

The Southern Pine Beetle: Biology and Tree Protection



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Impacts of SPB

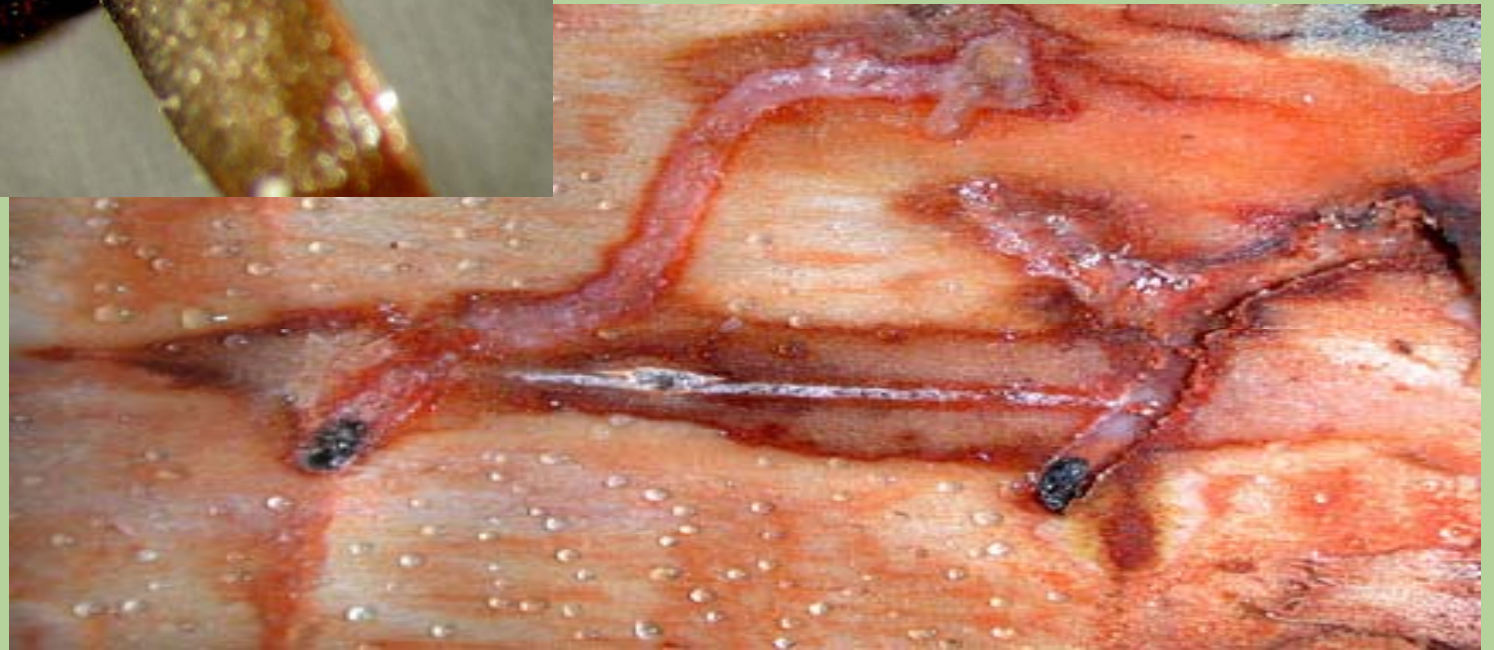


Tree defense against SPB

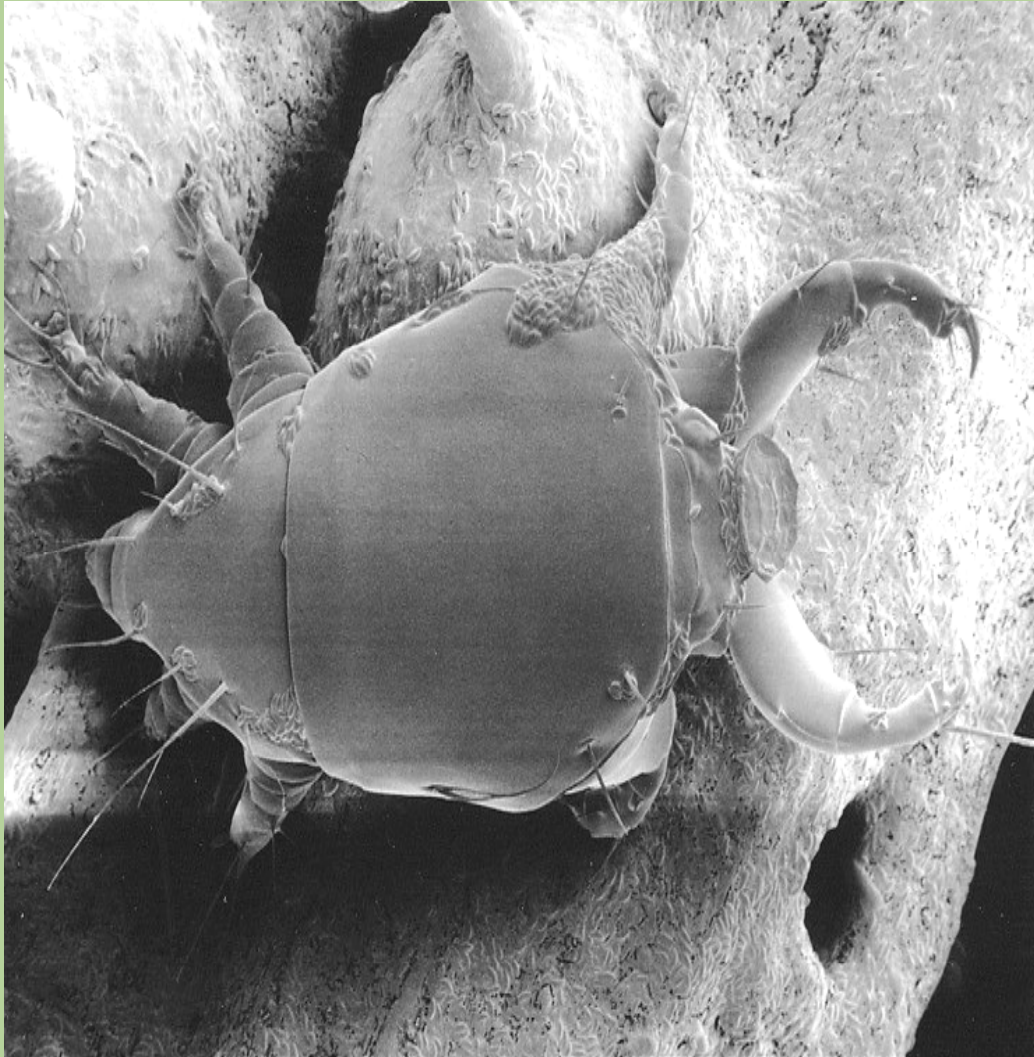
- Resin comes out
- Chemical defenses kick in



