

Successful Suppression of a Southern Pine Beetle Outbreak - How It Was Done in Gainesville

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Abstract

The southern pine beetle, *Dendroctonus frontalis*, erupted in the Gainesville area in the spring of 1994. Analysis of subsequent detection records shows that the community-wide suppression program reduced outbreak severity and duration. Cost sharing of the felling and spraying of infested trees on private property saved the city money by lowering tree mortality on public lands. The city's experience demonstrates how coordinated community action reduces the economic and environmental impacts of this tree-killing bark beetle.

Key Elements to Program Success

- Interagency commitment, unity, and cooperation
- Statutory authority for FDACS to treat infested trees
- Cost-share funding available from USFS
- City government willing to search for and facilitate solutions
- City-owned utility with contracted tree trimmers
- Willingness of forest industry to accept and quickly process infested trees

The Suppression Program - Initial Action

Definition of Appropriate Suppression Objective - Treat all infested trees quickly and thoroughly so as to reduce the numbers of flying beetles and thereby reduce subsequent infestation and mortality of trees

Declaration of a Tree Emergency - legal requirement for implementation of the suppression program and waiver of normal permitting procedures

Formation of Technical Advisory Committee - city arborist, city parks biologist, utility vegetation manager, county environmental specialist, DOF district manager, DOF forest entomologist, DPI bureau chief, university tree physiologist, and university forest entomologist

The Suppression Program - Operation

- Aerial survey and telephone reporting of suspected infestations
- Ground check by DOF
- Presentation of control options
 - 1) Pay city \$75/tree for cut and spray by utility crew
(city pays utility the full cost of \$150)
 - 2) Hire private contractor for acceptable treatment or disposal
 - 3) Pay state lien of \$150/tree for mandated cut and spray
- Follow-up by DOF to assure compliance
- Regular meetings of Technical Advisory Committee for assessment and recommendations
- Continuous information and education of the citizenry through public appearances and the radio, television, and print media

Some Problems

- Reluctant landowners
- Absentee landowners
- Slow response of government agencies (e.g., DOT, Park Service, University)
- Locating and checking spots in remote areas
- Unscrupulous tree surgeons and pesticide applicators
- Undependable loggers
- Unlawful disposal

Origin of the Outbreak

- SPB unknown in Gainesville area from 1947 until 1994
- Increasing acreage of mature loblolly pine in NE Florida
- Tree stress from below normal rainfall in 1993 and 1994

Evidence of Program Success

- SPB present across the community during Fall 1994 pheromone trap survey
- Infestations in urban area diminished with time
- SPB numbers during 1995 declined to levels lower than predators and associates

Benefits of Community-wide Program

- Preservation of thousands of trees in the urban forest
- Minimal application of insecticides; no contamination of water supply
- Economic and ecological impacts greatly reduced

Interesting Stories

- Fish-head "control" by a paranoid schizophrenic
- Infestation initiated by utility crew climbing a pine tree
- Infestation initiated by January tree pruning
- Failure of one-tenth dosage insecticide to protect yard trees
- Failure of spraying at active front to stop spot growth
- Test of Orthene injections for SPB control

The Bottom Line

- Outbreak populations of the southern pine beetle can be suppressed
- Quick detection and prompt treatment of *all* infested trees over large areas substantially reduces the duration and severity of SPB outbreaks

More information about pine bark beetles available on the web at
<http://www.ifas.ufl.edu/~eny3541/>

Quick Facts, Southern Pine Beetle Biology and Control

SPB Key Points

- Scientific name *Dendroctonus* means "tree killer"
- Mass attacks by thousands of beetles kill vigorous pines
- Beetles disperse widely and reproduce rapidly
- Community-wide detection and suppression programs reduce beetle impact

Benefits of community-wide suppression programs

- Reduced mortality of pine trees
- Reduced usage of protective insecticides
- Cost sharing encourages prompt control
- Cost sharing reduces the financial burden to individual property owners

Life Cycle

- Eggs hatch in less than 1 week
- Larvae develop in 2 weeks
- Pupal stage lasts about 1 week
- Females may live 1 month and lay 160 eggs

Behavior

- Females initiate attacks and produce aggregation pheromone
- Swarms of beetles can kill healthy pines
- Parents emerge in 1 week to disperse and infest additional pines
- Brood adults emerge in 4 to 6 weeks to disperse and infest new pines

