FORESTRY: Study Tips

Use Your Resources

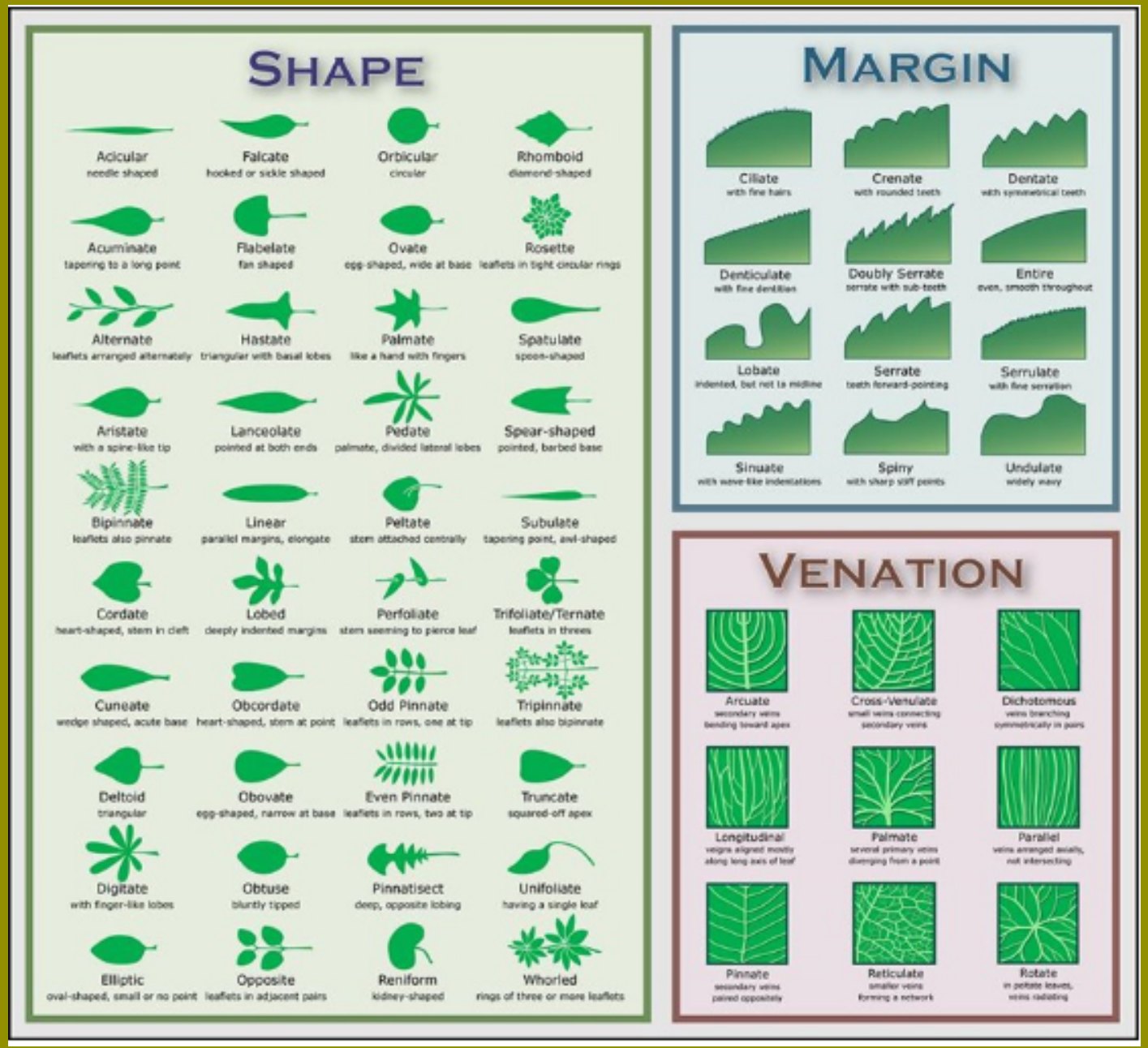
This study guide does not replace the online forestry guide found at:
https://www.irlenvirothon.org/general-1

Use the Study Guide and pay attention to its visual cues

If text is **bold**, underlined, and *italicized*, it's fair game for the test!

EXAMPLE: Crown - The ***crown*** is the site of active food making and growth. Leaves are the main component o the crown and are responsible for manufacturing the tree's food. This process is called ***photosynthesis***. Photosynthesis is a chemical process that utilizes energy from the sun and converts water, minerals, and carbon dioxide into sugars.

Dendrology - Tree Identification



Tree Groups

Trees are divided into two main groups, ***angiosperms*** and ***gymnosperms***. Angiosperms are also called hardwoods or broadleaf trees. They typically have broad, flat leaves (See Figure 4.8) that are either simple or compound. Their wood is dense compared to that of gymnosperms. Broadleaf trees generally lose their leaves in the winter, a condition termed ***deciduous***. Examples of angiosperms include live oak, magnolias, maples, ashes, sycamores, and mangroves. Trees may be divided into two main groups, broadleaf and conifer. Other names for broadleaf trees are deciduous, hardwood, and angiosperm. Other names for the conifer are evergreen, softwood, and gymnosperm.

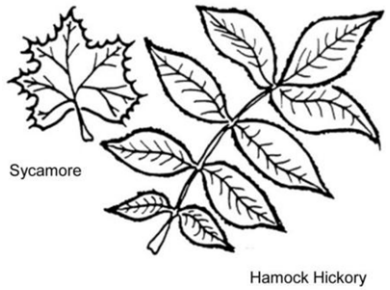


Figure 4.8. Hardwoods typically have broad, deciduous leaves, either simple or compound. They are also called deciduous or broadleaf trees.

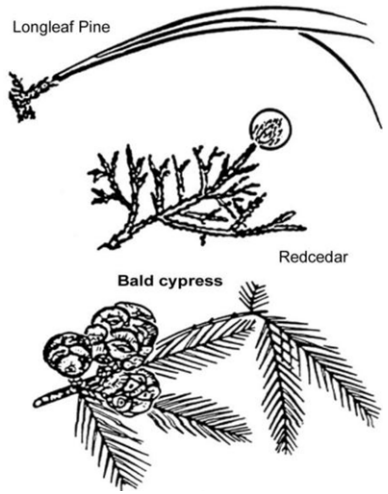


Figure 4.9. Conifers have persistent needles or scale-like leaves and are sometimes called evergreens or softwoods.

Gymnosperms are also called softwoods or conifers. Their leaves are needle-like, scale-like, or feather-like (See Figure 4.9). Unlike angiosperms, they bear cones and have relatively soft wood. Conifers retain their leaves during the winter and are often called **evergreens**. Examples of evergreens in our area include pines, cypress, and red cedar.

Several trees listed in the two groups do not totally conform to these descriptions. For instance, southern magnolia and live oak, considered broadleaf trees, do not lose their leaves in the fall. Baldcypress, considered a conifer, does. Red cedar, a conifer, does not bear cones at all; it bears a fleshy fruit instead. Hardwoods such as cottonwood and willow have wood that is much softer

than that of longleaf pine, a softwood tree with rather dense, hard wood.

Palms are not included in these groups of trees. Palms - including our state "tree" the sabal palm - do not have a vascular cambium. They have vascular bundles, tubes that are grouped together and run up the length of the "tree". It is because of this difference that palms are not considered a true "tree".

TREE NAMES

Trees, much like humans, have common names and scientific names. For example, Debbie, Eric, and Becky are common names, but their scientific name is *Homo sapiens*. South Florida slash pine, southern pine, yellow pine, slash pine, and Dade County pine are all common names of one tree whose scientific name is *Pinus elliottii* variety *densa*. Each tree has only one scientific name. Scientific names are frequently used by foresters and biologists to eliminate confusion when speaking about specific trees.

A scientific name consists of two parts, ***genus*** and ***species***. Sand pine's scientific name is *Pinus clausa*. *Pinus* is the genus, *clausa* is the species. Some trees share the same genus such as longleaf pine, *Pinus palustris*, and slash pine, *Pinus elliottii*. Examples of scientific names are given in the dichotomous key at the end of the Forestry Section.

TREE CHARACTERISTICS

When identifying trees, foresters use the tree's characteristics to aid them. Characteristics include: leaves, bark, twigs, flowers, fruits, and tree shape. Leaves are the easiest characteristic to use in tree identification. They can have varying sizes, shapes, margins or leaf edges, orientations on the branch, and simple or compound leaves. Please refer to the Appendix for examples of leaf characteristics.

Conifer leaves vary in shape, but Florida's most important conifers (longleaf, loblolly, slash, and sand pines) all have needles of similar form. Florida's other important conifers, bald cypress and red cedar, are easily distinguished by their leaf shape. Pine needles arise from the branch in little bundles or bunches called ***fascicles***. Needle length and the number of needles per fascicle will distinguish the various pine species.

When identifying hardwoods by their leaves, one must first determine whether the leaf is ***simple*** or ***compound***. Simple leaves are defined as having one leaf per ***petiole***. Whereas a compound leaf will have many ***leaflets*** per petiole. It is important to distinguish leaflets from simple leaves. Beginners make the error of examining leaflets on a compound leaf, mistaking them for a simple leaf. This can be avoided by following the petiole back to the leaf bud. The leaf bud is positioned between the petiole and the twig. Drawings of leafs parts can be found in the appendix.

