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SEASONAL DIAMETER GROWTH IN TREES ON JACKSON STATE FOREST

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Introduction

When does the period of seasonal diameter growth begin and end for important timber species on the Jackson State Forest near Fort Bragg in Mendocino County, California? What months would be preferable for taking tree measurements for comparative purposes? How does the rate of diameter growth vary during the growing period?

With the development of a continuous forest inventory for the Jackson State Forest using permanent plots measured at periodic intervals, the need for answers to these questions was apparent. Failure to adjust the time interval between periodic measurements of trees for seasonal growth could lead to substantial errors in growth calculations. Conceivably, in a five calendar year remeasurement period there may be from four to six actual growing seasons depending on the length of the growing season and the months when the tree measurements are taken. A 20 percent error in growth could result if a "five year period" actually represents only four growing seasons.

H. A. Fowells 2/ did considerable work on growth patterns of ponderosa pine and associated species in the Sierra Nevada. Whether Fowells' findings would hold true for species on Jackson State Forest where the climate is markedly different from the Sierra was not known. It was suspected that growth patterns might be considerably different. This suspicion was substantiated by a review of earlier

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2/ FOWELLS, H. A., 1941. The period of seasonal growth of ponderosa pine and associated species. Jour. For. 39: 601 - 608.

studies conducted by MacDougal 3/ and Haasis 4/ in their measurements of diameter growth of Monterey pine and redwood near Carmel.

The project described here was undertaken to obtain information needed for the continuous forest inventory being made on Jackson State Forest. It was designed to determine when seasonal diameter growth begins and ends and the rate at which growth changes during the growing season. The study will be continued for more than one year to compare variation from season to season with different weather conditions.

Method

The western boundary of Jackson State Forest lies within a mile and a half to four miles of the Pacific Ocean. The easternmost boundary is as far inland as 20 miles from the ocean. Since the climate varies greatly from the coastline inland, provision was made to test radial growth periodically at different distances from the coast.

Three radial growth plots (table 1) were established along State Highway 20, which crosses the forest in an east-west direction. Trees measured on the plots

Table 1. Plots for radial growth on Jackson State Forest, 1959

Plot No.	Elev. (in feet)	Timber Site a/	Soil Series	Distance from coast (miles)	No. trees tested by Species					
					R	DF	BP	WH	LWF	T
1	400	III	Caspar	4	5	4	5	3	-	-
2	900	II	Mendocino	9	4	6	-	-	5	1
3 b/	600	III	Hugo	20	3	5	-	-	-	-

a/ Forest Survey, 1948. Site Classification for Douglas Fir. California Forest and Range Experiment Station.

b/ Plot 3 originally had five redwoods and one tanoak. Dendrometers were removed from some trees by vandals.

were either dominants or codominants in crown class. To test the growth patterns of the major species, 15 Douglas-fir (Pseudotsuga menziesii) and 12 redwood trees (Sequoia sempervirens) were distributed nearly equally among the three plots. Fourteen trees of four minor species: western hemlock (Tsuga heterophylla), Bishop pine (Pinus muricata), lowland white fir (Abies grandis), and tanoak (Lithocarpus densiflorus), were also measured.

3/ MAC DOUGAL, Daniel T., 1936. Studies in tree-growth by the dendrographic methods Carnegie Institution of Washington Publication No. 462. 256 pp.

4/ HAASIS, Ferdinand W., 1934. Diametral changes in tree trunks. Carnegie Institution of Washington Publication No. 450. 103 pp. (Contains extensive bibliography on early work conducted).

A circular area, six inches in diameter, was shaved on the bark of the sample trees at breast height. The shaved area, which left about one-half inch of bark thickness, was then coated with shellac to minimize bark swelling and shrinkage due to moisture changes.

