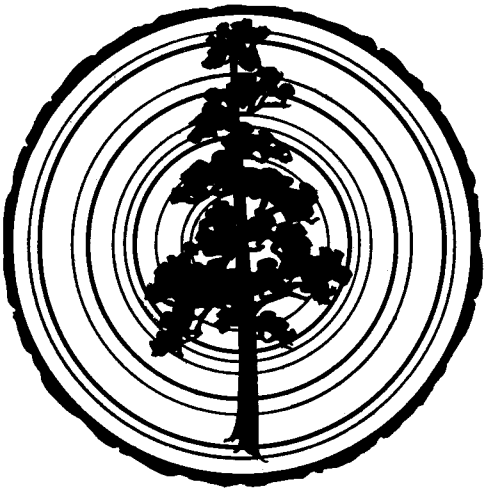
TREE-RING BULLETIN

VOL. 15 JANUARY, 1949 NO. 3

A Quarterly



CONTENTS

PUBLISHED BY THE TREE-RING SOCIETY
with the cooperation of
THE LABORATORY OF TREE-RING RESEARCH
UNIVERSITY OF ARIZONA

Annual Subscription, $1.50 Single Copy, 50¢

THE TREE-RING BULLETIN
Editor-in-chief.....Dr. A. E. Douglass
Managing Editor Dr. Edmund Schulman
Associate Editors:
Arctic Studies..Mr. J. L. Giddings, Jr.
Botany.....Dr. Charles J. Lyon
Archaeology....Mr. W. S. Stallings, Jr.

THE TREE-RING SOCIETY
President.....Dr. A. E. Douglass
Secretary.....Mr. Harry T. Getty

Tree-Ring Laboratory
University of Arizona
Tucson, Arizona

THE PIONEER TREE-RING WORK OF JACOB KUECHLER

T. N. CAMPBELL*

INTRODUCTION

In the history of science there are many instances of early, isolated researches which foreshadowed later important developments. Sometimes the results of those researches were obscurely published, but they were eventually discovered, confirmed, and extended by others. So it was with Mendel, whose early work in the field of genetics went unnoticed for forty years. Sometimes the published results of such early researches were not discovered until after some one else had gone over the same ground. Among these ironies of science is the case of Jacob Kuechler, who in 1859 published a brief but important paper on the relation of tree-rings to climate. This paper, which appeared in an obscure German-language newspaper on the American frontier, clearly anticipated the classic tree-ring work of A. E. Douglass.

Kuechler's paper, entitled *Das Klima von Texas*,[1] was published in the *Texas Staats-Zeitung* of San Antonio. In the recent literature on tree-rings occasional reference is made to J. Kuechler[2] of Gillespie County, Texas, as one of the earliest actual tree-ring investigators. One is struck, however, by the fact that the students of tree-rings who refer to Kuechler have not seen the original publication describing his work. Even the title of Kuechler's article is unknown to them. Antevs,[3] Lowry,[4] Stallings,[5] Schulman,[6] and Glock[7] all refer to a secondary source, an editorial by Cleveland Abbe[8] in the *Monthly Weather Review* for November, 1893. Abbe obtained his information on Kuechler's tree-ring work from Col. William W. Haupt of Kyle, Texas. The editorial implies that Haupt provided Abbe with a transcript of Kuechler's newspaper article, but Haupt may have sent only excerpts or a summary. At any rate, Abbe gives only a brief account of Kuechler's tree-ring work.

It may seem rather odd that our present knowledge of Kuechler's pioneer work should be derived from a secondary source. The truth is that no one has been able to locate a copy of that particular issue of the *Texas Staats-Zeitung* in which Kuechler's report was published.[9] In the Texas State Archives I recently found what is probably the only surviving copy of Kuechler's original article. Because of its significance in the history of tree-ring studies, I believe that specialists in the field will be interested in having this primary source made more accessible. A translation of Kuechler's article is given below, accompanied by prefatory and concluding remarks by Gustav Schleicher, editor of the *Texas Staats-Zeitung*. The translation is followed by additional information pertaining to Kuechler's tree-ring work.

