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## GROWTH PLOTS ON MOUNTAIN HOME STATE FOREST

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Ten permanent sample plots were established to determine tree mortality caused by insects and disease and to collect tree growth data on the Mountain Home State Forest near Springville, Tulare County, California. All but one plot were in recent cut-over areas. Plot 4 was in a 70 year old even-aged stand of Sierra redwood (*Sequoia gigantea*). This paper reports the results of remeasurement of these permanent plots after a five-year period.

### METHOD

The plots and the methods used were promulgated by the Bureau of Entomology and Plant Quarantine, Agriculture Research Administration of the U. S. Department of Agriculture to determine insect mortality losses. Procedures were designed by Ralph Hall, Entomologist (now U. S. Forest Service), and Daniel Dotta, Forest Manager (California Division of Forestry).

The ten 1-acre plots were established in 1952 and 1953. Plot locations were varied as to aspect, species, age, types, density, logging disturbance, etc., to sample the different conditions on the forest. The plots are 2 chain by 5 chain rectangles. Plot corners are marked by redwood posts, and posts or stakes are set on the plot boundaries at 1 chain intervals. All sawlog trees (11.6" DBH and over) were tagged with numbered round aluminum tags placed at DBH. Total height in feet was measured for the sawlog trees from the average ground level to the tip. The diameters breast high were measured in inches and tenths. Trees from 1.1 to 11.5 inches DBH were counted on the entire plot and recorded by 2 inch classes. This group was called "poles." The reproduction on the plots when remeasuring after five years was estimated by counting a 6.6 foot strip (1/20 acre) through the center of the plot lengthwise.

### RESULTS

The findings of the five-year remeasurements are shown for sawlog trees, poles and reproduction. The Sierra redwood plot is separated from the other plots for the sawlog tree results.

## Sawlog Trees

### Plot 4 - Sierra redwood

This is an even-aged stand of young Sierra redwood 70 years old originating after logging which took place between 1886 and 1890. There were 110 original trees tagged when the plot was established in 1952. After five years there was an ingrowth of 11 trees (poles which had increased to 11.6" DBH or larger). Total volume increased from 44,342 board feet to 55,828 board feet. This is an annual increase over the period of 2,297 board feet per acre. These figures may be as much as 30% too high because there is no young-growth volume table for Sierra redwood, and a Coast redwood (Sequoia sempervirens) volume table <sup>1/</sup> was used.

The results on this plot are amazing even with a 30% volume table deduction. The plot is not fully stocked because of the presence of brush patches, a meadow, and a veteran redwood in the plot. This veteran was excluded from all measurements and calculations. The average five-year periodic height growth was 8.9 feet. Mean annual net increment for the entire 70-year life of this stand is 798 board feet per acre.

### Nine Plots - Mixed Conifer

Plots 1 to 10, exclusive of plot 4, were established in mixed-conifer type on selectively cut land logged from 1940 to 1953. The composition was predominantly white fir (Abies concolor), with sugar pine (Pinus lambertiana) and incense cedar (Libocedrus decurrens). Plot 8 had a few black oaks (Quercus kelloggii). Eight large redwoods (over 55 inches DBH) containing about 144,000 merchantable board feet in four of the plots are not included in the figures in table 1. Dunning's <sup>2/</sup>Site II volume table was used to compute volumes. Mortality was caused mainly by mechanical damage. One large redwood fell into plot 10 from natural causes and knocked down three tagged trees. Bark beetles caused some mortality in white fir.

## Pole Trees

The 10 plots yielded the data shown in table 2 from the "pole count" of trees 1.1" to 11.5" DBH.

During the five-year period 9.7 trees per acre moved into the pole class and 3.5 poles moved into the saw timber class, leaving a net increase of 6.2 poles per acre. The "net pole ingrowth" is the actual ingrowth less the mortality loss in this size class. Mortality in the pole class could not be accurately determined, but 4 Sierra redwood and 20 white fir were tallied as having died during the period.

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<sup>1/</sup> FOREST SURVEY, California Forest and Range Experiment Station. 1956. Tenth-Inch Volume Tables for the Commercial Conifer Species of California; Pg. 37. Young-Growth Coastal Redwood, Scribner Board Feet (CF&RMS-1952). USDA, Forest Service, California Region, Division of Timber Management, Division of State and Private Forestry. 52 pp. multilithed.

<sup>2/</sup> DUNNING, Duncan. 1945. Diameter Class Volume Tables for California Old-growth Timber. Forest Research Note No. 42. California Forest and Range Experiment Station, U. S. Forest Service. 4 pp. Multilithed.

Table 1. Number and volume of sawlog trees (11.6"  $\neq$  DBH) on nine mixed conifer plots.

	Original Trees (1951-1952)	5-year Ingrowth	5-year Mortality	Total After Five Years (1956-1957)	Periodic Net Annual Increase
Total number of trees	364	28	8	384	4
Average number of trees per acre	40.4	3.1	0.9	42.7	0.5
Total volume (fbm)	239,164	1,555	2,318	267,802	5,728
Average volume per acre (fbm)	26,574	173	357	29,756	636

Table 2. Average number of poles per acre for ten plots.

Species	Original Poles (1951-1952)	Net Pole Ingrowth	Lost by Sawlog Ingrowth	Net Total After 5 Years (1956-1957)
Sugar pine	20.1	3.6	0.1	23.6
Ponderosa pine	0.4	0	0	0.4
Sierra redwood	14.3	7.0	0.8	20.5
White fir	56.1	1.4	2.0	55.5
Incense cedar	18.4	-2.3	0.6	15.5
Total	109.3	9.7	3.5	115.5

Mortality in white fir poles was probably caused by Armillaria root rot and Scolytus beetles. Redwood was killed by competition within the stand.

#### Reproduction

Reproduction (trees from 1 foot high to 1.0" DBH) on the plots was estimated by counting a strip through the center of each plot. A summary of these counts is shown in table 3.

Table 3. Number of reproduction per acre, ten plots.

Species	Number of reproduction per acre (Strip count 1956-1957)
Sugar pine	114
Ponderosa pine	4
Sierra redwood	0
White fir	183
Incense cedar	98
Total	399

The after five-year tally averages 399 seedlings per acre on the 10 plots. There is an average of 565 stems per acre for the ten plots including reproduction, poles, and saw timber (all trees over 1 foot high).

#### CONCLUSION

These plots have indicated much higher growth on cut-over land than was expected. The nine cut-over plots have a net annual growth of 636 board feet per acre. The plots indicate a healthy progression from reproduction to poles to sawlog stems. This would show that the uneven-aged character of the forest is being maintained for the nine mixed-conifer plots.

The measurements indicate that the plot in young-growth Sierra redwood made the phenomenal growth of 2,297 board feet per acre per year over the 5-year period. This 70 year stand, which is not fully stocked, has averaged nearly 800 board feet per acre per year over its life.