PROTECTING THE FOREST

WILDFIRE

Wildfire has always been a natural part of Florida's forests. Over time, Florida's trees and plants have adapted to the presence of frequent fire. Some plants, such as wiregrass, have evolved to require fire as a means to perpetuate itself. On occasion, wildfire can be destructive. It can damage forests, kill timber or retards its growth, reduce soil fertility, cause erosion, pollute air and water, and alter or destroy wildlife habitat. Two main causes of wildfire in Florida are carelessness and arson. Although wildfire can be a problem, properly planned prescribed burns can benefit plant communities that wildfire once served.

Fire Season

Each year there are periods when the danger of forest fire is especially high. These periods are referred to as *fire seasons*. Florida's main fire season occurs January through April, when air humidity is low and flammable forest fuels — especially dead, dry leaves and grasses — are abundant. Human activities in the woods also increase at this time of year, due in part to Florida's hunting season and cooler weather. The larger number of people in the woods increases the chances of a wildfire. The fire season ends when grasses green up in the spring or when summer rain showers begin. In times of drought, however, the fire season may extend through the summer.

Detecting Wildfires

Forest fire lookout stations are strategically located throughout Florida. Most of these towers are spaced on approximately a 16-mile grid, but others are located in remote or heavily forested areas. The system has developed gradually over the years, expanding and adjusting to meet changing conditions. When smoke is spotted, the forest towerman determines its direction from the tower.

Aircraft are used to cover extensive areas not covered by fire lookouts or when visibility has been reduced by haze, fog, or smoke. Air patrols can often spot small fires before the smoke becomes visible to the tower.

Reporting of fires by the public supplements the detection system. Concerned individuals often report small fires via cell phone before they are detected by either aircraft or towers.

Fighting Wildfires (See Figure 6.1.)

Most forest fires are suppressed by indirect attack, which involves removing forest fuels in a strip called a ***fireline*** or ***control line***. In Florida, firelines constructed by tractor-plows are the main means of suppressing fires. Brush, trees, and litter are removed ahead of advancing flames. The fire burns up to the line and stops. However, wind can send burning embers across the line to rekindle the wildfire. The width of the fireline and its distance from the flames are dictated by the weather and fuel conditions. Safety is a most important item to consider in combatting forest fires.

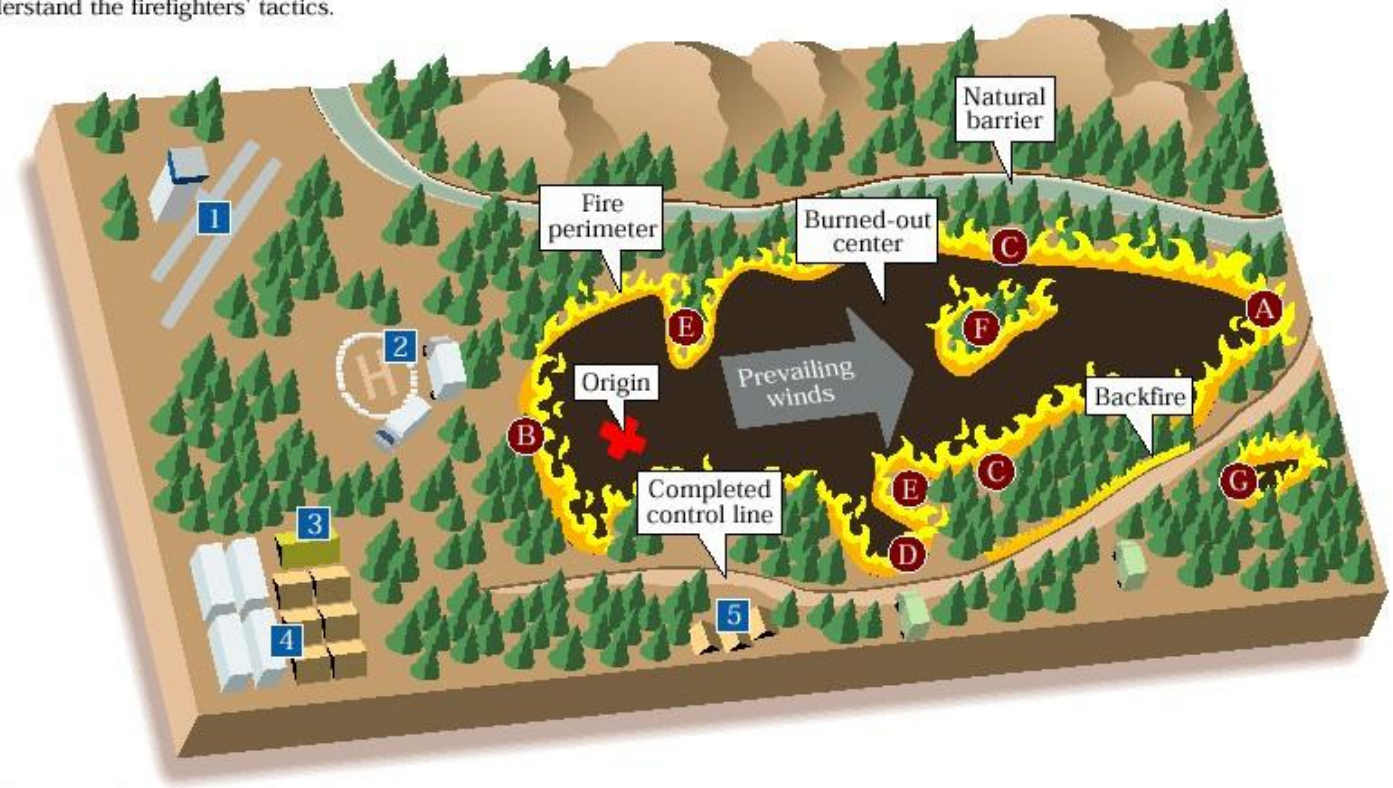
Firefighters will often use ***counterfiring***, which is deliberately setting fire to forest fuels with the intention of stopping a wildfire. Firelines are constructed ahead of the wildfire, then the fuel between the fireline and the advancing flames is burned, widening the fireline and stopping the fire. Counterfiring is not used in extremely heavy fuels, dry leaf litter, or excessively high winds. Under these conditions, counterfiring can compound the fire problem instead of suppressing it.

