Mountain Pine Beetle: Conditions and Issues in the Western United States, 2003

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Abstract

The mountain pine beetle (*Dendroctonus ponderosae* Hopkins) is by far the most destructive insect pest of pine species in western North America. It is once again at outbreak levels in many parts of the western United States, currently affecting more than 1.5 million acres (0.7 million ha). The infested area in the western US nearly doubled from 2001 to 2002. While infesting most pines within its range, and causing significant concerns in ponderosa, western white, and whitebark pines, lodgepole pine is the most frequently infested and most heavily damaged of the beetle's hosts. Nearly 90% of the current mortality is in lodgepole pine. Management strategies and tactics have been developed to better deal with the devastating impact of mountain pine beetle infestations across the western US.

Mountain Pine Beetle History in the United States

Outbreak populations of mountain pine beetles have occurred in western North America for much of the past 30 years. During the 1990s, populations were at relatively low levels, having decreased from more than 4.6 million acres (2.1 million ha) in 1981. It is unlikely that such a high level of infestation will reoccur, due to a lack of suitable hosts; however, more than 1.5 million acres (0.7 million ha) are currently infested and populations continue to increase in many western states. Because of their prevalence, and the rapidity with which they can alter forest conditions, mountain pine beetles have significantly affected management philosophies, decision-making processes, and silvicultural activities for the last several decades of the 20th century. It now appears they will also impact the 21st century.

In the northern Rocky Mountains, and wherever host species occur in the intermountain West, mountain pine beetle outbreaks have been reported with some regularity since the early 1900s. Devastating outbreaks in the late 1970s and early 1980s—unprecedented and perhaps never to be repeated—began in vast areas of mature lodgepole pine from northern Utah into British Columbia (BC). By 1978, millions of acres in western Montana and other western states were infested. We have estimated that in northern Idaho and western Montana, alone, from 1975 to 1995, more than 3 million acres (1.4 million ha) were infested to some extent—and more than a quarter-billion trees were killed. Recent outbreaks, not yet as extensive, are extremely damaging in some areas (Unpublished office reports, USDA Forest Service, Northern Region).

Mountain Pine Beetle Symposium: Challenges and Solutions. October 30-31, 2003, Kelowna, British Columbia. T.L. Shore, J.E. Brooks, and J.E. Stone (editors). Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Information Report BC-X-399, Victoria, BC. 298 p.

Management Issues, Concerns, and Strategies

Until the mid-1970s, pest and land managers in the US somewhat naively believed that beetle-killed trees were a manifestation of an insect "problem" and the solution was the destruction of the pest. Attempts at implementing this solution were many and varied—virtually all of them unsuccessful. It is certain many beetles were killed. What is less certain is that any long-term alteration of outbreak effects was realized.

By the mid-1970s, we came to realize that the real problem was not a plethora of beetles, but rather, a preponderance of susceptible hosts. We noted that most host stands experiencing mountain pine beetle outbreaks shared remarkably similar characteristics. Most were older stands, densely stocked with large-diameter trees that had begun to slow in growth due to advanced age, overstocking, and/or drought. Recognizing these commonalities was an important step in developing management strategies and tactics for reducing beetle-caused mortality.

One of the first major accomplishments was the advent of a hazard-rating system for lodgepole pine, developed by Amman et al. (1977), in which we recognized those stand conditions most likely to support a mountain pine beetle outbreak. They were stands:

- in which average diameter was greater than 8 inches (20 cm);
- in which age exceeded 80 years; and
- were growing at elevation/latitudes conducive to beetle survival.

At about the same time, Stevens et al. (1980) demonstrated similar, recognizable conditions existed in ponderosa pine stands. Their work showed that high-hazard ponderosa pine stands were:

- ones in which average diameter exceeded 10 inches (25 cm);
- had stocking >150 square feet of basal area/acre (34.4 m^2/ha); and
- single-storied and mostly single-aged.

Hazard-rating models for the mountain pine beetle have been recently updated and improved. The one currently in use for lodgepole pine was developed by Shore and Safranyik (1992). Schmid et al. (1994) developed the current hazard rating system for ponderosa pine.

Knowing which conditions defined the likelihood of beetle infestation led to the realization that stand conditions could be altered to minimize the impact of the beetle. Thinning studies conducted during the late-1970s and early-1980s demonstrated that beetle-caused mortality could be reduced by creating less-than-favorable conditions for beetles (McGregor et al. 1987). Silvicultural recommendations for dealing with existing and threatening mountain pine beetle outbreaks now include:

- regeneration;
- sanitation/salvage;
- basal area reductions with or without species discrimination;
- thinning to promote non-host species; and ultimately
- creation of a mosaic of age, size, or species diversity.

In 1984, pheromone "tools" became available to the land manager and in some situations made silvicultural treatments more effective (Borden et al. 1983). Tree baits are now used somewhat routinely—at least in situations where trees can be removed. Pheromone traps have been used primarily for monitoring, but trap-out scenarios are now becoming more promising. Verbenone, an apparent mountain pine beetle anti-aggregant, has shown promise in protecting high-value trees and stands from beetle attack (Bentz et al. 2004).

Current Conditions in the United States

Mountain pine beetle populations have been increasing in the United States since 1999. In particular, the US Forest Service's Northern Region is currently experiencing an outbreak expansion.

