



Aerial Survey to Detect Tree Mortality and Bear Damage in Western Oregon

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Fig. 1 Bear damage on Douglas-fir tree

Background

In the Pacific Northwest, black bears damage young conifer trees by peeling the bark in spring (figure 1). Approximately one year after the damage occurs, tree crowns turn red-brown and are visible from the air. In young Douglas-fir plantations, bears can kill up to 75 percent of the trees.

Since 1987, we have surveyed western Oregon periodically with a fixed-wing aircraft and mapped recently killed conifer trees. We survey 5 to 6 million acres of forestland each year. A ground-verification project in 1989 estimated that 75 percent the polygons mapped in the survey contained trees damaged by bears. The purpose of the project reported in this poster was to update ground-verification data and describe the accuracy of the aerial survey.



Results: Accuracy of Location of Sketch-mapped Polygons

- Based on the helicopter verification (n=35 polygons), 60% of polygons were within 1/4 mile of the true location, 83% were within 1/2 mile of the true location, and all were within 3/4 mile of the true location (figure 5).
- For the polygon set checked by cooperators (n=79), 88% were sketch-mapped accurately enough to be located by ground crews.
- Estimates of the number of dead trees in a polygon or its area (acres) did not differ significantly between the fixed-wing and the helicopter surveys.

Frequency Distribution of Distance Between Fixed-Wing and Helicopter Polygon Centers

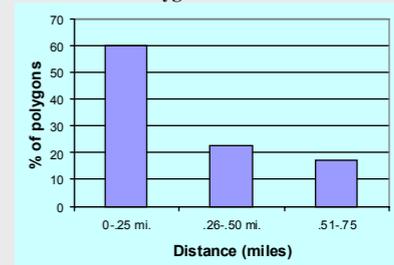


Fig. 5 Distance from sketch mapped polygon center to polygon center determined by helicopter.

Objectives

- To describe the spatial accuracy of polygons sketch-mapped from fixed-wing aircraft
- To determine the causes of death for recently-killed conifer trees detected by the aerial survey
- To describe the amount and severity of bear damaged in the surveyed area

Methods

In June 2000, we surveyed 6.4 million acres of forestland from a fixed-wing aircraft equipped with a digital sketch-mapping system (figures 2 and 3). Aerial observers mapped all conifer trees with red crowns, indicative of recent tree death (figure 4).

We randomly selected two sets of polygons (n=35 and n=79) for ground-verification and derived latitude and longitude for them from the digital sketch map.

We used a helicopter to establish the true location of one set (n=35) of polygons. Ground crews assessed tree damage in a 5-acre sampling area within each of these polygons.

Cooperating landowners visited the other 79 polygons and determined the causes of tree mortality.

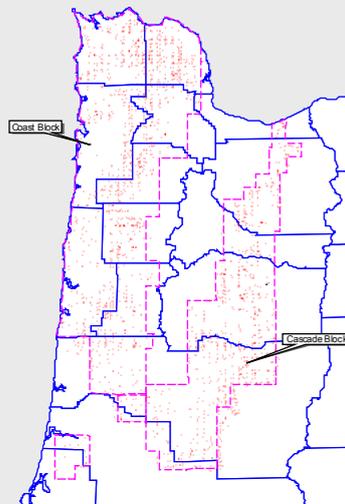


Fig. 2 Map showing polygons with tree mortality detected in the 2000 aerial survey.

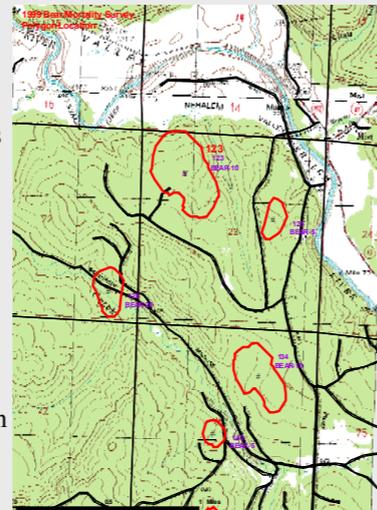


Fig. 3 Example of map used to locate polygons in the field

Results: Causes of Mortality

Mortality Agent Frequency



Fig. 6 Estimated percentage of polygons containing trees killed by various agents.

Of the 1,835 polygons mapped in the survey, we estimated that 42% had trees with bear damage, 63% had trees with root disease, and 43% had trees with damage from other agents (figure 6). 89% of polygons contained trees with damage from bear and/or root disease. Most polygons had more than one damage agent present.

Frequency Distribution of Bear Damage by Polygon Size

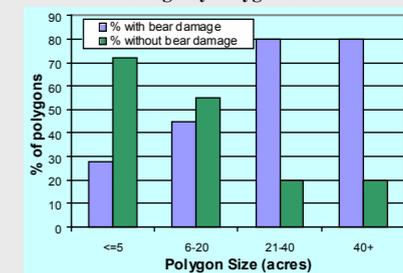


Fig. 7 Percentage of sample polygons with or without bear damage, in relation to estimated size of the polygon (acres).

Large polygons (in terms of acres or number of dead trees) were more likely to contain trees with bear damage than small polygons (figure 7). Bears were the primary damage agent for all polygons with more than 50 dead trees (as estimated by aerial observers).

In the survey area, bears *damaged* more trees than did other agents, but root disease *killed* more trees than did other agents.

Aerial Signature of Dead Douglas-fir



Figure 4 Douglas-fir trees killed by bears appear red or reddish brown the year after being girdled by bears.

Results: Other Findings

- Within the 6.4 million-acre survey area, we estimated that at least 55,000 trees are killed or damaged by bears *annually*.
- The majority of sample polygons had fewer than 10 trees per acre killed or damaged by bears. The sample polygon with the most severe bear damage had 57 trees per acre killed or damaged by bears.
- Based on crown color of bear-killed trees, we confirmed June-July as the preferred time to detect trees killed by bears one year prior to the survey.
- The ratio of partially peeled trees (living) to completely peeled trees (dead) was 2:1.
- Ninety-one percent of bark peeling occurred at the base of trees, within 2 feet of the ground (based on a sample of 1,014 trees).

Acknowledgements

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