

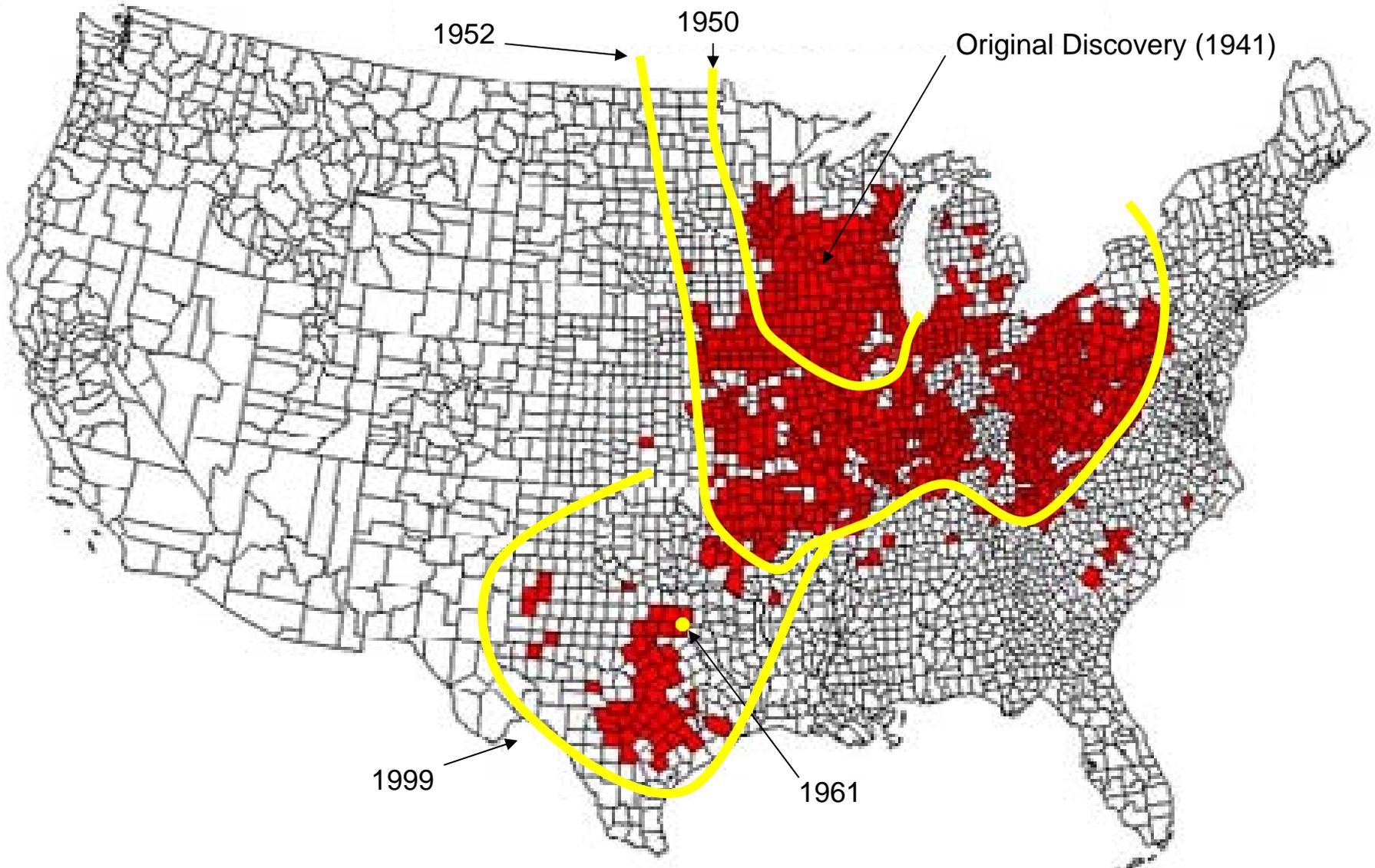
Oak Wilt and Other Forest Health Issues

Oak Woodlands of Central Texas

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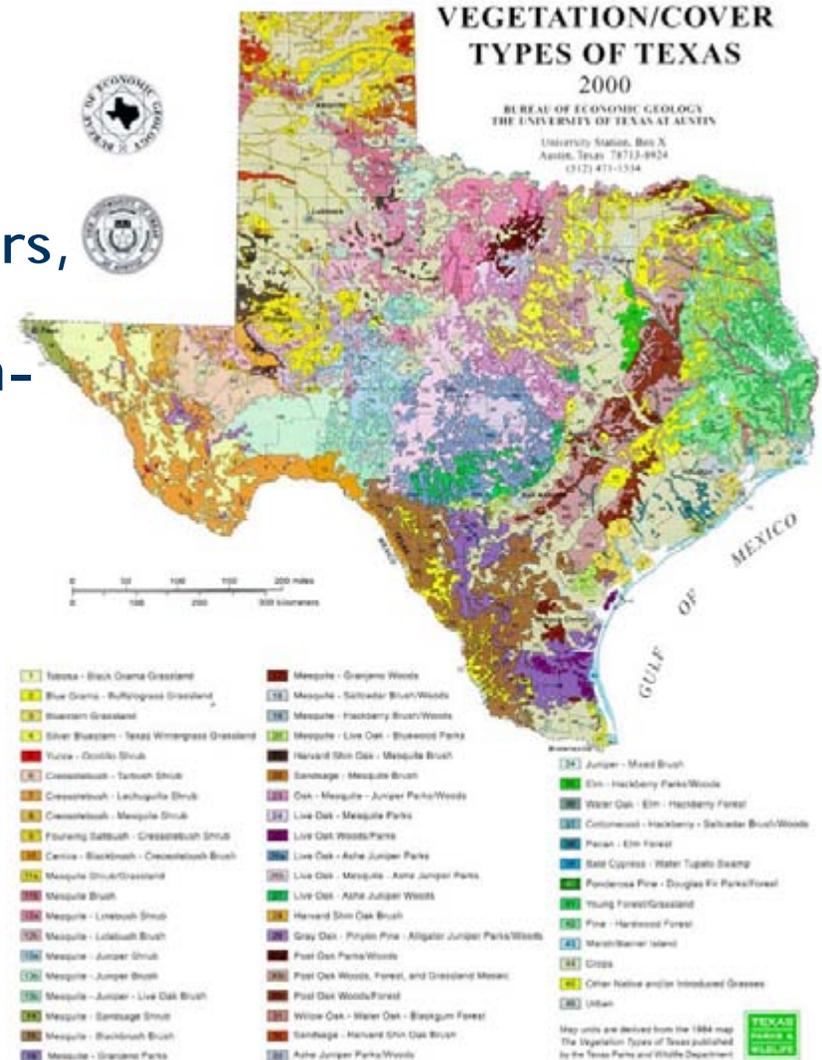
Background - Origins, Spread, Range of *Ceratocystis fagacearum*



