Impacts of Southern Pine Beetles in Special Management Areas

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Abstract.—Southern pine beetles have had great impacts on wilderness and other special management areas. Infestations have spread and affected adjacent land, and they have disrupted the intended uses and goals desired for these areas. Coping with SPB in special management areas requires advance planning and management, then the use of new and integrated techniques for SPB risk reduction once the areas are established.

INTRODUCTION

The southern pine beetle (SPB), *Dendroctonus frontalis* Zimmermann, is the most destructive forest insect pest in the southeastern U.S. Four control methods are prescribed by the Final Environmental Impact Statement for the Suppression of the Southern Pine Beetle (USDA 1987): cut and remove, cut and leave, cut and hand spray, and pile and burn. These methods are efficacious in preventing the expansion of individual SPB infestations, but their effects on area-wide SPB populations is unknown. All four methods also involve felling trees, which can lead to conflicts with management restrictions in special management areas.

SPB IMPACTS IN SPECIAL MANAGEMENT AREAS

Wilderness

Prior to the enactment of the SPB FEIS, SPB control was allowed in wilderness. In Texas, 262 of 599 total SPB spots were treated in 5 wildernesses during a SPB epidemic in 1984–86. Total acres impacted was 1477, with 1392 acres treated. In the Kisatchie Hills Wilderness in Louisiana, 48 of 70 SPB infestations were controlled, with treatment on 3300 of 3930 acres impacted. SPB control in wilderness was very controversial, and various environmental groups filed suit in 1985 to prevent further action (Kirby 1986).

In 1987, the SPB FEIS established strict criteria for SPB suppression in wilderness. Treatment was allowed only to protect endangered species habitat or to protect susceptible pines on adjacent private or high value federal lands. For the endangered red-cockaded woodpecker (RCW), a SPB spot growth model must predict the infestation would impact essential clusters or critical foraging area within 30 days. Before control can be initiated to protect adjacent private land or high value federal land, the infestation must be within 1/4 mile of susceptible pines on the adjacent land, and a site specific analysis must predict the infestation would impact those pines.

The private landowner must also be willing to control SPB on his/her property. In all instances, the Forest Service must be assured of a reasonable chance of successful control before suppression may begin.

Though the possible impacts of limiting SPB suppression in large areas forested with pines had been discussed (Billings 1986, Smith and Nettleton 1986) and documented (Billings and Varner 1986), the effects of the new criteria were not evident until another epidemic began in Texas in 1992.

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Large infestations developed in all five wildernesses in Texas. The size and intensity of the infestations when they reached the 1/4 mile mark often made control difficult or impractical. Eighteen spots were treated to protect adjacent land, with treatment occurring on 126.4 acres in wilderness. Ten spots crossed over to private land, affecting approximately 205 acres, with another 456 acres harvested prior to predicted infestation. In Little Lake Creek Wilderness, 31 spots were treated to protect RCW clusters and critical foraging habitat, encompassing 274.2 acres. Total acres infested are given in Table 1. Approximate percentages of Texas wildernesses impacted through FY 1944 are: Indian Mounds—3 percent, Turkey Hill —38 percent, Upland Island—14 percent, and Little Lake Creek—26 percent.

Current Conditions

In 1987 in Kisatchie Hills, a 7500 acre wildfire burned much of the 4000–5000 acres affected by SPB the previous two years. A study by Pearson et al. (1991) found that virtually no overstory canopy was present on the wildfire and beetle killed areas. Loblolly pines increased in the beetle killed only area, while pines were not present in the wildfire and beetle killed area. A visit by the author in April 1995 found loblolly pines 10–15 feet tall in the beetle killed only site, with scattered hardwoods mixed in. No overstory was evident in the beetle killed and burned area. Small patches of 2–3 foot tall pines were present, but the area appeared dominated by small oaks and yaupon.

In Texas wilderness, the large areas once dominated by pine which were killed by SPB are now characterized by standing and downed snags. Access into these areas is difficult and hazardous, and the tops of many snags have been snapped off by high winds. The fire hazard is great due to the amount of woody material on the ground. Other areas which originally had a pine hardwood mix now have a open hardwood canopy mixed with pine snags. Little pine regeneration is evident in any of the beetle killed areas. Recreational use in these areas is extremely limited, though the potential for solitude is very high.

Table 1.—Estimated total acres infested by SPB in Texas by fiscal year.