The use of water to cool and extinguish wildfire is called direct attack. It is usually coupled with indirect attack since limited water availability and difficulties in transporting water through the woods usually make widespread direct attack unfeasible.

Water is also used in the final stages of suppression, or mop-up. Small ***spot-fires***, smoldering stumps, and burning logs are extinguished to prevent rekindling of a wildfire. Water or fire retardant chemicals may be used in either indirect or direct attack when dropped from large aerial tankers. In direct attack, the chemicals or water are dropped directly on the fire. This tactic is usually used on small fires. Indirect attack from aerial drops is similar in its effect to that of firelines. Chemical retardants are dropped in a continuous line across the path of the fire. This technique is used in inaccessible areas, on very hot fires, and to reinforce ground efforts.

Fire basics

Three components are needed to produce a fire: fuel, heat and oxygen. Combined, they're called the "fire triangle." By nature, a triangle needs three sides. Take away one of the sides, and the triangle collapses. The same is true of fire. Take away any of the three components of fire – fuel, heat or oxygen – the fire collapses, meaning that it can't burn. Firefighters try to do just that – remove one of the three essential components of fire. For example, when they dig a line around a fire, fuel is removed. When water is dropped on a fire, it reduces the heat. Retardant blocks the oxygen. If you think of fighting fire in terms of breaking the fire triangle, then it's easier to understand the firefighters' tactics.



Combating the fire

1 Airport
Airtanker bases are at fixed locations throughout the country. Aerial operations can also be run by setting up a portable retardant base.

2 Helicopter base (heliport)
Often dispatched with support personnel and support vehicles, helicopters are used for transport of crews and cargo in addition to dropping water or retardant.

3 Incident command post
Where the incident management team is based.

4 Fire camp
Where firefighters eat and sleep. May include the mess tent, medical and shower trailers, and supply cache.

5 Spike camp
Forward base for firefighters.

Anatomy of the fire

A Head
Often where the fastest rate of spread occurs. The "front" of the fire is the section that burns most intensely and is difficult to control.

B Foot
Opposite of the head, usually nearest to the point of origin.

C Flanks
Sides between the head and rear. If the wind shifts one of the flanks could become the head. Flanks usually burn less intensely than the head.

D Fingers
Shifting winds and changes in topography and fuel can cause points, or fingers, to develop behind the head and along the flanks.

E Pockets
Deep indentations in the fire perimeter of unburned fuel.