Central Texas Ecology

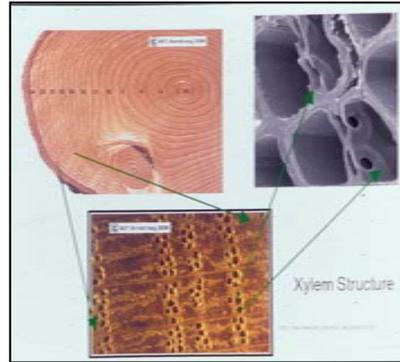
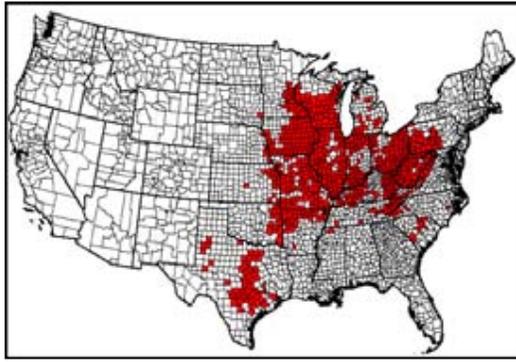
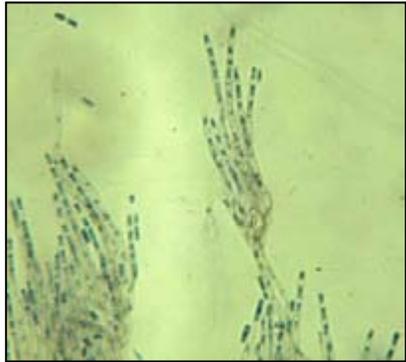
The Texas "Hill Country"

- Dominated by Edwards Plateau
- Limestone-layered tableland
- A region of biological transition
- canyons, perennial springs and rivers, caves.
- A challenge for responsible environmental stewardship



Oak Wilt

Ceratocystis fagacearum

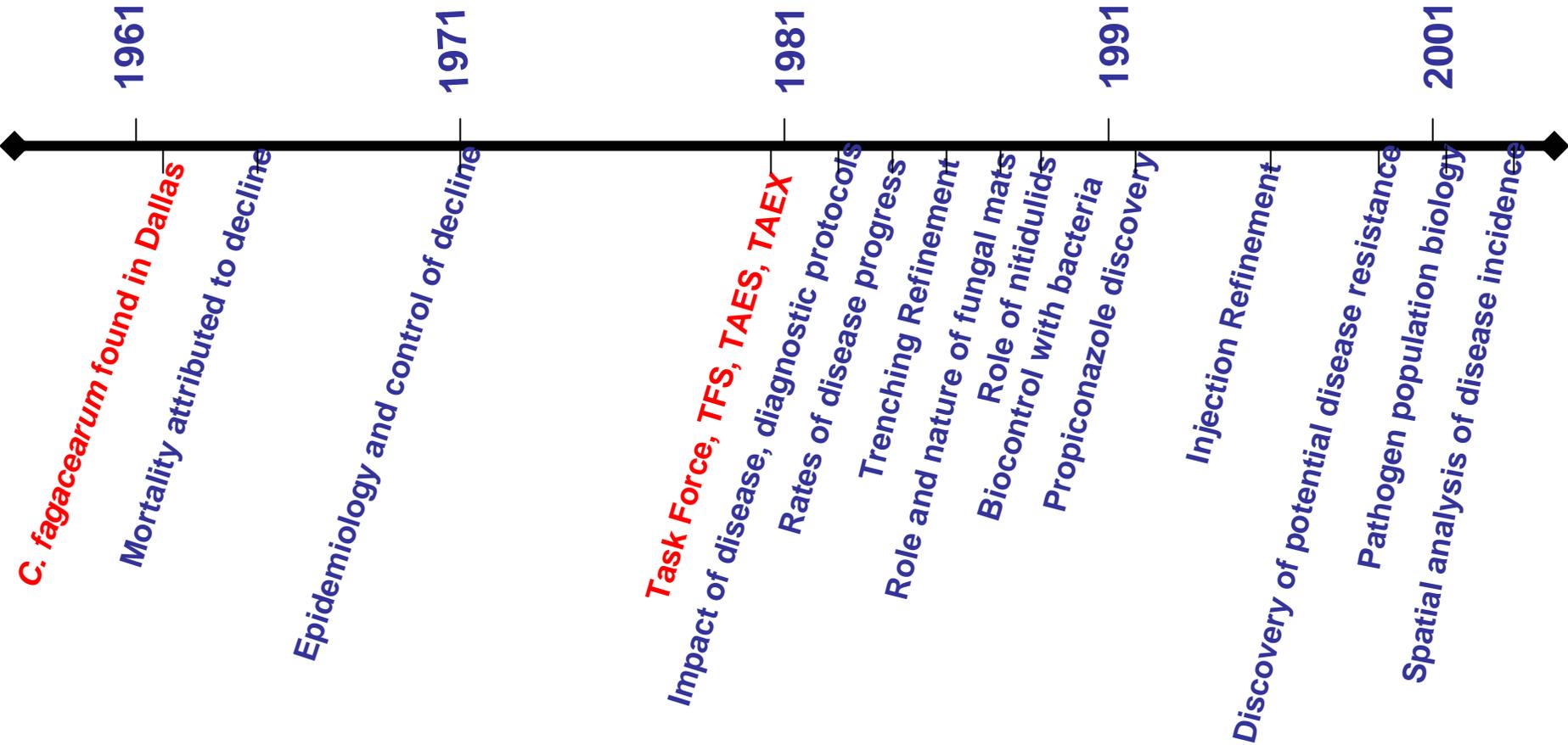


- Fungus (heterothallic Ascomycete)
- Vascular parasite
- First described in 1941 in Wisconsin
- "*Ceratocystis fagacearum*, the cause of oak wilt, is a fungus with the potential to be one of the most destructive of all tree pathogens." (Gibbs and French, 1980)
- First described in Texas in 1961

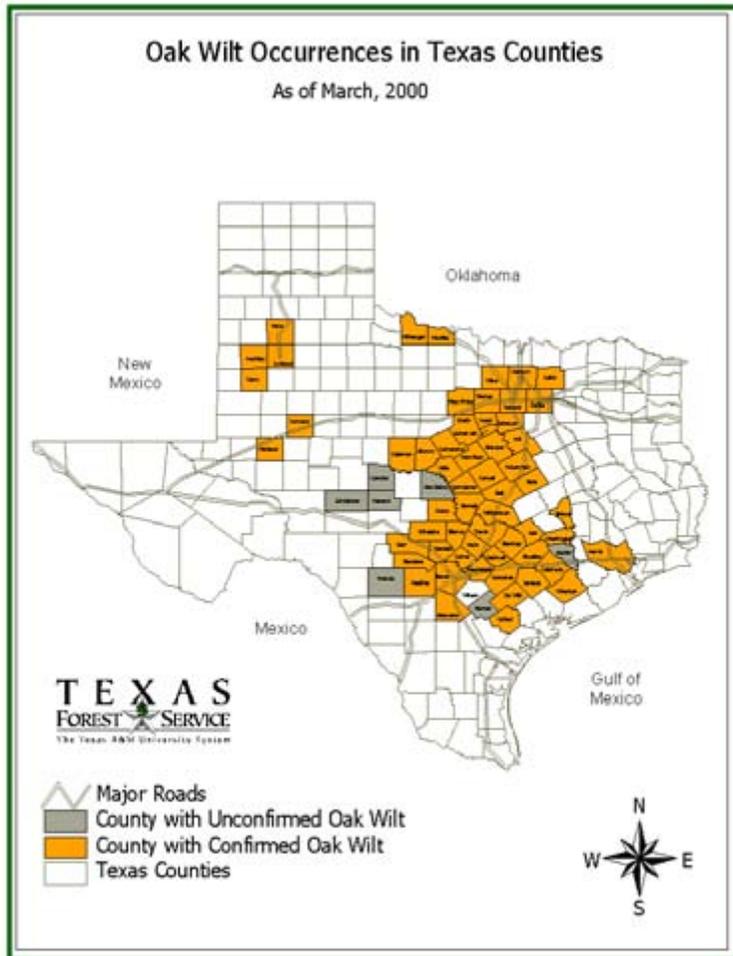
Chronology of TAMU Oak Wilt Research

Decline (*Cephalosporium spp.*) **Confusion** **Oak Wilt** (*Ceratocystis fagacearum*)