*Department of Anthropology, University of Texas.

[1] Kuechler, 1859.

[2] The name is variously given as Kuechler or Keuchler. The former is correct.

[3] Antevs, 1917, p. 366.

[4] Lowry, 1934, pp. 1-5.

[5] Stallings, 1937, pp. 27-28.

[6] Schulman, 1940, p. 34.

[7] Glock, 1941, pp. 650, 657, 677.

[8] Abbe, 1893. Antevs (1917, p. 379) and Schulman (1940, p. 34) incorrectly attribute this editorial to Mark W. Harrington, who was Chief of the Weather Bureau but not editor of the *Monthly Weather Review*. Abbe's editorial was summarized in two European journals, *Nature* (Anonymous, 1894) and *Just's Botanischer Jahresbericht* (Weisse, 1897).

[9] Kuechler's original report was summarized and partially quoted in the *Texas Almanac* for 1861 (Anonymous, 1861, pp. 136-137). Several errors were made in reproducing Kuechler's rainfall table. This additional secondary source was located by Geiser (1937, p. 327).

KUECHLER'S ORIGINAL PUBLICATION

Editorial Foreword (by Gustav Schleicher). Perhaps our readers remember a suggestion which we made to our farmers some time ago, namely, that through studies of tree-rings we might obtain a record of past seasons in this state. What we merely stated as a general idea has been developed by Mr. J. Kuechler of Gillespie County. His work has been done with such scientific and conscientious exactness, and in such a diligent and unselfish manner, that he has earned not only our thanks but the thanks of the whole population. The chronicle of Nature does not lie. Her events can be read in the strata of mountains, in the fossils of prehistoric times, in trees and plants. Recognition must be given to those who, through intelligence and industry, open Nature's book for all to see.

The Climate of Texas (by J. Kuechler). The farmers have been very much discouraged by a succession of dry years. Looking into the future with fear and misgiving, they are inclined to think of dry years as the rule and wet years as rare exceptions. No one is able to provide reliable information on the true character of the Texas climate and its effects on agriculture. The land has been cultivated for only a short time. The Indians have no written history, and they report only single dark memories of great droughts and subsequent floods. West Texas[10] lies on the border of an area which has a variable climate, and it extends into an area which has a regular climate, the trade winds bringing dry summers and wet winters. In general it may be classified with the arid regions. Nevertheless in the following report I believe I have provided reassuring evidence that the present dry period is more or less an exception, and that agriculture can be pursued advantageously even without irrigation.

Our records are of such recent date that we must turn to the annals of Nature, particularly of the plant world, and search for an answer to our important question. A tree contains the record of its life history, and this history is most closely interwoven with the annual rainfall. Water is the principal factor in the growth of a plant, for without water growth is impossible. A plant will reach a maximum growth with adequate moisture, but its growth will be retarded in proportion to the supply. We can follow the progressive growth of a tree from its earliest youth up to its present state. Annual growth is shown by the tree-ring, the width of which depends on the available water. Thus broad rings indicate the wet years; and narrow rings, sometimes so small they can scarcely be seen with the naked eye, indicate the dry years. This is what leads us back into the past. Great care must be exercised in the selection of trees for experiment, for one can be led astray by trees which have been subject to abnormal conditions. In my work I set up two primary conditions: (1) a high location, so that drought will have an early effect; and (2) a completely healthy tree. I cut down three post oak trees, two of which were a little over one hundred years old, the third being one hundred and thirty years old. At the thick end I cut a section from each tree, planed its surface very smooth, and then varnished it, which made the rings plainly visible. Fat applied to the wood has the same effect as varnish. Then for each section I prepared a table which gave the relative proportions of the tree-rings. When compared, these three tables showed complete agreement, a proof that moisture is the only cause of variation in tree-rings. The following table is the result of this experiment. [11]

1855-1858, dry; 1851-1854, average[12]; 1849-1850, wet; 1848, very wet; 1847, dry; 1845-1846, very wet; 1843-1844, dry; 1842, average; 1841, dry; 1839-1840, very wet; 1838, average; 1837, dry; 1835-1836, very wet; 1833-1834, very dry;

[10] In 1859 the San Antonio region was considered to be in West Texas. What is now known as West Texas was still occupied by Indians.—TNC

[11] In the original article this table was printed in columnar form, with the latest date at the top. The same sequence is given here, but the columnar form has been abandoned in order to save space.