Are fungi important? They mite be



Symbiosis – living together



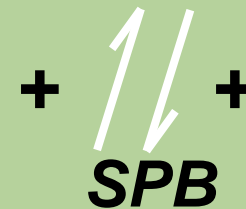
Mites



Bluestain fungus



Mycangial fungi



Trees



Mites

+ \updownarrow +

Bluestain

- \updownarrow -

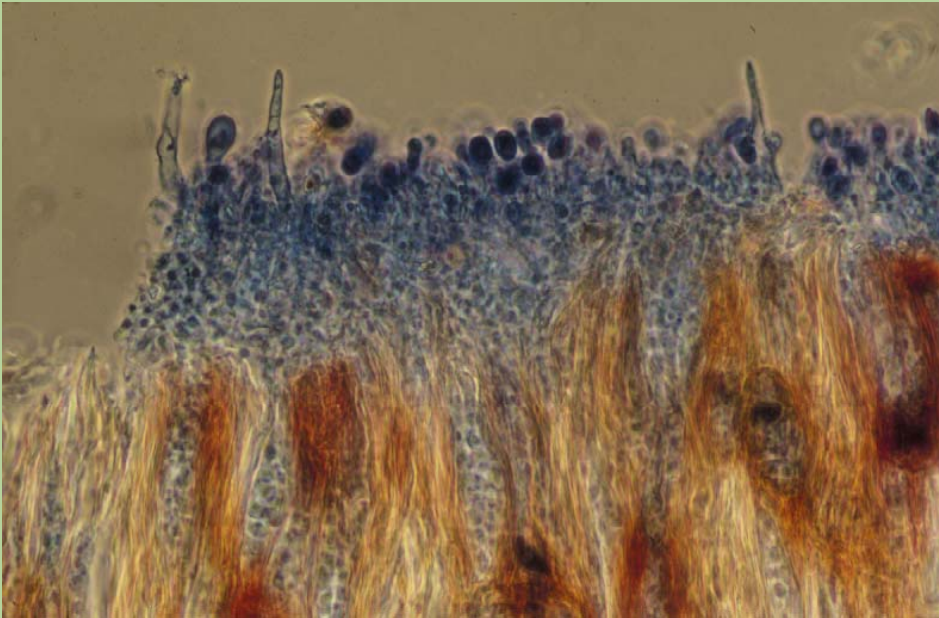
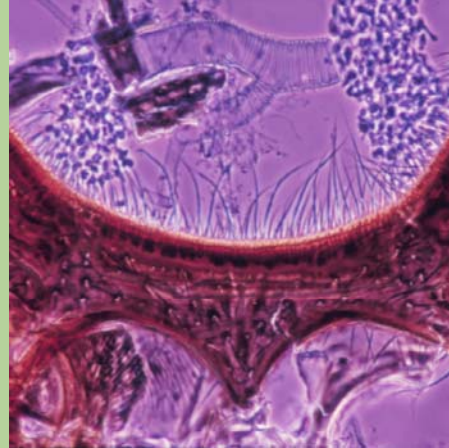
Mycangial fungi