- Diagnosis
- Survey and Assessment
- Demonstration
- Epidemiology and Control
- Basic Understanding of Disease Biology



Range of Oak Wilt in Texas and Impact on Major Population Centers

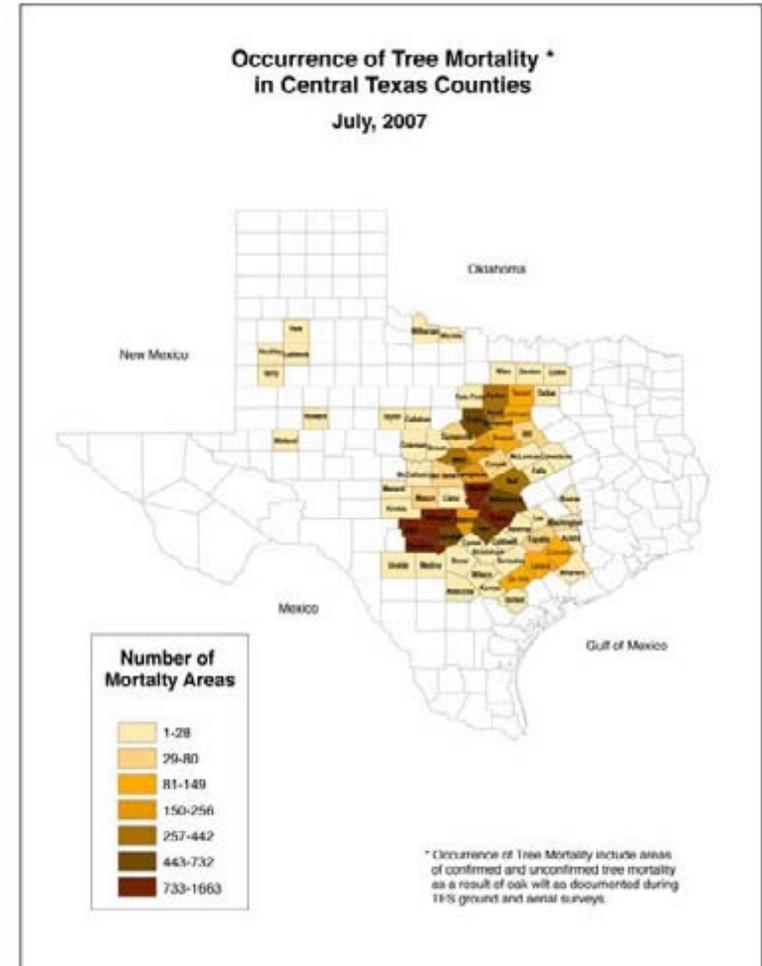
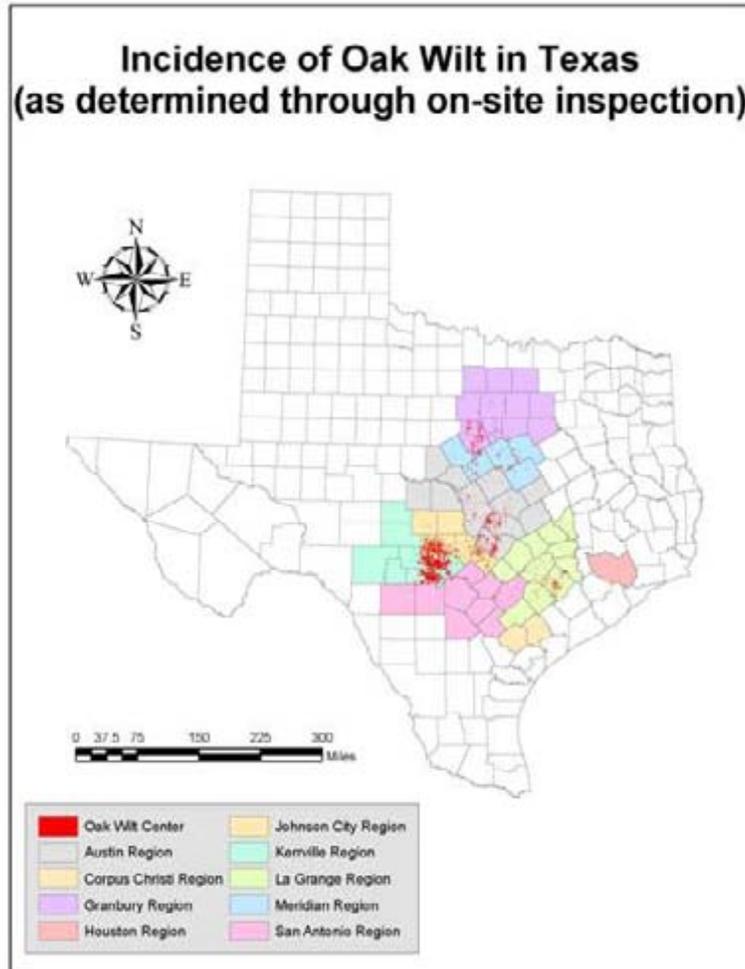


Major Population Centers in Texas

Ecoregions of Texas

- Piney Woods
- Oak Woods & Prairies
- Blackland Prairie
- Gulf Coast Prairies & Marshes
- Coastal Sand Plain
- South Texas Brush Country
- Edwards Plateau
- Rolling Plains
- High Plains
- Trans Pecos
- Llano Uplift

