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DOUGLAS-FIR BEETLE POPULATION ASSESSMENT IDAHO PANHANDLE NATIONAL FORESTS, 2000

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Introduction

This report documents Douglas-fir beetle (DFB), *Dendroctonus pseudotsugae* Hopkins, activity and population assessments conducted in the year 2000, the third year of the current outbreak in standing trees on the Idaho Panhandle National Forests (IPNFs). We include ground surveys of current beetle populations and aerial survey, which reports trees killed in previous years. This outbreak was started by DFB infesting and reproducing in an abundance of winter-damaged trees in the spring of 1997. DFB populations increased dramatically in downed and damaged trees and spread to standing green trees in the spring of 1998. Previous reports (Kegley 2000 and Kegley et al. 1999) describe DFB populations in standing trees in 1998 and 1999. The purpose of this assessment is to provide information on the status of the current outbreak.

Current Beetle Population Assessments

Current (2000) Douglas-fir beetle attacked trees were located by looking for fresh boring dust (frass) on tree boles. Once a group of currently attacked trees was found, all infested trees were measured and recorded. Up to five currently attacked trees were randomly chosen for population sampling in each group. Standing on a ladder, we removed a 6- by 12-inch piece of bark from the bole of each tree at about 12 feet from the ground. A tree was determined to be successfully attacked if a DFB beetle egg gallery with complete larval mines was found.

Unsuccessfully attacked trees contained resin soaked galleries or no galleries at all. On each bark sample from successfully attacked trees, number of gallery starts and number of larvae, pupae, and new adults were counted. Brood to parent ratios were 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 numbers and types of parasites and predators found were recorded. Population sampling was conducted in September and October 2000.

Proportion of Successfully Attacked Trees

Currently attacked trees proved difficult to find in 2000 and all found were located in close proximity to trees killed the previous year. It was common to find trees that were attacked successfully high on the bole in 1999 and re-attacked in the uninfested lower bole in 2000. This habit of beetles re-infesting trees more than 1 year is an indicator of a declining population. These trees were not sampled because they were not considered representative of the population in green trees. A total of 27 trees attacked only in 2000 were sampled from seven different areas on the Priest Lake, Sandpoint, and Coeur d'Alene River Ranger Districts (RD). Areas sampled on the Priest Lake RD were Pyramid Pass, Lamb Creek, and two near Binarch Mountain.

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Kickbush Ridge was sampled on the Sandpoint RD. Kings Ridge and Mineral Ridge were sampled on the Coeur d'Alene River RD. Number of currently attacked trees in each area varied. The largest group contained 12 newly attacked trees.

Overall, 74 percent of the attacked trees contained successful beetle galleries and will die. The average diameter of successfully attacked trees was 19.8 inches. About 26 percent of the trees sampled contained unsuccessful beetle galleries or no galleries at 12 feet above the ground. The average diameter of these trees was 15.5 inches, significantly smaller than the successfully attacked trees. These trees will likely survive the beetle attack unless they were sufficiently inoculated with the pathogenic blue stain fungus, *Ceratocystis pseudotsugae*, in which case it would take several years for the tree to die. Regardless of whether or not these unsuccessfully attacked trees survive, they will not produce any new Douglas-fir beetles.

The percent of unsuccessfully attacked trees more than doubled from 12 percent in 1998 to 29 percent in 1999. However, this index declined slightly to 26 percent in 2000. A higher proportion of unsuccessfully attacked trees from one year to the next indicates beetle populations are declining. In a previous outbreak on the Clearwater National Forest (NF) in northern Idaho, the percent of unsuccessfully attacked trees averaged 22, 58, 29, and 35 each subsequent year from 1971 to 1974. The decrease from 58 percent in 1972 to 29 percent in 1973 was thought to be due to droughty conditions that are stressful to trees and favorable to beetles (Furniss et al. 1979).

Northern Idaho experienced lower than normal moisture levels in 2000 (National Weather Service), which may explain why the number of unsuccessful attacks decreased.

Douglas-fir Beetle Population Index

Brood to parent ratios on the three districts sampled ranged from 0.6 to 0.8 (Table 1). Overall, the average was 0.66, similar to an average of 0.69 found in 1999 (Kegley 2000). Broods to parent ratios of less than 1 indicate a declining population (McGregor et al. 1975).