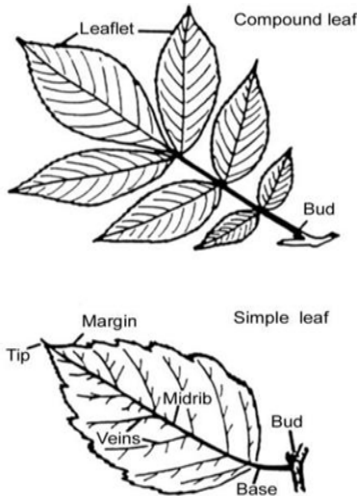
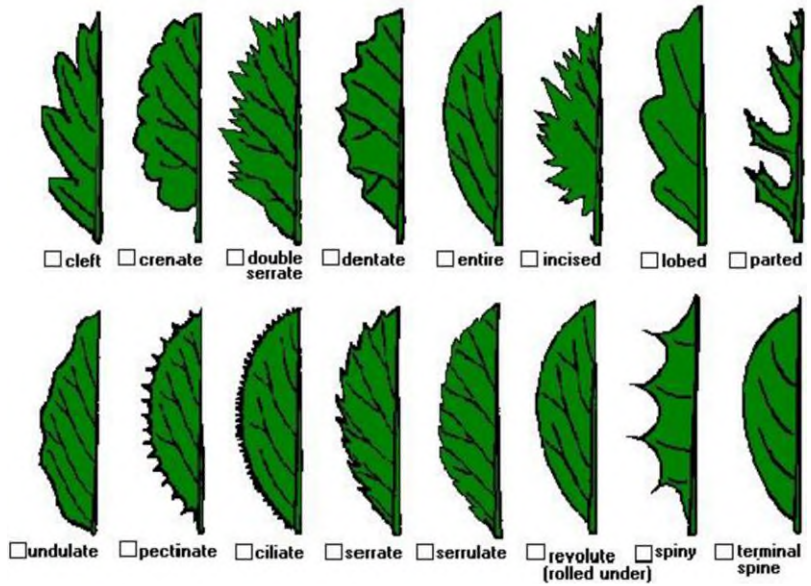


Figure 4.10. Hardwood leaves are either simple or compound.

The ***leaf margin***, or edge of the leaf, is useful in identifying hardwood trees. Examples are shown below:



There are 3 common types of leaf ***orientations***: ***opposite***, ***alternate***, and ***whorled***. Most trees have an alternate leaf orientation. Opposite leaf orientations can be found on maples, ashes, dogwoods (M.A.D.), and mangroves. Catalpa trees have a whorled leaf orientation, but do not occur naturally in our area.

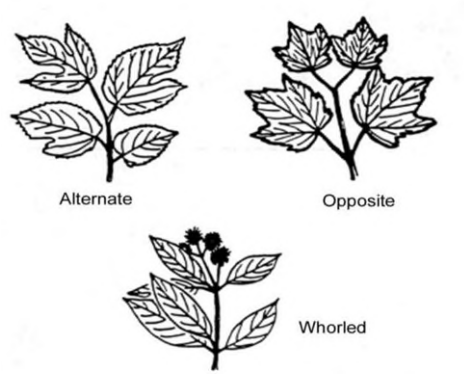


Figure 3.11. Leaf orientations.

Trees may also be identified by observing the site in which they grow. For example, dry, sandy soils are often colonized by longleaf and sand pines. Tidal areas along estuarine waters will contain mangroves. Moist, rich soils may support red bay, live oak, and red mulberry. Be aware that trees planted in landscaped areas may be growing outside of their preferred conditions.

DICHOTOMOUS KEY

A dichotomous key is a chart that botanists and foresters use to identify trees according to a tree's group and characteristics. Here's how the dichotomous key works:

Pretend you are looking at a broadleaf tree whose leaves have U-shaped lobes, toothed leaf margins, and are arranged in an alternate fashion on the twig. What tree is it?

> First decide which dichotomous key is the appropriate one to use...conifer or hardwood? Hardwood!!
> Next, go to the #1 on the hardwood key...are the leaves and twigs alternate or opposite? Alternate!! Good! Proceed to #3 on the hardwood key.
> Are the leaves lobed or unlobed? According to our observation, the leaves are unlobed. The number in the right-hand margin indicates that we must proceed to #4.
> The #4 description that matches our described tree is that of the red mulberry, *Morus rubra*.

Below is the dichotomous key that will be handed out at the Envirothon competition. You will be allowed to use this key to identify trees at the Forestry site. This key will not identify all trees in Indian River, Martin, Okeechobee, and St. Lucie counties. This key is intended for use in the Indian River Lagoon Envirothon.

CONIFER KEY

1. Leaves needle-like, in fascicles 2
1. Leaves feather-like or scale-like 4

2. Needles in fascicles of three only. **LONGLEAF PINE (*Pinus palustris*)**
2. Needles in fascicles of 2, or 2 and 3 3

3. Needles in fascicles of 2; needles 2-3 inches long; cones 2-3 inches long **SAND PINE (*Pinus clausa*)**
3. Needles in fascicles of 2 and 3; needles 8-12 inches long; cones 3-6 inches long **SLASH PINE (*Pinus elliottii*)**

4. Needles are feather-like; deciduous; cones are ball-like, 3/4-1 inch long **BALD CYPRESS (*Taxodium distichum*)**
4. Needles are scale-like 5

5. Needles are scale-like in two fashions; the most common is dark green clasping tightly to the stem. The other kind appearing on young stems or vigorous growth is awl-shaped and sharp-pointed; fruit is a small gray-blue berry
SOUTHERN RED CEDAR (*Juniperous silicicola*)

HARDWOOD KEY

1. Leaves and twigs are opposite 2
1. Leaves and twigs are alternate 3

2. Leaves are compound and 7-12 inches long; 5-7 leaflets per leaf **CAROLINA ASH (*Fraxinus caroliniana*)**
2. Leaves are simple 11

3. Leaves are lobed 4
3. Leaves are unlobed 6

4. Lobes on leaves are V-shaped 5
4. Lobes on leaves are U-shaped, toothed leaf margins **RED MULBERRY (*Morus rubra*)**

5. Leaves 3-5 lobes, 4-9 inches long and broad, light green and smooth above and paler below ___ **SYCAMORE (*Platanus occidentalis*)**
5. Leaves star-shaped, 5-7 lobes **SWEET GUM (*Liquidambar stryaciflua*)**

6. Tree is evergreen 7
6. Tree is deciduous 10

7. Leaf margins are entire 8
7. Leaf margins are pointed or toothed 9

8. Leaves are 3-4 inches long, oblong-lanceolate, apex is acuminate; leaves are edible used in cooking, fruit is a dark blue berry (drupe)
RED BAY (*Persea borbonia*)
8. Leaves are 2-3 inches long, leathery, oblong-obovate, apex is obtuse (immature leaves may have a toothed margin); fruit is an acorn
LIVE OAK (*Quercus virginiana*)

9. Leaves are 4-6 inches long, finely toothed; fruit is a woody capsule that splits and releases seed **LOBLOLLY BAY (*Gordonia lasianthes*)**
9. Leaves are $1^1/_2$ - 3 inches long, toothed above the middle toward the apex; fruit is a red berry **DAHOON HOLLY (*Ilex cassine*)**

9. Leaves 2-4 in. long, $^1/_2$ in. wide, coarsely serrate-toothed; fruit is a 1/8 inch berry covered with a bluish wax **WAX MYRTLE (*Myrica cerifera*)**

1. Lvs. are 2-3 in. long; entire leaf margin (immature leaves may have toothed margins); fruit is an acorn **LAUREL OAK (*Quercus laurifolia*)**

10. Leaves are $2^1/_2$-5 in. long; entire leaf margin or just a few teeth towards the apex; fruit is a berry **SUGARBERRY (*Celtis laevigata*)**

11. Leaves have 3 lobes **RED MAPLE (*Acer rubrum*)**
11. Leaves are unlobed 12

12. Leaves dark green on both sides, thick & leathery; proproots extend downward from the trunk; seeds pencil-shaped;
RED MANGROVE (*Rhizophora mangle*)

12. Lvs. dark green on top, but distinctively pale and silver-green underneath; leaf surface often coated with salt; lvs. Narrow
and oblong **BLACK MANGROVE (*Avicennia germinans*)**

12. Leaves are oval & have a small notch at the leaf tip; two small salt glands are visible on either side of the stem below the leaf blade **WHITE MANGROVE (*Laguncularia racemosa*)**

FOREST COMMUNITY TYPES

The composition of ***forest communities*** depend on soil, climate, and successional stage. When left untouched, forest communities are comprised of multiple species. Sometimes, man's influence can create forest communities dominated by a single species. These communities are called ***monocultures***.

Regional forest communities are identified in Figure 5.1. Keep in mind that these communities contain thousands of microcommunities too small to be shown. Despite differences, these microcommunities all have similarities that fit into a few broad, generalized communities.

COMMUNITY TYPES IN OUR FOUR-COUNTY AREA

Sand Hill Communities

These areas commonly occur in Indian River, St. Lucie, and Martin Counties along the coast. There are patches of sandhill communities near Fort Drum in Okeechobee County. They have extremely dry, sandy soils. Common tree species include sand pine, turkey oak, bluejack oak, longleaf pine, and sand live oak. Sand pine grows extremely fast in these areas and is the best-suited tree for these sites. Sandhill communities also provide habitat for endangered and threatened species such as the scrub jay, gopher tortoise, gopher frog, and the Florida mouse.

Mixed Hardwood-Pine Communities

These communities are located in north and west Florida on the southern coastal plain. As the name suggests, they are a mixture of pine and hardwood trees. Species include longleaf, loblolly, and slash pine, water and laurel oak, mockernut hickory, sweetgum, magnolia, and black cherry. Mixed hardwood-pine communities in west Florida are often converted to southern pines, producing excellent stands of longleaf, slash, and loblolly pine.

Flatwood Communities

The typical species in flatwoods are slash pine with an understory of gallberry and palmetto. Other species include wax myrtle and cabbage palm. This forest community is the most common in our four county area. Longleaf pine exists in drier areas of flatwoods in northern Okeechobee and Indian River counties. Red cockaded woodpecker, indigo snake, and gopher tortoise frequent this habitat. Melaleuca, Australian pine, and Brazilian

pepper have invaded many of these areas in South Florida and out-compete native trees.

Hammocks

A ***hammock*** is a slight elevation arising from wetter soil and covered with hardwood trees which may be frequently associated with one or more palm species. Hammocks are usually associated with limestone outcrops. They are most noticeable in the flatwoods or in treeless areas, but are found in swamps. The hammocks are extremely dense and have great diversity in tree species. South Florida hammocks in our area may be dominated by one or more temperate zone species such as live oak, red maple, mulberry, and hackberry.

Cypress Swamps

Cypress swamps may consist of either bald or pond cypress, with few other species present. The cypress community often assumes a dome-shaped appearance when the swamp is in an isolated depression. Cypress swamps not only produce valuable timber, but also are considered water recharge areas.

