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DOUGLAS-FIR BEETLE POPULATION ASSESSMENT IDAHO PANHANDLE NATIONAL FORESTS

by
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Introduction

The unusually large amount of ice, snow, and wind-damaged trees that occurred during the winter of 1996-97 provided prime habitat for populations of the Douglas-fir beetle (DFB) *(Dendroctonus pseudotsugae)* to build to epidemic numbers. Beetles emerged during the spring and summer of 1998, attacking hundreds of thousands of standing Douglas-fir trees. Beetle attacks continued in green trees in 1999. This report documents DFB population assessments in 1999, including ground surveys of current beetle populations and aerial survey, which reports 1998 killed trees.

Current Beetle Population Assessments

Methods

Current (1999) Douglas-fir beetle attacked tree groups were located by external signs of beetle attack such as beetle boring dust, pitch streamers, and/or tree crowns that were starting to fade to a yellow-green color. In each beetle-attacked group, 5-10 trees with boring dust were sampled to determine the success of beetle attack, brood to parent ratios, and number and type of parasites and predators. On each sampled tree, we used a chisel or axe, rubber mallet, and bow saw to remove a 6- by 12-inch piece of bark from the bole at 5 and 12 feet from the ground.

The 12-foot sample was taken from a ladder. A tree was determined to be successfully attacked if a beetle gallery with complete larval mines was found in either sample. In each sample, number of gallery starts and number of larvae, pupae, or new adults were counted. Brood to parent ratios are calculated by multiplying the number of gallery starts by 2 (representing a male and female beetle for each gallery start) and dividing that number into the total number of new brood (larvae, pupae, and new adults added together). The number and type of parasites and predators was also recorded.

Results

Thirty-four Douglas-fir beetle infested tree groups were sampled on the Idaho Panhandle National Forests (IPNFs). These varied by district (table 1). In these groups, 167 trees were examined for beetle population assessment. The average diameter of all sampled trees was 18.7 inches. All sampled trees had boring dust. About 68 percent of sampled trees also had pitch streamers as evidence of beetle attack.

On the IPNFs as a whole, 71 percent of the beetle-attacked trees with boring dust

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contained successful beetle galleries and will die. Twenty-nine percent of trees had unsuccessful beetle galleries or no galleries at either 5 feet or 12 feet along the bole.

The range was 20-60 percent by ranger district (figure 1). Most of these trees will survive. Some may eventually succumb to the pathogenic blue stain fungus, *Ceratocystis pseudotsugae*, if sufficiently inoculated by DFB, but it may take several years (M.M. Furniss, personal communication). More than twice the number of unsuccessfully attacked trees was found in 1999 than in 1998 (Kegley et al. 1999). There are an even greater number of unsuccessfully attacked trees if those with pitch streamers as the only sign of beetle attack are included. On three trees cut down and sampled with pitch streamers alone, no successful beetle galleries were found anywhere along the bole although they had been attacked. Adult beetle galleries were found soaked in resin with no larval mines.

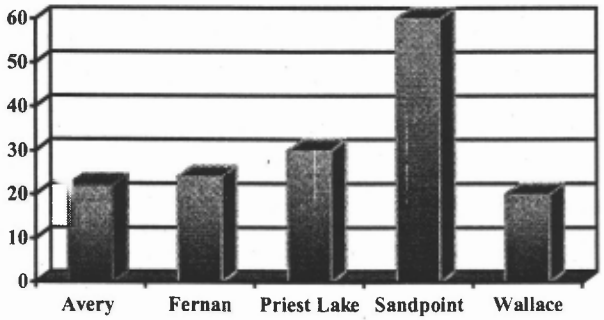
Although a small sample, this is consistent with what was found in trees with pitch streamers as the only sign of beetle attack sampled in 1998 (Kegley et al. 1999). The diameter of successfully attacked trees (19.6 inches) was significantly greater ($p < .01$) than the diameter of unsuccessfully attacked trees (16.6 inches).

