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THE TREE-RING BULLETIN

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EARLY HEIGHT GROWTH IN DOUGLAS FIR

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The age of dendrochronologic trees, as distinct from the ring count on increment cores, has occasionally been used in climatic studies at the Tree-Ring Laboratory. To obtain the total age, a conservatively small number of years of estimated height growth has usually been added to the length of the ring record at the sampling level. In order to provide a better basis for such estimates, a study was made of a primary species, Rocky Mountain Douglas fir (*Pseudotsuga taxifolia*). Core samples of young trees, ranging from two to twelve inches in diameter at breast height and from fifteen to fifty feet in height, were taken during the summer of 1949 near Divide, Montana, at Mesa Verde National Park, Colorado, and at three locations in the Santa Catalina Mountains, near Tucson, Arizona.**

- Site 1. Divide, Montana. Dry, rocky, south and southwest slopes of hillside north of the road and east of the bridge about one mile west of Highway 91; elevation 5500'; reproduction occurs in groups in an old cut-over area; samples were taken from isolated trees on the outer fringe of the denser groups; associated species include big sagebrush (*Artemisia tridentata*) and mountain mahogany (*Cercocarpus* sp.).
- Site 2. Mesa Verde National Park, Colorado. Relatively moist and shaded creek bed of Spruce Tree Canyon just below Spruce Tree House; elevation 6800'; all trees within a few feet (or root distance) of the stream bed.
- Site 3. Santa Catalina Mountains, Arizona. Dry site near head of Bear Canyon about one-quarter mile above Hitchcock Tree; elevation 6500'; open Douglas fir and ponderosa pine (*Pinus ponderosa*) stands, the former more common on the north slopes; soil a decomposed granitic type; associated vegetation primarily oak; all sampled trees on a north slope, some very near the ridge top.
- Site 4. Santa Catalina Mountains, Arizona. Canyon bottom near Hitchcock Tree picnic area; elevation 6000'; relatively shady and moist; very slight north slope just above the stream bed; most of the specimen trees were overtopped by other trees.
- Site 5. Santa Catalina Mountains, Arizona. One mile northwest of the Mount Lemmon Lodge; 100 yards above the junction of the Red Ridge Trail with an access road; elevation 8500'; moist 30 to 40 degree north slope in a semi-open, cut-over area; granitic soil; dominant vegetation Douglas fir and ponderosa pine; specimen trees were in thickets or overtopped.

Cores included in each of the five groups were taken at three levels in the stem. The lowest level, called A, was at either six inches or one foot

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above the ground at Divide and Mesa Verde and at six inches in the Santa Catalina Mountains; level B was at 33½ inches (two lengths of the increment borer, a convenient field measure) above the first; and level C an additional 33½ inches above the second.

In the three Santa Catalina Mountain collections the pith was present in all cores, but in the Divide and Mesa Verde collections it was necessary in some instances to extrapolate the series to derive the pith dates. By extension of the circumference of the innermost ring, which in most instances was within three years of the pith, and in the light of the expected average ring-widths for the years in question as given by the master chronology for the area,¹ it was possible to arrive at a substantially exact estimate of the pith date. Relatively microscopic rings, for 1902 and 1904, occurred very near the pith in the Mesa Verde cores.

The data in Table 1 show that the average growth rate between levels A and B was approximately half that of the growth between the upper levels B and C. This initial suppression may be extreme in some cases. The maximum suppression recorded in this study was that of tree No. 13, a low latitude, low elevation, dry site individual that took twenty-four years to grow the first 33½ inches above level A and fifteen to grow the second. This tree, though on an unfavorable site, was not, however, growing under extreme conditions for this species. A six-foot Douglas fir at Mesa Verde proved to be about 135 years old.² Others of even slower height growth have been sampled in recent field surveys, not yet published, of the Tree-Ring Laboratory. The most rapid growth noted in Table 1 was five years for the first growth interval and three years for the second, in two specimens, trees 24 and 19, both of which were growing under relatively favorable conditions. This wide range in rapidity of height growth may be due to a variety of unevaluated site conditions in addition to evident biotic and edaphic relationships.