Parasites were abundant in our samples. However, only pupae of *Coeloides vancouverensis* (=*brunneri*), a parasitic wasp and larvae of the parasitic fly, *Medetera* spp. were found. Predatory clerid and ostomid beetles found in previous years were lacking in our sample. The proportion of parasites to DFB larvae, pupae, and new adults (brood) has increased every year since 1998. In 1998, only one parasite to every 21 DFB brood was found (Kegley et al. 1999). In 1999, numbers of parasites and predators increased to 1 for every 2.3 DFB brood (Kegley 2000). In 2000, an average of 1 parasite was found for every 1.8 DFB brood (Table 1). Numbers of parasites per square foot of bark ranged from 5.5 to 11 with an average of 8.7 overall. In 1999, the density of parasites and predators averaged 7.9 per ft^2. Total parasites and predators on bark samples from the DFB outbreak on the Clearwater NF averaged 6.6 – 15.55 per ft^2 from 1971-1974; however, no clear trend towards increasing or decreasing density was found from the beginning to the end of the outbreak (Furniss et al. 1979).

Table 1. Brood to parent ratios and parasite information on successfully attacked trees by RD.

Ranger District	Brood/parent Ratio	Ratio of parasites to new DFB brood	# parasites/ft^2
Priest Lake	0.6	1:1.6	9.3
Sandpoint	0.6	1:1.4	11.0
CDA River	0.8	1:4.0	5.5
Average overall	0.66	1:1.8	8.7

Aerial Survey Data

Aerial surveys conducted during summer months can detect trees killed by bark beetles--most often 1 year after they are attacked. In the case of DFB, attacked trees can take from several months to a year or more to fade. A key to detecting recently killed Douglas-fir trees is faded foliage (reddish hue) visible from the air. From 1998 through 2000 successfully attacked Douglas-fir faded in a wide variety of ways from one year to the next. Variations included turning red, turning red quickly and losing foliage, turning chlorotic (light green or yellow), turning chlorotic and quickly losing foliage, and staying green and losing foliage. From the air, only trees with red foliage were counted and, therefore, some Douglas-fir mortality went undetected. In addition, much of the forests were flown in late September when more trees lost their foliage and adjoining State and private lands were minimally surveyed in 2000. These factors suggest that Douglas-fir mortality from aerial survey was underestimated.

Aerial survey, conducted on the IPNFs in July and September detected nearly 204,000 trees killed on over 104,000 acres in 2000. Acres infested and trees killed varied by reporting area (Table 2). This is a decrease from 1999 when almost 250,000 trees were killed on over 108,000 acres. Acres infested with DFB over the past 30 years on the IPNFs are shown in figure 1. Numbers of trees killed during the last two outbreaks starting in 1987 are shown in figure 2.

Table 2. DFB infested acres and number of trees killed on the IPNFs and adjacent State and private land as detected by aerial survey from 1998-2000.

Reporting Area	2000 Acres infested	2000 Trees killed	1999 Acres infested	1999 Trees killed	1998 Acres infested	1998 Trees killed
Coeur d'Alene	66,796	114,704	69,635	146,207	2,730	1,651
Kaniksu	30,440	73,054	32,255	80,435	471	1,025
St. Joe	6,805	15,994	6,639	22,956	1,978	3,600
Total IPNFs	104,041	203,752	108,529	249,598	5,179	6,276

Figure 1. Aerial survey estimates of DFB infested acres for the past 30 years on the IPNFs and adjacent State and private land.

