

Southern Pine Beetle in Mississippi: *An Overview*



The scientific name for the southern pine beetle (SPB) is *Dendroctonus frontalis* Zimm, meaning “tree killer.” The SPB has been just that in Mississippi for thousands of years. At low population levels, SPB will attack stressed, damaged, or overly stocked stands. However, at high populations of an outbreak, SPB will attack pine trees en masse, killing trees regardless of age, health, or condition until they run out of pines.

Many landowners have suffered losses, ranging from a few trees to entire stands. Such widespread damage captures public attention in a way that few other forestry issues do.

Inadequate monitoring and failure to control known infestations can result in the loss of valuable stands of pine timber. Producers lose money when they have to prematurely harvest during poor market conditions to avoid an expected loss to the SPB. With proper monitoring and control efforts, losses should be less than 10 percent of the stand over the course of an epidemic period. A few landowners will have large losses, but these are usually cases where the infestations have been undetected or ignored. Producers must react to the SPB, but overreacting could decrease the economic returns from the timber stand. It is important to recognize the SPB, to know what control tactics are available, and to make an informed decision concerning this pest if you have an infestation on your property.

SPB Biology

Pine trees are killed by adult beetles and their larvae. Female SPB begin the attack on the tree by boring through the bark. The female then bores through the inner bark and lays small white eggs on the side of the tunnel (gallery) as she constructs it. The male follows her in the gallery, moving the frass (excrement and dust) left by the female and packing it behind him. Winding S-shaped galleries, which may cross one another, are created by many females in the infested portion of the bark. The infested portion of the bole can occur from near the ground to the first live limb; however, the SPB typically focuses on the mid-bole of the tree.

After gallery construction is complete and eggs are laid, the adults either die, “overwinter” in the galleries, or bore out through the bark to attack again if environmental conditions are conducive. The tree is killed by a combination of girdling due to gallery construction and the introduction of blue stain fungi, which block water transport.

Eggs hatch and the larvae bore through the inner bark away from the adults’ gallery. The white grub-looking larvae grow larger as they move, until they are approximately one-eighth of an inch long. When mature, the larvae bore into the outer bark and begin to change into the pupae, or resting stage. The pupae are very soft and white with visible eye patches and premature wings.

After pupation, the newly formed adults bore their way out of the bark. These adults fly to other trees in the vicinity, or they may fly some distance away to create a new infestation. The distance an adult can fly depends on its health and weather conditions at the time.

Beetles overwinter in all stages of development. Anytime the temperature rises above 55°F, the eggs, larvae, and pupae can continue to develop, and overwintering adults can emerge and attack new trees. There can be as many as seven generations a year, depending on climatic conditions. SPB populations tend to go through cycles. Periods between epidemics (large beetle populations) vary from 3 to 15 years, with most epidemics lasting 3 to 5 years. It has not been determined why the population fluctuates in this manner, nor is it possible to accurately determine when the numbers will go up or down.

Recognizing SPB Infestations

It is important to be able to recognize both active and inactive trees. Active trees are those that are currently under attack by the SPB and can be identified by fading crowns and pitch tubes coming out of the bark. Inactive trees are those that are no longer under attack by the SPB. Inactive trees have fully reddened/browened needles or a total lack of needles, and the bark is loose.

Working together, state and federal pest management specialists have been conducting a spring strapping survey.

This strategy uses insect attractants, or pheromones, to sample SPB populations throughout the South. This method has been employed since 1986 to estimate SPB hazard levels across the southern United States.

Later in spring, fading trees are usually the first noticeable symptom of an SPB attack. As the trees die, their needles turn yellow and then red before they fall off. This characteristic is used to find active SPB infestations with aerial surveillance. The Mississippi Forestry Commission (MFC) conducts aerial surveillance on private lands; other organizations (U.S. Forest Service, wildlife management units, the forest industry, or other large private or public landholders) do so on land for which they are responsible. You can find information on possible infestations on private land by contacting the MFC county forester in the county where the property is located or by contacting foresters with other organizations if the private land is adjacent to your property.

Pitch tubes on the bark are another good indicator that your tree may be under attack by the SPB. Pitch tubes are formed when the beetles enter a tree. Pitch tubes are the tree's attempt to force (or "pitch") the beetle out. They are dirty pinkish, yellowish, or white balls of resin that resemble popcorn and are about one-fourth to one-half of an inch in diameter.