Signs of Attack

- Popcorn-like pitch tubes on trunk of loblolly pines, brown pitch-runs on slash and longleaf pines
- 1-mm-diam holes in bark
- Serpentine egg galleries through the inner bark
- Pine needles changing from dark green to light green, to yellow, to red, and then falling to the ground
- Woodpeckers debarking stems of green pines

Epidemiological Factors of SPB Outbreaks

- Weather
- Insect Population Dynamics
- Forest Conditions
- Landscape Structure

Three Levels of Infestation

- Tree
- Spot
- Forest

Factors Affecting Rate of Spot Growth

- Tree resistance
- Beetle numbers

Factors Affecting Tree Resistance

- Pine species
- Tree age, size, and growth rate
- Competition with other plants
- Weather
- Season of the Year
- Trauma — lightning, trenching, fire, thinning

Factors Affecting SPB Attacks/Day

- Distance to, size, and age of surrounding infestations
- Tree and beetle-produced attractants
- Tree and beetle-produced repellents
- Weather

Three Sources of Attacking Beetles

- Immigrant adults
- Reemerged parent adults
- Newly emerged brood adults

Suppression Objective

- To reduce SPB populations such that the number of attacking beetles is unlikely to exceed a tree's ability to resist colonization

SPB Control Options

1. Cut and remove infested trees (Sanitation Salvage), process log to kill beetles
2. Cut and spray trees with approved insecticide
3. Cut and leave (Spot Disruption) - does not stop beetle dispersal
4. Do nothing

SPB Impact

1. Ecological Considerations
 - Forest composition
 - Fire hazard
 - Wildlife habitat
 - Insecticide side effects
2. Socio-economic Considerations
 - Disruption of management plans
 - Falling trees
 - Property usage and value

Remedial/protective Insecticides

- Cut infested trees and spray bark to kill emerging beetles
- Spray healthy trees from crown down to ground
- Dursban 1% — 2 - 4 months of protection
- Lindane 0.5% — 3 - 6 months of protection

Preventing SPB Attacks during Outbreaks

- Support the quick detection and treatment of SPB-infested trees
- Promote tree vigor
- Avoid pruning and other activities that produce pine terpenes and attract beetles
- Spray the base of trees attacked by the black turpentine beetle

Long-term Reduction of SPB Infestations

- Quickly detect and treat SPB spots
- Promote tree vigor
- Reduce forest susceptibility
- Increase spacing between pines
- Plant resistant hardwoods and less susceptible slash and longleaf pines

More information about pine bark beetles available on the web at

<http://www.ifas.ufl.edu/~eny3541/>

Frequently asked questions about Southern Pine Beetle suppression.**1. How can I recognize a beetle-infested pine tree?**

Most infested pines are discovered when we see that needles throughout the crown have changed from the normal dark green to a light green, yellow or red. On close examination of the trunk we then see holes about the diameter of a pencil lead where beetles have chewed through the bark. A resistant tree will flood the attack site with resin resulting in popcorn-like pitch tubes on loblolly pines and brown runny streaks on slash and longleaf pines. A moisture-stressed tree may have no resin and then we have to look closely for boring dust on bark ledges, leaves, and spider webs around the base of the tree. A homeowner who regularly examines yard trees may find the boring dust or pitch before the needles fade, thus allowing more time to treat that tree and protect surrounding trees.

2. How do I determine whether it is the southern pine beetle or a different beetle infesting the tree?

There are five different species of bark beetles which infest pine trees, either individually or in concert. To identify the species present we remove some bark and look at the size and shape of the beetles and their associated egg galleries. The southern pine beetle (SPB) is the smaller of the two beetles with rounded rear ends. It is about 1/8 inch long, about half the size of a grain of rice, while the larger black turpentine beetle (BTB) is about 1/4 to 3/8 inch long. The three Ips beetles all have scooped-out rear ends with small spines around the margin and range in length from 1/10 to 1/4 inches. Southern pine beetles make winding, intersecting egg galleries packed with boring dust. Black turpentine beetles start with a short horizontal gallery and then turn and tunnel downward toward the ground. Galleries of the Ips beetles are distinguished by 1 to 4 clean galleries prepared by females radiating out from the nuptial chamber made by the male where he attacked the tree.

3. Why is it important that SPB-infested trees be treated as soon as possible?

The southern pine beetle at times is an exception to the general rule that bark beetles are generally scavengers of dead or severely weakened trees. When populations are high, this species will mass attack and kill trees that otherwise would live for many additional years. Because this species can develop from egg to reproducing adult in as little as four weeks, we have relatively little time to detect an infested tree and keep the brood from dispersing to colonize new trees.