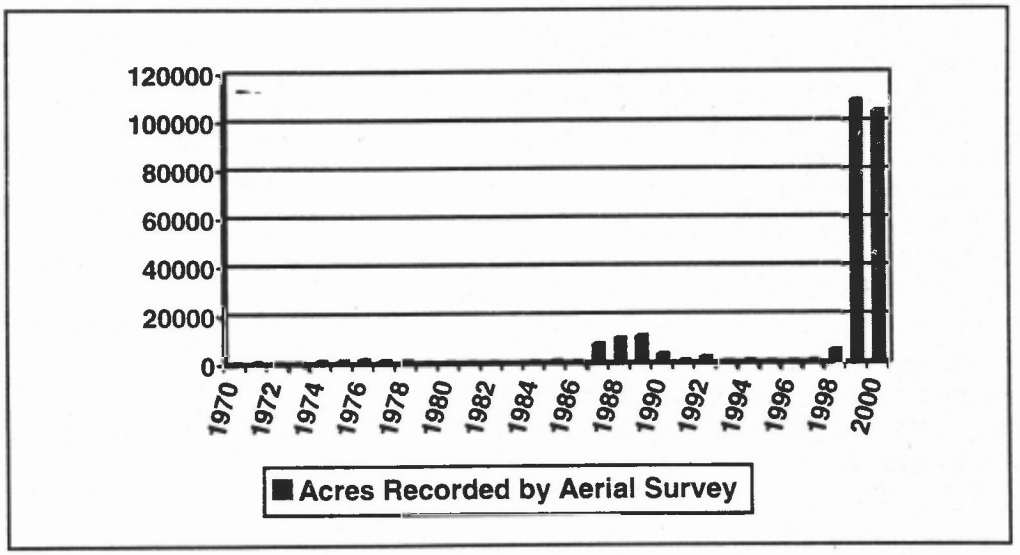
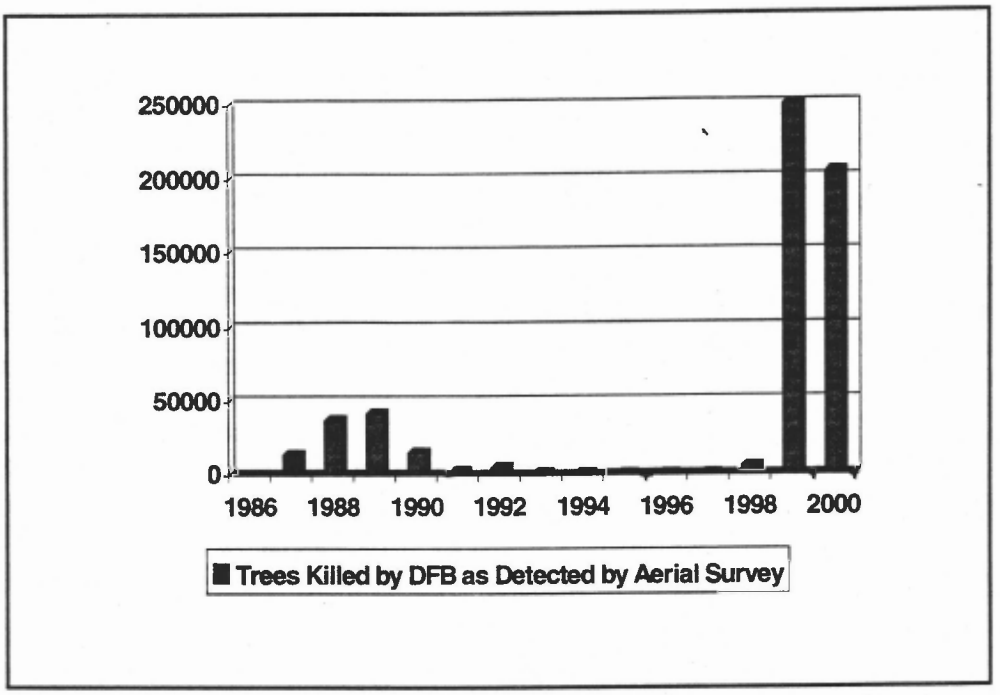


Figure 2. Number of trees killed by DFB in 1985-1999 as detected by aerial surveys conducted from 1986-2000 on the IPNFs and adjacent State and private land.



Summary

The current DFB outbreak on the IPNFs is the largest recorded by aerial survey. Aerial survey data suggest the overall outbreak is declining and that the peak occurred in 1998 (detected by aerial survey in 1999). Ground data from the DFB population assessment in 1999 also suggested an overall population decline from 1998 based on an increase in unsuccessfully attacked trees, brood to parent ratios less than one, and an increase in parasites (Kegley 2000). The sample obtained for the current DFB population assessment is limited and only representative of the areas where the data were collected. The 2000 sample showed brood to parent ratios less than one, an increase in parasite density from 1999, but a similar percent of unsuccessfully attacked trees to 1999. These data suggest a continued decline in the DFB populations in those areas.

There still may be localized areas where heavy mortality is occurring. Current below normal moisture conditions may make remaining Douglas-fir trees more susceptible to DFB attack and we could see increased mortality levels in certain areas in 2001. However, we do not expect mortality levels similar to1998 to return.

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References

Furniss, M.M., McGregor, M.D., Foiles, M.W., and Partridge, A.D. 1979. Chronology and characteristics of a Douglas-fir beetle outbreak in northern Idaho. USDA For. Serv. Gen.Tech. Rpt. INT-59. 19p.

Kegley, S., Randall, C, Jewett, D. and Wulff, D. 1999. Douglas-fir beetle population surveys, Idaho Panhandle National Forests, 1998. USDA For. Serv. Northern Region Rpt. 99-5, 5p.

Kegley, S. 2000. Douglas-fir beetle population assessment, Idaho Panhandle National Forests. USDA For. Serv. Northern Region Rpt. 00-4. 6 p.

McGregor, M.D., Furniss, M.M., Bousfield, W.E., Allmas, D.P., Gravelle, P.J. and Oakes, R.D. 1975. Evaluation of the Douglas-fir beetle infestation, North Fork Clearwater River drainage, Northern Idaho, 1970-1973. USDA For. Serv. Northern Region Rpt. No. 74-7. 17 p.