+ \updownarrow +

SPB

+ \updownarrow -

Trees



Mites

+ \updownarrow +

Bluestain

- \updownarrow -

Mycangial fungi

+ \updownarrow +
SPB

+ \updownarrow -
Trees

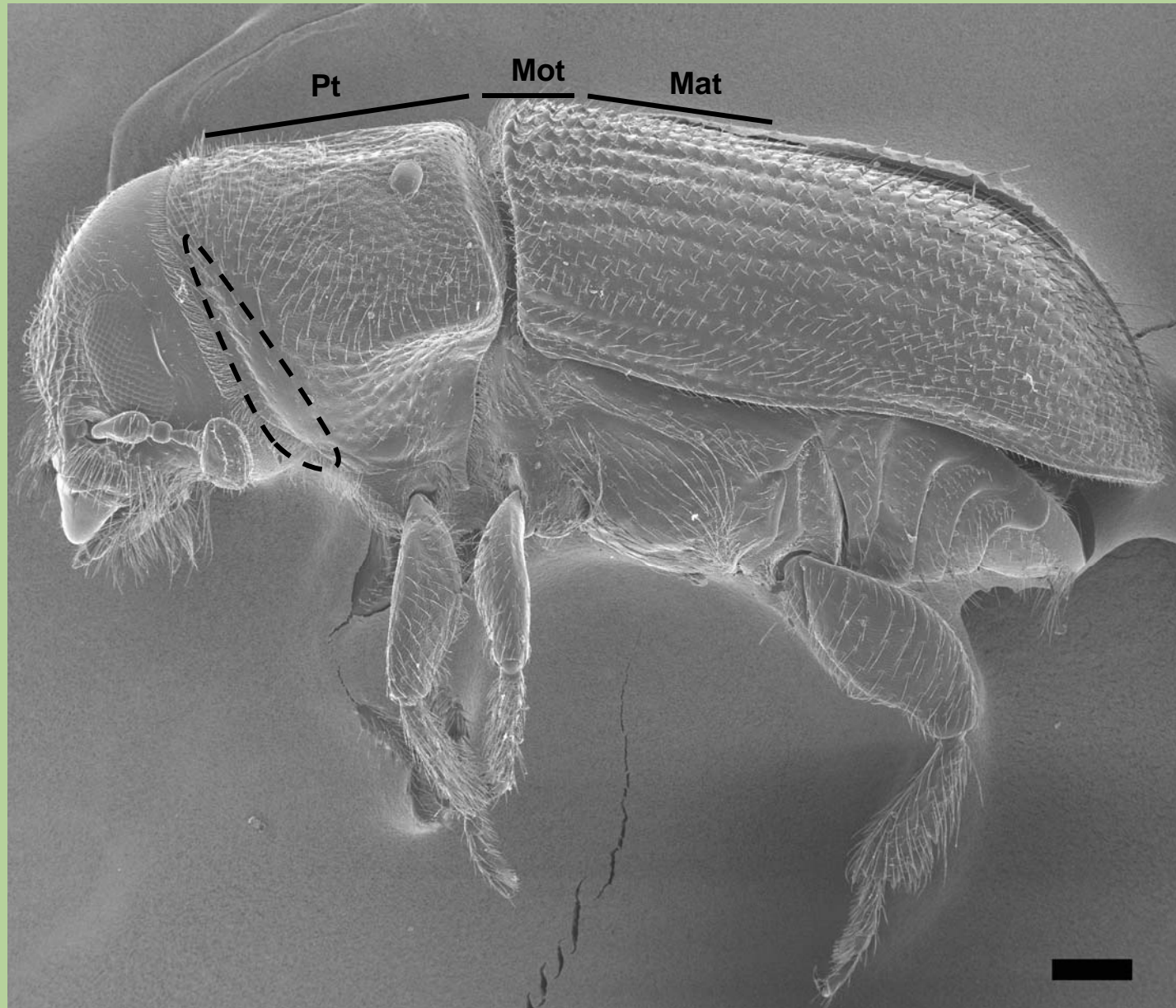
Southern Pine Beetle Fungi

mutualistic

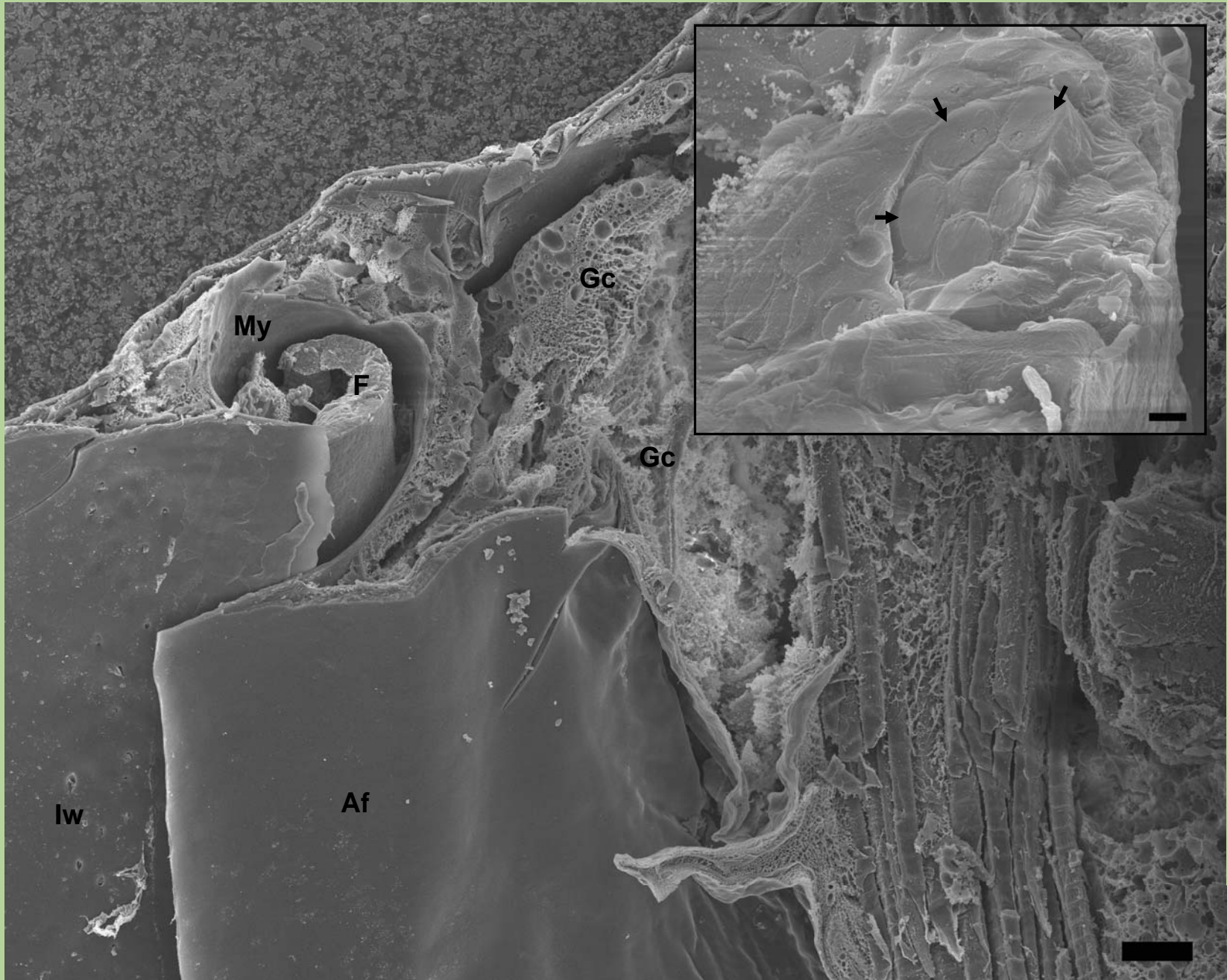


antagonistic

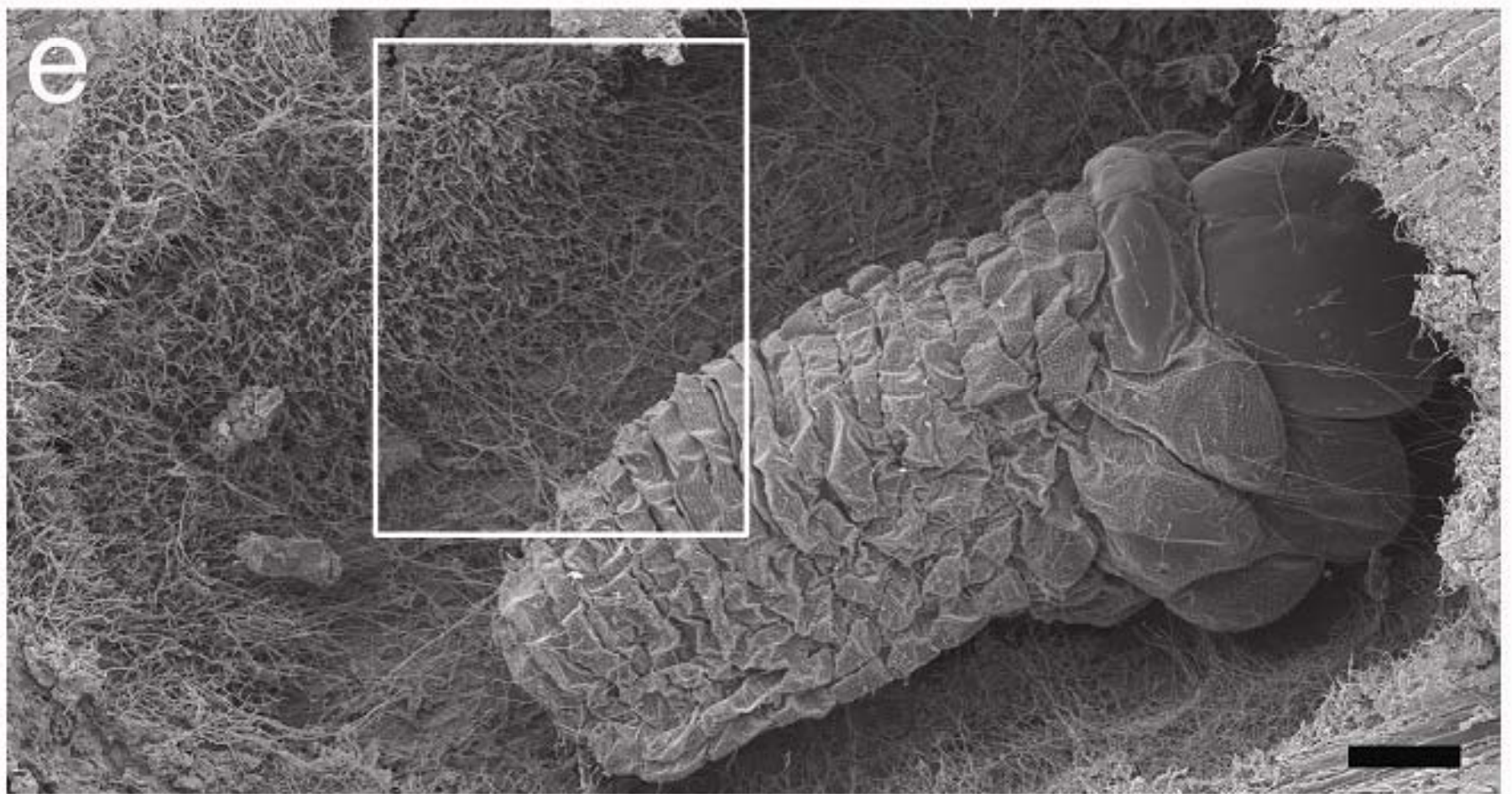




Bar: 200 um



Larvae and fungal feeding



The bluestain fungus: ***Ophiostoma minus***

- Commonly associated with SPB
- May help kill trees
- Harmful to SPB development





TRAIL CLOSED

UNTIL
COMPLETE REMOVAL
OF
INFESTED SOUTHERN
PINE BEETLE TREES



NO

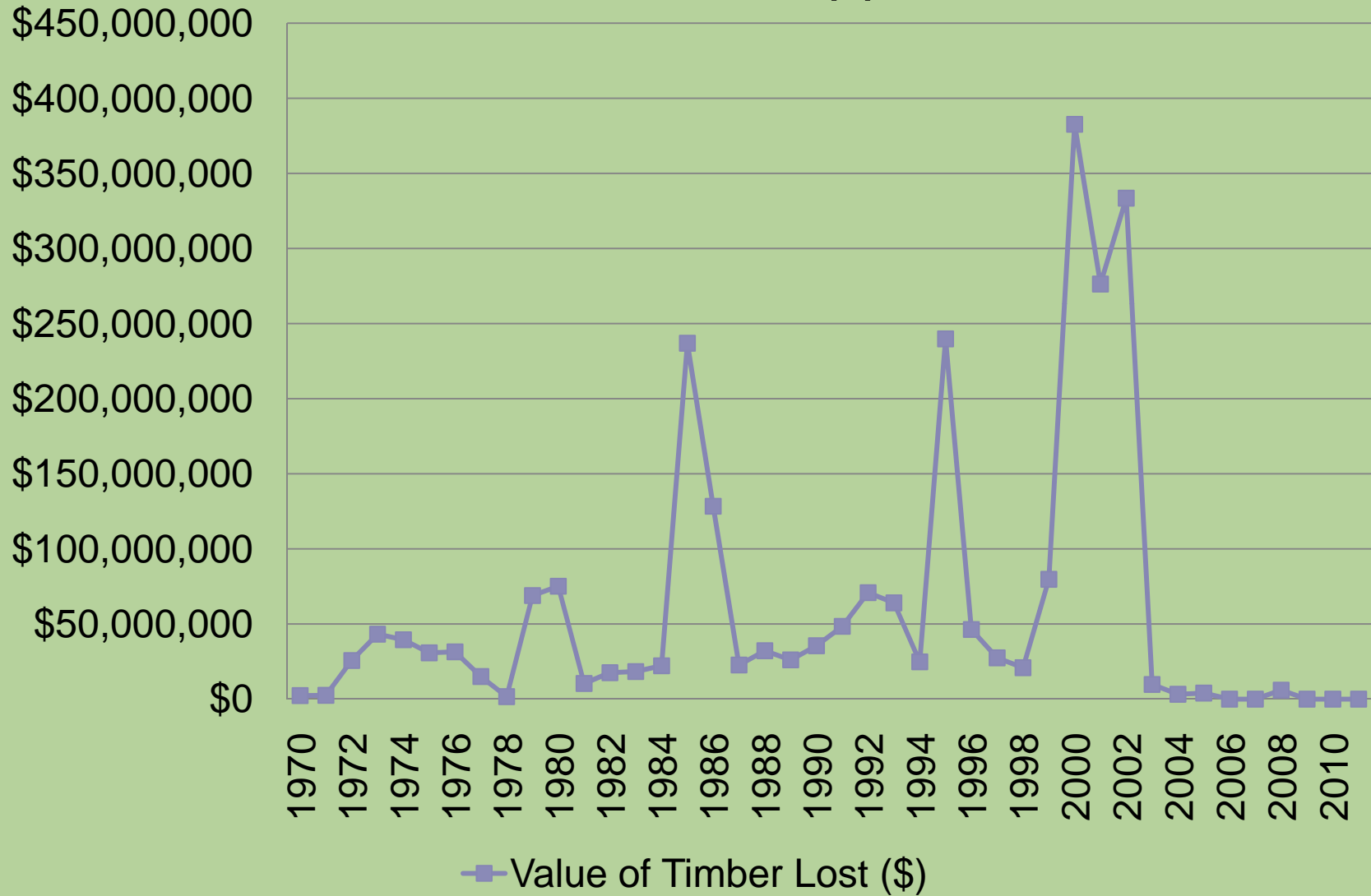




FORESTRY

THIS PARK IS CURRENTLY
UNDERGOING LOGGING TO
REMOVE SOUTHERN PINE
BEETLE INFESTED TREES

Value of Timber Lost (\$)





ENDANGERED
SPECIES SITE

DO
NOT
DISTURB



RESTRICTED
ACTIVITY

RED-COCKADED
WOODPECKER

-10A

Some successful (and unsuccessful) approaches to protecting trees from bark beetles.



Effects on SPB - Nice Tries...

Essential Oils	All oils increased trap catch	Attractants in oils?
Injected Systemics and 4AA	No significant decreases in mortality	Some other effects
Plant Defense Elicitors	Methyl jasmonate – 2X resin flow	No other significant effects

Tree Injection



Registered for bark beetles, including SPB:

- Astro (Permethrin) and off-label equivalents.
- Onyx and Onyx Pro (Bifenthrin) and off-label equivalents (some differences in labeling).
- Tree-age injectables (emamectin benzoate).
- Sevin (Carbaryl) Does not work for SPB.
- Imidacloprid labels – may include bark beetles, but first data indicate low activity.

How do we know if they work?



Emamectin Benzoate
120 day treatment



Control

Low Dose

Medium dose

High Dose

Southern Pine Beetle:

Field Identification

Control of Infestations

Sources of Landowner Assistance

Bud Mayfield, Ph.D.
Research Entomologist
USDA Forest Service

Aug 23, 2011

Field Identification

- How can I distinguish an SPB infestation from mortality associated with other bark beetles?