Relative Impact of Oak Wilt on Central Texas Oak Population



Oak wilt in Texas

Breaking the Rules

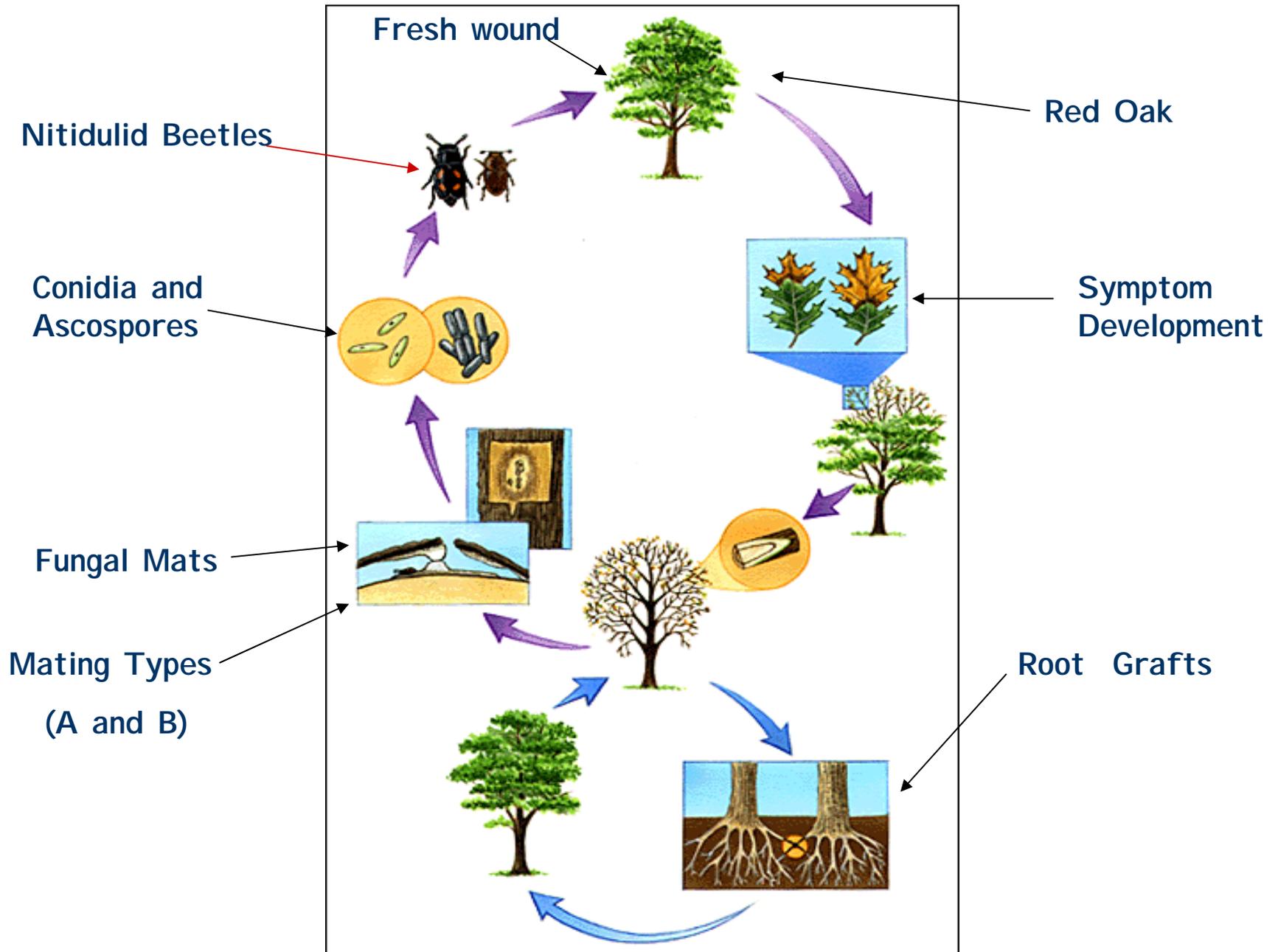
- Summertime temperatures regularly exceed 30°C.
- *Hypoxylon atropunctatum* is a common inhabitant of trees killed by oak wilt.
- Primary host is *Quercus virginiana*, where no fungal mats form.
- Fungal mats do form on *Q. buckleyi*, *Q. marilandica*.

Impact of Oak Wilt on Central Texas Oak Savannahs and Woodlands

- Both live oak and Texas red oak are represented in most Hill Country plant associations
- Oak wilt has killed millions of trees, probably at least since the 1940s.



Key Features in Oak Wilt Disease Cycle

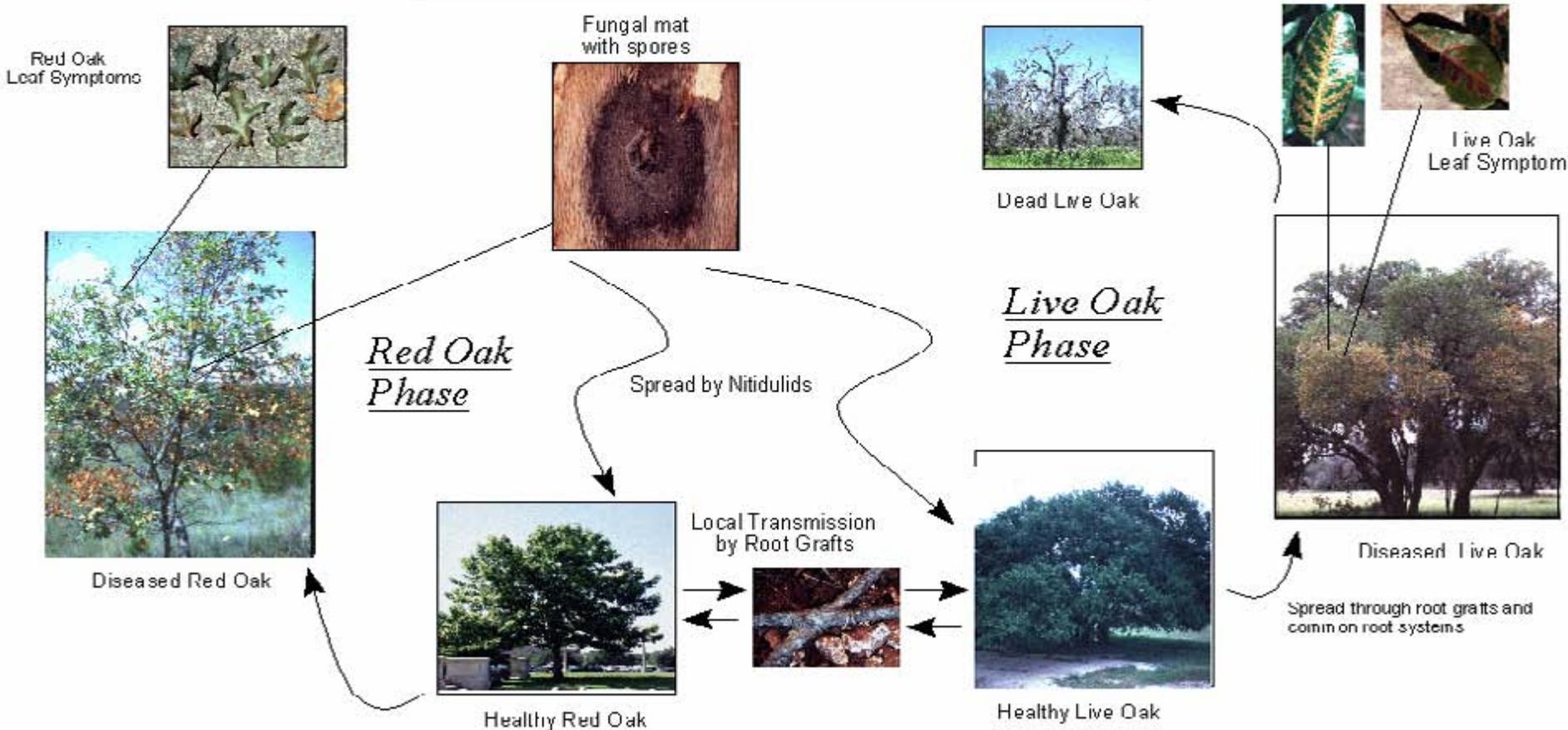


Ceratocystis fagacearum

Ascomycete, vascular parasite

Oak Wilt Disease Cycle

Infection of *Quercus* spp. by *Ceratocystis fagacearum* in Texas



Oak Wilt Epidemiology

Inoculum Production and Availability



- Fungal mat formation peaks in spring (February – May)
- Occurs on red oaks infected prior season
- Mats are ephemeral, lasting only a few weeks
- Presence of red oaks key to epidemiology

Oak Wilt Epidemiology

- **Transmission**

- **Insects - “long distance, overland”**

- Nitidulid beetles peak in spring
 - Feed and breed fungal mats, among other habitats

- **root grafts - “local”**

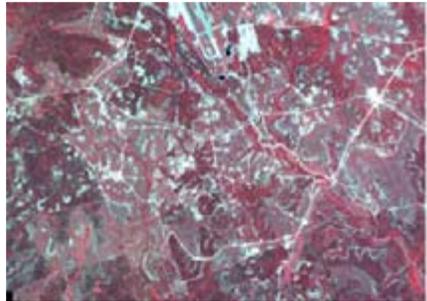
- Responsible for majority of losses
 - Can expand at 40-50 m./yr.