The best way to identify the SPB is by the gallery patterns that can be seen under the bark. They have an "S"-shaped pattern with many adult gallery intersections. The larval galleries will tend to be on alternate sides of the gallery, traveling perpendicular to the parental galleries. Other bark beetles (e.g. Ips engraver beetles) tend to have straight, "H," or "Y" shaped galleries.

Controlling SPB Infestations

Several control techniques are available for SPB infestations. Market conditions, size and number of trees involved, and money available will help you decide what to do. Three basic categories of control are:

1. Salvage removal
2. Cut and leave
3. Pile and burn

Each of these tactics gives better results when applied as soon after detection of an infestation as possible. By treating early, fewer SPBs are allowed to develop and spread to other trees. Delaying treatment might allow an increase in the number of active trees to a level that would make control difficult.

In all cases, both actively attacked trees and a buffer of healthy, un-attacked trees at least as wide as one tree length (preferably two tree-lengths) around the spot need to be

included in the control operation. If any infested trees are missed, or if the buffer of healthy trees is not adequately treated, the infestation can resume and will result in further economic loss. Trees that have already been killed by the SPB (very red needles, grey or no needles, and very loose or no outer bark, usually at the center of an infestation) can be left behind, as natural enemies of the SPB will increase their populations on these trees. With any of the following control tactics, the area should be checked periodically after treatment for trees that may have been missed or for an outbreak around the treated area.

Salvage Removal

Often, the trees involved in the infestation can be sold. This is obviously the preferable choice of the three basic control techniques. Even if only pulpwood is sold and the operation just breaks even, it is better than no return. Another advantage is that the beetles are removed with the trees. Often the market is flooded with beetle-killed wood during an epidemic, making it impossible to salvage. Even during good markets, the price received will be considerably lower than for trees sold in a regular timber sale. It is expensive to move logging equipment and cut a logging road for the relatively low total volume of wood involved in most infestations.

Once the infestation is located, the trees with active SPB should be marked with paint or flagging. Also, mark a buffer strip of green uninfested trees at the head of the infestation. This ensures the removal of trees that might come under attack between the time the trees are marked and cut. The buffer strip should be 1–2 tree lengths wide, and it should extend, at a minimum, around the actively growing head of the spot. An even more conservative approach would be to mark a two-tree-length buffer around the entire spot. If the area involved is large enough, you can flag the outside edge of the area to be cut instead of marking every tree.

Each tree must be examined carefully to determine if it contains beetles. You should consider a green tree infested if it has discolored needles, beetle entrance holes, brownish boring dust at the base, or spider webs on or near the bole and/or on the upper leaf surface of the understory trees. Boring dust indicates that the tree is coming under attack. Since beetles usually start their attack near the middle of the bare bole (10 to 20 feet above the ground), pitch tubes may not be visible until the second or third day of the attack, but they are a sure sign of infestation.

After salvage, monitoring is extremely important to ensure that all infested trees were removed, and that the spot does not start to expand again.

Cut and Leave

This technique is the same as salvage removal except that the trees are not removed from the area. It is important to fell the trees toward the center of the infestation, but it is also good to avoid creating a large pile of wood that shades much of the infested bark. Direct sunlight on the bark can increase the temperature enough to kill the beetles. Since higher temperatures play an important role in the success of this tactic, it is restricted to the summer months when temperatures average above 85°F.

This technique is used when the market or other conditions will not allow salvage. It is the least expensive of the non-salvage techniques. The infestation is usually disrupted; however, some SPBs emerge from the felled trees to move to other areas in the forest. Forcing the beetles to fly greater distances should increase the natural mortality, which will also have an adverse effect on the SPB population. The cut and leave method will provide adequate control if properly applied, but is obviously less preferred because the trees are not taken to market.

Pile and Burn

This is probably the oldest of the control tactics. It is very effective when properly used. As the name implies, the active trees are piled and burned, making sure the bark is charred thoroughly. There is a greater liability since fire is involved. This control technique is used when the landowner wishes to prepare the site for tree planting, or to enhance wildlife habitat. Check burning conditions by contacting the county forester, and do not set a fire unless it is safe. It is important to avoid damaging or stressing residual live trees during this process.

Protecting High-Value Trees

Onyx is a chemical for SPB prevention, but it is available only for ornamental pines. Onyx is applied to the outside bark of the tree, and it kills beetles on contact for 4 to 6 months. Onyx is best used as a preventive method of controlling SPB infestations in high-value urban trees.