Southern Pine Beetle

- *Dendroctonus frontalis*



Other pine bark beetles

- “Ips” engraver beetles
 - *Ips avulsus*
 - *Ips grandicollis*
 - *Ips avulsus*
- Turpentine Beetles
 - *Dendroctonus terebrans*
 - *Dendroctonus valens*



**Black
Turpentine Beetle**
Dendroctonus terebrans



**Southern
Pine Beetle**
Dendroctonus frontalis



Ips avulsus



Ips grandicollis



Ips calligraphus

**Ips Pine
engravers**

Field ID: Tree mortality patterns

Southern Pine Beetle

- Mortality progresses in rapidly expanding “spots”



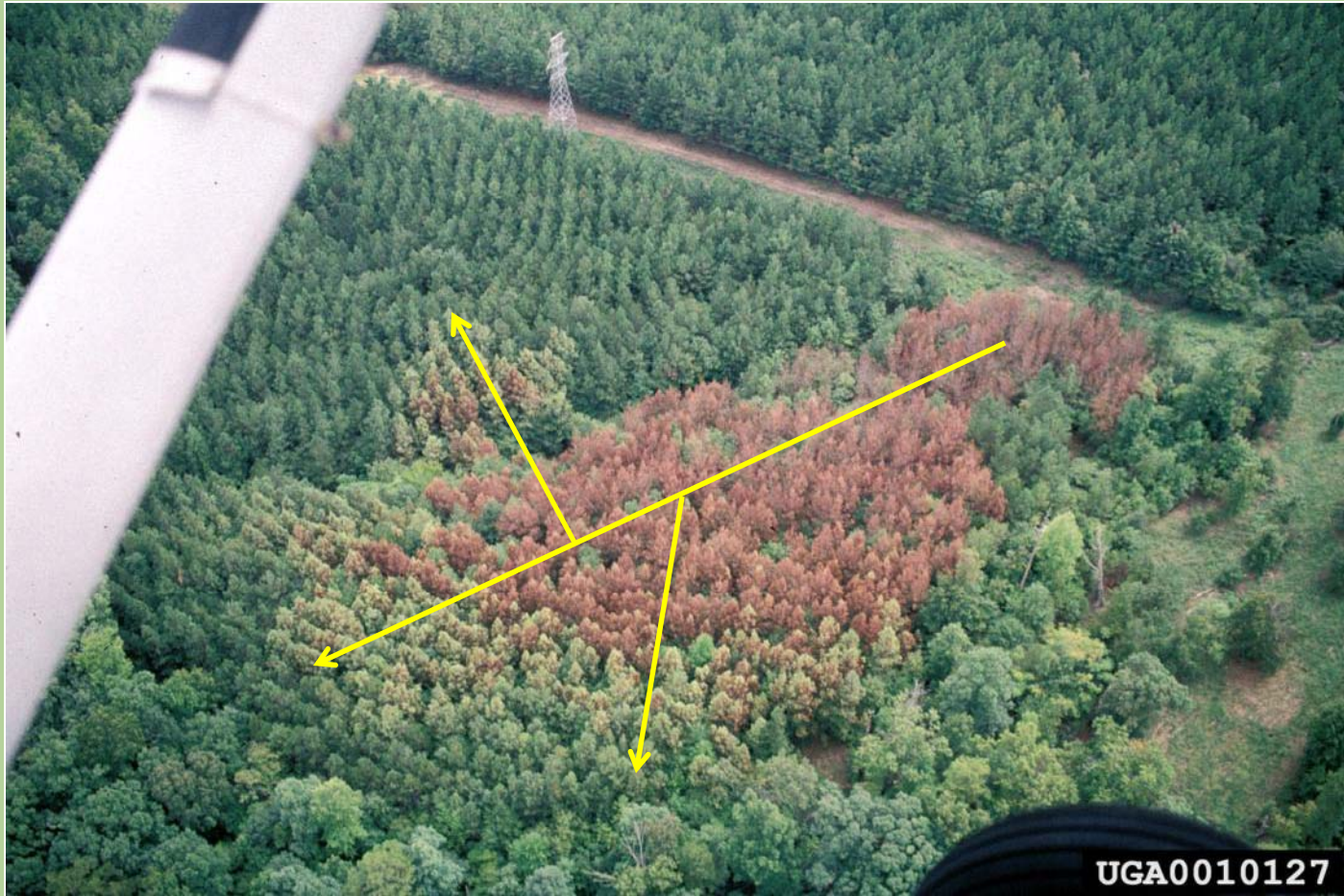
Other Pine bark beetles

- Mortality often more limited, scattered, patchy, assoc. with stress



Field ID: Tree mortality patterns

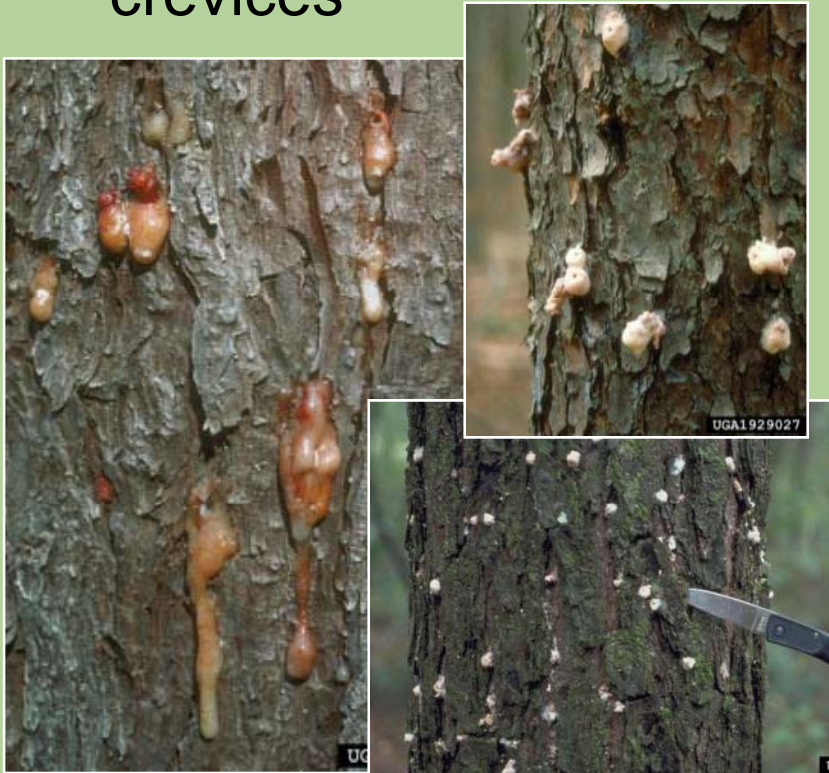
Southern Pine Beetle



Field ID: Pitch Tubes

Southern Pine Beetle

- Often located in bark crevices



Other Pine bark beetles

- Ips engravers: Often on flat face of bark plate
- Turpentine beetles: large, limited to lower trunk