F Island
Unburned areas inside the fire perimeter.

G Spot fire
Spotting occurs when the wind or hot air rising from the fire carries embers upward and over to other fuels ahead of the fire, starting a new fire.

Mark Waters/The Arizona Republic

Figure 6.1. Fireline (*completed control line*), Counterfire (*backfire*), and Spotfire (*letter "G"*).

INSECTS AND DISEASES

Insects and diseases that damage and kill trees will always exist in our forests. Under normal circumstances, they are held in check by natural predators, parasites, and ***pathogens*** or environmental conditions, such as temperature or moisture. Occasionally, however, insect and disease populations will increase to the extent that large volumes of timber are killed or damaged in a relatively short period of time.

Insects and diseases are generally unspectacular in the way they attack and kill trees, yet they cause a greater loss of trees than fire.

Since complete eradication of forest pests is impossible, control measures are designed to reduce losses to an acceptable level. Diagnosis of pest problems and application of economical control measures are the responsibility of forest managers, with the help of forest ***entomologists*** and forest ***pathologists***.

Insects and diseases are often closely associated. For example, a disease may be spread by insects which carry fungus spores from tree to tree. Other times, an insect will only attack a tree previously infected by a disease. Whether a tree is damaged by insects or diseases, the result is a slower-growing or dead tree. Trees have their own natural defense mechanisms against insect and disease attacks. It is when a tree is weakened or injured that insects and diseases often find it easy to gain entry. This injury or weakening can be due to

- Fire
- Weather, including wind storms, lightning, floods, drought, or extreme cold
- Pollution
- Grazing damage from too many hogs, cattle, or other animals in an area or the lack of a correct food supply
- Logging damage, construction damage, or damage from heavy equipment
- Soil or site factors
- Poor forest management

Forest Insects

Entomology is the study of insects. An insect is an animal possessing three pairs of legs, antennae, a ***head***, ***thorax*** and ***abdomen***, and usually one or two pairs of wings. These characteristics separate insects from their relatives the spiders, mites, and crustaceans. A wide variety of insects may attack roots, stems, and leaves of both conifers and hardwoods. Usually, however, one insect will damage only one specific part of a tree. This is a key to

identifying the insect problem. In addition, one insect species normally infests only one species of tree or one tree species group, such as pines. Dendrology skills, therefore, are also very helpful in identifying an insect problem.

Pine Bark Beetles
Longleaf, slash, loblolly, and other pines that have been weakened by lightning, over-crowding, drought, fire, logging damage, and other stress factors are susceptible to bark beetle attack. Pine bark beetles damage and kill trees by tunneling and feeding in phloem tissue. These tunnels, called ***galleries***, vary in shape depending on the beetle species.

The ***Ips engraver beetles*** are the the most common pine bark beetles in Florida. Three species of these beetles are known to damage pines in the state. One species attacks the upper stem and branches, one species attacks the lower crown and midtrunk, and one species attacks the lower portions of the trunk. In many cases, all three species may be found in the same tree. See Figure 6.2.

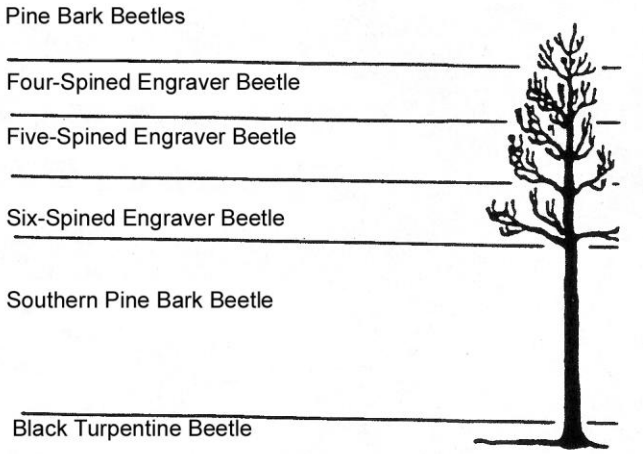


Figure 6.2. Pine bark beetle species can sometimes be identified by the part of the tree attacked.

Adult Ips beetles are brown to black in color and approximately one-quarter inch long. A distinct characteristic of the adults is a scooped-out rear-end, with four to six teeth on the edge of this cavity. Ips beetle attacks may be identified by the presence of dime-sized globs of pitch on the tree bark called ***pitch tubes*** and by Y- or H-shaped galleries beneath the bark. See Figure 6.3.