4. What are acceptable ways to treat a beetle-infested pine?

There are a number to ways to prevent beetles from developing in and dispersing from infested bark. Sometimes a cluster of infested trees can be cut and sold to a wood processor where the bark is quickly removed and burned while the wood is processed for pulp or lumber. In urban situations, however, a homeowner must often contract a tree service to cut a tree and kill the beetles. Several insecticides are registered and effective at killing beetles as they emerge. Burning and burying infested bark are other ways to control beetles.

5. The needles are still green, can't we save the tree?

A tree is doomed once bark beetles colonize and destroy its inner bark. Without this phloem tissue, the carbohydrates produced in the needles cannot nourish the living cells in the roots. Without living roots to provide water and nutrients to the crown, the needles dry out and die. The blue-stain fungus carried by beetles often hastens needle death by growing into the sapwood and plugging the water-conducting cells.

6. Why should pines be felled and cut into short sections before applying an insecticide?

Insecticides kill beetles in part by penetrating the bark and killing the developing brood and in part by killing beetles as they chew out before flying away. For the area-wide suppression program to be effective as soon as possible, it is important that all infested bark be sprayed to the point of runoff. By cutting the trunk into easily rolled sections and by adding a conspicuous coloring agent to the insecticide, the applicator is able to assure the necessary coverage.

7. Should I spray my pine trees to keep beetles from attacking them? Are systemic insecticides effective?

Where an area-wide suppression program is underway it is rarely necessary to spray trees to protect them from future attacks. One case where a homeowner may wish to invest in a protective spray is when lightning, construction, or other injury weakens a tree and it produces terpenes which might attract beetles. In such cases the homeowner must contract a pest control operator who has the appropriate license and equipment for putting a registered insecticide at least 35 feet high on the trunk. With regards to systemic insecticides, no research test has ever shown systemics to be anywhere nearly as effective as chlorpyrifos or lindane sprayed onto the bark. Systemic insecticides apparently do not remain in the phloem tissue in sufficient concentrations to affect beetle attack and colonization.

8. Why do we need an area-wide program to suppress southern pine beetle outbreaks?

Southern pine beetles develop from eggs to reproducing adults in as little as four weeks except during the cooler months of winter. Young females may then fly several miles before attacking new trees and laying as many as 100 eggs before dying. When populations are high, thousands of beetles may attack a tree in one afternoon and overwhelm its ability to resist colonization. This combination of a high reproductive rate, great dispersal ability, and aggregation to mass attack trees requires that all infested bark over a large area be treated so that we can reduce beetle numbers below the threshold needed to overcome tree resistance. Leaving just 10 or 20% of the trees untreated may allow an outbreak to expand and persist for many months.

9. What are the benefits of having a mandatory area-wide suppression program?

The principle direct benefits of an area-wide suppression program are that fewer trees will be killed and fewer dollars will be spent to remove or treat infested trees. Another benefit is that protective chemical treatments are unnecessary, saving the economic and environmental costs of insecticide applications.

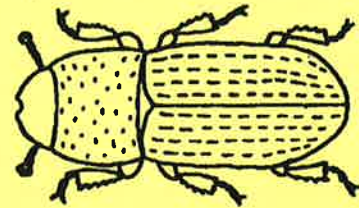
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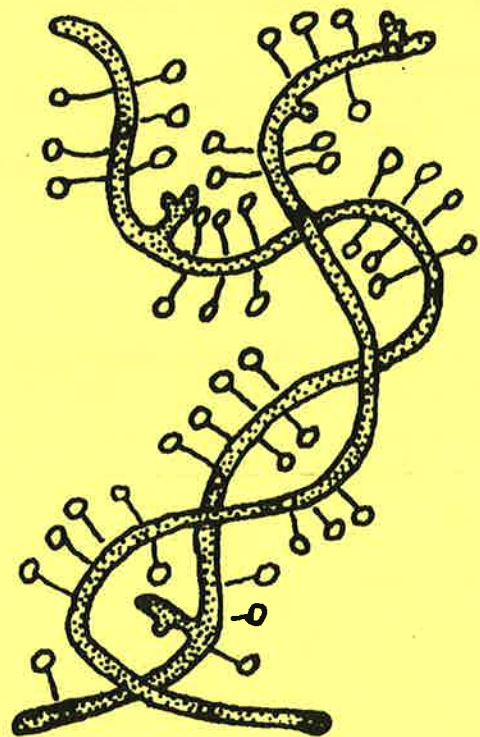
The Southern Pine Beetle in Florida