Field ID: Galleries

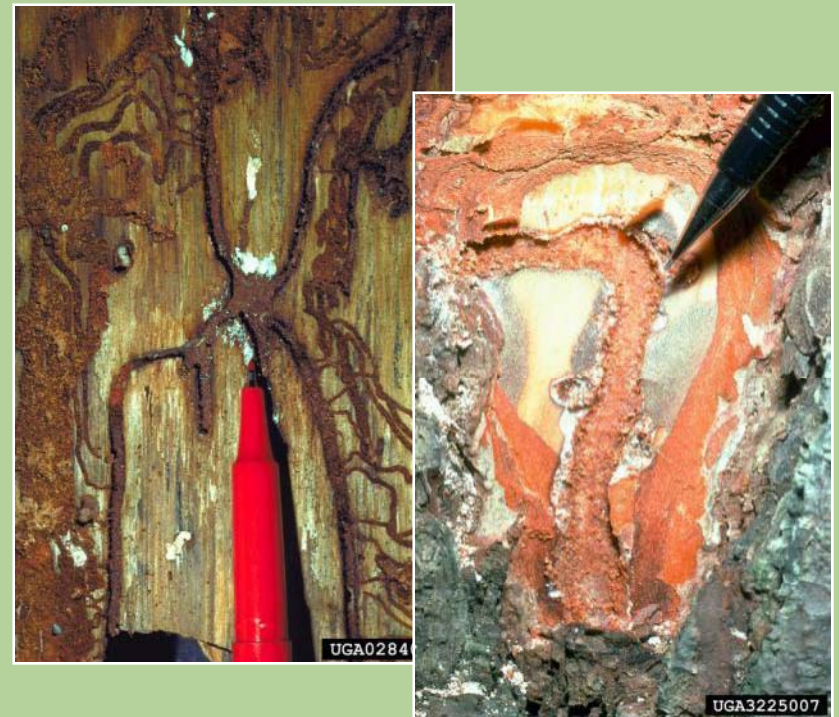
Southern Pine Beetle

- Winding “S”-shaped galleries packed with frass



Other Pine bark beetles

- Ips engravers: H, Y or I-shaped
- Turpentine: large, low



Field ID: other clues for SPB trees

- Checkered beetles on bark
- Pupae in outer bark
- High-hazard loblolly or shortleaf pine?
- Outbreaks in your area?



Control of SPB Infestations

- First confirm that the infestation is SPB and is “active”
 - forester assistance
- Decide on best control option for the given situation:
 - Cut and Remove
 - Cut and Leave
 - Cut, Pile and Burn (limited use)
 - Cut and Spray (limited use)



SPB Control: Cut & Remove

- Prompt removal of all infested trees, plus buffer of adjacent green trees
- Objectives: reduce beetle populations and halt spot expansion



SPB Control: Cut and Remove

- Identify active spot “head” of recently-infested trees
 - fresh boring dust & pitch tubes, green or fading crowns
- Mark buffer strip around active head
 - Width ~ avg. height of trees
- Remove infested and buffer trees ASAP
- Vacated trees may be left standing



Vacated
trees

Infested,
beetles
emerging

Active head,
recently infested

Buffer strip,
uninfested

SPB Control: Cut and Remove

Delineate final buffer strip at time of control to prevent spots from “breaking out”



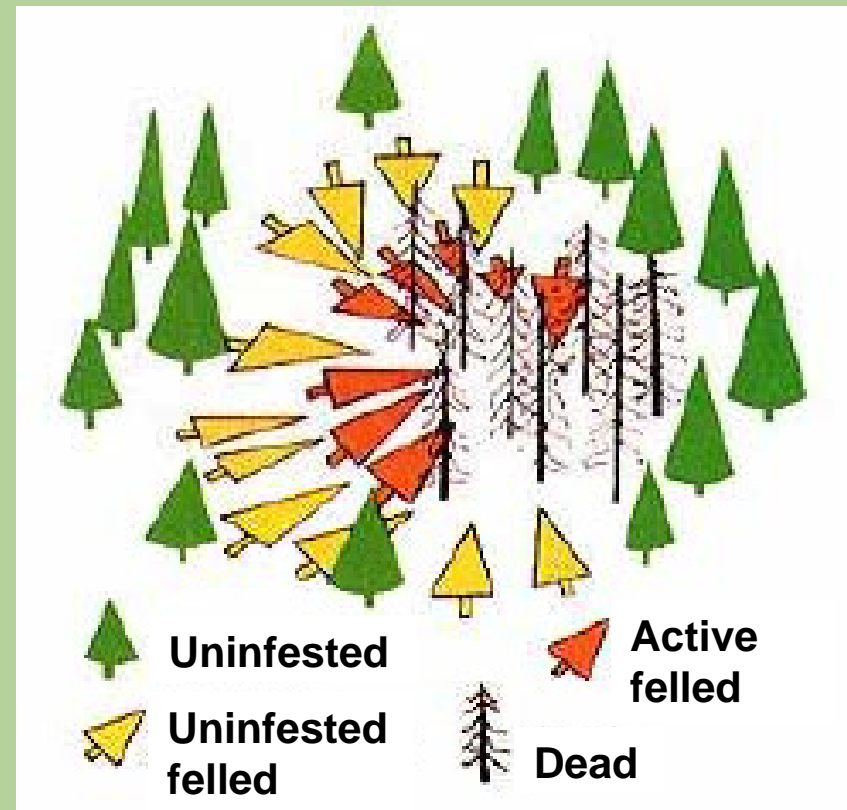
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SPB Control: Cut and Remove

- Advantages:
 - Reduces beetle population
 - Salvage harvest may provide revenue
 - Site cleared for regeneration practices
- Disadvantages
 - Requires access, entry of harvest equipment
 - Need buyer or other outlet for the wood
 - Timing

SPB Control: Cut and Leave

- Fell infested and buffer trees toward spot center and leave on ground
- Objectives: Disrupt pheromone biology and beetle attack behavior, halt spot expansion



SPB Control: Cut and Leave

- Advantages
 - Use when salvage or site access not feasible
 - Relatively inexpensive
 - Can be conducted promptly
- Disadvantages
 - No beetles removed
 - Recheck frequently
 - No revenue from felled trees
 - Not suitable for large spots (<100 trees)



SPB Control: Cut, Pile & Burn

- Fell all infested trees and pile in spot center
- All bark must be promptly burned until thoroughly charred
- Objective: reduce beetle population, halt spot growth



SPB Control: Cut, Pile & Burn

- Advantages
 - Effective when done properly, one of oldest techniques
 - Compatible with site preparation for regeneration
- Disadvantages
 - Environmental constraints (wildfire hazard, erosion)
 - Comply with all local permits and regulations
 - Relatively expensive, no revenue, requires heavy equipment

SPB Control: Cut & Spray

- Fell infested trees (no buffer) and buck stem into workable lengths
- Spray entire bark surface to point of runoff
 - Low pressure sprayer
 - Turn logs to get full coverage
- Objective: Kill emerging beetles, halt spot spread



SPB Control: Cut & Spray

- Advantages:
 - May be appropriate for small spots in residential settings
- Disadvantages
 - Lack of labeled, on-the-market insecticides available for this use
 - Environmental constraints
 - Expensive
 - Not feasible for large spots, forest stands

SPB spot control priorities

- If possible, control all SPB spots with fresh attacks and/or trees with developing brood
- Otherwise, prioritize:
 - Spots with a high proportion of green/fading infested trees to red trees, and room to run
 - Spots threatening other property/resources
 - Spots threatening high value sawtimber
 - Spots threatening endangered species habitat
 - Otherwise prioritize based on accessibility, size, growth rate

Sources of Landowner Assistance with SPB

- State-level Divisions of Forestry
 - County or District forester
- USDA Forest Service
 - Forest Health Protection (State and Private Forestry)
- Cooperative Extension Service
- Consulting foresters



Mississippi Forestry Commission and Mississippi State Extension Landowner Workshop





Thanks!

