

ANNUAL GROWTH OF PINES IN THE SAN JUAN BASIN, COLORADO.
AS RELATED TO PRECIPITATION AND STREAMFLOW

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As a result of the interest in climate and the possibility of permanent climatic changes, engendered by the drought years of the 1930's, this study was made of the growth of pine, *Pinus ponderosa*, in the San Juan Basin of southwestern Colorado. Annual ring-widths were compared with the October-June precipitation and the streamflow records at Durango.

A group of twenty-one old trees on or near the Fort Lewis Reservation and a group of ten young trees from Dolores were sampled with an increment borer. Of the Ft. Lewis trees, six were growing on rather steep dry slopes while the remainder grew on gently sloping land with good early-season water supply in average years. The soil of the latter lands is a deep clay loam, with a trend toward a much finer texture in the case of the sites for two trees in the "Washboard" section. The soil on the steep slopes is clay loam at the surface but at slight depth is much thinner, tending to show gravel. One rather old tree from near Dolores was included in the Ft. Lewis group. A few sections from old stumps or logs from the Falls Creek-Durango archeological site were loaned by Mr. I. F. Flora and served to take the record back to a period preceding that of living trees. At Falls Creek, conditions as to soil and slope tend to be similar to those of the steeper sites at Ft. Lewis.

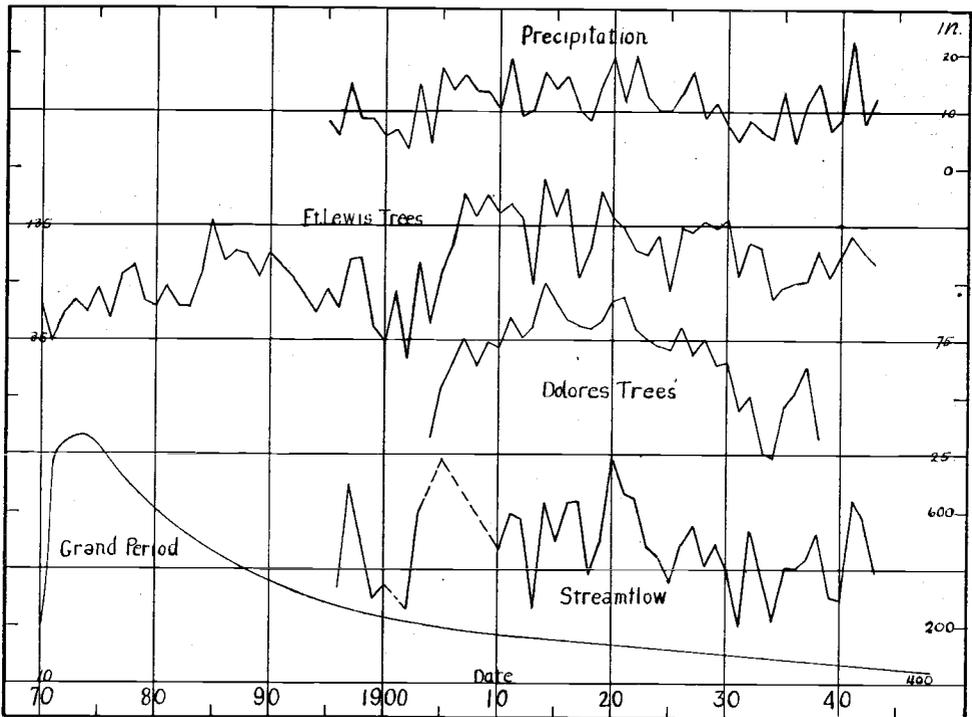


Figure 1. Annual ring-width compared with Nov.-June precipitation at Durango, Colorado, and runoff of the Animas River at Durango. The lowermost curve represents the composite growth trend with age.

If, in Figure 1, the 49 years of recorded Durango precipitation are compared with the Ft. Lewis tree growth for the same interval, it is found that approximately 32 years show positive agreement; 10, negative agreement; and the remaining years, no correlation. The correlation coefficient, $+0.59$, is highly significant. A correlation of $+0.44$ was found between ring-widths of the young trees at Dolores and precipitation at Durango. As with the comparison of curves above, the correlation is much better during certain periods than in others. From 1906 to the 1930's radial growth was excessive as compared with the apparent moisture supply. Other factors controlling growth have not yet been studied.

If the flow of the Animas River at Durango is compared with ring-widths, a significant correlation of $+0.45$ is shown for the Ft. Lewis trees, and $+0.66$ for the Dolores trees.

For the Ft. Lewis trees, the average period of continuous subnormal growth, and its standard deviation, is 2.6 ± 0.3 years, and of above-average growth, 2.8 ± 0.3 . The maximum length of a continuous period of subnormal growth is 11 years, and of above-average growth, 9 years, as determined from the average of 10 trees. These means are based on a 200-year series.

That young trees are growing approximately as well today as in earlier centuries seems to be indicated by the comparisons of several groups of trees. Ten young Dolores trees, none of which was over 30 years of age, have an average ring-width of 3.52 mm, whereas the average ring-width for the same period in the lives of 14 old Ft. Lewis trees, which for the most part began their growth in the 1600's, is 2.68 mm. For 4 Falls Creek logs, all of which were seedlings in the years between 1430 and 1594, the average ring-width for their first 25 years is 2.14 mm. Two groups of young trees in northern Colorado, studied earlier, grew at the rates of 2.53 mm and 3.06 mm respectively. Old trees in the same group had grown at the rates of 2.74 mm and 2.40 mm during similar youth periods.

To correct growth curves for the "age" effect, the records of measurements for 18 trees were averaged and a composite growth curve obtained (Figure 1, bottom). Such a curve would need correction when applied as a standardizing line to the individual tree curve but would be preferable to lines with abrupt and arbitrary changes in direction.

Although it is impossible to derive the details of climate from even the more intricate tree-ring studies, one may conclude from the data presented herewith that the climate of the San Juan Basin has not differed greatly during the last four or five hundred years from that covered by our weather records. Some of the weather fluctuations have no doubt been greater than those shown in gage records.

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NOTES ON DENDROCHRONOLOGIES AT THE ARNOLD ARBORETUM

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The Arnold Arboretum of Harvard University, at Jamaica Plain south of Boston, Massachusetts, contains several species of particular interest to dendrochronologists. In general, mesophytic forest types prevail, as a con-