

U. S. DEPARTMENT OF AGRICULTURE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
R. W. COWLIN, DIRECTOR

FOREST SERVICE

Research Note

Number 150

Portland, Oregon

July 1957

CLIMATE AND GROWTH RATE AS RELATED TO AN OUTBREAK OF SILVER FIR BEETLES

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EDITOR'S
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In 1947, an outbreak of silver fir beetles, Pseudohylesinus grandis Sw. and P. granulatus (Lec.), was discovered in northwestern Washington. The epidemic flourished for the next six years, killing some 525 million board-feet of Pacific silver fir, Abies amabilis (Dougl.) Forbes. Prior to 1947, the silver fir beetles were considered to be of little economic importance because they had been observed to attack only slash, windthrows, and suppressed or otherwise weakened trees. While the recent destructive outbreak was in progress, it was reasoned that some factor or factors might have weakened the trees sufficiently so that these relatively non-aggressive beetles could kill them. Climate was suspected as a factor in weakening the trees. A study was undertaken, therefore, to determine whether a relationship existed between tree growth and weather patterns before and during the beetle outbreak.

METHOD

Radial growth was used as a measure of tree vigor, and precipitation and temperature were used as measures of climate. Single increment cores from each of 287 live silver fir trees from 4 areas in the Mt. Baker area of Washington were measured for the study. The cores were taken in 1951 prior to major salvage cutting in the study areas. Precipitation and temperature records were obtained from the nearest permanent weather stations. Locations of the study areas and weather stations, and the numbers of study trees used were as follows:

<u>Area</u>	<u>Location</u>	<u>No. of trees</u>	<u>Location of weather station</u>
Dock Butte	T37N, R8E, Sec. 34, W. M.	50	Concrete, Wash.
Sulphur Creek	T37N, R8E, Sec. 23, W. M.	82	Concrete, Wash.
Cornell Creek	T39N, R8E, Sec. 13, W. M.	70	Bellingham, Wash.
Carry Creek	T34N, R5E, Sec. 22-23 - 26-27, W. M.	85	Sedro Woolley, Wash.

Study trees were 200 to 300 years old, with the exception of the 50 trees from the Dock Butte Area, which were 75 to 150 years old. Growth data and climatic data were obtained for the 26-year period 1925 through 1950. It would have been desirable to obtain growth data at least until the end of the epidemic in 1954; however, nearly all the study plots were logged while the outbreak was in progress. Annual radial growth on increment cores was measured to the nearest .01 mm with a core measuring machine equipped with a movable stage and micrometer scale. Measurements were taken with the aid of a binocular microscope mounted on the machine.

Growth data were summarized to obtain average annual radial growth figures for each of the study areas during the period 1925-50, inclusive. Weather data were analyzed for each area in two ways: by averaging both temperature and total precipitation for the five-month period May through September, and by combining temperature and rainfall data as a numerical expression of "climate." The latter was done by computing the algebraic sum of the average annual departure from the normal for temperature and precipitation.

To determine the relationship between growth and climatic factors, the data were subjected to statistical analyses. Significance of the correlations between growth and temperature, growth and precipitation, and growth and "climate" was tested.

RESULTS AND CONCLUSIONS

Weather records showed that both temperature and precipitation during the growing season were below normal for 1925 through 1930. No such period of drought occurred again until 1942. From 1942 through 1946, the Mt. Baker area experienced generally hot, dry summers. This was the period immediately preceding the start of

the beetle outbreak in 1947. The season of 1948 was very wet, but the following five years, through 1953, were warmer and drier than normal. This is the period in which the epidemic reached its peak. During 1954, the year in which the epidemic ended, temperatures were normal and precipitation above normal (fig. 1). The generally adverse weather conditions prevailing from 1942 to 1954 are considered to be possibly underlying causes of the epidemic.

Trees from Sulphur Creek, Carry Creek, and Cornell Creek areas showed very poor growth and few fluctuations during the 26-year study period, indicating stagnation caused by overmaturity (fig. 2). Statistical analyses of these data showed that no significant correlation existed between growth and precipitation, growth and temperature, or growth and "climate." Radial increment of the 50 trees on the Dock Butte plots showed a steep downward trend, apparently due to the effects of overstocking. This trend was so strong it was believed to have completely overshadowed any effect of climate. Consequently, these data were omitted from the analyses of climatic effect.

Although the study failed to show a positive correlation between climate and growth, it did reveal that abnormal weather conditions prevailed before and during the beetle outbreak. Whether climate contributed either directly or indirectly to the epidemic by creating conditions favorable for increase of the beetle population is unknown. The growth and weather patterns shown here are presented as a matter of record.