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Prevention of Southern Pine Beetle

Forest Health Protection-Region 8

USDA Forest Service

John T. Nowak



SPB Management = Forestry 101

- Thin when it is biologically and economically appropriate
- Keep trees growing well (diameter and height)
- Maintain low understory competition
- Plant the right species on the right site
- Plant at appropriate densities

Multiple Benefits to Prevention Treatments

- Reduced susceptibility to SPB
- Increased economic return
- Reduced fire risk
- Improved wildlife habitat
- Improved aesthetics

Low Hazard vs High Hazard

- Low basal area (<80 sq ft)
- Healthy diameter growth
- Good live crown ratio (> 33%)
- Adequate tree spacing (> 20 ft)
- High basal area (<120 sq ft)
- Slow or stagnant diameter growth
- Low live crown ratio (< 33%)
- Tight tree spacing (< 20 ft)



- Appropriate species for site
- Fire is part of the equation
- Low stand density is preferable



2006 NIDRM: estimates
8.4 million acres at risk for
SPB related mortality



- Maybe not the best species on most sites
- Fire is often excluded
- High stand density is common

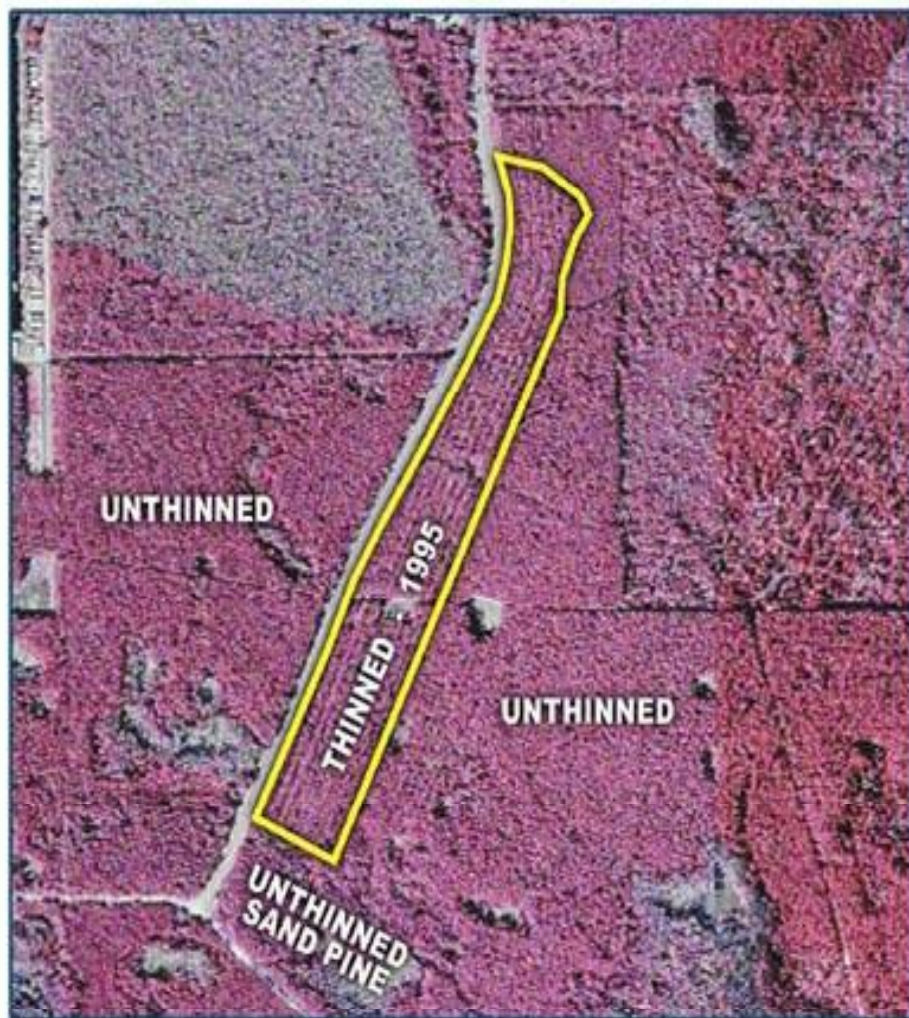




First Thinning



Lake George State Forest
1999



Lake George State Forest
March 12, 2002



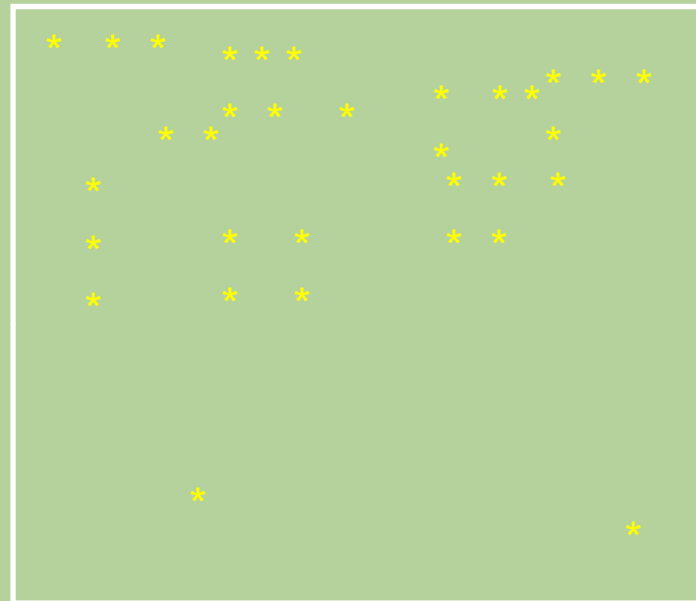
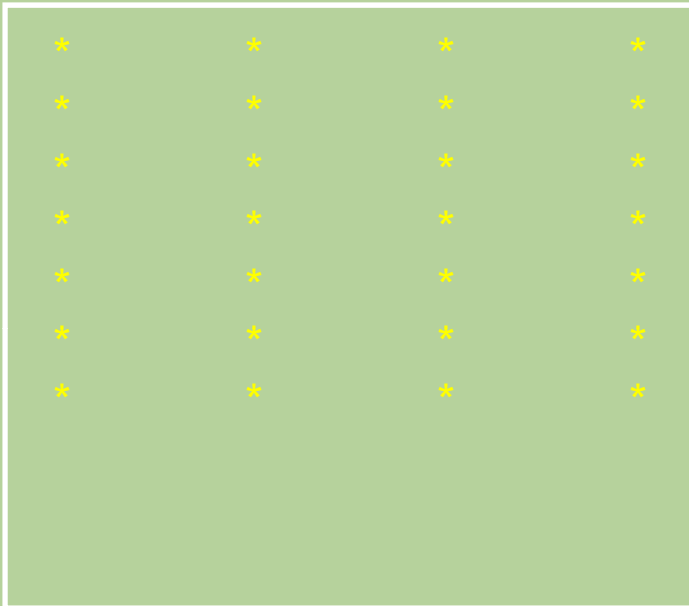
Why Does Thinning Work?