Fiscal year	General forest	Wilderness
1991	1,095	117
1992	2,689	2,130
1993	2,134	10,179
1994	174	96

Habitat Management Areas

SPB also has the potential to severely impact wildlife species requiring pines, such as RCW. RCW prefer older pines for cavity excavation (Conner and O'Halloran 1987) and foraging (C.Rudolph, pers. comm.), and these trees are also highly susceptible to SPB attack (USDA Forest Service 1993). At least 162 active cavity trees and 39 inactive cavity trees were killed by SPB in Texas from 1983–1993. Infestations can also destroy foraging habitat and lead to forest fragmentation, which may impact a variety of wildlife species, both positively and negatively.

Other Special Management Areas

Research natural areas (RNAs) have restrictions on SPB control similar to wilderness. Infestations have the potential to greatly reduce the pine component in RNAs as they have done in wilderness. Cain and Shelton (1995) found that areas infested by SPB in the R.R. Reynolds RNA in Arkansas are converting from pine to hardwood. The shade intolerant pine regeneration is shaded out by hardwoods and the standing dead pines. Hardwoods are expected to dominate the SPB killed areas in the absence of any other major disturbance. Scenic, botanical, and old growth pine management areas may also convert to hardwoods when SPB control and/or active management is limited.

Other non-Forest Service lands have had severe SPB impacts. The Big Thicket National Preserve in Texas has had many large infestations develop over the last three SPB epidemics. When established, the Preserve had approximately 51,000 acres of susceptible host type out of a total of 84,550 acres. Between 1975–86, 8,677 acres were impacted by SPB (USDA 1987), and from 1992–1994 at least 3215 more acres were killed (Clarke and Ardoin, 1992, Clarke et al. 1993). Horseshoe Bend National Military Park in Alabama, the Natchez Trace Parkway, Fort Benning , GA, and many other federal lands with varying management emphases and goals have had significant SPB activity in recent years.

COPING WITH SPB IN SPECIAL MANAGEMENT AREAS

Desired Future Condition

The first step in dealing with SPB in special management areas (SMAs) is to identify the desired future condition (DFC) of the SMA. This should ideally be decided before the SMA is established. The DFC describes how the area should look in a specified timeframe, and is determined by the specific needs and potential uses identified during the SMA planning process. Once the DFC is set, the techniques required for SPB risk reduction and suppression which help reach the DFC can be designed. If it is clear that the necessary techniques are not available due to limitations in management activities imposed by management area emphases, then the area should be considered for reclassification. For example, the Four-Notch area in southeast Texas was proposed as a wilderness. The landscape consisted of primarily shortleaf and loblolly pine. In 1983, SPB infestations began to develop, but control was delayed due to the area's status as potential wilderness. A massive SPB infestation resulted, and as Coulson et al. (1986) note, the attributes which led to its selection as a wilderness candidate were lost as a result of the disturbance caused by SPB. The area was subsequently dropped for wilderness consideration.

Public involvement is very important in this process. The public must be informed of the possible consequences that can occur with SMA designation and restrictions in SPB suppression. For example, if a unique stand of old growth pine is located, the public must be aware that relegating the stand to wilderness or a RNA will not allow protection of the pines from SPB. If the pine component of a scenic or botanical area is considered valuable and desirable, then standards and guidelines for the area must allow for SPB suppression, and the public must understand why suppression is necessary. If letting nature take its course is the only DFC of an area, then SPB suppression is only required in emergency situations.

Set Boundaries Appropriately

Once a special management area designation is selected, it is important to set the boundaries appropriately. Boundaries should be drawn so as to provide access as needed, prevent adjacent overdevelopment, and avoid potential conflicts with neighboring private lands or other management areas. While it has been recommended that wilderness not be buffered (Phillips 1986), designating stands of mature, dense pine adjacent to susceptible pines on private lands as wilderness is asking for trouble. Common sense dictates that leaving a patch of general forest area between wilderness and private land in such situations will alleviate the threat of SPB populations in wilderness to pines on private land. Site-specific conditions and projected wilderness usage should guide boundary designation.

Manage Adjacent Areas to Reduce SPB Risk

When SPB suppression is limited in SMAs, the adjacent areas should be managed to reduce the risk of SPB. All SPB infestations should be quickly controlled. Pine basal area should be reduced, but pines should not be eliminated if susceptible pines on adjacent private land are nearby. Leaving some pines on adjacent GFA provides an opportunity to steer SMA populations onto GFA and away from private land, limiting the amount of suppression activity required in the SMA. Restoring adjacent areas to less susceptible pine species such as longleaf pine when appropriate can also reduce impacts. Ideally, the areas adjacent to wilderness should be defined use zones which limit development (Phillips 1986). However, the need to limit management and development next to wilderness must be balanced against the potential for insect and other destructive agents within wilderness to affect adjacent lands. As conditions within wilderness or other SMAs change, so too should the management strategy for adjacent lands.

