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MORTALITY AND GROWTH PLOTS ON BOGGS MOUNTAIN STATE FOREST

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INTRODUCTION

This note deals with tree growth and the extent of mortality caused by insects and diseases following logging on Boggs Mountain State Forest. Boggs Mountain State Forest is located near Hobergs in south-central Lake County, California, at an elevation of from 2,500 to 3,500 feet in the Coast Range mountains. The Forest contains 3,433 acres. The Forest is mostly ponderosa pine (Pinus ponderosa) forest type (fig. 1). Other tree species within the



Fig. 1. A view of young growth timber on Boggs Mountain State Forest, 1961.

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stand are sugar pine (Pinus lambertiana), Douglas-fir (Pseudotsuga menziesii), and incense-cedar (Libocedrus decurrens). Ten permanent 2½ acre plots were established on cutover areas of the Boggs Mountain State Forest in 1952 and 1953 to measure growth and mortality, especially to determine losses from forest insects. Results of a 1960 remeasurement of these plots are presented in this report.

The Boggs Mountain State Forest was acquired in 1949 as a recent cutover young growth forest from which all merchantable timber had been cut except for a few seed trees and scattered patches of mature trees considered inaccessible at the time of purchase. Cutting and logging were carried out under the terms of a precutting agreement with the former owners.

METHOD

Procedures were designed by Ralph Hall, entomologist, who at that time was with the Bureau of Entomology and Plant Quarantine, Agriculture Research Administration, United States Department of Agriculture.

Ten permanent plots were established in 1952-53. The 2½ acre, five-chain square plots, were located at section corners or quarter corners for ease of relocation. Plots were distributed to sample varying conditions existing at the time of their establishment. Plot corners were made permanent at the time of the 1960 reinventory with mounds of rock and 1/2 inch by 3 foot concrete reinforcing rods. All trees 11.6" d.b.h. and over were measured and numbered with white paint at the time of initial measurement. Since many of these numbers were difficult to read seven and eight years later, all trees were tagged with numbered one-inch square aluminum tags in 1960. Tags were attached at d.b.h. with two-inch aluminum siding nails. Diameter measurements were taken to the nearest one-tenth inch immediately above the tag nail with diameter tape. Tree height and age by increment core borings were taken on 15 to 20 percent of the dominant and codominant trees on each plot. Each sawlog tree was assigned a Keen^{2/} tree class and Dunning^{3/} tree class. Trees infected with western dwarfmistletoe (Arceuthobium carylopodum) were rated by Gill's^{4/} mistletoe rating system. The presence of any other abnormality was noted for each tree.

2/ KEEN, F. P. 1943. Ponderosa pine tree classes redefined. Jour. For. 41: 249-253.

3/ DUNNING, Duncan. 1928. A tree classification for the selection forests of the Sierra Nevada. Jour. Agri. Res. 36: 755-771.

4/ GILL, Lake S. 1935. Arceuthobium in the United States. Conn. Acad. Arts and Sci. Trans. 32: 111-245.

The initial measurement of these plots was made during two different years. Seven plots were established prior to the 1952 growing season and three plots were established prior to the 1953 growing season. All plots were remeasured prior to the 1960 growing season in order to facilitate future remeasurements.

RESULTS

The primary purpose for establishing these plots was to determine the extent of losses from insect attacks following logging. The distribution and the small number of plots render them unsuitable for inventory purposes. The results given are for the plots only and cannot be projected to other areas of the Forest with any known degree of accuracy.

Results of the growth analysis are shown in tables 1, 2, 3, and 4. These tables were compiled from individual tree volumes as computed for each plot. Dunning's site class^{5/} was determined for each plot on the basis of height-age measurements of dominant trees. One-tenth inch volume tables^{6/} corresponding to the Dunning site class were then used to compute tree volumes for each plot. The results are separated by timber types: ponderosa pine, ponderosa pine—Douglas-fir, and Douglas-fir.

Insect caused mortality on all plots over the past seven to eight years has been of little consequence. A total of only five sawlog trees died from all causes on the entire ten plot (25 acre sample) area. All were ponderosa pines. The death of two pines representing a combined volume of 3,768 board feet was attributed to attacks of the western pine beetle (Dendroctonus brevicornis). Of the other three dead trees, one died from mechanical damage, one from dwarfmistletoe, and one from undetermined causes. This data does not indicate any particular insect problem following logging on the Boggs Mountain State Forest. Only an occasional old high risk pine has been killed by insects in recent years.

Western dwarfmistletoe was found to be present in varying amounts on eight of the plots. Although mistletoe is widespread on the Forest, it has caused little damage to date. However, it could develop into a serious problem and should be considered in future management of ponderosa pine on the Forest. An indication of the rate of spread and the seriousness of this parasite may be obtained by close observation of these infested plots.

^{5/} DUNNING, Duncan. 1942. A site classification for the mixed conifer selection forests of the Sierra Nevada. Calif. For. and Rge. Exp. Sta. Res. Note No. 28.