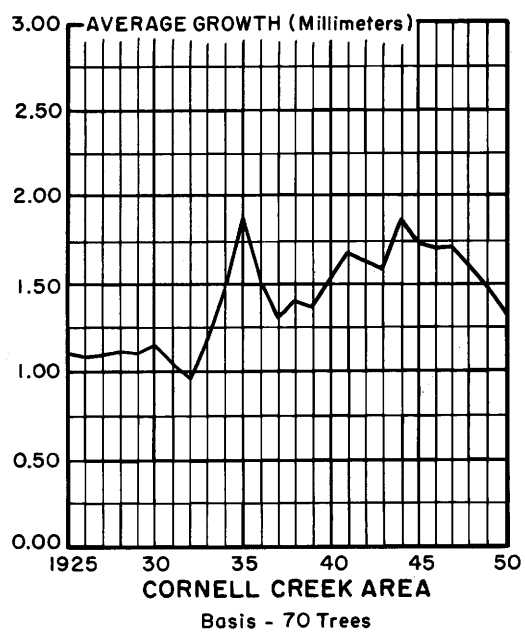
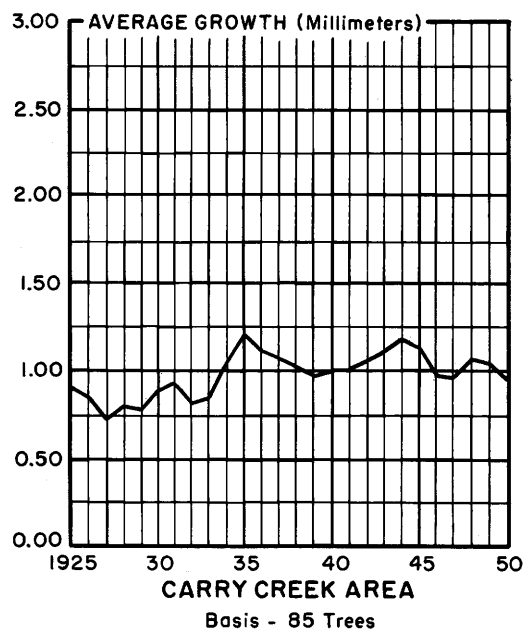
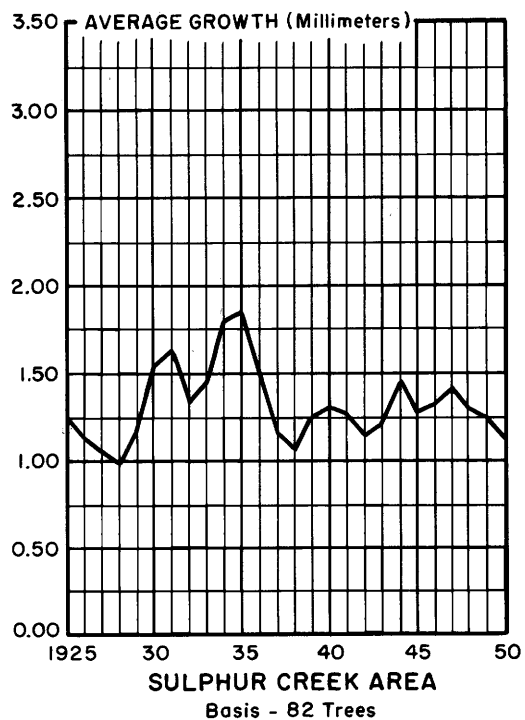
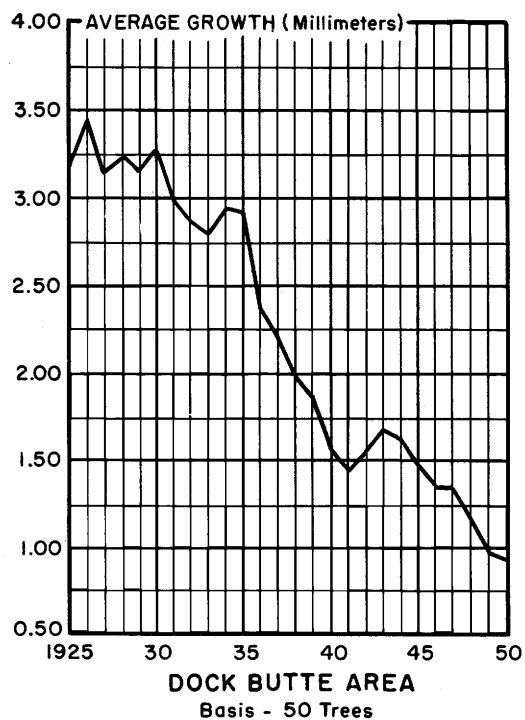


Figure 2. - Growth trends for Pacific silver fir in the Mount Baker area of northwest Washington, 1925-1950.