The Southern Pine Beetle, *Dendroctonus frontalis*, is the most aggressive and destructive of 5 bark beetle species infesting pines in the southern United States. In recent years outbreaks in northern Florida have increased in frequency and severity owing to the increasing acreage and maturity of loblolly pine, the beetle's most important host. This document provides a brief overview of SPB biology, behavior, dynamics, and control. It will help citizens across the state to monitor beetle populations in dying pines and, when appropriate, initiate community-wide suppression activities. As demonstrated in the Gainesville area in 1994-1995, quick detection and prompt treatment of all infested trees will substantially reduce the duration and severity of SPB outbreaks. If you suspect SPB activity, contact your local office of the Florida Division of Forestry or the University of Florida Cooperative Extension Service.

Biology and Behavior. The adult SPB is a reddish-brown to black cylindrical beetle about 3 mm long, smaller than a grain of rice. Females initiate the attacks on trees and emit a pheromone that attracts males and additional females. Within a few days thousands of beetles may colonize the tree and overwhelm its defenses. Excess beetles often land on and colonize nearby trees. Females tunnel through the inner bark, periodically constructing a niche and laying an egg. Males follow the females and close the gallery behind them with boring dust. After about a week of egg laying, parent beetles emerge to infest additional trees. Larvae feed on inner bark for about 2 weeks, then pupate in the outer bark. New adults begin emerging just 4 weeks after initial attack, about the same time the tree crown is turning from yellow-green to red. These beetles may fly 1 or 2 miles before attacking a new tree.



Detection and Identification. SPB infestations usually occur in spots that gradually enlarge with time. Red-crowned pines and surrounding green trees should be examined for signs of infestation. Popcorn-like pitch tubes, boring dust, and numerous holes through the bark are signs of bark beetle infestation. A southern pine beetle infestation is distinguished by the winding and overlapping galleries constructed under the bark by females as they lay eggs. The egg galleries of the *Ips* beetles, in contrast, are I-, Y-, or H-shaped with 2 to 4 relatively straight galleries radiating out from the "nuptial chamber" constructed by male beetles. The black turpentine beetle infests around the base of the tree and makes only a short, mostly vertical gallery before laying a large clutch of eggs. All five species often occur on the same infested tree, so a tree should be examined at several heights on the trunk to avoid overlooking an SPB infestation.



Identifying Outbreak Conditions -- The SPB, like most bark beetles, may be present for many years as an innocuous scavenger of dead and dying pine trees. Occasionally, populations explode to levels where thousands of beetles will infest and

kill healthy trees. Criteria for assessing population status include the distance between beetle spots (clusters of beetle-infested trees), spot size, spot growth, and the abundance of the SPB relative to other species of bark beetles. No suppression is required when small, inactive spots are separated by great distances and the SPB accounts for only a small percentage of the bark beetles present. Signs of outbreak conditions include an increasing number of spots, more infested trees per spot, spots continuing to enlarge beyond the initial cluster of infested trees, and the SPB being the dominant species infesting the main stem. During outbreaks, quick detection and rapid treatment of small spots will greatly reduce tree mortality and SPB-caused disruption of management plans.

Control. Because of the dispersal and aggregation abilities of this insect, it is important that all infested trees over a large area be treated during outbreaks. If possible, remove newly infested trees and destroy or treat the infested bark before beetles mature and emerge to attack surrounding trees. Once beetles have emerged from a tree, removal is unnecessary except to protect life and property from falling branches and stems.

Prevention. Infestations often start on stressed and injured trees in older-aged dense stands, so cultural practices that promote healthy trees will reduce the frequency and severity of infestations. During outbreaks, avoid pruning and other activities which produce terpenes that attract dispersing beetles. If nearby trees are infested, homeowners may wish to have a pest control service apply insecticide to their uninfested trees. Two currently registered insecticides are 1% chlorpyrifos (Dursban) which provides 2 to 4 months of protection and 0.5% lindane which provides 3 to 6 months of protection. The insecticide should be applied on dry bark, to the point of runoff, from at least the base of the crown down to the ground line. If *Ips* beetles are abundant and aggressive, then the upper stem and larger branches should also be treated. When carefully and properly applied, these insecticides dry in a few hours and pose little danger to birds, squirrels, and humans. CAUTION: Lindane is an extremely difficult chemical to remove at wastewater treatment plants. If long-term tree protection is unnecessary, use chlorpyrifos rather than lindane.

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