Cypress may take on a dwarfed or "hatrack" appearance and stand only a few feet high despite many years of age. Such stunting is due to rock formations just below the soil surface which limit growth.

Hardwood Swamps

Hardwood swamps are found on moist to flooded soils near or adjacent to a river or creek. These communities are dependent on periodic flooding. A great diversity of species is found in these areas. Among the species found are baldcypress, loblolly bay, redbay, red maple, sweetbay magnolia, Dahoon holly and Carolina ash. These areas are generally attractive to wildlife.

Mangrove Swamps

Three types of mangroves are prominent in mangrove swamps: red, black, and white. Red mangroves can be identified by prop roots that grow down from larger branches. Black mangroves can be identified by ***pneumatophores*** extending above the soil surface. Pneumatophores are roots, resembling pencils, that project above the soil surface. White mangroves can be found growing upland of red and black mangroves. These areas are common along estuarine shorelines that are sheltered from wave action.

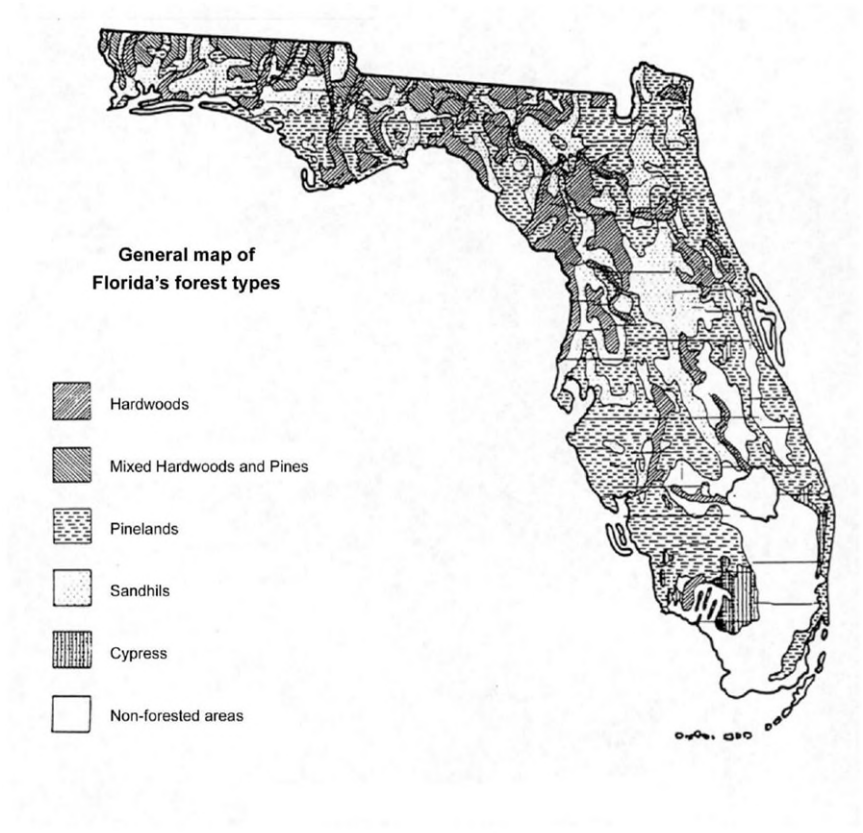


Figure 5.1. Forest types vary with soil features and topography.

Florida Natural Areas Inventory

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Guide to the Natural Communities of Florida - 2010 Edition

Wet prairie natural community in Apalachicola National Forest. Photo by Amy Jenkins April 2020

Links:

- View/download full print version (140mb)
- View natural community accounts
- View/download natural community short descriptions (159kb)
- View/download crosswalk between 1990 and 2010 natural community guides (196kb)

In 2007, with funding from the Florida Department of Environmental Protection (FDEP), Division of State Lands, the Florida Natural Areas Inventory (FNAI) began a process of updating the "Guide to the Natural Communities of Florida" (the Guide), first published in 1990 by FNAI and the then Florida Department of Natural Resources (now FDEP). Only the forty-five land-based communities (23 terrestrial and 20 palustrine communities, plus tidal marsh and tidal swamp in the marine category) were included in the current update, leaving the remaining aquatic communities to be updated at a later time. The purpose of the update was to clarify distinctions between communities by listing characteristic species and features distinguishing similar communities, as well as to add information for each community on variations throughout its range (with common variants noted specifically), range, natural processes, management, and references.

Changes include **1)** minor changes to the classification itself, **2)** a new organization for grouping the communities, and **3)** the addition of a list of

*There will NOT be questions on the test from the Florida Natural Areas Inventory “Guide to Natural Communities of Florida”. This is being provided as a resource if you are interested in learning more about Florida’s natural communities. This document is extremely helpful in understanding the Florida landscape and how different species compose specific communities.

- **Thank you to Jeff Eickwort for providing the following slides on bark beetles.**

- Jeff is the Entomologist and Supervisor, Florida Health Section with the Florida Forest Service. He also teaches graduate courses at University of Florida focused on entomology and forestry management. Below is his contact information if you would like more information on bark beetles and their effects in Florida and the SE.

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Game Plan!

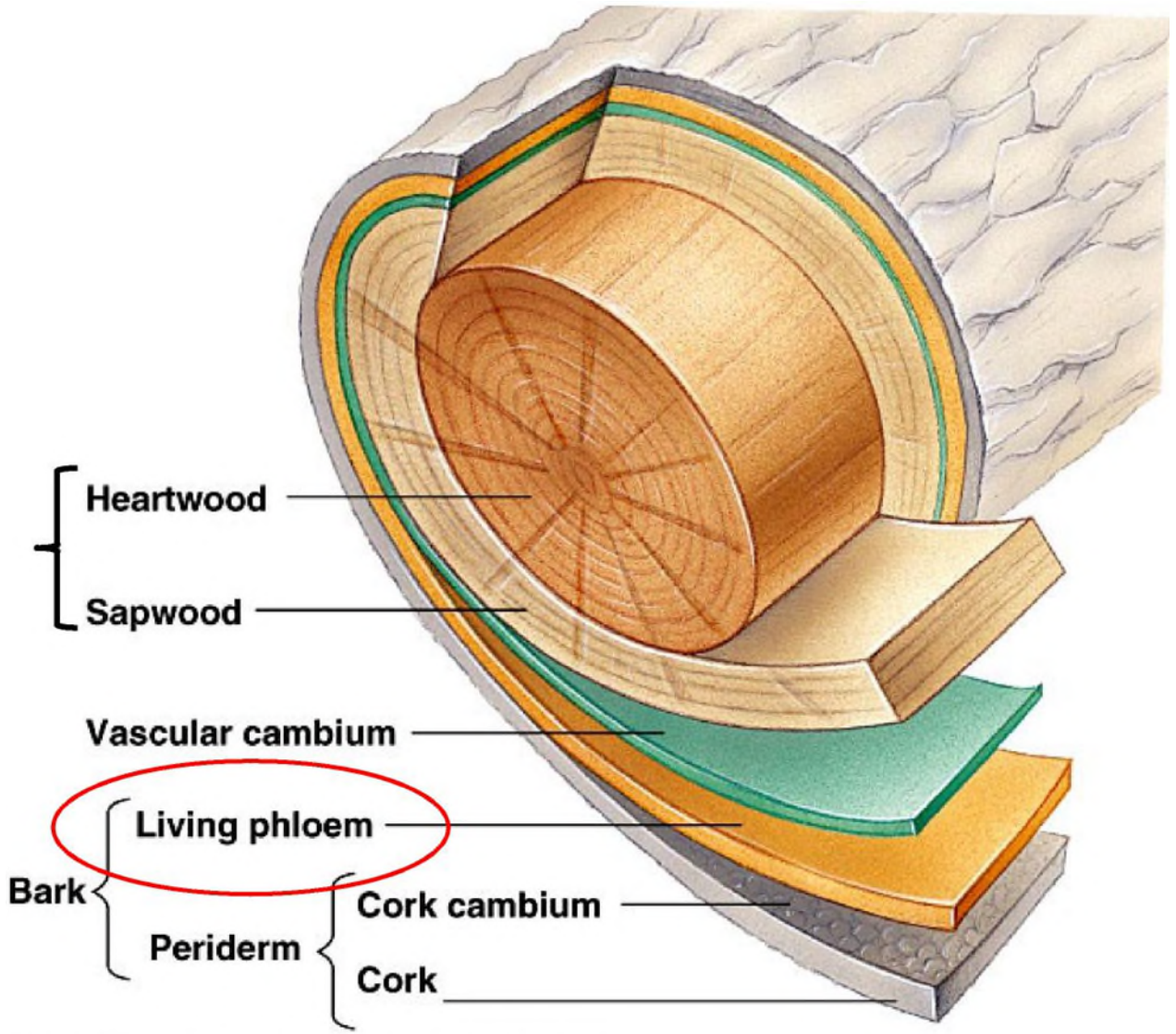
- Bark beetles are a big & important topic – enough for a stand-alone lecture.
- Use the important species in the southeastern US as models
- Refer to important examples found in other regions of the US, other countries.

•Bark Beetles: In General

- **Small beetles in the subfamily Scolytinae.**
  - **•– Previously in their own family, Scolytidae. (“scolytids”)**
- **•– Now understood to be a subfamily of •weevils (Curculionidae). (“scolytines”)**
- **Feed, breed, & develop in the inner bark layer of trees.**
- **Some species can transmit tree pathogens.**
- **The vast majority only infest trees (or branches, twigs) that are already dead**
  - **•– Not pests, so you will never hear of most of them (unless you’re a bark beetle nerd).**

Quick reminder

- Many types of insect that feed in tree stems spend part or all of their time in the "inner bark."
- It's often misstated that they're in the cambium, but mainly they're after the nutrient-rich phloem xylem layer.
- This is the primary habitat of bark beetles.



- There are around 3,000 phloem-feeding bark beetle species globally.

•Quiz!

•How many bark beetle species are known from Florida?

