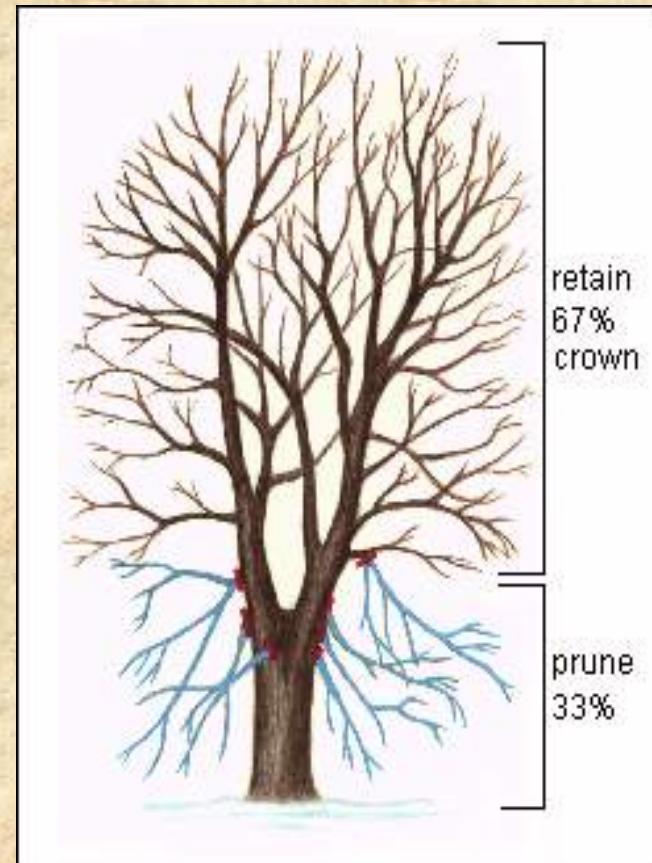
Crown Reduction

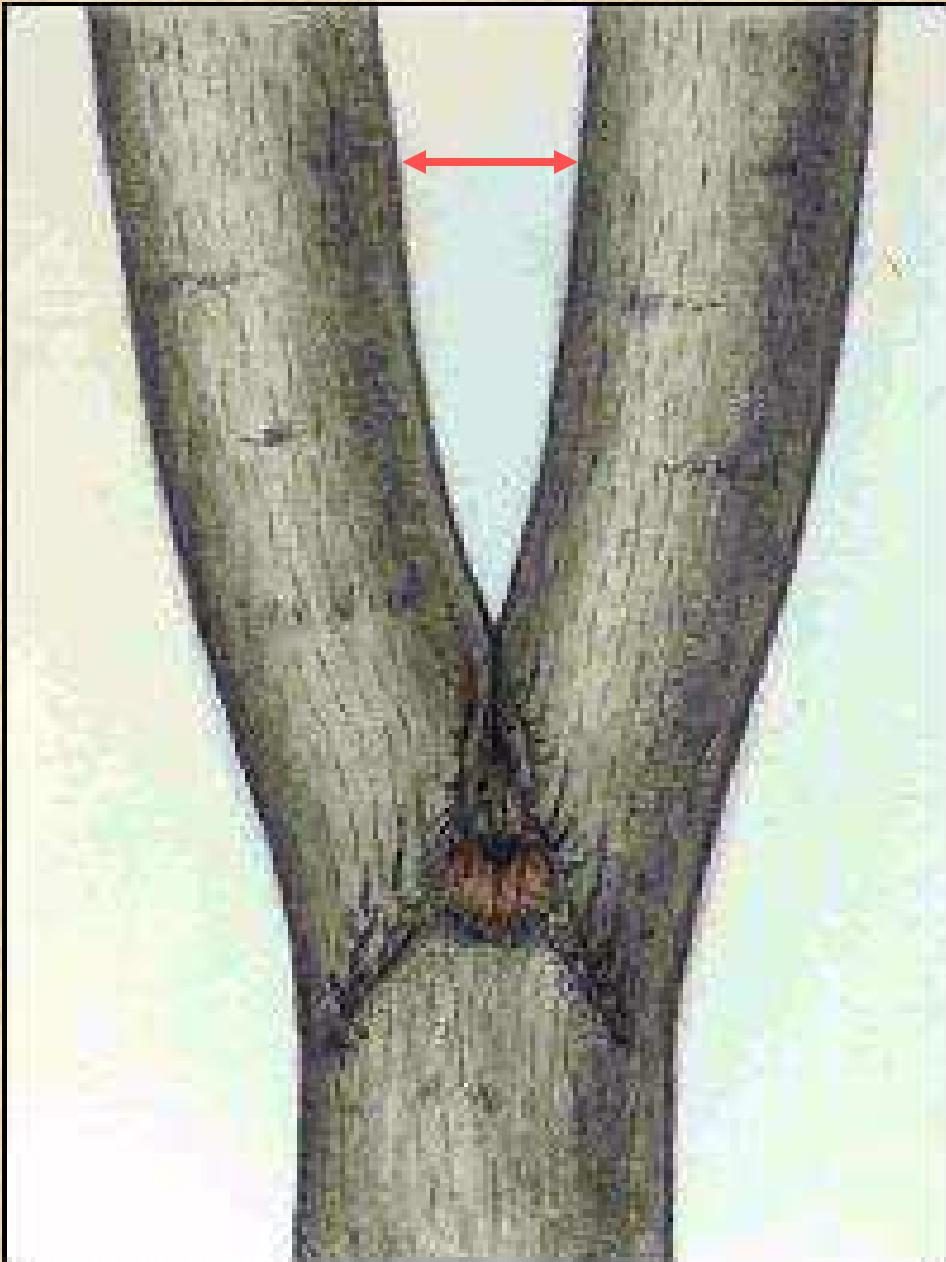


- **Use only when necessary.**
- **Make the pruning cut at a lateral branch that is at least $\frac{1}{3}$ the diameter of the stem to be removed.**
- **If removing more than $\frac{1}{2}$ of the foliage from the branch, remove the entire branch.**

Crown Raising