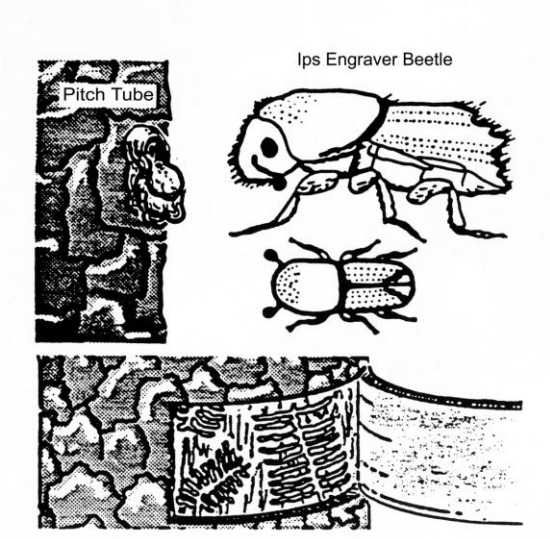


Figure 6.3. Ips engraver beetles are the Number One insect killer of pines in Florida. Ips beetles construct galleries beneath the bark.

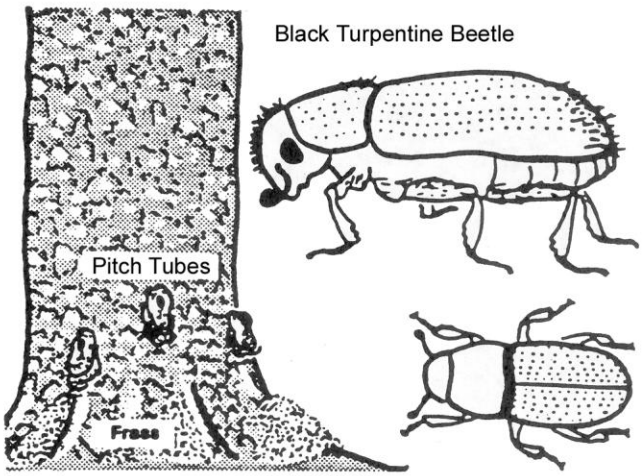


Figure 6.4. The black turpentine beetle makes large pitch tubes at the base of pine trees.

The ***black turpentine beetle*** is larger than the Ips beetle, but it is less prevalent. Adult beetles are brown to black and approximately one-half inch long. Thumb-sized reddish-white pitch tubes and large fan-shaped or D-shaped galleries beneath the bark identify black turpentine beetle attacks. See Figure 6.4.

The best control of pine bark beetles is achieved by maintaining a healthy forest.

Pine Tip Moths

Larvae of the ***pine tip moth*** bore into and kill buds and leaders of young loblolly and shortleaf pines in Florida. This damage usually results in growth loss and deformed trees, and only rarely are trees killed outright. Tip moth damage does not normally occur on trees over 15 feet tall.

Pine tip moths are one-quarter inch long with a one-half inch wingspan. They are copper colored with silvery markings on their wings. See Figure 6.5.

Tip moth infestations can be controlled by planting less-susceptible pine species on appropriate sites and by applying insecticide on high-value shade and Christmas trees.