It is very difficult to determine success of DFB attack from the ground in northern Idaho. On 71 percent of the trees sampled, no successful DFB galleries were found at the 5-foot height on the bole, but in fact, 60 percent of those had successful galleries higher up on the tree. Many of our sample trees would have mistakenly been assumed alive and unsuccessfully attacked based on the 5-foot sample alone.

Table 1. Plots and trees sampled for DFB population assessment by ranger district on the IPNFs.

District	# Of Plots	Total # Of Trees Sampled	Ave. Tree DBH
Avery	2	9	19.9
Fernan	16	79	18.7
Priest Lake	9	44	18.4
Sandpoint	4	20	16.1
Wallace	3	15	19.7
TOTALS	34	167	18.7

Figure 1. Percent unsuccessful DFB attacked trees, IPNFs 1999



The Sandpoint Ranger District had the highest proportion of unsuccessfully attacked trees. This may, in part, be explained by the size of the trees attacked. The average diameter of trees attacked on the District (16.1 inches) is significantly smaller ($p < .05$) than the average diameter of attacked trees elsewhere on the IPNFs.

The average brood to parent ratio for the IPNFs was 0.69 and ranged from 0.40 to 1.3 by ranger district (table 2). Brood to parent ratios were calculated on trees with successful galleries only and with the bark sample from 12 feet only. Beetle galleries are known to be more consistent at this height (Furniss et al. 1979). Brood to parent ratios of less than one indicate a declining population (fewer brood adults will emerge from these trees than the number of parent beetles that attacked them) (McGregor et al. 1975). Other mortality agents affect the beetles during the winter, during spring flight, and as they attack new trees. A 30 percent reduction for these other mortality agents has been assumed in previous population assessments (Furniss et al. 1979). In applying that reduction to the ratios we found, all would be less than one.

Table 2. Brood to parent ratios by ranger district on successfully attacked trees.

District	Brood/Parent Ratio
Avery	1.3
Fernan	0.7
Priest Lake	0.4
Sandpoint	0.8
Wallace	0.7
Average on IPNFs	0.69

Parasites and predators were more abundant in 1999 samples than those examined in 1998. In 1998, one predator or parasite was found for every 21 Douglas-fir beetle larvae, pupae or new adult (new brood) (Kegley et al. 1999). In 1999, one predator or parasite was found for every 2.3 new DFB brood. The most abundant parasite found on all districts was *Coeloides vancouverensis* (=*brunneri*), a parasitic wasp (table 3). We also found larvae of a parasitic fly, *Medetera* spp., and predatory clerid beetles and ostomid beetles.

Table 3. Parasites and predators found in trees infested by Douglas-fir beetles.

District	*Medetera* sp.	*Coeloides vancouverensis*	Predatory clerid	Predatory ostomid	Ratio of parasites to new DFB brood
Avery	1	10	0	1	1:6.8
Fernan	29	248	13	0	1:2.0
Priest L.	2	90	1	0	1:1.9
Sandpoint	1	32	0	0	1:3.5
Wallace	5	44	1	0	1:2.6
Total	38	424	15	1	1:2.3

Aerial Survey Data

Aerial surveys currently provide the best cost-effective broadscale information on insects affecting forests. A major drawback is that they can only detect trees with fading or defoliated crowns, or trees broken or windthrown. Trees that are infested by bark beetles can take from several months to over a year for their crowns to fade from green to red. Aerial survey flights conducted from July through September each year detect trees that were killed by bark beetles the

previous summer. Only current tree mortality is mapped each year so that trends from year to year can be obtained.