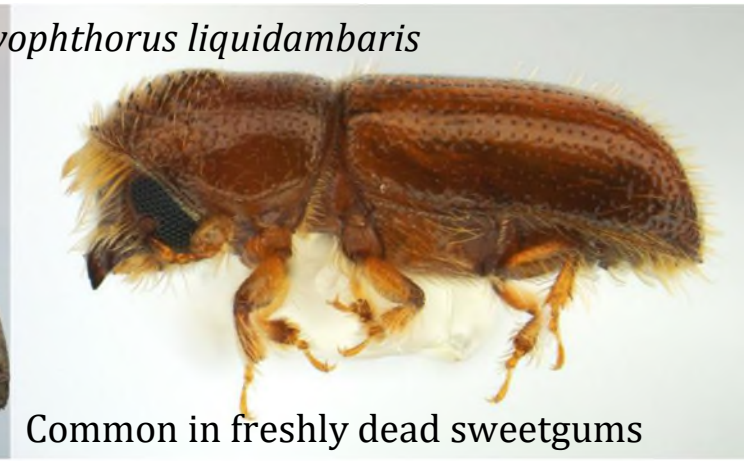
a. ~5
b. <u>~24</u>
c. ~80

•How many bark beetle species are considered <u>economic pests</u> in Florida?

a. 5
b. 24
c. 80

Bark Beetles – Ecological Roles

- The vast majority of species: "post-mortem" bark beetles
  - Utilizing the inner bark of trees (or parts of them) that are dying or recently dead
    - An ephemeral habitat; must fly & detect "dead host" odors, attract mates with pheromones.
- A more select group: "stress-responders"
    - Typically don't attack healthy trees, often infest dead/dying hosts.
    - Can attack & kill trees that are already in trouble (severely stressed/damaged/ declining)
    - Respond to "stressed host" odors, pheromones
- The rarest type: outbreak tree-killers
    - Can overwhelm healthy host defenses by "mass attack" when population explodes
    - Often act as post-mortem or stress-responding species when population is low.



Pityophthorus liquidambaris

Common in freshly dead sweetgums

Orthotomicus caelatus

Common in freshly dead pines

•Why the focus on conifer bark beetles

- There are many bark beetles
  - •that infest hardwoods
    - •– But very few of them kill trees in substantial numbers (except as pathogen vectors).
- Only a small subset of conifer-
  - •infesting bark beetles kill trees.
    - •– But they are among the most economically damaging forest pests in the world.

- **5 important species in the**
- **southeastern US:**
  - **3 species of *Ips* pine engraver beetles**
  - **2 species of *Dendroctonus***
    - ***D. frontalis* (SPB)**
    - ***D. terebrans* (BTB)**

small southern pine engraver (*Ips avulsus*)

eastern fivespined ips (*I. grandicollis*)

sixspined ips (*I. calligraphus*)

southern pine beetle (*Dendroctonus frontalis*)

black turpentine beetle (*D. terebrans*)

More useful groupings for most management purposes:

SPB

The periodic outbreak tree-killer

Southern Pine Beetle (SPB)
Dendroctonus frontalis

VS.

Ips & BTB

The ever-present "stress-responders"

Ips avulsus

Ips grandicollis

Ips calligraphus

Black Turpentine Beetle (BTB)
D. terebrans

Interpretations & Responses: The "Stress Responders" vs. SPB

Ips and BTB

- Small infestations are common and widespread every year, anywhere with pines.
- When a pine tree dies anywhere in the Southeast, they will probably infest it (especially *Ips*).
- Best understood as an indicator of some other problem.
- Common following major disturbances and disasters (hurricanes, droughts, floods, fires)
- Control measures are usually not called for.
- Should prompt you to ask: "Why are the trees so stressed that they are being infested with *Ips*/BTB?"

SPB

- In most years, SPB is pretty rare. – Some years (like 2020-21) with zero SPB infestations statewide.
- Not found in South Florida.
- In an outbreak, SPB is the primary problem.
- Not associated with disturbances; outbreak triggers are poorly understood.
- Control measures are important to reduce further losses.
- If an active infestation is found, should prompt you to immediately consider taking action.

Ips Pine Engraver Beetles

- Commonly attack stressed, declining, dying, or recently dead trees, including logging debris Three species, 3 sizes, attack different heights/ diameters of the tree (but often overlap)
- Head mostly concealed from above by pronotum (like it's wearing a hood or helmet)

Ips avulsus, 2.3-2.8 mm long

Ips grandicollis, 2.8-4.7 mm

Ips calligraphus, 3.5-6.5 mm

S. Appalachians: ***Ips pini***

Black Turpentine Beetle (BTB)

Dendroctonus terebrans

- Largest of SE pine bark beetles
- Attacks near base of tree, bottom 8-12 ft.
- Generally infests stressed, injured, dying/dead trees (also cut stumps)
- Rounded back end
- Head always visible from above (as on all *Dendroctonus*; pronotum is more like a turtleneck).

On millimeter grid paper

Larva

Pupa

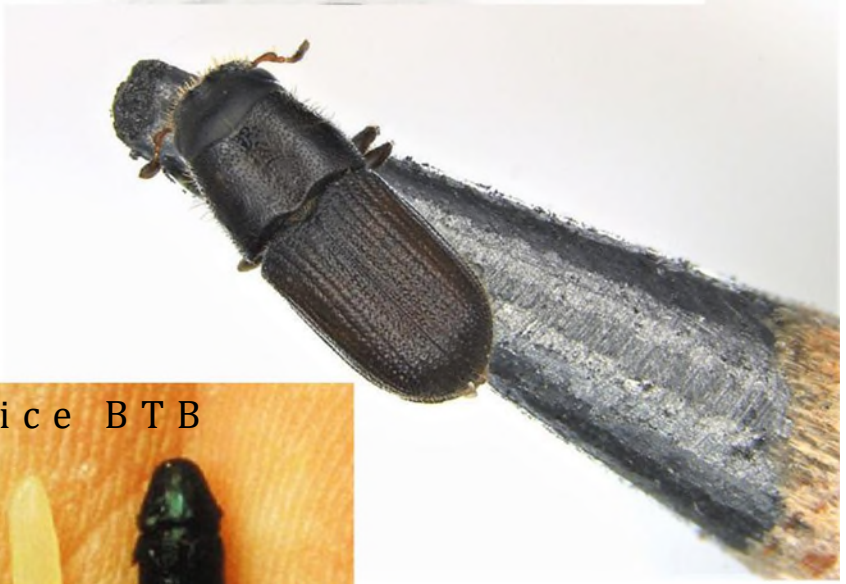
5-8 mm

•Southern Pine Beetle (SPB)

•*Dendroctonus frontalis*

- **Highly aggressive during outbreaks**
- **Can "mass attack" to kill healthy trees when population is high.**
- Utilizes very weak (e.g. lightning-struck) trees when population is low
- Preferred hosts: loblolly, shortleaf, pond, pitch, Virginia, and spruce pines
- Usually in trees >5" dbh, any height on
•main stem
- Shape and color is very similar to BTB, but much smaller

•3 mm



•SPB rice BTB

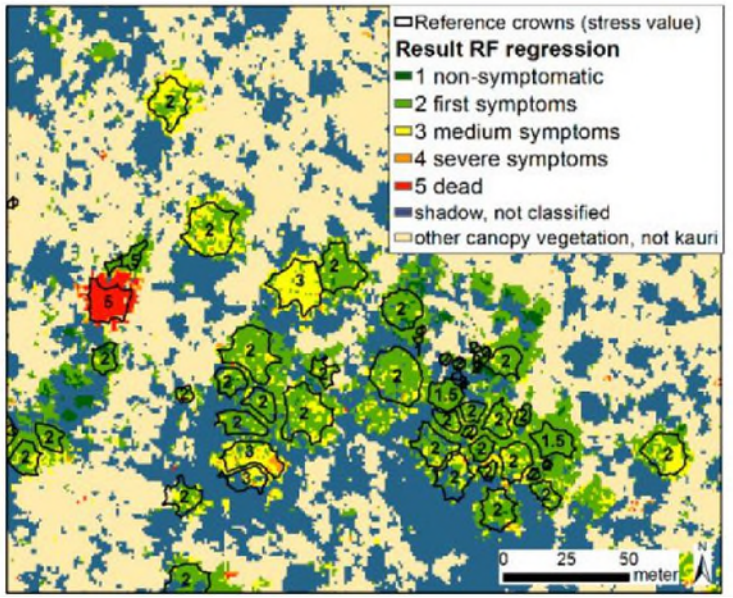
Common statement from landowners/homeowners about attacks by the "stress-responding" bark beetles:

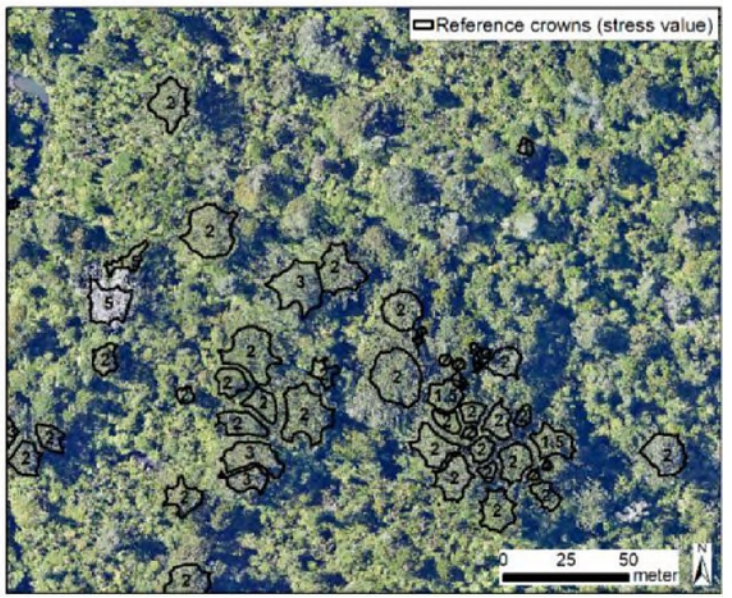
But those trees looked perfectly healthy!

However:

- Stress often does not cause visible symptoms (such as crown wilt) until after the tree is functionally dead.
- Bark beetles are able to detect the scent of a stressed tree long before we can see symptoms.