- **Infection courts**

- **Fresh wounds of any kind**
 - **< 72 hrs. old**



Experimental approach to spatial analysis - hierarchical interpretation



IKONOS 1-meter satellite imagery

Fine - scale interpretation

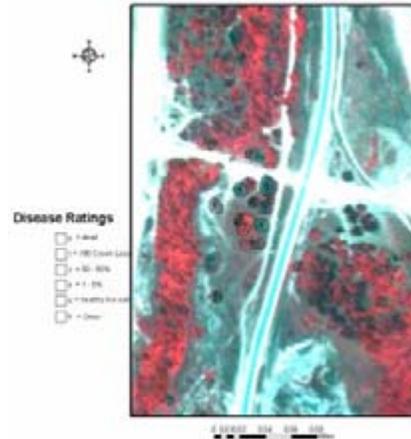


Figure 3. Disease attributes of trees in Polygon No. 88.

Broad - scale Interpretation



Figure 4. Map of GCW habitat and delineated polygons.

- impact on ecosystem structure and function
- comparative disturbance regimes e.g. fire vs. oak wilt
- determinants of spread, local transmission

- impact on ecosystem structure and function
- influence of environmental factors on incidence and severity
- determinants of spread, long distance transmission

- ### Deployment strategies for oak wilt control
- natural resource managers
 - landowners
 - homeowners

Justification for the Study

The Golden Cheeked Warbler

Conflicting Management Objectives

- Need for land use vs. conservation of warbler habitat,
- Perception of dramatic increases of oak wilt in the past decade,
- Fear of loss of habitat,
- Complex natural resource problem.



Oak Wilt Management

Prevention

- Cautious movement and handling of firewood
- Rogue infected red oaks
- Use of wound paints in high hazard areas
- Trenching and roguing of trees to disrupt connected root systems
 - At least 4 ft. deep
 - Backhoes, earth saws, ditch diggers
ripper bars



Oak Wilt Management

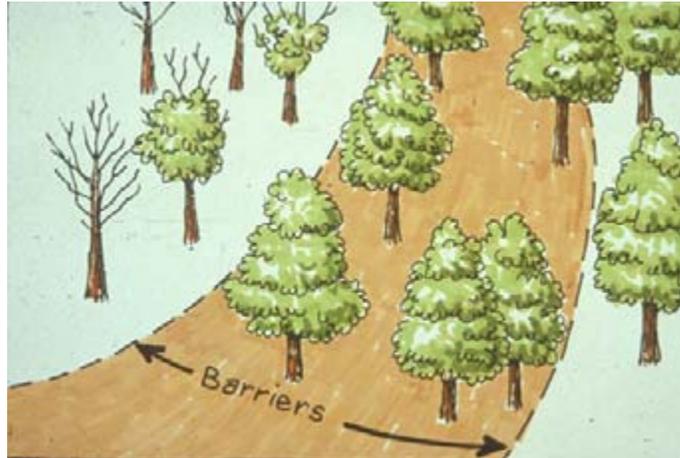
Direct Control



- Intravascular injection with systemic fungicides
- Alamo[®] (propiconazole)
- Alternative products, injection technologies

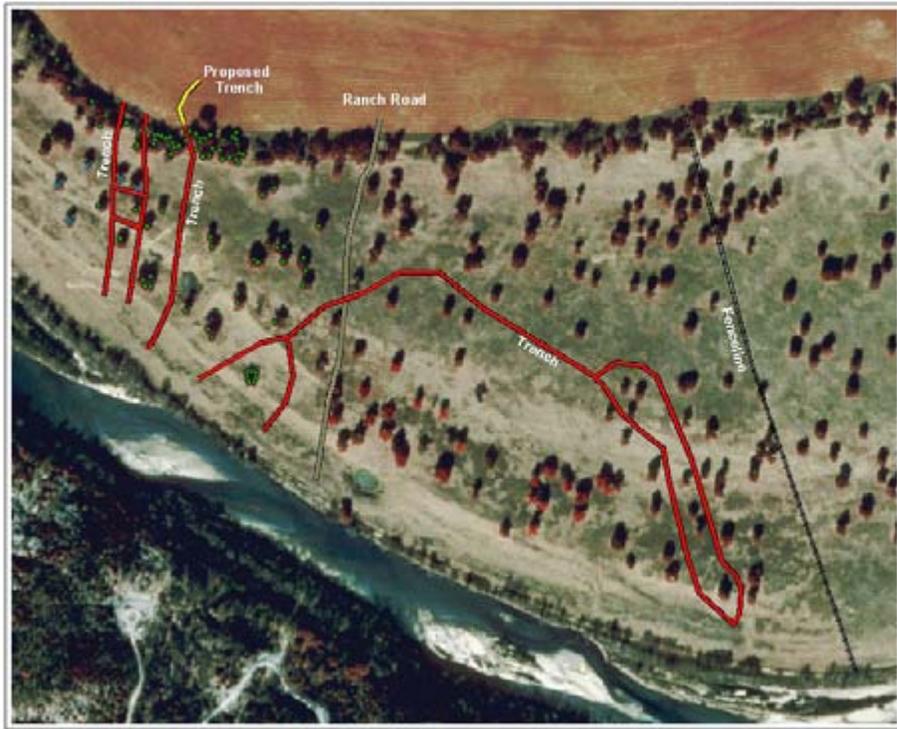
Oak Wilt Management

Placing Treatments



- Proper recognition and diagnosis are key to success
- Must place treatments to avoid latent infections
- Preventative treatments more effective than therapeutic
- Constant observation are necessary to accommodate failures

Rocking W Ranch Oak Wilt Plan



0 75 150 300 450 600 Meters

TFS Form 6875

CITY OF LAKEWAY Vanguard Oak Wilt Treatment Plan



200 0 200 400 600 800 1000 1200 1400 1600 1800 Feet



TOWNS Number: 88-LC-52-3
 Project Name: Vanguard/ New Lido
 County: Travis
 USGS Quad: Bee Cave
 Latitude: N 30° 21' 34"
 Longitude: W 97° 59' 00"
 Trench length 4613 feet
 Prepared by: Carrie Burns, City Forester
 Last Updated: July 18, 2003

Oak Wilt Management Plans

The Oak Wilt Threat

What do we need to know?