Outbreak Status in the Northern Region

The current outbreak in the Northern Region began to attract attention in 1996. At this time, following a couple of years of slightly increasing infestations, just over 53,300 acres (21,570 ha) were infested. In 1997, the infested area increased to 71,600 acres (28,975 ha), then almost doubled to 114, 700 acres (46,417 ha) in 1998. In 1999, the infested area grew to 144,000 acres (58,275 ha) and in 2000 to 149,200 acres (60,379 ha). In 2001 we experienced a significant increase—to 236,500 acres (95,708 ha). And in 2002, the infested area came close to doubling again, increasing to 517,600 acres (209,465 ha). Data for 2003 infested areas have not been compiled; but in most infested areas, populations and beetle-killed trees are still increasing. In all infested areas, resources are being seriously impacted.

Current (2002) Conditions by State

Table 1 summarizes the infested area, by state, for those states reporting mountain pine beetle-infested areas in 2002.

Table 1. Mountain pine beetle-infested area, by state, 2002.

State	Infested Area (acres) (2002)	Infested Area (ha) (2002)
California	186,800	75,595
Colorado	209,000	84,579
Idaho	339,300	137,310
Montana	249,500	100,969
New Mexico	3,800	1,538
Nevada	2,600	1,052
Oregon	182,300	73,774
South Dakota	102,900	41,642
Utah	26,700	10,805
Washington	173,100	70,051
Wyoming	88,000	35,612

Figure 1 illustrates mountain pine beetle trends for the past 25 years. The peak infestation year of 1981, the decline in the early-1990s, and the resurgence in infested area in the past few years are all clearly seen.

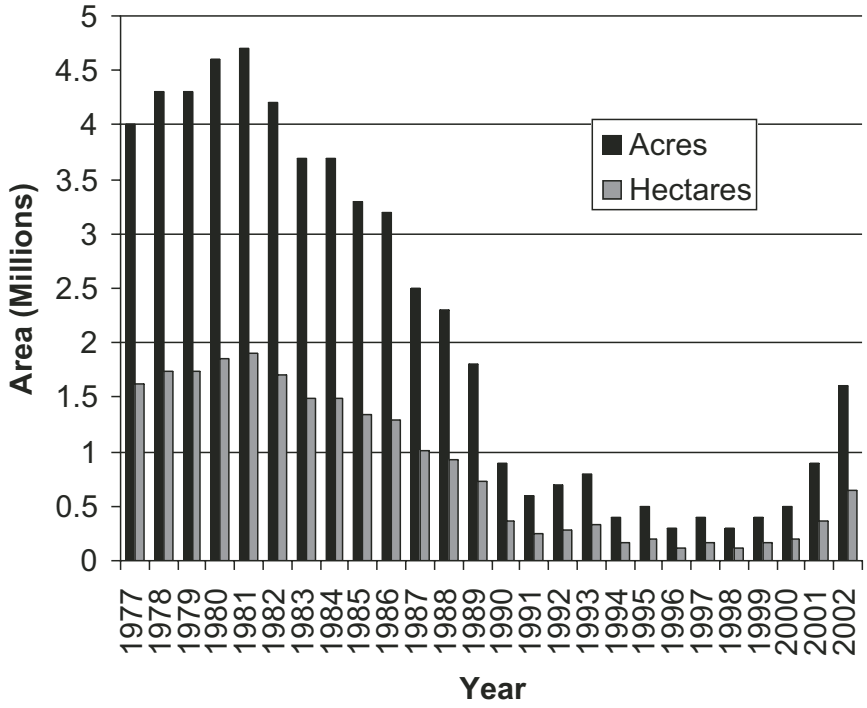

Figure 1. Mountain pine beetle-infested area, western United States, 1977-2002.

Other Affected Species

Although most management efforts to date have dealt with beetle-caused mortality in lodgepole pine stands, and to a lesser extent ponderosa pine, mountain pine beetle depredations in other hosts are significant. Prior to white pine blister rust (*Cronartium ribicola* J.C. Fisch.) devastating western white pine stands, mountain pine beetle outbreaks were regarded as one of western white pine's most damaging pest. With the desire to develop rust resistance in those forest types, the impetus to prevent beetle-caused losses has taken on a new emphasis.

In many parts of the northern Rocky Mountains, limber pine "decline" is a matter of serious concern to resource managers. While there are likely several factors involved in the decline of this most valuable, mid-elevation species, one of the most obvious agents contributing to tree mortality is mountain pine beetle.

Finally, at high elevation sites throughout the Rocky Mountains, whitebark pine is of importance because it is often the only, or major, tree species on those sites and is essential for an array of watershed, wildlife, and recreational amenities. Within the past few years, at least in our region, and I believe this to be the situation elsewhere, mountain pine beetles have killed thousands of trees in these fragile ecosystems. White pine blister rust is also becoming more prevalent. It is imperative that we strive to protect these high-value trees from beetle infestations.

Conclusions

In conclusion, mountain pine beetles, as native inhabitants of pine-dominated ecosystems in North America, were here long before us and will no doubt remain long after we are gone. Still, we must try to reduce tree mortality and realize management objectives. The past 25 years have seen great developments in our understanding of mountain pine beetle population dynamics, host interactions, and how beetle populations may be manipulated to our advantage. Most of the time, we know what we should do, and when we should do it; but often our resolve meshes poorly with those whose philosophies are counter to our own. In the US, we are frequently incapable of conducting management activities that would best serve the needs of the resource. Still, we learn, continue to improve, and develop more effective management strategies. I caution against becoming too self-confident in efforts to "out smart" mountain pine beetles, however. Most of the lessons I've learned in nearly 30 years of trying suggest we have yet to progress that far.

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