- Always maintain live branches on two-thirds of a tree's total height.
- Removing too many lower branches will hinder strong stem development.
- Remove vigorous epicormic sprouts and basal sprouts.





Weak Branch Union

- Characterized by very narrow angles of attachment (**Branch Axils**) and very weak unions.

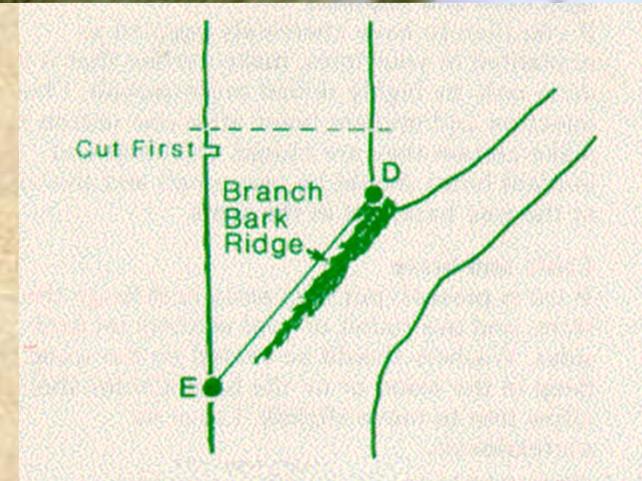
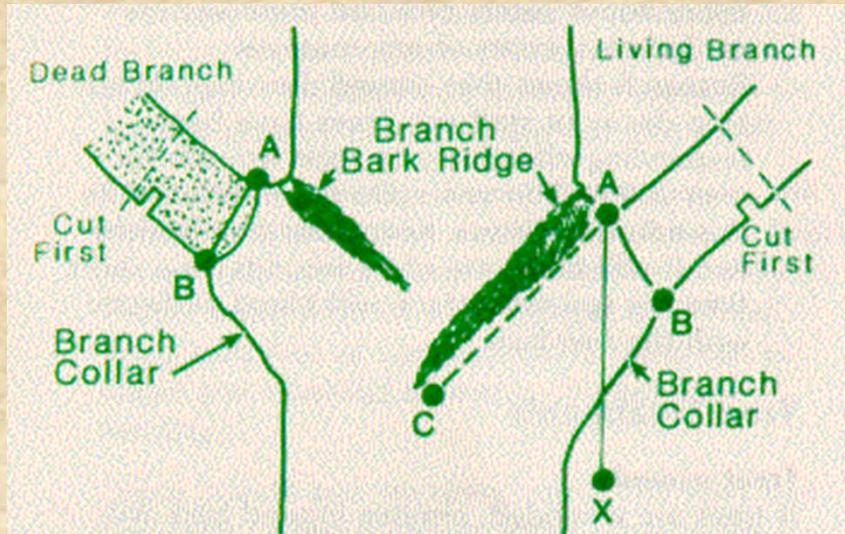
Where to cut the limb