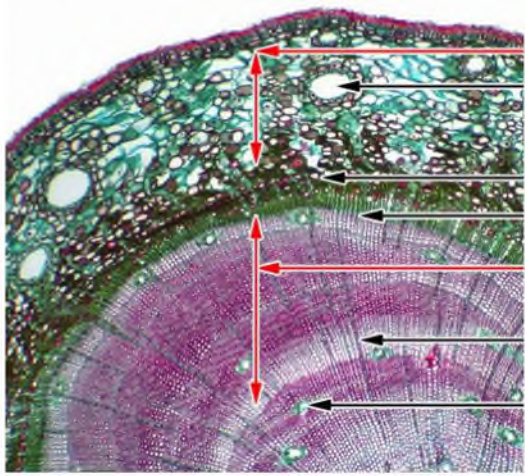
Possible future tool for forest managers:
Hyperspectral imagery from UAVs (drones) to automatically identify tree species and detect tree stress.





•Indicators of an Infested Tree: Pitch Tubes

- Defense triggered when bark beetles disrupt pressurized resin ducts (canals) in phloem
- Resin gushes, may smother and “pitch out” beetle
- Beetle keeps excavating, resinous clump builds on outer bark.
- May be absent when beetles infest severely stressed or functionally dead trees (no resin pressure).



Pitch tubes: differences between species

Details highly variable, but in general...

- *Ips*: Small pitch tubes, randomly located, often on bark plates
- SPB: Small pitch tubes, mostly along bark crevices
- BTB: Large pitch tubes, near base of tree, also mostly in crevices. Entrance hole larger in diameter.
- Pitch color is not diagnostic – mainly varies with the species of pine (e.g. loblolly = white, slash = reddish)

•Indicators of an Infested Tree: Boring Dust

- Reddish-brown, crumbly boring dust from entry through outer bark
- Can be especially abundant with *Ips*, because they keep their tunnels clear by shoving out the frass

- Indicators of an Infested Tree: **Galleries**

- Tunnels through inner bark, may score sapwood surface
- Shape of galleries often useful for ID.
- Often obscured by secondary borer feeding.
- If the bark is loose: chop around an area with a hatchet, then peel from edge.
- If bark is tight: shave through outer bark with knife, chisel, machete, etc.

- Peel the bark!

•*Ips* galleries

- Male excavates nuptial chamber
  - 1 to 6 females excavate egg galleries, roughly parallel to grain of wood (resulting **"I" "Y" "X"** shapes), kept clear of frass.
- Larval feeding galleries emerge from egg galleries

Ips galleries: real-world examples




•SPB galleries

- Female initiates attack
- Male & female excavate winding, S-shaped egg galleries, packed with frass
- Late-instar larvae feed on fungal mycelium in chambers, often move into outer bark layers to pupate.

SPB galleries: real-world examples

•BlB galleries

- Galleries wide, often no clear pattern.
- Larvae sometimes feed together in an expanding swath

•Initial Egg Gallery Larval Feeding

•Larvae form small chambers at end of development

•Indicators of bark beetle infestation: Exit Holes

- Small, scattered circular holes in outer bark
- About the width of the adult beetle
- Indicates that some or all of the next generation has already left

Indicators of an Infested Tree: Blue Stain Fungi

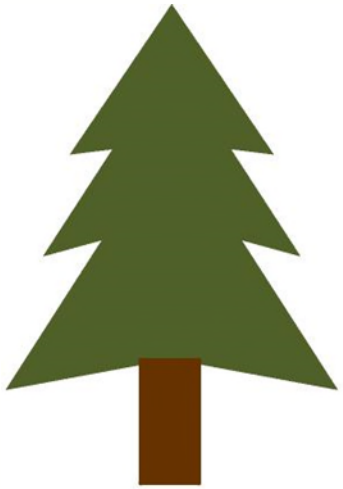
- *Ophiostoma, Ceratocystis, Leptographium* spp. carried by bark beetles.
- Disrupt sapwood function
- Infection is <u>not necessary</u> to infest or kill the tree, but does contribute to its rapid death
- Can be antagonistic w/ beetles (especially SPB), <u>not symbiotic</u> as once thought.
- Does not decay the wood, but reduces timber value (except for specialty paneling)


"Denim wood"

Indicators of an Infested Tree: Crown Wilting

- Often the first symptom noticed, but almost the last to happen.
- Gradually fading to yellowish, then brown, then bare.
- Bark beetles have often finished & left before crowns fade.
- Can indicate whether or not it's an active outbreak, which direction(s) it's spreading, etc.

Crown wilting of infested pines: how to “read the tree.”



Still Green

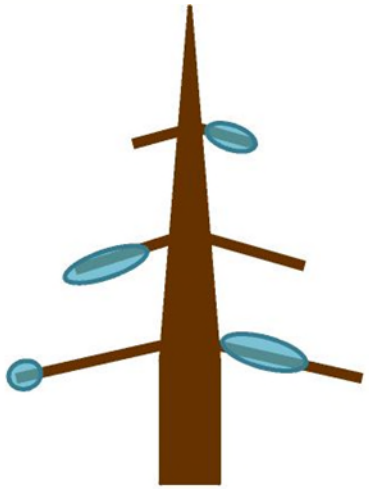
- Freshly-infested tree.
- Indicates that the spot is “active.”
- Bark is often still tight, difficult to peel.
- If no pitch tubes are forming, tree was dead or near death before beetles attacked.

Yellowing/Fading

- Tree is effectively dead by this point.
- Bark becomes easier to peel.
- Bark beetle reproduction is well underway, some emergence may occur.
- Often the best choice for identifying the bark beetle species involved.

Reddish/Brown

- Bark very easy to peel.
- *Ips* and SPB: next generations often have already emerged.
- BTB: often still developing.
- Feeding from other insects (roundheaded/flatheaded borers, termites, etc.) often obscures evidence of bark beetle species.



Grayish/Bare

- Needles mostly faded, fallen. Wood decay sets in.
- Bark often falling off the stem by itself.
- No active bark beetles left in the tree, galleries often obliterated.
- Termites, wood-boring beetles, other scavengers, predators, etc.

Prognosis for an Infested Tree

- ***Ips* and SPB:** successfully colonized trees usually die.
  - Are often near death before infestation (*Ips*, non-outbreak SPB)
  - Usually many more attacks than you can see from ground level.
  - Associated fungi invade sapwood
- **BTB:** Trees often survive a mild to moderate infestation
  - May better tolerate defenses of trees that are "stressed" but not yet "dying."
  - Slower to develop, limited to lower stem.
  - "Rule of Thumb" to evaluate survival chances

Rule of Thumb (for BTB only)

Green crown, and fewer pitch tubes than the diameter of the tree in inches: tree might survive!

No. of pitch tubes greater than diameter of tree in inches, and/or needles have begun to visibly wilt ...survival unlikely.

•Stand-level Prognosis

- ***Ips*** **and BTB (the "stress-responders"):**
  - Infestations usually single, scattered, or clumped, and limited in time and space (≤ 1 ac, ≤ 1 year)
  - Severity can be high, resulting from stress and disturbance factors
    - Drought
    - Flood
    - Fire
    - Storm
    - Thinning, site disturbance
    - Root disease

•Typical – scattered & clumps

•Texas in 2011 – Severe Drought

- **Early Summer 2019 – After Hurricane Michael (October 2018)**
  - Widespread pine mortality with reported in trees that had initially survived the storm.
  - Hidden damage from wind, especially in younger trees that bent, rather than breaking.

- Primary bark beetles at work: *Ips* pine engraver beetles.

•Stand-level Prognosis

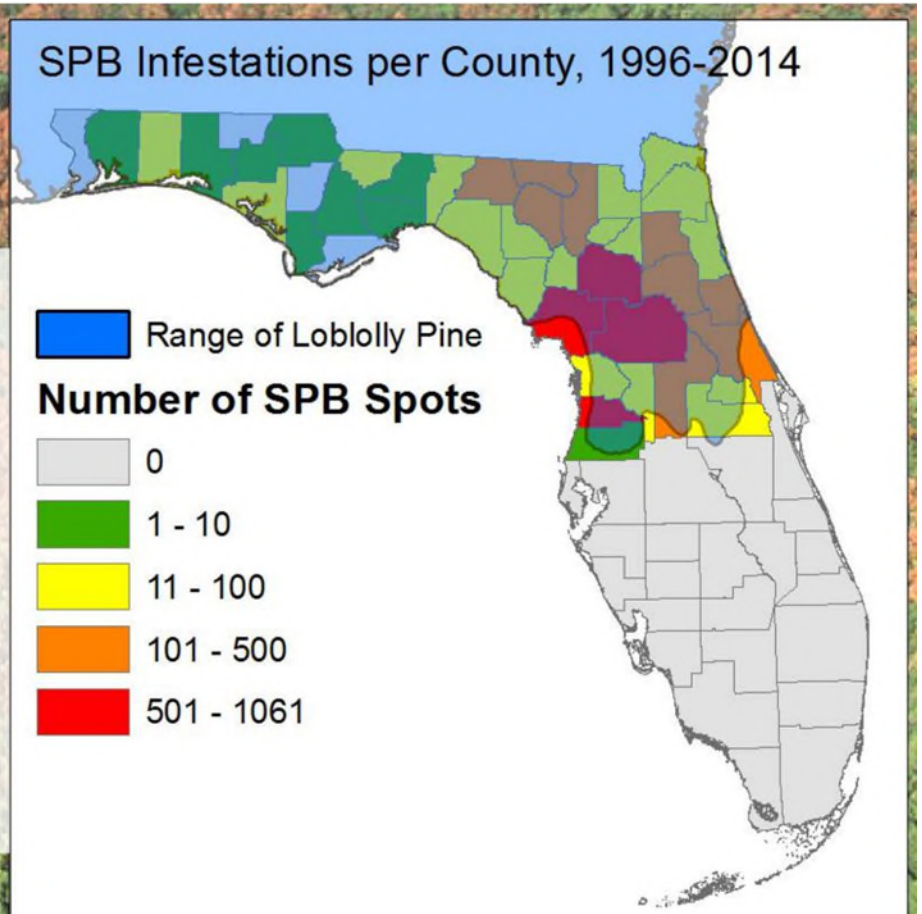
- **SPB:**
  - Infestations develop in spreading "spots"
  - Mass attack mediated by pheromone signals
  - Tree stress is a risk factor, but not required – <u>stand density</u> is the most important risk factor.
  - In outbreak conditions, can kill
- apparently healthy pines across large areas
  - Spread can be very rapid (up to 75 ft/day)