Each tree was numbered with a metal tag. Radial growth measurements were obtained by use of the Reineke dendrometer (fig. 1). 5/ A brass screw hook and a round-

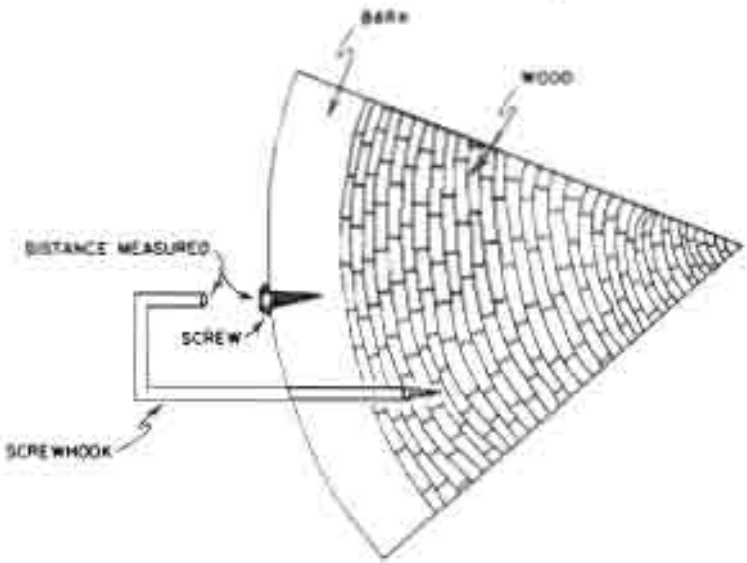

Fig. 1. Diagram showing stationary and moving contact points for radial growth measurements of the Reineke dendrometer.

head brass screw 3/8 of an inch long were used for redwood. A roundhead screw ½ inch long was used for all other species. The brass screw hook was screwed through the bark 1½ inches into the stem wood. The roundhead screw was screwed into the bark only, directly opposite the extreme end of the screw hook. Measurements were taken near the 1st and 15th of each month (except July) with a six inch engineering scale using the 50 division scale and interpolating to one-hundredth of an inch. The scale was modified to fit the slots of the roundhead brass screws. The distance between the tip of the screw hook and the roundhead screw was recorded at each measurement. The difference in consecutive semi-monthly readings gave the radial growth at breast height for each period.

Preliminary Results

The growth measurements for the sample trees were very variable without apparent relation to plot location. No significant difference in location variations could be found in the amount of growth for those trees on plots near the coast and those further inland. However, the number of observations was probably too few to make a positive conclusion in this respect.

5/ REINEKE, L. H., 1932. A precision dendrometer. Jour. For. 30: 692 - 697.

A cumulative growth curve for all species and all plots is shown in figure 2. Growth in 1959 appeared to initiate about the middle of March for all species. The first major flush of growth occurred in the last two weeks of April for Douglas-fir, white fir, and Bishop pine. However, the first major growth did not occur until the first two weeks of May for redwood. This difference can be noted in figure 3 which compares the growth of Douglas-fir and redwood as measured. This difference between the growth of redwood and Douglas-fir for the measurement of May 4, 1959 (which accumulated the growth of the last two weeks of April), was statistically significant. This was the only difference in semi-monthly measurements which was statistically significant.

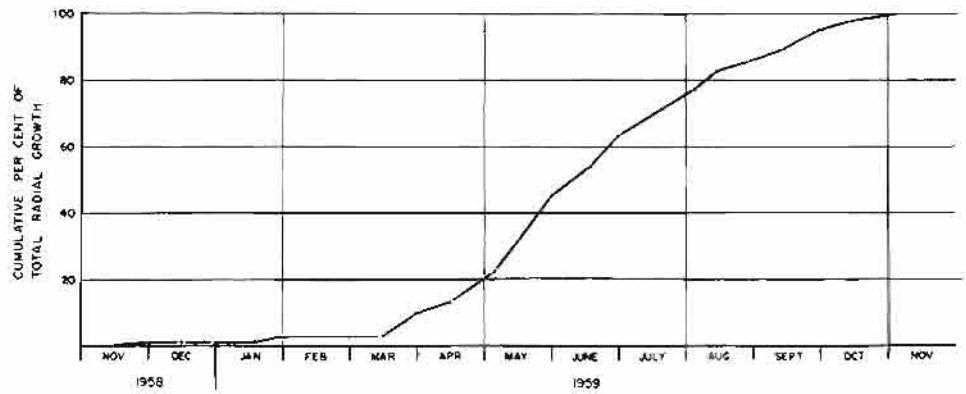

Fig. 2. Cumulative percent of total radial growth for one year all species and all plots - 44 trees.