[12] The editor of the *Texas Staats-Zeitung* appends the following footnote: According to our experience, the years which the correspondent designates as "average" may be called "wet". Thus one can prepare his own scale for the remainder of the table.

1832, average; 1827-1831, very wet; 1826, average; 1825, average; 1822-1824, very dry; 1821, very wet; 1820, very dry; 1819, average; 1812-1818, very wet; 1806-1811, extremely dry; 1800-1805, very wet; 1799, very dry; 1793-1798, very wet; 1792, average; 1791, average; 1788-1790, dry; 1784-1787, wet; 1781-1783, average; 1779-1780, wet; 1777-1778, average; 1771-1776, extremely dry; 1765-1770, very wet; 1764, very dry; 1762-1763, wet; 1759-1761, very dry; 1758, average; 1755-1757, very wet; 1750-1754, very wet; 1742-1749, very wet; 1739-1741, dry; 1733-1738, very good *(sehr gut);* 1731-1732, dry; 1730, very wet; 1728-1729, dry; 1725-1727, very wet.[13]

According to the above observations, in the 134 years there were 19 dry years, 11 very dry years, and 12 extremely dry years. It is remarkable that the latter follow each other without interruption from 1806 to 1811 and from 1771 to 1776. On the other hand, there were 22 average years, 11 wet years, and 59 very wet years.

Concluding Editorial Comment (by Gustav Schleicher). We hope that these tests will be continued at different places over the state and that as a result our knowledge will be further enlarged.

We wish to remark that differences between various localities will not be very great. Cloudbursts in summer sometimes fall locally, but the moisture from winter and spring rains which saturates the earth is always distributed rather evenly, making good harvest years. Good harvest years are good everywhere. Only in bad harvest years do individual summer rains save anything. But the growth of trees depends on winter and spring rain; if they have no young shoots in spring, single summer rains alone contribute little to tree growth. In our opinion Kuechler's experiment is valid for upper West Texas.

ADDITIONAL INFORMATION ON KUECHLER'S TREE-RING WORK

The scene of Jacob Kuechler's tree-ring investigations was probably somewhere near the town of Fredericksburg (Gillespie County), which is located on the Edwards Plateau near its eastern margin. The elevation of Fredericksburg is 1742 feet. Here the Pedernales River has developed a valley which contains good farm land. The first settlers in this valley were German colonists, who arrived in 1846.

The above document clearly indicates that Kuechler's research near Fredericksburg resulted from a suggestion made by the editor of the *Texas Staats-Zeitung.* The editor, Gustav Schleicher,[14] seems to have been motivated by a very practical idea. The region around San Antonio had been experiencing severe drought, and he wished to find out for his readers if exceptionally dry years had been common in the past. He believed that tree-ring studies might yield data which could be used for purposes of prediction. Where or how Schleicher got his idea is not known, but Glock[15] has pointed out that nineteenth century literature contains abundant references to annual growth rings in trees. Lowry, quoting H. P. Hunnicutt, an Austin informant, presents evidence which suggests that as early as the 1840's the German colonists of the San Antonio area were already aware of the significance of tree-rings as climatic indicators. According to Hunnicutt,[16] a group of German colonists near New Braunfels became greatly discouraged because of epidemics, Indian attacks, and especially drought. They were planning to abandon the colony, but a Mr. Pechner pointed out to them that the variable growth rings in local trees showed drought to be only a temporary phenomenon. He thus persuaded them to remain.

[13]Attention is called to the following errors which appear in Abbe's version (1893) of Kuechler's rainfall table: 1806-1811, extremely wet; 1794, average; 1792, very wet; 1777-1778, wet.