SPB Beetle Spot Growth


Indian Mounds Wilderness, Texas, 1993 (Ron Billings)

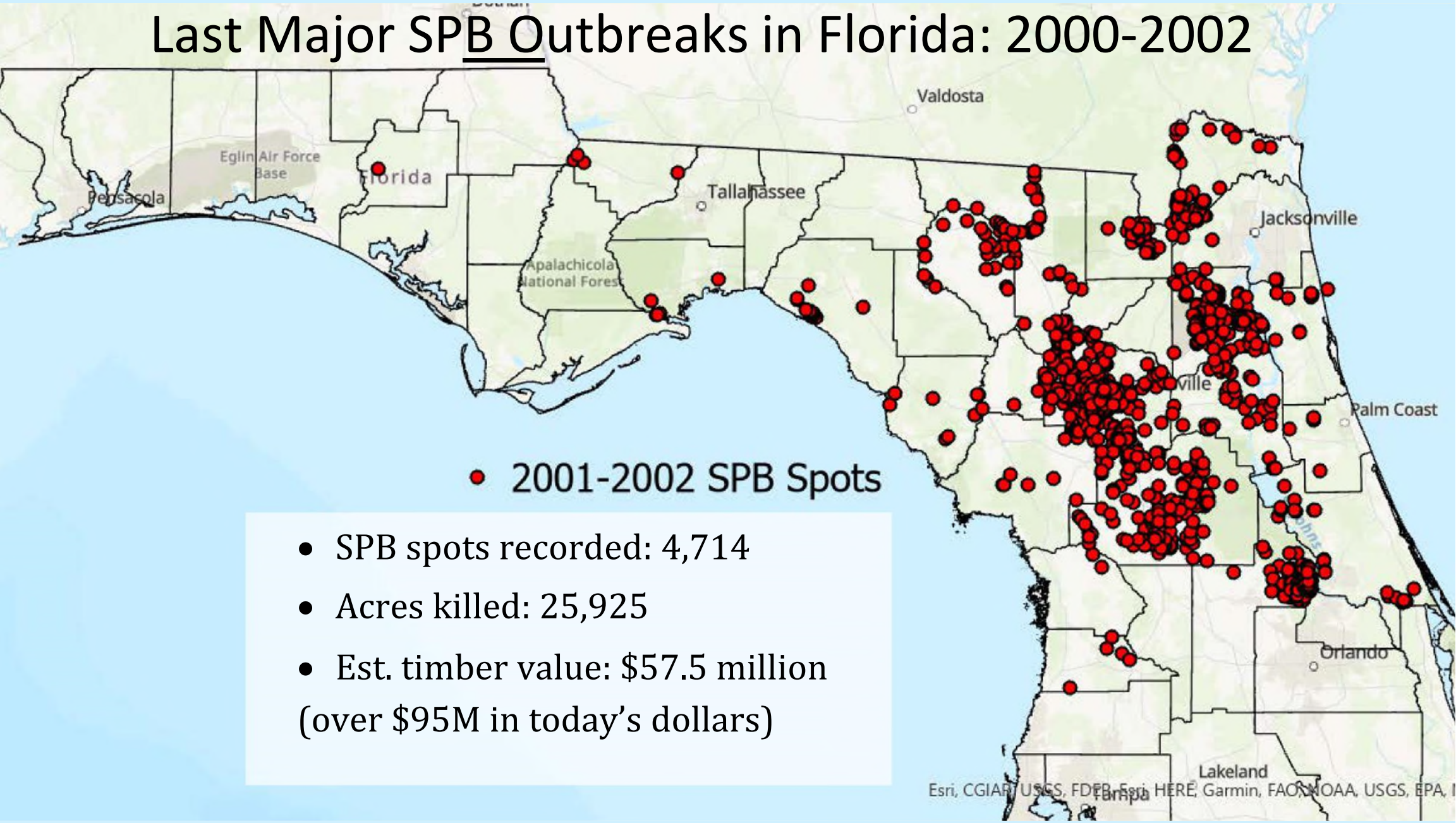
Southern Pine Beetle Outbreak History

- Historically, regional outbreaks ~every 7-12 years
- Last major outbreaks in FL: 2001-2002 (centered around Gainesville)
- **Never reported in South Florida** (range ends around Orlando)



Corresponds to range of preferred host, loblolly pine

Last Major SPB Outbreaks in Florida: 2000-2002

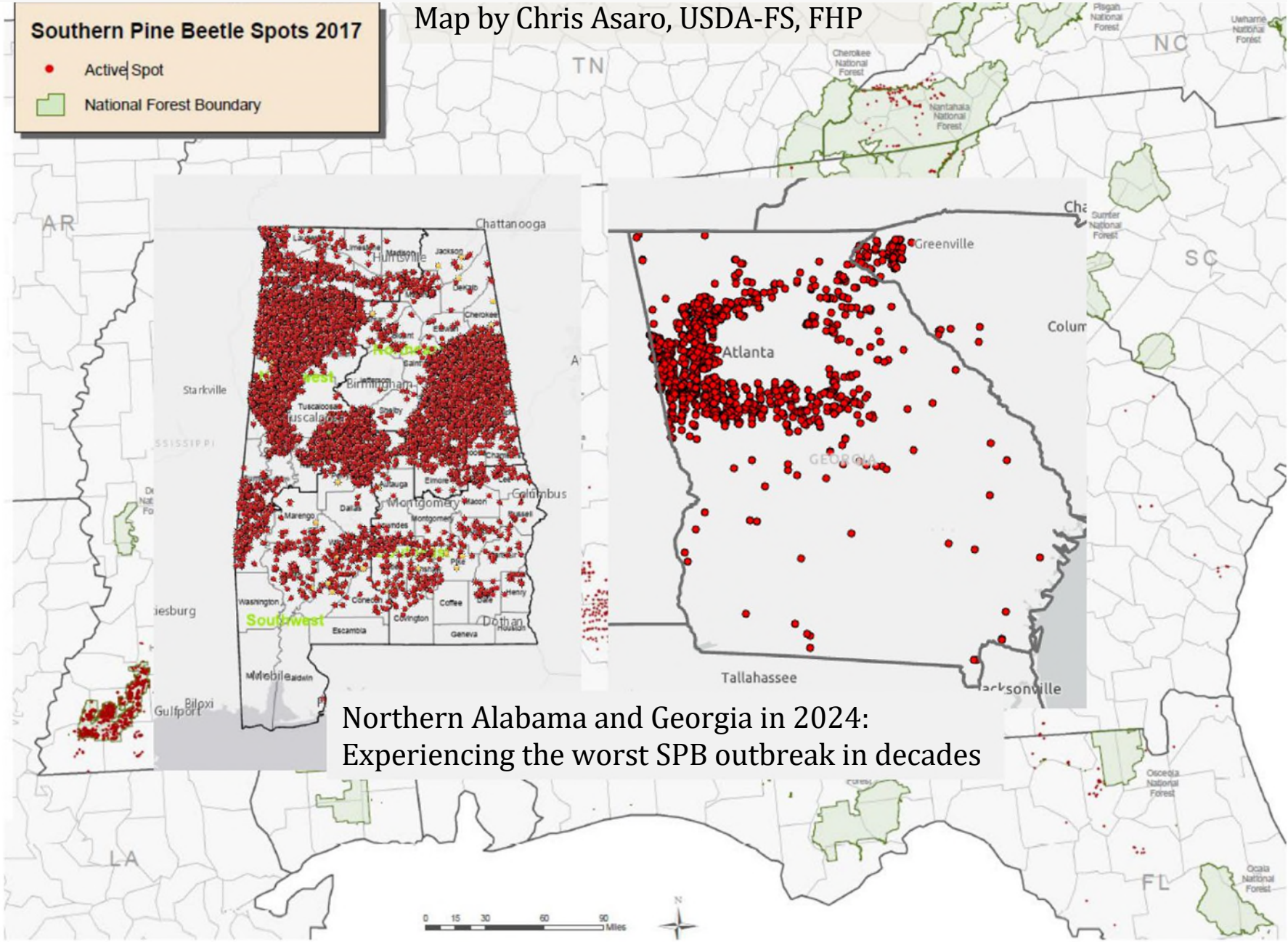


- SPB spots recorded: 4,714
- Acres killed: 25,925
- Est. timber value: $57.5 million

(over $95M in today's dollars)

Recent activity southwide: strongly concentrated in <u>National Forests</u>

(Due to an abundance of mature, overstocked, unmanaged, even-aged loblolly pine stands.)



•Pine Bark Beetle Management:

•Suppression

- **For *Ips* and BTB:**
- **Selective removal of infested trees from a stand is not recommended**
  - **Stand disturbance increases tree stress, susceptibility**
  - **If the trees are stressed enough, beetles will fly from far away to find them. If they're healthy, beetles nearby will ignore them.**
- **Monitor rate of new infestations**
  - **Will often be self-limiting**
  - **If losses begin to exceed your tolerance, clearcut in contiguous blocks**
- **In urban & ornamental settings: remove dead/dying trees that may fall on people or property. Otherwise, removal is not urgent.**

•Polk Co. Florida: trees remaining 1 year after repeated attempts to selectively remove BTB-infested trees.