- Where did *C. fagacearum* come from?
- Where has oak wilt been and what have we learned?
- What attributes make *Ceratocystis fagacearum* a threat to new regions - how might it spread?
- What regions are at risk to invasion by *C. fagacearum*? What would the impact be?



Retreating of The North American Ice Sheets

A. Full glacial conditions.

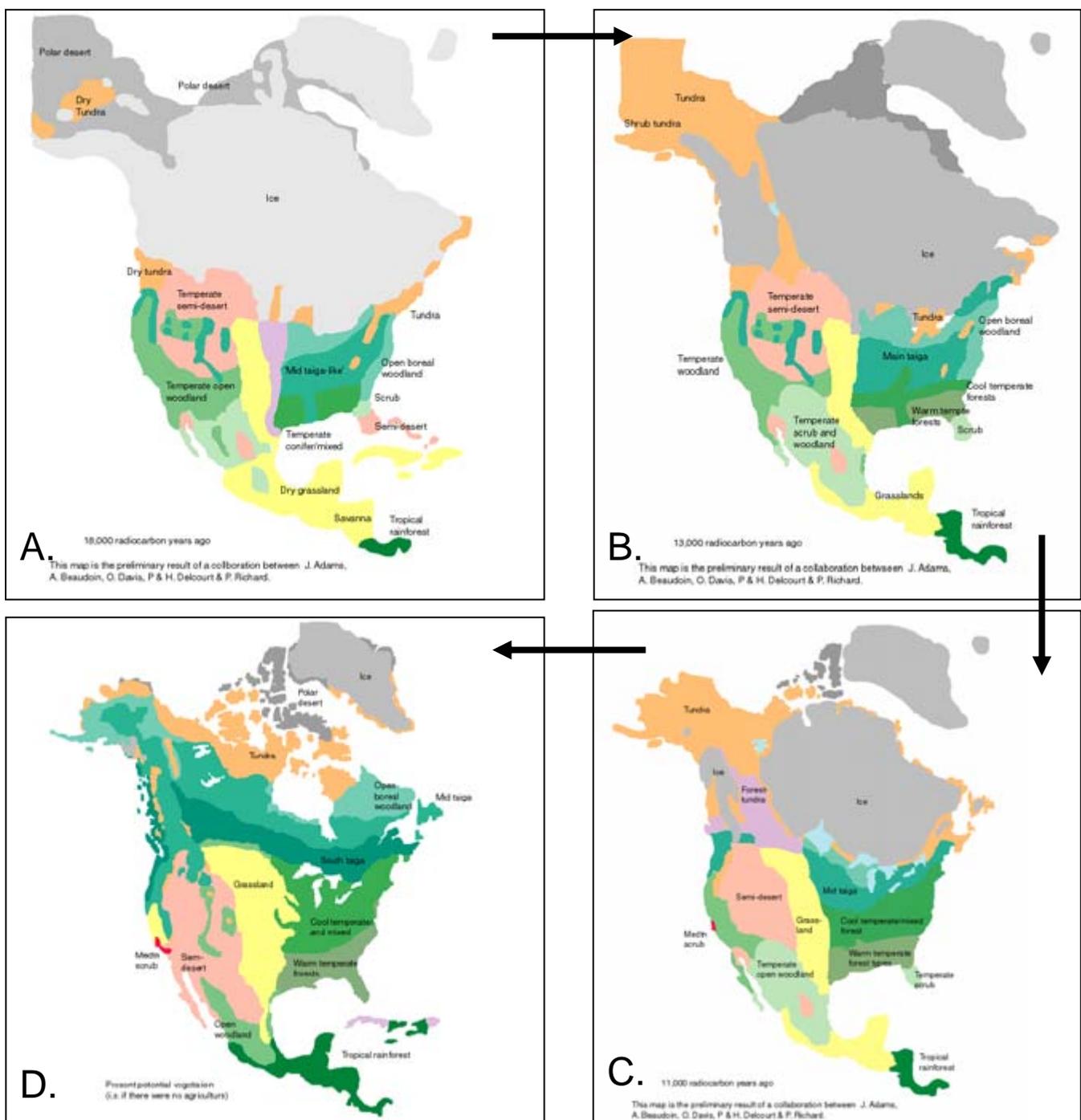
- open conifer woodlands,
- spruce.

B. Ice sheet retreating.

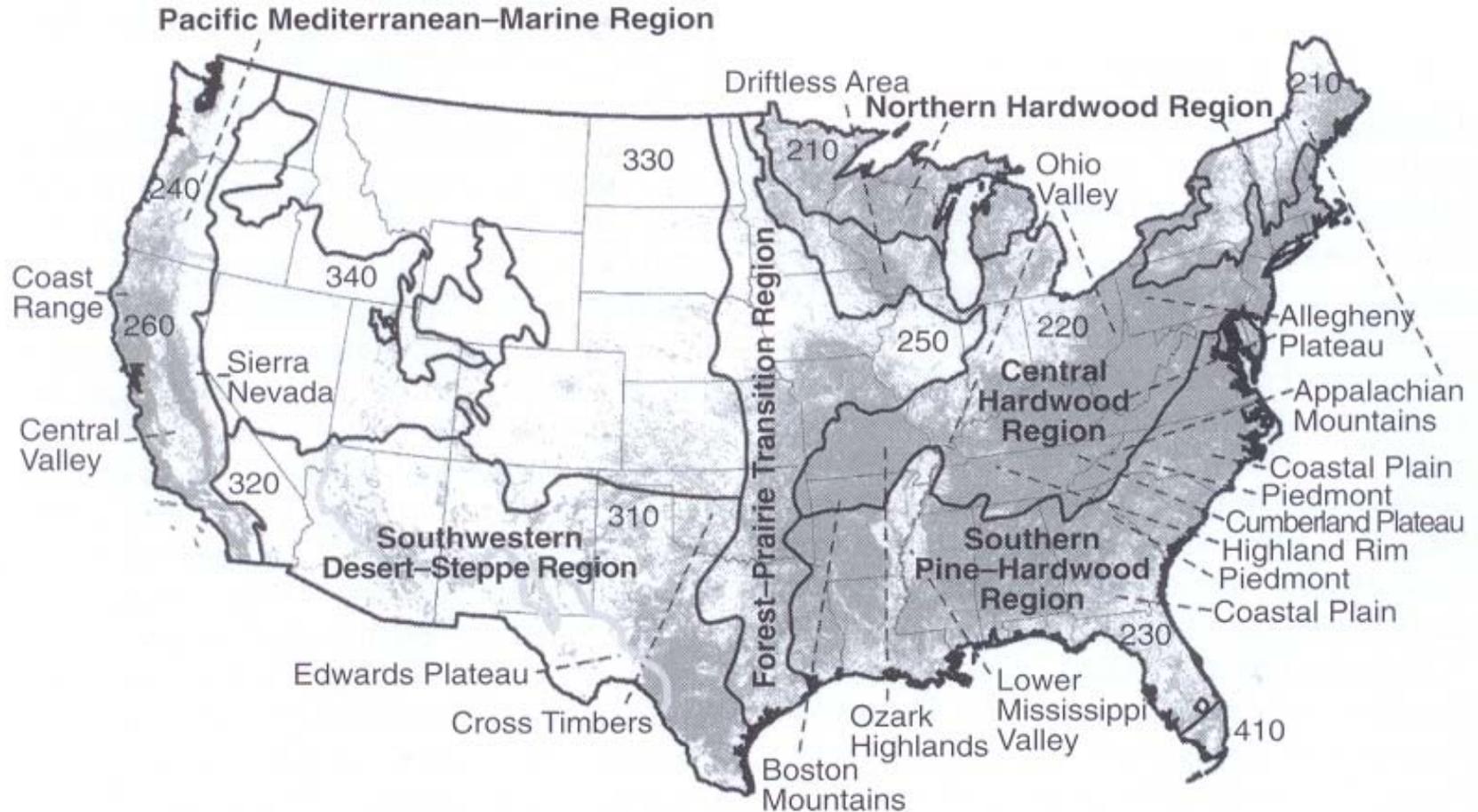
- cold climate conifers,
- cool temperate forest vegetation spreading.