[14]Gustav Schleicher (1823-1879), a graduate of the University of Giessen (architecture and engineering) came to Texas from Germany in 1847. After living on the frontier for several years, he moved to San Antonio, where he became a prominent political figure. He served in the Texas Legislature, first as a representative and later as a senator. From 1874 until his death in 1879 he served as a representative from Texas in the Congress of the United States (Biesele, 1930, p. 155).

[15]Glock, 1941, pp. 649-651.

[16]Lowry, 1934, p. 135.

One wonders why Kuechler happened to follow up the suggestion made by the editor of the *Texas Staats-Zeitung*. One answer to this question may be found in the scanty biographical material on Kuechler that I have been able to locate.[17] It is known that Kuechler came to Texas from Germany in 1847 with a group of forty idealistic students from the Universities of Giessen and Heidelberg and from the industrial school at Darmstadt. These enthusiastic young men, known as *Die Vierziger*, settled at Bettina on the Llano River. Their experiment at communal living lasted less than a year. The colony failed, and the members moved to various other German communities that were already well established in that region. In the surviving Bettina records, which give the profession or occupation of each member of the colony, Kuechler is listed as a forester.[18] It is thus evident that Kuechler had the necessary botanical background for tree-ring research.

Of interest in connection with Kuechler's tree-ring studies is a sentimental novel of frontier life which appeared serially in *Harper's* in 1867.[19] This novel is about a family of Virginians who settled in central Texas near Austin, which is some 70 miles from Fredericksburg, the scene of Kuechler's tree-ring studies. These Virginians encountered a German colonist known as Hoogenboom, who did the same type of tree-ring research as Kuechler. The description of Hoogenboom's work shows that it is virtually identical with that of Kuechler. According to an editorial footnote,[20] Harrington wrote this novel in Texas in 1859, but its publication was delayed by the Civil War. Although the evidence is circumstantial, it appears that Harrington must have known Kuechler in Texas. Incidentally, Harrington's account mentions similar tree-ring studies "all over Texas." Thus far no documentary evidence of such work has come to light.

CONCLUSION

Final critical appraisal of the value of Jacob Kuechler's pioneer tree-ring studies must be left to botanists, meteorologists, and climatologists. Nevertheless Kuechler deserves recognition for making certain initial efforts in what has proved to be a fruitful field of scientific investigation. As others[21] have already pointed out, Kuechler made one of the earliest recorded studies of tree-rings as climatic indicators. He recognized growth rings as being annual in character, and he assumed that rainfall was the only significant factor in tree-ring variation, an assumption which is still being debated. Thick rings were associated with abundant rainfall, thin rings with inadequate rainfall or drought. Kuechler followed certain procedures which survive in some form today, *i. e.*, use of healthy trees only; selection of trees from elevated, well-drained topographic positions; taking a transverse section of the tree near its base; planing and treating the surface of the section to improve visibility. Kuechler was apparently the first to make use of cross-dating, for he claimed to have observed identical growth-ring sequences in three trees of approximately the same age from a small geographic area. This was his basis for developing a table which purported to show fluctuations in rainfall over a period of 134 years (A.D. 1725-1858). In considering Kuechler's contribution, the part played by Gustav Schleicher must not be overlooked. Schleicher should receive credit for stimulating Kuechler's tree-ring investigations, which occurred more than forty years before Douglass began his work in Arizona.

[17]Fortunately Kuechler was a man of some prominence and there are records of his activities. The date of his birth is unknown; he died in 1893 at Austin, Texas. From 1870 to 1874 he was Commissioner of the General Land Office of Texas, a high political office. Brief references to his early days in Germany and Texas may be found in Weber (1894, pt. 1, pp. 26, 29; pt. 2, p. 12), Reinhardt (1899, p. 34), Tiling (1913, p. 94), Biesele (1930, p. 155). Weber (1894, pt. 1, pp. 44-51) gives a short biographical sketch which covers the latter part of Kuechler's life.

[18]Gustav Schleicher, previously referred to as the editor of the *Texas Staats-Zeitung*, was also a member of the Bettina colony. In the records he is listed as an engineer.