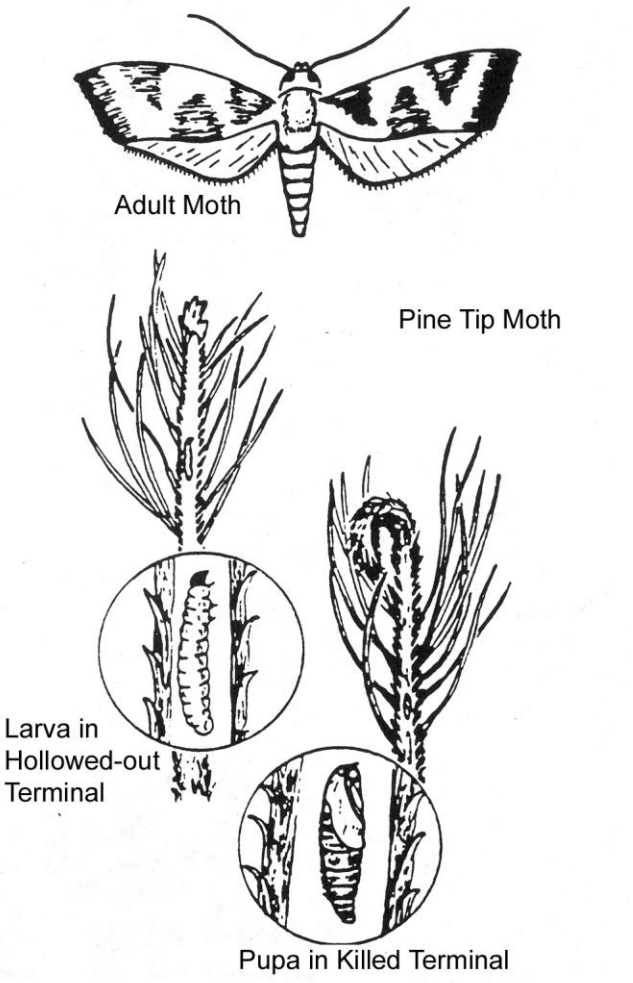


Figure 6.5. Pine tip moths are usually found in young loblolly pine plantations in Florida.

Reproduction Weevils

Reproduction weevils are problems in areas that have been clear-cut and then replanted shortly after the timber harvest. Adult weevils are attracted to fresh-cut stumps to lay eggs and feed on the bark of recently planted seedlings nearby. This feeding girdles the seedlings. Weevil infestations may result in a 50–80% loss in a young pine plantation.

Adult weevils are one-quarter to three-eighths inch long and are a grey to brownish color. They possess a pronounced snout or beak, to which bent or jointed antennae are attached. Dead or dying seedlings with patches of bark missing are clues to reproduction weevil attack. See Figure 6.6.

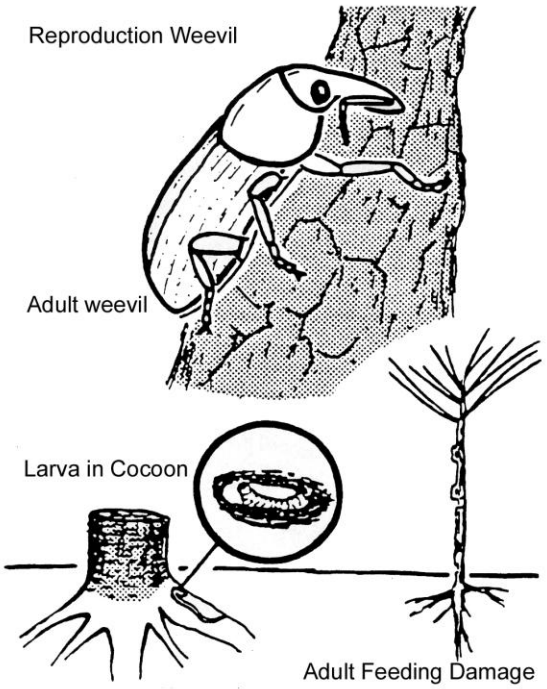


Figure 6.6. Reproduction weevils are problems in areas clear-cut and replanted to pine. Cocoons are made of chewed wood.

Control can be achieved by delaying replanting a clear-cut area for 9 to 12 months. If this is not feasible, seedlings can be dipped in recommended insecticides prior to planting.

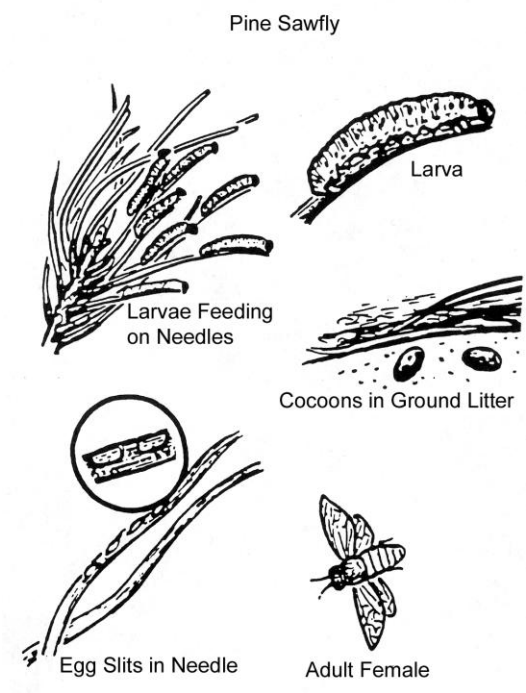


Figure 6.7. Pine sawflies feed on the needles of southern pines.