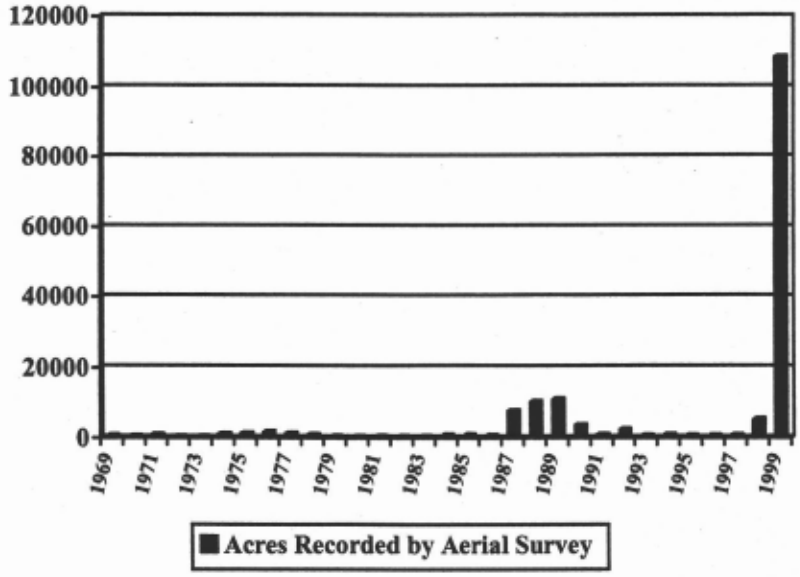
The regular aerial survey conducted during the summer of 1998 detected about 6,000 trees killed by DFB on just over 5,000 acres on state, private, and federal land in the IPNFs reporting area. This actually represents trees that were attacked and infested in 1997. The majority of DFB in 1997 were infesting downed and broken trees produced by winter storms. In 1999, aerial survey detected nearly 250,000 trees on over 108,000 acres. This information is separated by ownership in table 4. Again, this represents trees attacked in 1998. Many trees attacked in 1998 lost their needles by the time aerial survey was conducted in 1999 and were probably not detected. Therefore, the number of trees infested in 1998 is likely under estimated.

Table 4. DFB infested acres in 1998 on the IPNFs and adjacent state and private land as detected by aerial survey in 1999.

Reporting Area	Owner	Acres	Trees
Coeur d'Alene	BLM	527	1,510
	Private	4,247	9,985
	State	1,188	3,384
	USFS	63,673	131,328
Total CDA		69,635	146,207
Kaniksu	BLM	915	2,083
	Private	1,744	3,770
	State	871	1,938
	USFS	28,725	72,644
Total Kaniksu		32,255	80,435
St. Joe	BLM	278	1,237
	Military	6	65
	Private	1,124	3,808
	State	653	1,836
	USFS	4,579	16,010
Total St. Joe		6,639	22,956
Total IPNFs		108,529	249,598

Data from aerial survey information for the last 30 years on the IPNFs Reporting Area show an increase in DFB-caused tree mortality in 1998 and a dramatic increase in 1999 for the first 2 years of the current outbreak (figure 1). Trees attacked and killed in 1999 will not be detected by aerial survey until the summer of 2000.

Figure 2. Aerial survey estimates of DFB infested acres, 1969-1999, IPNFs and adjacent state and private land.



Conclusions

The IPNFs and adjacent state and private land is experiencing the largest DFB outbreak seen in many years. However, data suggests it may have reached its peak.

The increase in unsuccessful DFB galleries from 1998 to 1999 (12 percent in 1998 compared to 29 percent in 1999), low brood to parent ratios, and increased numbers of parasites and predators suggest that DFB populations are declining. This does not mean beetles will disappear in 2000 (71 percent of 1999 infested trees will die and produce new beetles); but tree mortality should be less than in 1999. However, if another disturbance produces large amounts of downed and damaged trees over the winter, populations may increase once again. We do not know yet what damage might have occurred in the forest during windstorms that blew down many trees in the city of Coeur d'Alene in January 2000.

Many landowners salvaged beetle-infested trees before beetle emergence in spring 1999. Also, beetle pheromones were used to manipulate beetle populations in 1999. The anti-aggregating pheromone, MCH, was used to protect trees on large acreages from attack. Beetles that fly into treated areas do not stop to attack trees, theoretically are forced to fly longer and are exposed to greater risk of mortality. The attractant pheromone was used in 431 traps catching over 764,300 beetles. In some areas, a combination of salvaging beetle infested trees and the use of pheromones may have contributed to the beetle population decline.

Acknowledgements

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