[19]Harrington, 1867, p. 500; see also Gillette, 1936, p. 72.

[20]*Ibid.*, p. 779.

[21]Antevs, 1917, p. 366; Stallings, 1937, pp. 27-28; Glock, 1941, pp. 657, 677.

REFERENCES

Abbe, Cleveland. Climate of Texas: tree growth. *Monthly Weather Review* 21:331-332, 1893.

Anonymous. The droughts of western Texas. *Texas Almanac*, 1861, pp. 136-137.

Anonymous. "Notes." *Nature* 49:439, 1894 (summary of Kuechler's work based on Abbe's editorial in the *Monthly Weather Review*, November, 1893).

Antevs, Ernst. Die Jahresringe der Holzgewächse und die Bedeutung derselben as klimatischer Indikator. *Progressus Rei Botanicae* 5:285-386, 1917.

Biesele, Rudolph Leopold. The history of German settlements in Texas, 1831-1861. Austin, 1930.

Geiser, Samuel Wood. Naturalists of the frontier. Dallas, 1937.

Gillette, Halbert P. On developing long-range weather forecasting: cycles. *Bull. Amer. Meteorological Soc.* 17:70-72, 1936.

Glock, Waldo S. Growth rings and climate. *Botanical Review* 7:649-713, 1941.

Harrington, George F. The Virginians in Texas. *Harper's New Monthly Magazine*, vol. 34, 1867, pp. 72-83, 214-224, 332-341, 492-502, 621-632, 765-779.

Kuechler, Jacob. Das Klima von Texas. *Texas Staats-Zeitung*, August 6, 1859, p. 2, San Antonio.

Lowry, Robert L., Jr. Excessive rainfall in Texas. The State of Texas, Reclamation Department Bulletin 25, 1934.

Reinhardt, Louis. The communistic colony of Bettina. *Quarterly Texas State Historical Assoc.* 3(1):33-40, 1899.

Schulman, Edmund. A bibliography of tree-ring analysis. *Tree-Ring Bull.* 6:27-39, 1940.

Stallings, W. S. Some early papers on tree-rings: J. Kuechler. *Tree-Ring Bull.* 3:27-28, 1937.

Tiling, Moritz. History of the German element in Texas from 1820-1850. Houston, 1913.

Weber, Adolph Paul. Deutsche Pioniere. Zur Geschichte des Deutschthums in Texas. San Antonio, 1894.

Weisse, Arthur. In: *Just's Botanischer Jahresbericht* 22:214, 223, 1894 (1897) (short summary of Kuechler's work, based on Abbe's editorial in *Monthly Weather Review*, November, 1893).

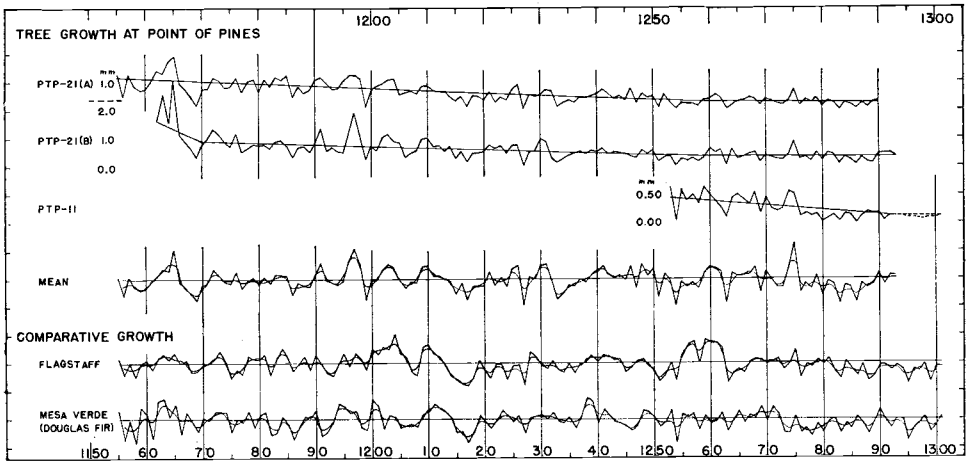
TREE-RING DATES FROM POINT OF PINES

TERAH L. SMILEY

The first two summers' excavations (1946-47) at Point of Pines (33°22'N, 109°43'W, elev. 6,200 feet) in the San Carlos Apache Indian Reservation, by the Field School of the Department of Anthropology and the Arizona State Museum, University of Arizona, have yielded only 23 pieces of charcoal, of which two have been dated—A.D. 1294+ and 1302+*.