Pine Sawflies

Eight species of ***pine sawflies*** are known to attack pines in Florida. Pines of all sizes and species may be harmed by one or more of these species of insects. Sawfly larvae feed on the needles. Attacked trees have a bottle-brush appearance, resulting from chewed needles.

Pine sawfly larvae are caterpillar-like and generally have a light green body with black spots or stripes and a red or black head. Adult females are one-half inch long, heavy bodied, and dark colored, and have slender antennae. See Figure 6.7.

Natural enemies normally keep these insects from causing extensive damage, but occasionall, infestations become large

enough to warrant an application of insecticides. Promoting tree vigor ensures a pine's ability to produce new needles following an infestation.

Forest Tree Diseases

Forest pathology is the study of forest tree diseases. A ***tree disease*** is a sustained and progressive impairment of the structure or function of any part of a living tree. Diseases can be caused by a wide variety of factors or agents, both living and nonliving. Living agents of diseases are called ***pathogens***. Types of pathogens include fungi, bacteria, viruses, parasitic plants such as mistletoe, and nematodes, which are microscopic worms. Nonliving disease agents include temperature extremes, moisture extremes, soil compaction, nutrient deficiencies, chemicals, and air pollutants.

In order for a tree disease to exist, a pathogen or a nonliving agent must have three elements: a susceptible host, a favorable environment, and time to develop. If any element is missing, the disease cannot exist. A pathogen alone, therefore, is not a disease.

Symptoms of a disease are abnormal characteristics shown by a diseased tree, such as loss of foliage or heavy pitch flow. ***Signs*** of a disease are the physical presence of the disease causal agent, such as mushroom-like fruiting bodies or powdery spores. Observation of these two clues is critical to diagnosing a disease problem.

Roots, stems, and leaves of both conifers and hardwoods can be attacked by any of a number of diseases. Generally, root and stem diseases are much more damaging then foliage diseases, since most trees can tolerate an ocassional defoliation. Root and stem diseases can ***girdle*** a tree or interfere with a tree's water and food transport system and are therefore considered more serious.

Fusiform Rusts

Fusiform rust is the most serious disease of slash and loblolly pines in Florida and is common in pine plantations. Seedlings and saplings are often killed when infested. Larger trees are weakened and disfigured by the disease, resulting in a loss of lumber grade. Larger trees are also susceptible to wind breakage.

The fungus requires two hosts to complete its life cycle — pines and oaks. However, the fungus does not cause significant damage to the oaks. ***Spores*** are produced on the underside of oak leaves in summer, then are carried to the young leaders, needles, or shoots of a pine. The spores may be carried for several miles. If conditions are favorable, the spores germinate. As the disease progresses, pronounced stem or branch ***galls*** or swellings develop.

Figure 6.8. Fusiform rust galls are a common sight in planted pine stands.

These galls may persist for many years and can either girdle the branch or stem or seriously weaken it. In 2 or 3 years, the fungus produces powdery, bright orange spores which are carried by wind to newly emerging oak leaves, completing the life cycle. See Figure 6.8.

Control of the disease can be achieved by planting less-susceptible species on high-hazard rust sites. Fungicides may be applied to nursery trees. Pruning infected branches is effective if the gall is greater than 1 foot from the main stem. Diseased trees are normally removed in thinnings, and young pines are not usually fertilized, which would increase the amount of shoot growth and thus the likelihood of infection.

Pitch Canker

Pitch canker is a major disease of slash pine in Florida. Severe outbreaks of the disease can result in significant crown and stem damage and mortality. Slash pines of all sizes may be affected.

Spores of the fungus are carried by wind or by the deodar weevil. The fungus enters the tree through wounds, including those caused by the feeding of deodar weevils. Infected trees produce flowing gum. Additional symptoms include death of foliage, called flagging, greyish dead needles persisting for over a year, and cankers (depressed areas) in the bark under which the wood becomes discolored and resin soaked. See Figure 6.9.