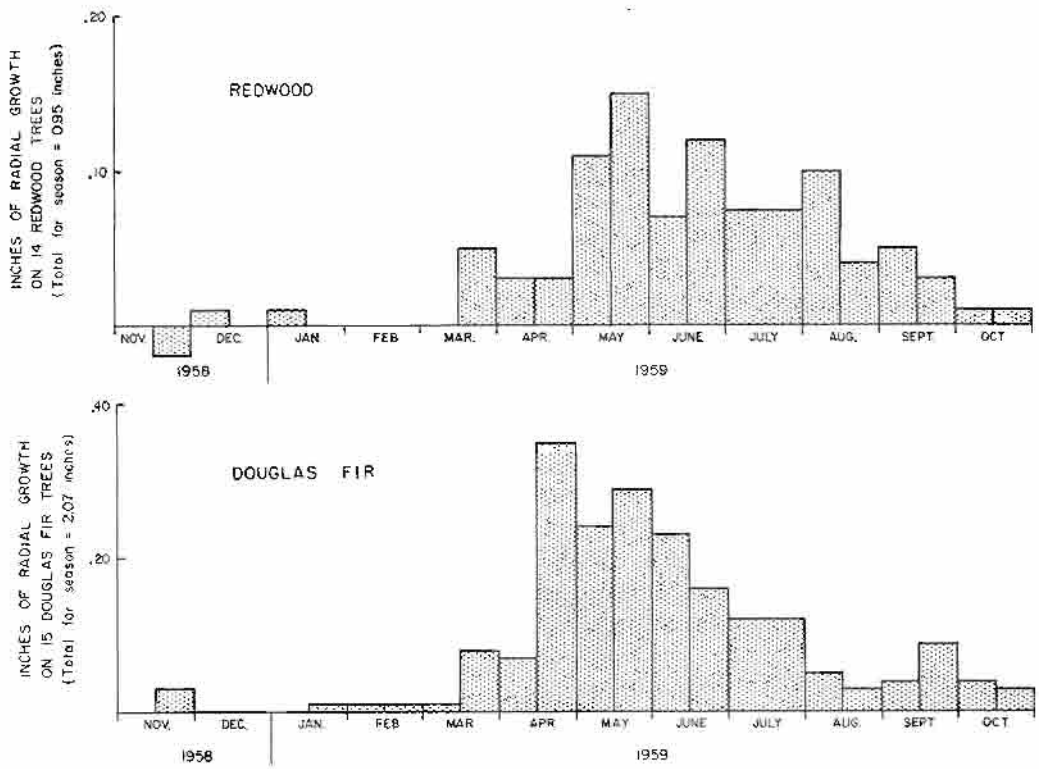

Fig. 3. Radial growth of 14 redwood trees and 15 Douglas-fir trees for each measurement period.

Ostensibly, trees which grew the most in diameter also had the longest growing season. This observation may be due to limitations in the measuring device used in this study. That is, trees with slow growth rates may have actually grown for the same period as the more vigorous trees, but the growth was not measurable because changes of less than one hundreth of an inch in a two weeks period could not be detected with the measuring device being used.

Based on these measurements only, it appears, for continuous inventory purposes on Jackson State Forest, that for plots established or plots remeasured during the months of October through March no adjustment for current seasonal growth is required. However, a correction factor will probably be required for plots established or remeasured in the April through September period. Almost 90 percent of the radial growth occurred in this period of rapid growth. This period is also the most favorable season for field work. Accumulation of more data such as that shown here, will be necessary to test variation between seasons and to develop correction factors for use in the Jackson State Forest Continuous Forest Inventory.

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