PTP—21 (A) and 21 (B) are different radii of the same specimen. This ponderosa pine log, originally about six inches in diameter, came from the Pueblo IV site, Ariz. P:10:50, fill from room 11. The outer ring, at A.D. 1294, is fairly constant around the circumference of the log and it is believed that few rings are missing from the outside.

PTP—11, a very small fragment of ponderosa pine, came from the Pueblo IV site Ariz. P:10:51, fill from room 21. Because of its small size no attempt will be made to determine the number of rings lost beyond the outside at A.D. 1302+.



*These dates have been checked by A. E. Douglass and E. Schulman. It is expected that the archaeological report, by Fred Wendorf, will appear as a University of Arizona Bulletin, Social Science Series.

The figure compares the measured ring chronology in the dated specimens with standard Southwestern series, published in recent issues of the Bulletin.

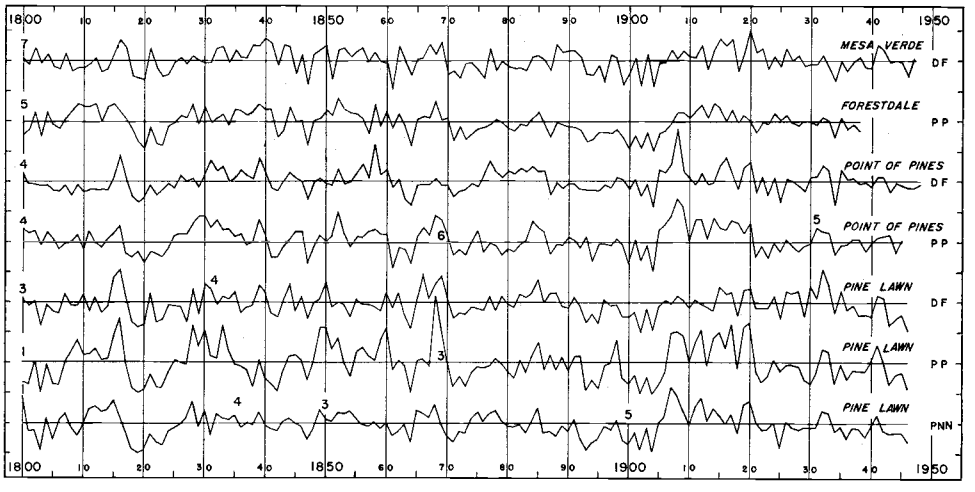
CHRONOLOGY CHARACTERS AT RUINS IN THE GILA BASIN*

EDMUND SCHULMAN

The extent of current and planned archaeological excavations in the Gila River Basin suggests the desirability of a skeleton survey of the problems in local ruin dating by wood and charcoal rings.

STATIONS

The Mesa Verde sequence in Douglas fir,[1] a standard index for the Pueblo area, is compared with the following exploratory collections by the writer. The standardized growth indices since A.D. 1800, based on the oldest and most sensitive trees in each set, are plotted in the figure. All of the following sites are in or near the border zone in which the ponderosa timberland meets the pinyon-juniper woodland; in moister areas near all sites Douglas fir may be found.



Forestdale. Arizona State Museum site[2] near the head of Forestdate Creek and some 220 miles south-southwest of Mesa Verde Park headquarters. Five ponderosa pines sampled in August, 1939, on sandstone ledges overlooking the campsite.