Pine Bark Beetle Management: <u>Suppression</u>

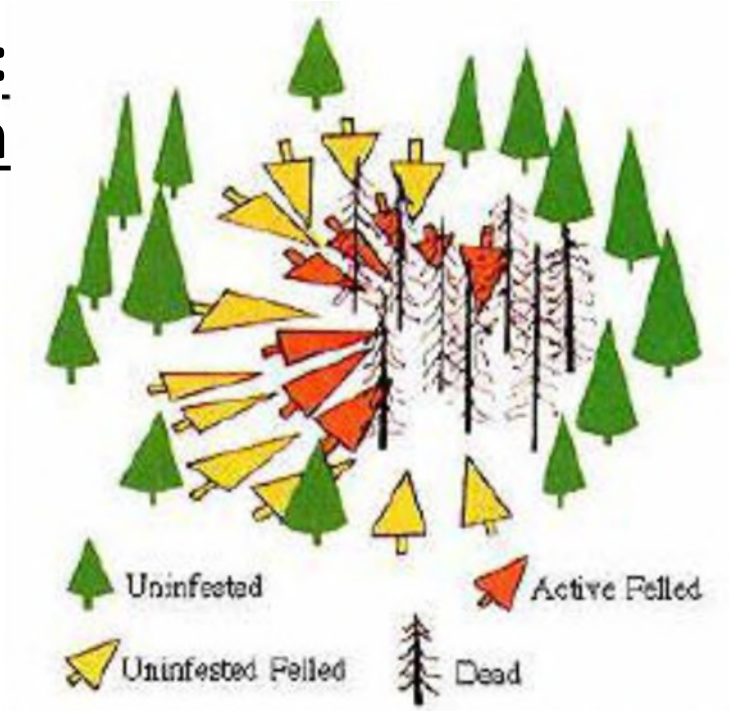
Southern Pine Beetle

- At earliest detection of an active, spreading infestation (spot), **Cut and Remove:**
  - Cut down & haul out all infested trees
  - Plus a buffer of un-infested trees in direction of spot spread.
  - Disrupts pheromone signaling for “mass attack”
  - Leave dead, vacated trees (for natural enemy development)
- <u>In urban/residential landscapes:</u> Rapid removal of infested trees is recommended, may consider insecticides on nearby un-infested trees.


•To avoid being leap-frogged by SPB:
•Delineate & establish buffer at time that suppression harvest begins
•Remove buffer ahead of leading edge
•40-70 feet wide, or equal to height of trees

•Pine Bark Beetle Management: <u>Suppression</u>

- **Southern Pine Beetle**
- If removal is not feasible:
  - **Cut and Leave:** cut down infested trees and buffer strip, lay down towards center of spot
    - Must be more closely monitored
    - SPBs visually target <u>vertical</u> stem profiles
    - Mass attack disrupted
    - May reduce SPB emergence from infested trees.




SPB CUT AND LEAVE

Forestry Management Technique: Prescribed Fire

PRESCRIBED BURNING

One of the cheapest and most effective practices used in the management of pines, except fire-intolerant sand pines, is a well-planned and -executed prescribed burn.

Prescription burning objectives are numerous and varied, such as

- Reducing hazardous fuel buildup
- Improving wildlife habitat
- Controlling undesirable competitive plant species
- Preparing sites for regeneration
- Controlling brownspot disease of longleaf pine
- Improving forage for livestock

Reduction of Fuel Buildup

In Florida, forest fuels such as leaves, grasses, shrubs, and small trees accumulate rapidly in pine stands. These fuels are significant fire hazards to pines, especially during periods of drought. The prescribed burn reduces these fuels by burning them under ideal conditions in a controlled manner. If a wildfire later occurs, the damage is less severe on an area that had previously undergone prescribed burning.

Fuel reduction burns are normally conducted during the winter when temperatures are cooler and the pines are dormant. The pine trees themselves should be at least 4 inches in diameter and measure 10–15 feet from the ground to the lowest green branches. Otherwise, the young trees may be severely injured or killed by prescribed fire.

Figure 8.3. Note how this prescribed fire has reduced the height of forest fuels.

Wildlife Habitat Improvement

Prescribed burning is used to improve timberlands for a variety of preferred wildfire food plants. This includes plants established as a result of seeding on bare soil as well as young succulent hardwood sprouts. Different benefits to wildlife and their habitats come from burning during different seasons. Time is important to benefit specific species.

Figure 8.4. Grass growth is stimulated by fire, which increases forage for this elk in Wyoming

Control of Undesirable Species

The use of fire for TSI has already been mentioned. Spring or summer burns provide the best kill of hardwood competition, but a fuel reduction burn may be needed during the preceding year to prevent heavy damage to the pine trees. Fire is the cheapest method of TSI available, but careful planning is needed to avoid damage to valuable trees.

Site Preparation

Figure 8.5. Note the pine needle-covered soil before the fire, versus the exposed mineral soil after the fire.

Site preparation burns to expose mineral soil or to reduce debris, logging residue, or competing vegetation may be required for planting, direct seeding, or natural regeneration. In open stands, burning is often the only site preparation needed. Burning in early spring prior to seed drop in the fall allows pine seeds to become established in a light grass, which should result in excellent seedling establishment.

Longleaf Pine Brownspot Disease Control

Brownspot is a serious fungus disease of young longleaf pines. The disease can kill or delay height growth in the grass stage of the trees for up to 10 years. Fire burns off infested needles and destroys the fungus. This burning is usually conducted in the winter. The fire does not destroy the tree's terminal bud which is protected by the cluster of green needles around it. This allows the seedling to survive during prescribed burns.

Figure 8.6. Longleaf pine in the grass stage.

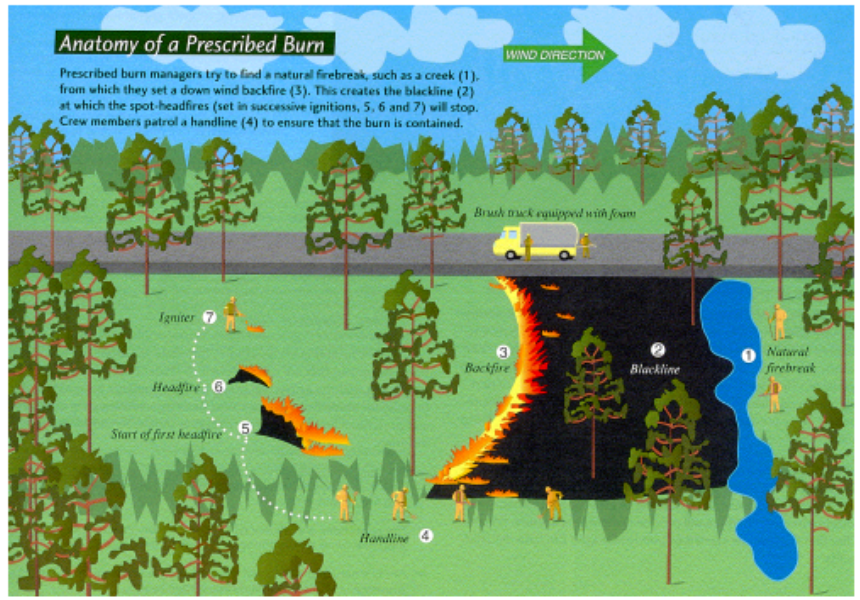
Livestock Forage Improvement

Just as wildlife is benefitted when prescribed burning produces new forage, so too is domesticated livestock. Years ago, cattle ranches made burning the woods an annual practice. Unfortunately, many of those fires were as damaging as wildfires. Today, however, modern burning techniques are used to improve forested rangeland.

Prescribed Burning Techniques

Various firing techniques can be used to accomplish the prescribed burning objectives. Almost all of these techniques incorporate backfiring. A ***backfire*** is started along a prepared firebreak, such as a road or fireline, and allowed to burn *against* the wind. As the backfire moves into the wind, it increases the width of the firebreak by creating a ***blackline***. A blackline is an area that has just burned and prevents the potential start of a wildfire. If embers are carried aloft, they usually fall harmlessly into the blackline. ***Headfires*** are allowed to burn *with* the wind. The major cause of unsuccessful control burns and killing desirable trees is trying to burn too much area too fast. Backfire is the safest, coolest, and slowest method of control burning.

Figure 8.7.



FIRE BEHAVIOR TERMS

1. Parts of a fire (Figure 7-1):
    a. **Head** – The forward, wind driven edge of a fire; usually the hottest and fastest moving area with the highest flames
    b. **Flanks** – The parts of the fire burning perpendicular to the wind
    c. **Rear** – The part of the fire burning into the wind; usually the slowest moving area
    d. **Islands** – Unburned patches of fuel inside the fire perimeter
    e. **Fingers** – Projections of the fire perimeter separate from the head
    f. **Pockets** – Areas of unburned fuel outside the fire perimeter that occur between the fingers and the head
    g. **Spot Fires** – Fires ignited outside the perimeter of the main fire by a firebrand

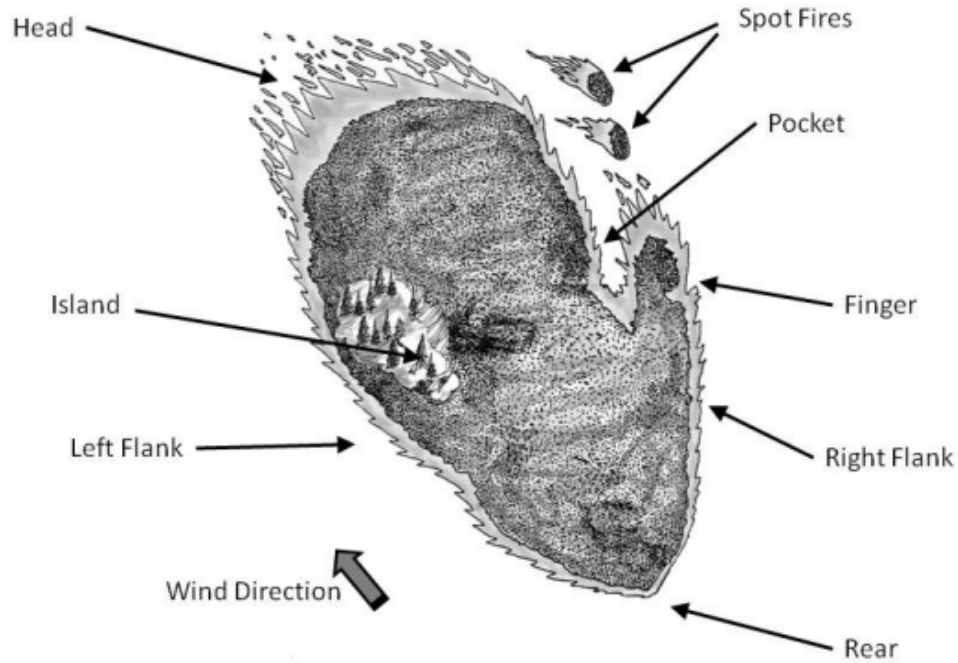


Figure 7-1
Parts of a Fire

Pacing

Forestry Skills: Pacing

1 pace = 2 steps

The standard unit of distance measurement is the ***chain*** or ***Gunter's chain***, which equals 66 feet. How many of your paces are in one chain?