Strategies for SPB in Established SMAs

In the past, SPB management has consisted of spot suppression by one of the four techniques listed above, and SPB hazard reduction. Hazard reduction was usually not a top priority, but rather one of the needs listed to justify proposed management activities, such as clearcutting and replanting with off-site loblolly pine. In the future, particularly in SMAs, SPB management must incorporate true integrated pest management (IPM), utilizing a variety of suppression and hazard reduction strategies. Hertel et al. (1986) discuss IPM in SMAs, and the following is an update on new strategies.

SPB Inhibitors

Two SPB inhibitors are currently being tested for SPB spot suppression: verbenone, a SPB produced anti-aggregation pheromone, and 4-allylanisole (4-AA), a phenylpropanoid in the oleoresin of many pines (Hayes and Strom 1994, Billings et al. 1995). Freshly attacked trees and an uninfested buffer strip are treated in an effort to disperse the emerging and reemerging SPB and stop spot expansion. Early results with verbenone indicate that it works best on small infestations, and that treatment efficacy can be improved by felling infested trees. Semiochemicals may provide a treatment alternative to the four treatments currently utilized if efficacy can be established and EPA registration is obtained. Environmental groups have expressed interest in these compounds, and the use of semiochemicals may even be an option in wilderness. Small infestations could be treated before they expand and threaten adjacent private land. Otherwise, treatments involving felling would eventually be required. Inhibitors also show promise in the protection of high-value individual trees, such as RCW cavity trees.

Natural Enemy Maintenance

Natural enemies can have significant impacts on SPB populations, but as yet have not been shown to suppress infestations or epidemics alone. *Thanasimus dubius* (F.), a clerid beetle, is the most common predator of SPB. Adults feed on adult SPB, while larvae feed on SPB larvae. Recent work by Reeve et al. (1995) indicates that clerids have an extended diapause, and may not emerge from trees until long after SPB have emerged. This extended diapause illustrates the necessity of leaving trees vacated by SPB during suppression treatments. In addition to protecting *T. dubius*, preserving these vacated trees also provides a resource for other wood-attacking beetles, which in turn provides an alternate food source for SPB natural enemies when SPB populations are low. Natural enemies may then be maintained in sufficient numbers to respond quicker to increasing SPB populations. Kroll et al. (1980) also recommend preserving vacated trees as nesting sites for woodpeckers. Woodpeckers feed on SPB brood in the bark, and can inflict heavy mortality on SPB populations.

Parasitoids can also impact SPB population levels. Some parasitoids can produce two generations for each SPB generation, but the adults may require supplemental feeding (Fred Stephen, pers. comm). Providing food sources for parasitoid adults may increase their efficiency.

Silvicultural Techniques

Silviculture has long been promoted as a way to reduce SPB impacts. Thinning, favoring more resistant species, removing high-risk trees such as lightning struck pines, and providing a hardwood-pine mix can all increase stand resistance to SPB (Belanger and Malac 1980, Brown et al. 1987). The impacts of other treatments such as prescribed burning are unclear. Conner and Rudolph (1995) give evidence which suggests that midstory removal in RCW clusters may increase the susceptibility of individual trees to SPB attack. While many silvicultural treatments may enhance long-term stand health and SPB resistance, they may temporarily or permanently increase individual tree susceptibility to SPB. Silvicultural activities should be evaluated for their potential impact on forest pest problems on a site-specific basis, and treatments should be scheduled when SPB populations are at low levels or after the main dispersal periods.

In special management areas, silvicultural options are often limited. Where felling is prohibited, girdling could be used to thin stands and to favor more resistant species. Prescribed burning could also be used to help regenerate longleaf where appropriate, and can also be used to thin young stands (Lloyd et al. 1995). Girdling could also be used to help suppress SPB infestations, as Dunn and Lorio (1992) report that SPB colonization was less successful above bark girdles than below. This technique might merit further research.

While neither silvicultural treatments, natural enemy maintenance, or use of semiochemicals alone can prevent SPB epidemics, a combination of these may reduce the severity of outbreaks and limit impacts, decreasing the need for suppression activity in SMAs.

SUMMARY

In the south, SPB will always remain a problem in areas where pine is a main or desirable component of the landscape. Coping with SPB in special management areas is best done at a site-specific level. Planners, silviculturists, and forest health experts must work together when designating SMAs, and when developing management strategies in those areas already established. Standards and guidelines for reducing susceptibility and suppressing infestations should be designed based on the desired future condition and predicted use of the SMA, the potential for adverse impacts to adjacent lands, and the management restrictions within the area. Public involvement is crucial, and they must be aware of the potential of SPB to positively or negatively affect the quality, appearance, use and structure of SMAs.

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