Onyx is not a magic bullet, and it will not stop beetles from killing an already heavily infested tree. Timing is critical when applying Onyx on infested trees. Onyx is best used on uninfested trees next to others that are infested. Onyx is not recommended for large areas with many infested trees.

You must treat the entire tree, coating the entire exterior surface from the top of the crown to the base of the tree. Onyx is not absorbed by the tree, so it will not kill beetles protected underneath the bark. If there are beetles inside the tree, the spray will not kill them until they emerge as adults.

Onyx is not water soluble, so precipitation will not change its effectiveness once the mixture has dried on the tree. However, the active ingredient is toxic to aquatic animals, so it should not be allowed to contaminate surface runoff during application. Only certified pesticide applicators may purchase and use Onyx. Local MSU Extension offices periodically offer certified pesticide applicator training sessions.

For yard trees, watering during the summer months can also help prevent SPB attacks on high-value trees. Using fertilizers will help to maintain tree vigor and increase a tree's ability to repel the SPB.

Reducing Losses with Timber Management

Maintaining a healthy pine stand is the best defense against the SPB. Densely-planted, slow-growing, or damaged trees are much more susceptible to attack. Thin stands to increase the growth rate of selected crop trees. When pine stands need thinning, it is not recommended to delay the thinning operation for better market conditions (Henderson and Londo, 2016). Harvest over-mature stands and replant the land. Conduct harvest operations in a manner that will protect the soil and the remaining trees by following Mississippi Best Management Practices.

Tree vigor or overall health is indicated by radial growth. Trees that are not healthy grow slower than healthy trees. Diseased, damaged, or crowded trees will not grow well. These trees attract SPBs and can become a focal point for a new infestation. Removing or at least felling these kinds of trees can lower the susceptibility of the entire stand.

Reducing competition between trees is the best way to prevent losses to the SPB. Removing the slower-growing trees from a stand through thinning allows the residual trees to flourish. These remaining trees are in an environment less favorable for the SPB, continue to grow at a faster rate, and have more resistance to SPB attack because of higher resin production. This reduces the risk of attack, but, more importantly, places the growth potential of the stand on the remaining stems. Concentrating this growth on the lower number of residual trees greatly increases the economic returns to the landowner because they can be cut for sawtimber much earlier.

As timber gets older, the growth of individual trees slows down. Stands that are biologically mature or old can become vulnerable to attack. Proper thinning can help extend health as the stand ages. If management decisions are based on economic returns, pine stands are harvested before age becomes a factor to SPB susceptibility. However, if older trees are being grown for aesthetic or

other reasons, it is very important to watch them closely during SPB epidemics and to remove infested trees as soon as possible.

Proper Response to SPB Infestations and Epidemics

Final harvests should be made only if the market and timber conditions make it advantageous. Timber stands increase in value at a higher rate while they are entering sawtimber size than at any other time. Pulpwood-sized stands should not be clear-cut to avoid a potential loss to SPBs. Landowners should plan their final timber harvest by working with a registered forestry consultant.

Observations should increase during epidemic periods and control tactics used when possible. Do not ignore SPB infestations. If infestations occur, it is important to control each spot as quickly as possible to minimize the possibility of larger infestations forming. Areas with the most valuable timber should receive priority. Within these areas, infestations with the largest number of active trees should be controlled first. Smaller spots are easier to control, so early detection and prompt control efforts are key to keeping losses at a minimum.

Summary

Management of pine forests is influenced by many factors. The southern pine beetle is one of them. This pest can have devastating results on individual stands. Maintaining healthy trees, improving surveillance during epidemics, and controlling infestations as early as possible can minimize losses.

References

Henderson, J.E. & A.J. Londo. 2016. Publication 2732
Protect Your Pine Plantation Investment by Thinning.
Mississippi State University Extension, 4p.

More Information

For more information, contact your Mississippi Forestry Commission Service Forester, local Extension agent, or area Extension Forestry Specialist. In addition, the following links have more information on the SPB:

MSU Extension publications
<http://extension.msstate.edu/publications>

Southeastern Forest Insect Working Group
<http://www.barkbeetles.org/spbl>

USDA Forest Service SPB II Publication
<https://www.srs.fs.usda.gov/pubs/39017>

The University of Georgia Center for Invasive Species and Ecosystem Health
Bugwood.org

Publication 2748 (POD-03-19)

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Produced by Agricultural Communications.

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Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. GARY B. JACKSON, Director