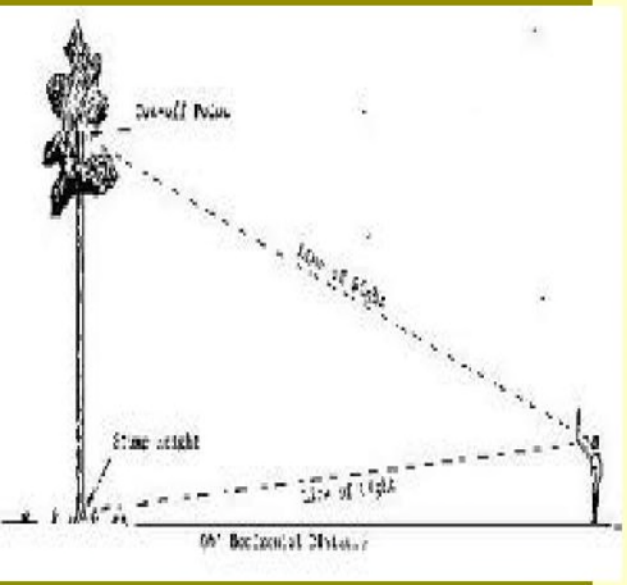
Several forestry tools are calibrated to be accurate from a distance of one chain.

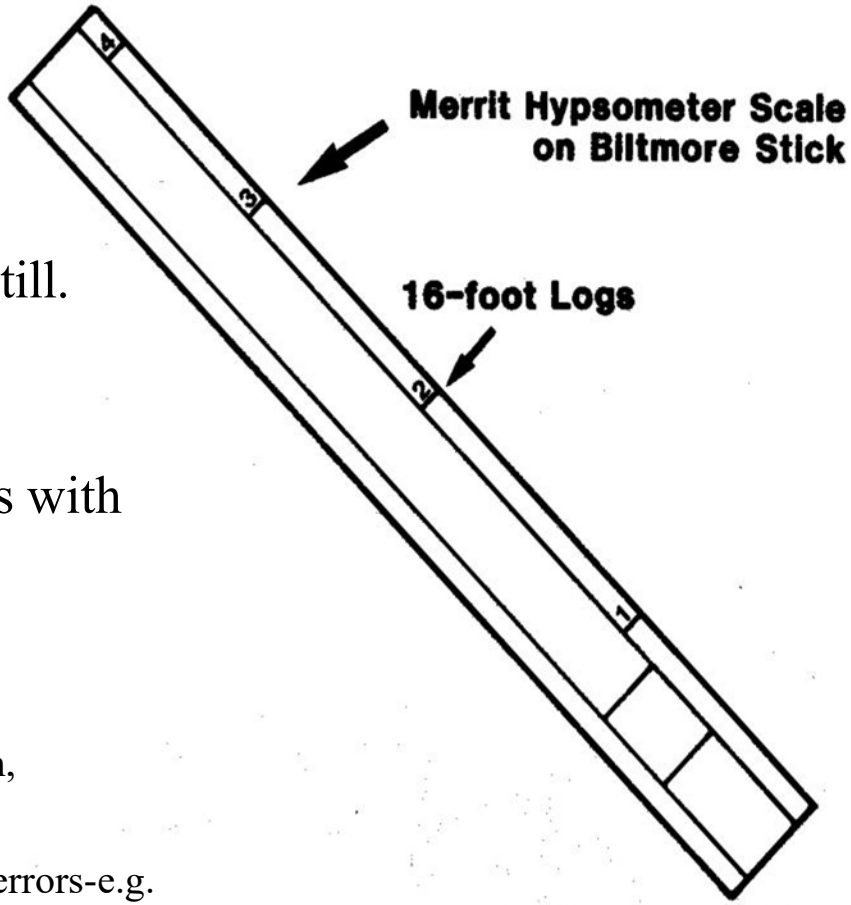
There are 10 sq chains in an acre. Students should be able to pace an area to determine its acreage as in the next example.

Forestry Skills: Biltmore Stick

Biltmore Stick

- Used to measure height
- Stands 66ft away from the tree
- Hold 25’ from eye
- Hold the stick straight and keep it still.
  - Line up the bottom of the stick With the base of the tree.
  - Read off the number of 16ft logs with your head still!



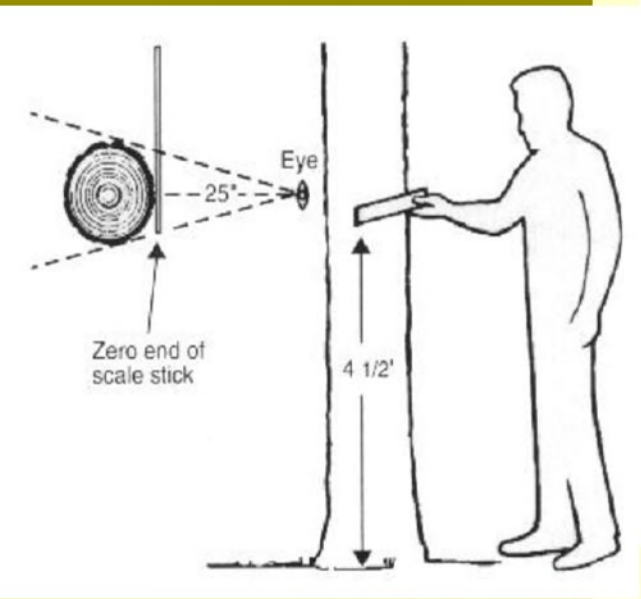


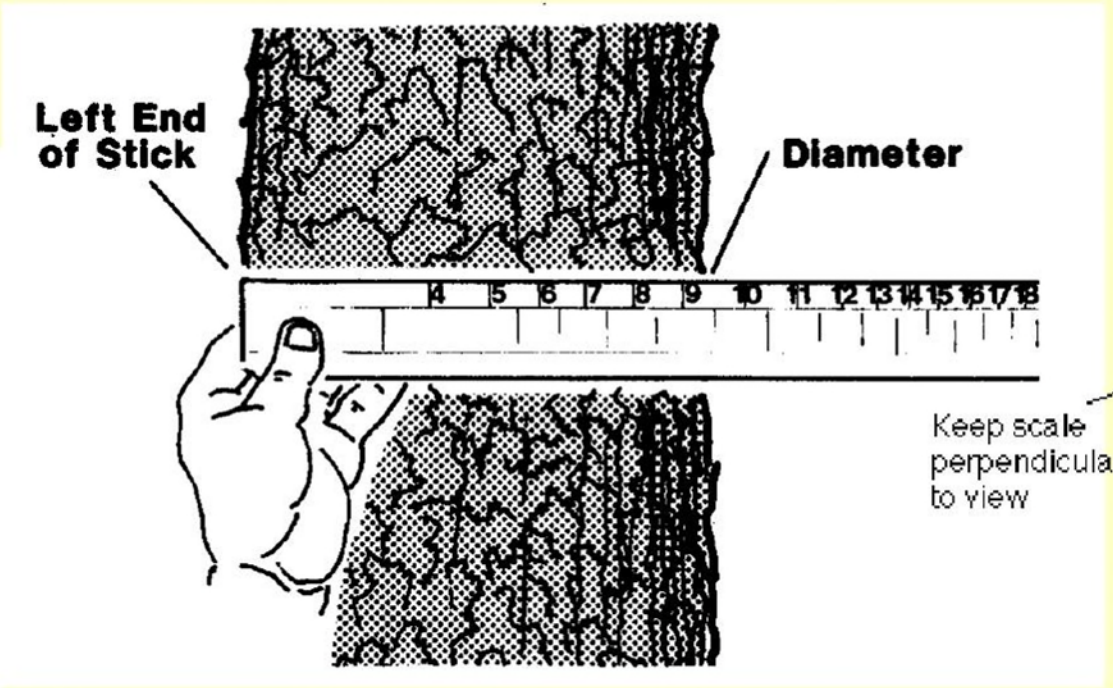
TIPS:

- Read the question carefully- e.g. are you measuring total height, height to first branch, merchantable height?
- Follow instructions regarding rounding errors-e.g. down to nearest $^1/_2$ log, $^1/_4$ log? Do you have to convert to feet??

Biltmore Stick

Forestry Skills: Biltmore Stick





Measure Diameter with a Biltmore Stick

- The stick is held against the tree trunk at arm's length (about 25 inches from the eye- practice to get it the right distance!).
- The stick should be perpendicular to your arm and should just touch the trunk.
- Align the "0" (zero) mark with the edge of the trunk, so it appears they are in line.
- Without moving your head, look at the far end of the stick, and note where the other side of the trunk crosses the stick.
- Read the measurement directly from the stick.

That's all there is! The key is to practice for accuracy and consistency.

The points to remember are:

- Keep the stick perpendicular to your reach.
- Hold the stick the right distance from your eye (25 inches is standard, but you can customize your stick)
- Do not move your head when reading the far end (this causes a shift in the intersect with the tree trunk)
- Accuracy is not guaranteed. Practice helps. The nearest two-inch diameter class is acceptable.

YouTube Videos to look at!

Forestry Measurement Skills:
https://www.youtube.com/watch?v=xvuLaWGQD2U

Pacing:
https://www.youtube.com/watch?v=4BBOnRmyM20

Biltmore Stick:
https://www.youtube.com/watch?v=NOWVuKNwzm0

Oral question:

The 2025 Current Issue is:

“ROOTS AND RESILIENCY: FOSTERING FOREST STEWARDSHIP IN A CANOPY OF CHANGE”

The Forestry Oral question will focus on the current issue and information included in the study material.

While using the study materials and links for the current issue, students should keep in mind the effects of climate change related events on forested ecosystems and rangelands across Florida, and as land managers, the solutions to suppress the effects of these events.