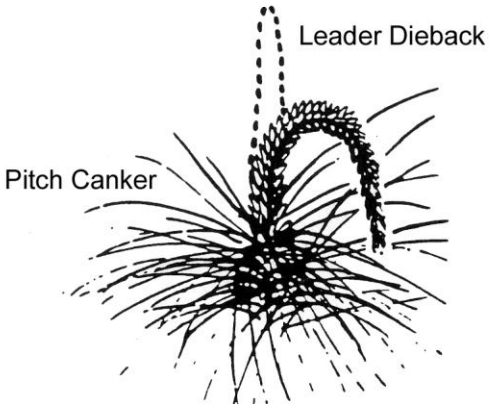


Figure 6.9. Pitch canker is normally found in slash pines in north-central, central, and south Florida.

Seriously infected trees are harvested and plantations are thinned to help control the disease. Care in woods operations needs to be exercised to reduce the incidence of wounding slash pines.

Longleaf Pine ***Brownspot Needle Blight***
Longleaf pine seedlings are susceptible to this disease, which may cause mortality or delay height growth in the stand. Young longleaf pine seedlings less than 3 feet tall are susceptible. Spores of the fungus are carried by wind and rain. Small yellow to brown spots with yellow or purple margins are typical symptoms on infected needles. Eventually, the needles may become brown and die.

Prescribed-burning the seedlings in winter destroys the needles and the fungus. Burning is not used once height growth has commenced. Fungicides are used on nursery grown longleaf pine seedlings to prevent infestations.

Pine Root Rot
Pine Root Rot can cause serious mortality in thinned stands of pine. The fungus colonizes freshly cut stumps, then is transmitted to live trees through root contact and root grafts. Infected trees may show symptoms of gradual crown thinning or windthrow.

At the base of a tree, the fungus produces a large brownish conk or bracket that is white underneath. It may be seen by removing litter and needles from the base of the tree.

Control of root rot is achieved by dusting tops of fresh-cut stumps with Borax to prevent colonization. Restricting thinning operations to summer months also discourages colonization, due to the fact that the stump surfaces are normally too hot to allow germination of the fungal spores.

Other Tree Problems

Chlorosis
Chlorosis refers to the uniform yellowing of the leaves resulting from a decrease in the normal amount of chlorophyll present in the leaves. Chlorosis may develop in the leaves of trees as an indicator of a number of difficulties. Chlorosis has been reported on the heavily shaded branches of some trees due to too little light being present. Some sources of injury which can induce chlorosis include fungi infection, pH, virus problems, physical damage to the root system, insects, low temperatures, toxic substances, excessive soil moisture, and too much or too little nutrient supply.

Leaf Scorch
This is the browning of the edges of the leaves and in the areas between the major veins of the leaves. Leaves develop ***leaf scorch*** when they are unable to obtain adequate amounts of water from the roots of the tree. This may occur due to some interference between the roots and leaves, or some soil condition. Some of the common causes are

- Trees growing in areas where root expansion is limited
- Paving of soil area over the roots of existing trees
- Excavation of large areas close to the tree
- Addition of soil fill material over the existing root system of the tree
- Application of salts or other harmful chemicals to the soil
- Trees growing in shallow soils
- Root or stem diseases or injury

Stress

Stress in trees can be induced by a variety of factors and may be chronic (recurrent or long-lasting) or acute (sudden and intense). Mineral nutrient imbalances and extended droughts are examples of factors inducing chronic stress. Untimely and severe freezes, ***lightning*** damage, floods, and construction damage are examples of acute stress.

Figure 6.10. Lightning strike in Okeechobee County.

Stress on trees can often be a subtle thing. Tree trunks and branches damaged (stressed) by construction activities are usually obvious (breakage and debarking). Stress resulting from soil compaction or air pollution is much more difficult to recognize and define.

Stressed trees are a preferred target of insects and diseases. Insect pests as well as certain tree pathogens (especially fungi) are actually better at recognizing trees under stress than most tree enthusiasts. As a result, stressed trees may go completely unnoticed until they are "suddenly" damaged or killed by insects or diseases.

Prevention of stress by avoiding unnecessary injuries to trees during construction, road building, timber removal, etc., is probably the single most effective method for controlling stress related pests.

HUMAN IMPACTS

Studies have shown that 60% of outdoor recreation participation for day use takes place within a 40-mile radius of an urban area. The overnight and weekend use area extends up to 125 miles from an urban area and accounts for 30% of the recreation visits. Many of Florida's prime recreational sites are located reasonably close to heavily populated areas. As Florida's population and people's time for recreation increase, the impacts on recreational areas increase.