^{6/} Forest Survey, Calif. For. and Rge. Exp. Sta. 1956. Tenth-inch volume tables for the commercial conifer species of California. California Region, U.S. Forest Service. 52 pp. Multilithed.

Ponderosa pine (five plots)

All five ponderosa pine plots were established in 1952. Results of the eight year growing period are shown in table 1. Composition of these five plots ranged from 81 to 100 percent ponderosa pine, with sugar pine as an associated species on better sites. Four of these plots are in Dunning's site class I; and one is site class II. A true picture of total growth on these plots is not shown by the data which is limited to sawtimber size trees. These plots are well stocked with pole-size trees (less than 11.6" d.b.h.) and reproduction (figs. 2 and 3). An eight year net increase of 1,824 board feet per acre or a periodic net annual increase of 228 board feet per acre was added to base growing stock of only 4,313 board feet per acre. However, many fast-growing pole-size trees added considerable volume which was not measured because of their small size. Also, the net increase figure was lowered because of a 211 board foot per acre loss, due to the death of a single large pine.

Table 1. Number and volume of sawlog trees on five ponderosa pine plots.

	1952 Inventory	8-year Ingrowth	8-year Mortality	1960 Inventory	Periodic net annual increase
Ave. No. trees/acre	25.0	7.0	0.1	32.0	
Ave. bd.ft. vol./acre	4,313	147	211	6,137	228

Ponderosa pine—Douglas-fir (4 plots)

Three plots were established in the ponderosa pine—Douglas-fir type in 1953. Table 2 shows the results of the seven year growing period on these plots. The data from one plot, which is also a ponderosa pine—Douglas-fir plot, has been given separate consideration in table 3 because it was established in 1952 and represents an eight year growing period.

Composition of the four ponderosa pine—Douglas-fir plots averaged 57 percent Douglas-fir, 26 percent ponderosa pine, 15 percent sugar pine, and 2 percent incense-cedar. All of these plots are in Dunning's site class I. The average periodic net annual increase for the four ponderosa pine—Douglas-fir plots was 380 board feet per acre. This is better than the 228 board



Fig. 2. Well stocked pole-size stand of ponderosa pine.



Fig. 3. Natural ponderosa pine reproduction following logging on Boggs Mountain State Forest.

feet per acre increase shown by the ponderosa pine plots. However, this increase was added to a base growing stock of 19,715 board feet per acre as compared with a base growing stock of only 4,313 board feet per acre on the ponderosa pine plots (fig. 4).

Table 2. Number and volume of sawlog trees on three ponderosa pine—Douglas-fir plots (7½ acre sample).

	1953 Inventory	7-year Ingrowth	7-year Mortality	1960 Inventory	Periodic net annual increase
Ave. No. trees/acre	30.2	3.7	0.3	33.6	
Ave. bd.ft. vol./acre	19,715	127	326	22,471	394

Table 3. Number and volume of sawlog trees on one ponderosa pine—Douglas-fir plot (2½ acre sample).

	1952 Inventory	8-year Ingrowth	8-year Mortality	1960 Inventory	Periodic net annual increase
Ave. No. trees/acre	28.0	2.4	0.4	30.0	
Ave. bd.ft. vol./acre	5,750	82	9	8,452	338

Douglas-fir (one plot)

Table 4 shows the data from the only Douglas-fir plot included in this study. Composition of this plot was 83 percent Douglas-fir, 11 percent sugar pine, and 6 percent ponderosa pine. The plot is Dunning's site I. The periodic net annual increase over an 8-year growing period was 731 board feet per acre on a base growing stock of 18,682 board feet per acre. This plot appeared to have had considerable volume removed by logging just prior to establishment.



Fig. 4. Old residual pines in the ponderosa pine—Douglas-fir stands.

Table 4. Number and volume of sawlog trees on one Douglas-fir plot (2½ acre sample).

	1952 Inventory	8-year Ingrowth	8-year Mortality	1960 Inventory	Periodic net annual increase
Ave. No. trees/acre	58.4	8.8	0.4	66.8	
Ave. bd.ft. vol./acre	18,682	490	451	24,528	731

CONCLUSIONS

Data from ten permanent growth plots on the Boggs Mountain State Forest indicates insect and disease caused mortality after the 1948-1952 logging has been of little consequence. The death of occasional old trees of high volume indicates a need for high risk harvest of old residuals. Infestations of western dwarf-mistletoe are widespread on the Forest. This parasite could become a serious problem and should be kept under close surveillance.

The periodic net annual growth on the ponderosa pine plots was 228 board feet per acre, the ponderosa pine-Douglas-fir plots 380 board feet per acre and the Douglas-fir plot 731 board feet per acre. These growth rates are dependent on the reserve saw-timber volume and ingrowth, not on forest type. The plot data may be indicative of growth rates from stands with a similar history and stand structure.