C. Continuing retreat of ice.

- return of the cool temperate forest belt.
- ## D. Current.
- warm adapted temperate forest,
 - Central Hardwoods.



Regions Where Oaks Occur in The United States*



* Johnson, P.S., and Shifley, S.R. 2002. *The Ecology and Silviculture of Oaks*. CABI Publishing, Cambridge, MA.

Central Hardwoods

Oak-Hickory Forest Type

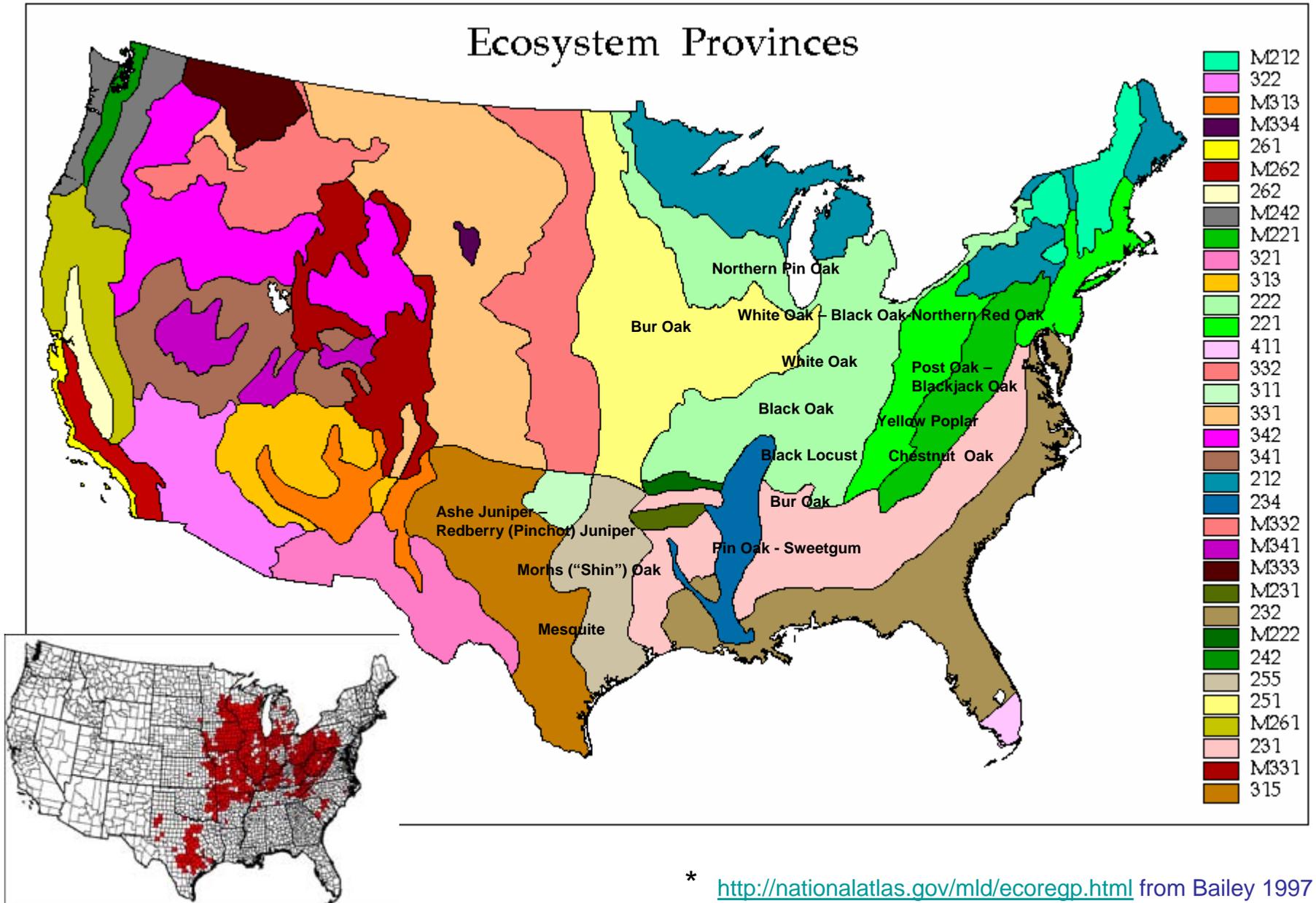
Eastern Type 6 of the U.S. Forest Service Renewable Resources
Evaluation (RRE) Group

- Largest and most extensive temperate deciduous forest in the world,
- Current vegetation affected most, in recent past, by ice age,
- Impact of humans may be just as significant,
- Logging, burning, grazing, fire control wildlife management, and pest introductions,
- Includes Native Americans and European settlement,
- Also pests and diseases – Chestnut blight, Dutch elm disease, Gypsy moth, Oak Wilt, Dogwood anthracnose,
 - vulnerable to others – Sudden oak Death?

SAF Forest Cover Types Within Oak Wilt Range

(Eyre, 1980)