- Improves the vigor of residual trees
 - increases resin flow potential
 - more capable of pitching out SPB
- Thinning changes the physical environment within stands.
 - Microclimate
 - pheromone plumes
 - inter-tree spacing





All thinnings are not created equal



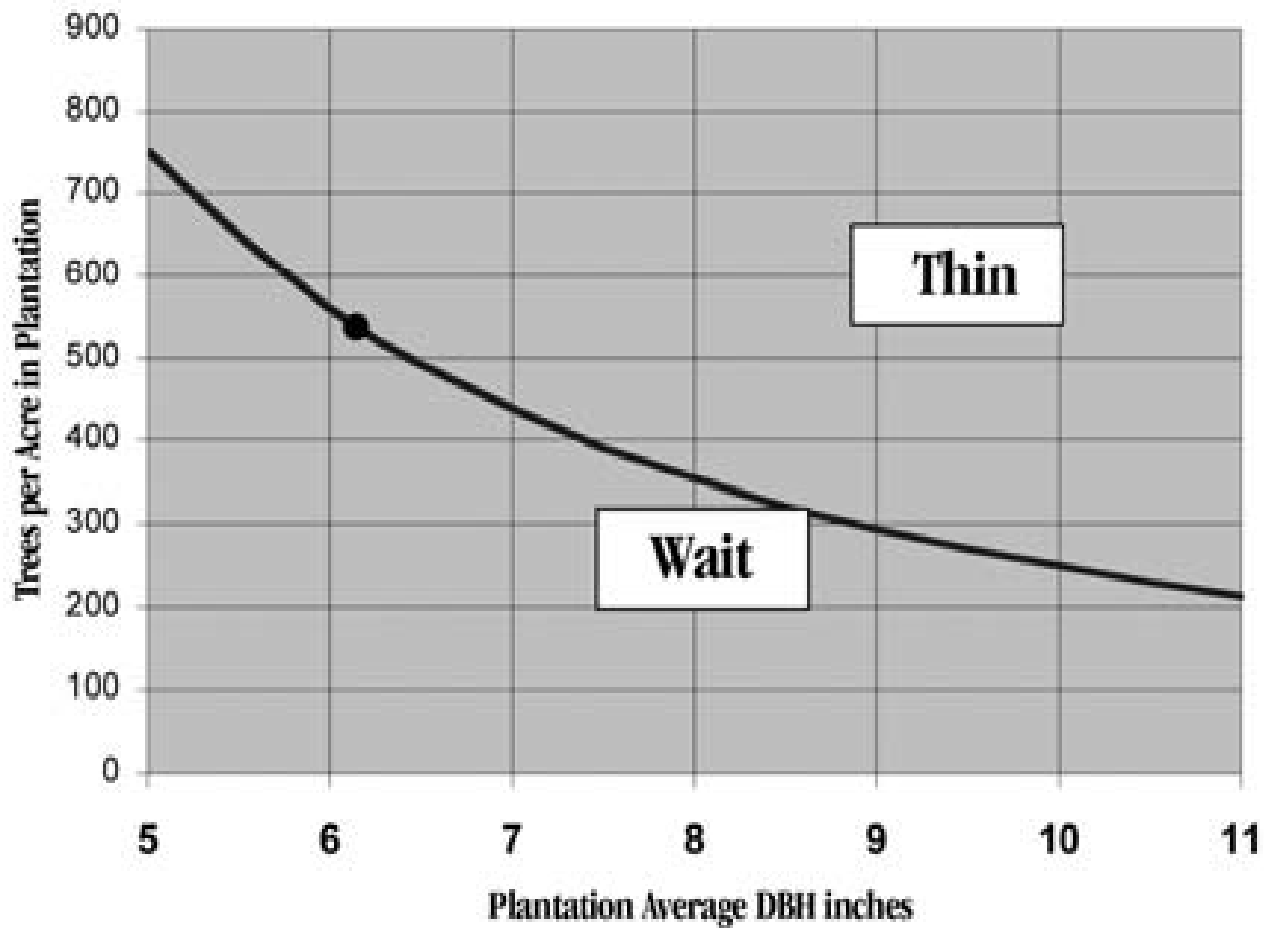
Whitehead and Russo (2005) and others have suggested increases in resin production were not as important in reducing MPB-caused tree mortality at the stand level as reductions in the number of initiated attacks, which is more likely associated with inter-tree spacing. Also see Gara and Coster (1967).

Pheromone Plumes

- Thistle et al. (2004, 2005) examined the near-field canopy dispersion of tracer gases, as a surrogate for bark beetle pheromones, within the trunk space of trees. They showed that when surface layers are stable the tracer plume remained concentrated and directional. Low density stands result in unstable layers and multi-directional traces that dilute pheromone concentrations.



Thin When it is Time



Per Acre Revenue During Rotation

Activity	Pulpwood Value (\$)	CNS Value (\$)	Saw Timber Value (\$)	Total (\$)
1 st Thin	168.27			168.27
2 nd Thin	183.89	603.95		787.84
Final Harvest	161.77	889.22	1,932.00	2,982.99
Total	513.93	1,493.17	1,932.00	3,939.09

You will only get \$514 for pulpwood for three harvests, while you'll get \$3,425 from CNS and saw log harvests.

By thinning the right way, when it's the proper time to thin, you set the stage for your stand to provide you with higher value sawtimber compared to low value pulpwood while maintaining good growth rates and vigor.



Pre-commercial Thinning







Prescribed Burning



Prescribed Fire

- Can be used to reduce competing vegetation and stand basal area – reduce tree stress and change stand structure.
- Low intensity fire part of pine ecosystems.
- Caution needs to be used when used as part of bark beetle prevention.



06/19/2002

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Planting and Stand Restoration



Planting Considerations

- Right species on the right site
- We recommend lower planting densities (less than 450 stems per acre)

Reasons we recommend lower density plantings: Currently have better survival rates than in the past and delays the time of when first thinning is needed without a loss in volume produced

Questions?