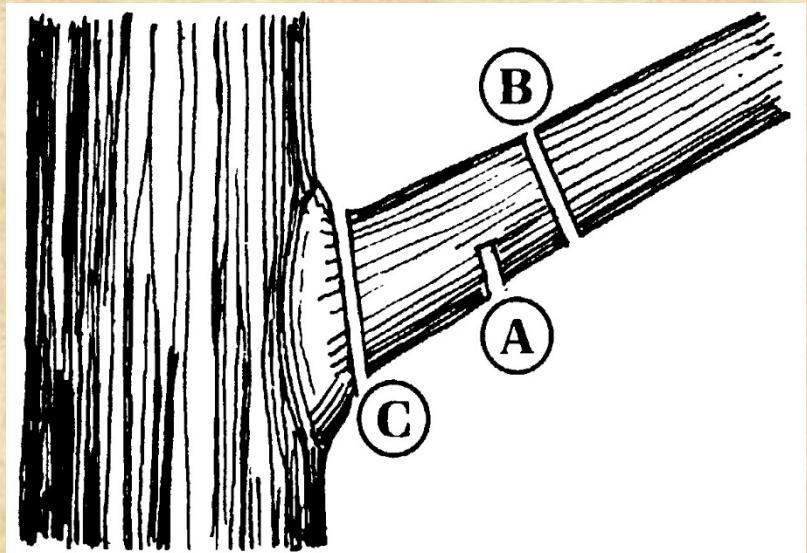
Cut beyond the “branch bark ridge” and collar

Where to cut the limb

No flush cuts! No stubs!

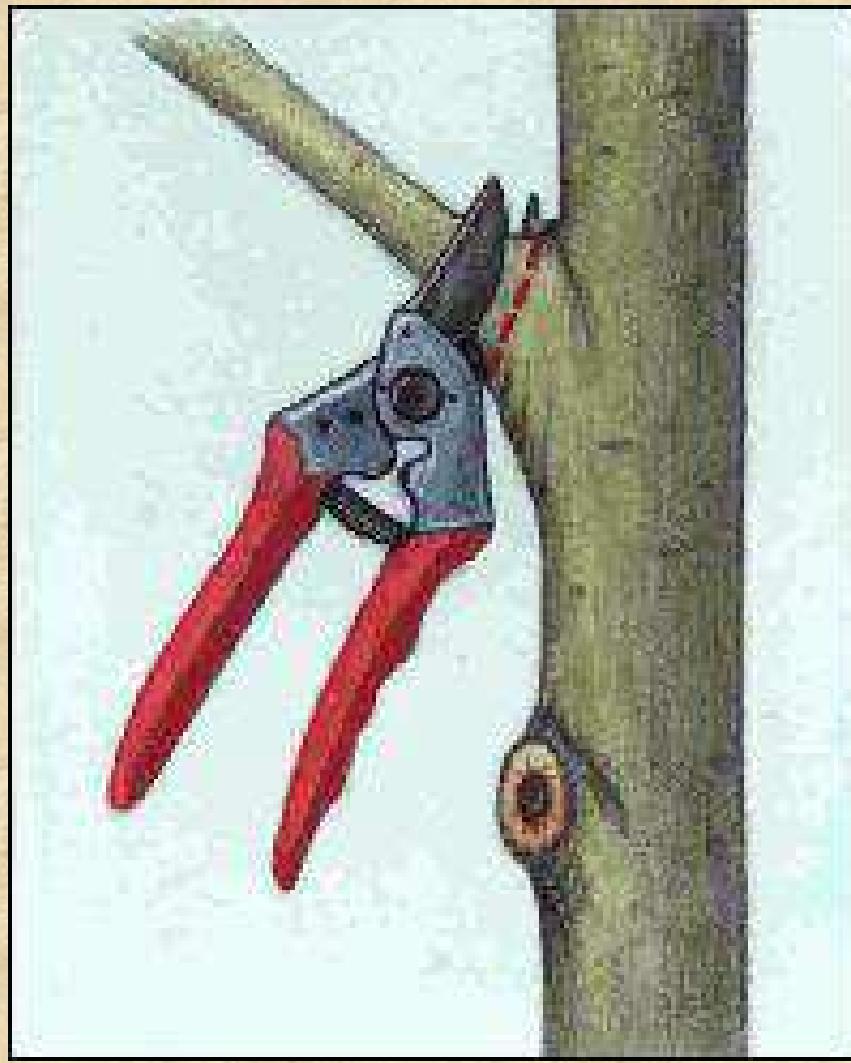


How to Cut the Limb



- Three cuts
- Prevents bark stripping and aids in compartmentalization

Small Branch Removal



Woundwood



- Lignified, differentiated tissues produced on woody plants as a response to wounding
- Also known as callus tissue



Questions