Ecosystem Provinces

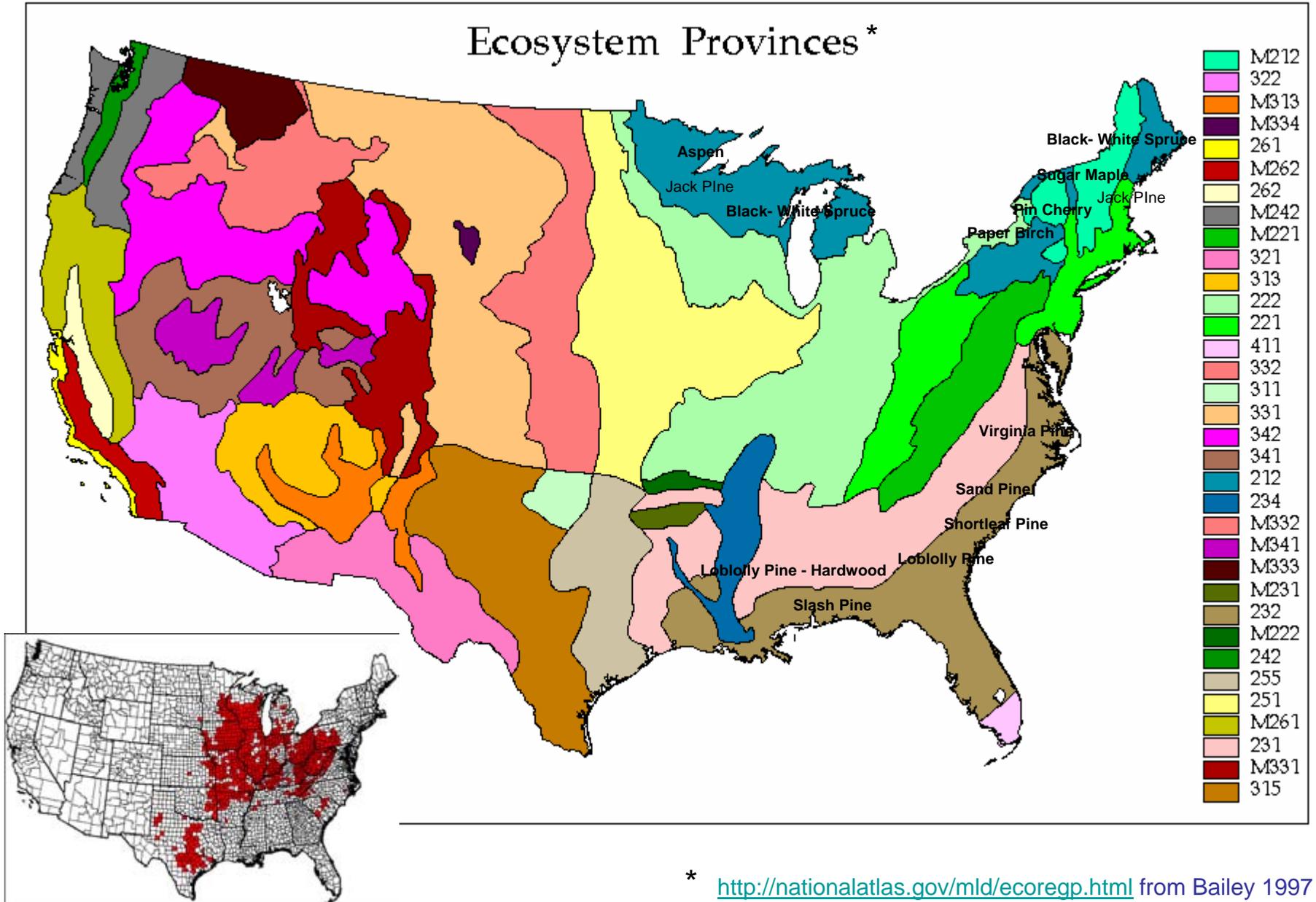


* <http://nationalatlas.gov/mlid/ecoregp.html> from Bailey 1997

SAF Forest Cover Types Within Oak Wilt Range

(Eyre, 1980)

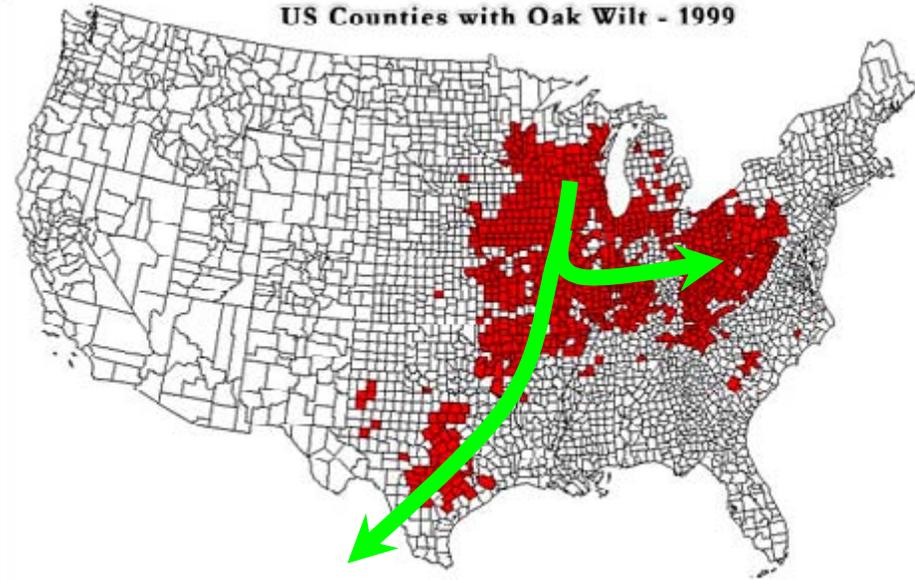
Ecosystem Provinces*



* <http://nationalatlas.gov/mlid/ecoregp.html> from Bailey 1997

Speculation on Origins (and Future) of *Ceratocystis fagacearum*

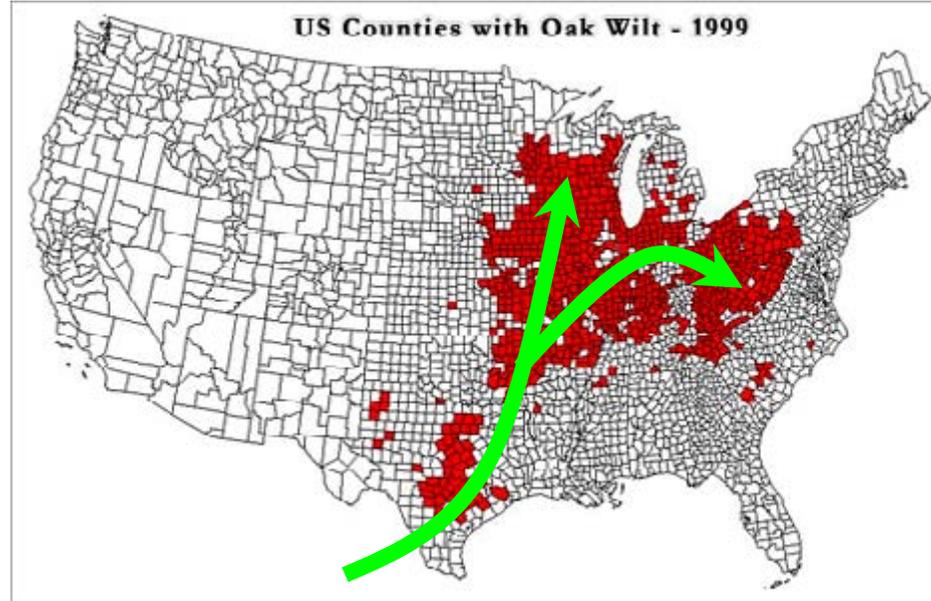
US Counties with Oak Wilt - 1999



Alternative A

- Introduction
- Speciation event

US Counties with Oak Wilt - 1999



Alternative B

- Invasion of exotic

Conclusions



- The incidence and severity of oak wilt are closely associated with *Quercus* component,
 - Proportion vs. other trees,
 - Red vs. white oaks,
 - Age.
- Oak wilt will continue to threaten other regions as stands are altered to favor those traits,
- Oak wilt may be acting as an “adjustor” to restore some measure of ecosystem balance.

Thanks To -

- Texas Forest Service
- Texas Agrilife Research (formerly the Texas Ag Experiment Station)
- Texas Agrilife Extension (formerly Texas Cooperative Exension)
- U.S. Forest Service, Forest Health Protection
- Forest Health Technology Enterprise Team
- Department of Defense
- The Nature Conservancy
- Texas Arboriculture Industry
- Landowners, homeowners of Texas