It is probable that there is a corresponding variation in seedling growth below the height level A of the borings reported here. In nursery practice, most coniferous species are considered suitable for field planting when from four to ten inches in height. The age of Douglas fir seedlings used in replanting throughout the central and southern Rocky Mountain region is three or four years.³ At the Savenac nursery of the Forest Service at Haugan, Montana, the approximate height for 2:1 Douglas fir (two years in the seed bed; one year in the transplant bed) is four inches and for 2:2 nursery stock it is six inches.⁴ It is probable that the trees reported here had an age of at least four or five years, and perhaps much more, at the lowest level sampled.

¹Schulman, *Tree-Ring Bull.*, 12 (3), 1946, pp. 18-24.

²*Op. cit.*, p. 24.

³Toumey, J. W. and C. F. Korstian, *Seeding and Planting in the Practice of Forestry*, 1943 pp. 431-2.

⁴Olson, D. S., *Growing Trees for Forest Planting in Montana and Idaho, U.S.D.A. Cir.* 120, Aug., 1930, p. 71.

Table 1. Height Growth in Rocky Mountain Douglas Fir

Tree No.	Estimated Height, feet	Average Ring-Width at Level A, mm.	Pith Dates at Sampled Levels			Height Growth, years		
			A	B	C	A-B	B-C	A-C
Site 1. Divide, Montana								
6	15	.98	1886*	1909*	1916*	23	7	30
7	25	1.57	1878*	1898*	1910	20	12	32
8	30	2.00	1906	1912	1915	6	3	9
9	35	2.61	1900*	1909	1911*	9	3	12
10	15	1.81	1901*	1913*	1920	12	7	19
Mean		1.79				14.0	6.4	20.4
Site 2. Mesa Verde National Park, Colorado								
1	30	1.49	1888*	1896	1906*	8	10	18
2	30	1.34	1896*	1907*	1912	11	5	16
3	40	1.59	1888*	1903*	1910*	15	7	22
4	30	1.16	1886	1896*	1906	10	10	20
5	35	1.05	1890*	1903*	1908	13	5	18
Mean		1.33				11.4	7.4	18.8
Site 3. Santa Catalina Mountains, Arizona								
11	25	.90	1888	1905	1910	17	5	22
12	15	1.03	1912	1918	1927	6	9	15
13	35	.62	1862	1886	1901	24	15	39
14	20	.67	1891	1912	1915	21	3	24
15	20	1.18	1909	1920	1927	11	7	18
16	20	1.47	1913	1920	1926	7	6	13
Mean		.98				14.3	7.5	21.8
Site 4. Santa Catalina Mountains, Arizona								
17	25	1.15	1909	1917	1920	8	3	11
18	15	.79	1915	1922	1928	7	6	13
19	50	2.63	1909	1914	1917	5	3	8
20	30	1.78	1909	1918	1923	9	5	14
21	25	1.27	1908	1917	1922	9	5	14
22	25	1.38	1912	1920	1923	8	3	11
Mean		1.50				7.7	4.2	11.8
Site 5. Santa Catalina Mountains, Arizona								
23	20	1.81	1923	1932	1936	9	4	13
24	30	2.96	1920	1925	1928	5	3	8
25	25	2.92	1926	1933	1936	7	3	10
26	20	1.57	1926	1935	1938	9	3	12
27	20	1.61	1926	1936	1940	10	4	14
28	15	1.90	1930	1940	1942	10	2	12
Mean		2.13				8.3	3.2	11.5

*Core did not contain pith, the date shown being an extrapolation (see text).

The data pertaining to height, ring-width at level A, and pith dates at level A suggest that there may be systematic differences in the age trends in growth among trees in different geographic regions.

The scope of the study was necessarily limited; with the acquisition of further data, it is likely that the differences in growth rate at various levels would be found to be much greater. However, the collections here reported seem to be characteristic of a very large number of sites throughout the Rocky Mountain region.