Mechanical Damage

Bark wounds not only interfere with the movement of organic compounds between the top and the roots but also open woods to microorganisms that can cause decay. Bark can be damaged by animals, wind, lightning, sun, ice, cold, fire, cars, lawnmowers, weedeaters, and vandals.

Figure 6.11. Lawnmower & Weedeater damage to red maple in Vero Beach.

Soil Compaction

Compaction is the result of pressure put on the soil through such activities as hiking, horseback riding, and biking. The amount of compaction will vary depending on the soil type, the amount of activity, and type of use. Compaction causes a reduction in water infiltration and aeration. If severe, this can cause injury to or death of vegetation. Studies have found that compaction is greater on slopes than on level sites and that compaction increases from hiker to cyclist to horses.

Soil Grade Changes

Two possible types of grade changes exist — ***fills*** and ***cuts***. Fills and cuts in a recreational setting may be due to the construction of roads or facilities.

In addition to decreasing the soil oxygen content, soil fills also tend to increase the moisture content of the soil, particularly beneath the added fill. Since the roots of a tree remain at the same level in the soil, they are subject to these conditions of reduced oxygen and increased moisture. In most instances, damage and death of the roots occur as a result.

Soil cuts as a whole are probably more damaging to tree vigor than are soil fills. Since the feeder roots of most trees are in the top 12-18 inches of the soil, with the majority of these in the shallower depth, many are lost when even a small amount of the surface soil is removed. Loss of roots and fertile soil will tend to increase the probability of the tree suffering from drought and mineral deficiencies.

Tree Removal

Clear cutting and individual tree removals are made in forests and urban areas. When trees are cut, quick removal of the debris eliminates any potential for insect infestations. Before removing trees, it is wise to consider any insect or disease activity in adjacent areas. For example, reproduction weevils are insects that can cause severe damage or death to newly planted pine seedlings, especially those on sites near recently clear cut sites. Female reproduction weevils lay eggs in the roots of recently cut stumps. The ***larvae*** emerge and overwinter in the sapwood. In the spring, the adults emerge and feed on pine seedlings.

Tree removal can also affect the microclimate around the tree. Small trees, shrubs, and ground cover that require the shade of overhead trees may be stressed by direct sunlight and increased soil temperatures.

Pollutants

Pollutants can range from litter to oil dripping from car engines to air pollution. Many gaseous pollutants exist in our atmosphere. Under widely variable forest conditions, however, only three major pollutants have shown to cause significant foliar injury to forest trees: ozone, sulfur dioxide, and fluoride. Recently, sulfates and nitrates — acid depositions — have been known to cause damage, but direct injury has only occurred where the vegetation is very close to the pollution source.

The accumulation of salts on or within plants often causes severe injury. Injury may occur on plants growing up to tens of miles inland from ocean sources. Uptake occurs through direct foliar application of wind-driven sprays or through root absorption of salts accumulated in soils.

Pesticides

Pesticides are chemicals used to prevent, suppress, or control insect and disease problems. The application of pesticides in a forest setting may be justified when the insect or disease problem is severe or when the value of the trees is especially high. In other cases, however, pesticide applications

may not be justified in the forest due to economic considerations, legal restrictions, or biological conditions.

EXOTIC SPECIES

Numerous trees from the far reaches of the globe have been introduced into Florida, particularly as ornamentals. Some of these exotic trees, such as royal poinciana, floss silk, and fig, grace the lawns of many South Florida residences, while camphor trees, golden rain trees, mimosa, Chinaberry, and tallow trees are popular in North Florida.

Still others, such as eucalyptus species, have been introduced as commercial timber trees, growing to 100 feet tall in 10–15 years.

Some exotics have become nuisances. Two major problem trees are the melaleuca and the Brazilian pepper, which are spreading in the Everglades and adjacent areas in South Florida. Both are growing unchecked by natural enemies and are crowding out native vegetation in those areas.

Australian pine is a nuisance tree along many South Florida coastal areas, colonizing beaches and estuaries. This exotic pest is a major problem on barrier islands used by sea turtles for nesting. The extensive shallow root systems prevent the turtles from digging nests in the sand to lay their eggs. These trees also pose a safety hazard during high winds and hurricanes.

Many other exotic trees have become naturalized, many times forming pure stands. Examples of some are Chinaberry, Chinese tallow, castor bean, and downy-rose myrtle.