Point of Pines. Arizona State Museum site[3] some 60 miles south-southeast of Forestdale. Lava soils. Four Douglas firs sampled August 26, 1948, on Nantack Ridge, about eight miles southeast of the campsite. Radial growth for 1948 was very nearly or quite complete but coloring of latewood cells was not yet strong.

Six ponderosa pines sampled in June, 1946, from well-drained slopes, two near the campsite and the rest about four miles southeast.

No pinyon pines have yet been noted in the camp vicinity, though some grow near and on the crest of Nantack Ridge some miles to the south. The frequency of this species in the extensive ruin charcoal excavated in 1948 suggests an important change in forest composition since Puebloan times.

Pine Lawn. Chicago Natural History Museum site about 75 miles east-southeast of Forestdale[4]. Lava soils. Four Douglas firs some ten miles northwest of the campsite and about three miles east of Luna Pass.

*Grateful acknowledgement is made of cooperation by the Arizona State Museum in the field work in Arizona, and of a grant to the Tree-Ring Laboratory by the Chicago Natural History Museum which greatly facilitated collections at Pine Lawn.

[1] E. Schulman, Tree-Ring Bull. 12(3), 1946, and 14(1), 1948.
[2] E. W. Haury, Univ. of Arizona Bull. 11(4), 1940, and 18(4), 1947.
[3] E. W. Haury, Kiva 12:3, 1946.
[4] P. S. Martin and J. Rinaldo, Field Mus. Anthrop. Series 32(3), 1947. See also 32(1), 1940 and 32(2), 1943.

Three ponderosa and five pinyon pines from the SU and Promontory sites near camp. No significant site differences in chronology within each species were found in hilltop and slope trees.

CHRONOLOGY CHARACTERS

In all areas a number of trees from well-drained sites, in addition to those noted above, and test borings from poorly located trees yield the following somewhat preliminary estimates of quality.

Crossdating. On well-drained sites crossdating was found on the whole to be slightly better at Point of Pines than at Pine Lawn; both are somewhat inferior to Forestdate in this respect. Fine looking, fast-growth ponderosa pines in wash bottoms and lowlands at all three sites in the Gila Basin showed complacent, erratic chronologies. Douglas firs, as elsewhere, showed excellent crossdating at both Point of Pines and Pine Lawn, false and missing rings being easily identifiable.

Length of series. 300 years seems to be a normal maximum in conifers throughout the Gila Basin, very few trees being noted which exceeded this age and most being substantially younger. An average ring-width from 0.5 to 1.0 mm seems to be characteristic of mature conifers on well-drained sites at Point of Pines and Pine Lawn, but young pines up to a foot in stem diameter averaged only about 50 rings. Slower growth and longer sequences are characteristic at Forestdale, though even here average ring-widths far exceed those to be found at Mesa Verde.

Missing rings. Increment borings in dry-site ponderosa pine at all three Gila sites and in pinyon at Pine Lawn indicate the normal proportion of locally-absent rings to be only two or three per century of mature growth. Because of weaker crossdating these are rather more difficult to identify with certainty at Point of Pines and Pine Lawn than at Forestdale.

False rings. The characteristic increase in frequency of false rings with decreasing latitude is well exemplified in the Gila Basin and, in the areas here discussed, seems to be greatest at Pine Lawn. Occasional false rings in ponderosa pine are so annual-like in character as to be identifiable only with most painstaking effort. No precise statement is possible, but an estimate of ten false rings per century, of varying strength, is perhaps not far off for ponderosa in all areas; even pinyon, characteristically less subject to this phenomenon, shows numerous cases of extra layering at Pine Lawn.

Relation to master chronologies. Figure 1 shows a general parallelism in chronology among all three Gila areas. The agreement of these chronologies with that at Mesa Verde is given more quantitatively in Table 1.

Table 1. Correlation Coefficients between the Mean Growth Index in Douglas Fir at Mesa Verde and Stations in the Gila River Basin.

Station	Species[1]	1800-1849	1850-1899	1900-1946	Mean
Forestdale	PP	.55	.55	.63[2]	.58
Point of Pines	DF	.65	.30	.58	.51
Point of Pines	PP	.43	.49	.55[3]	.49
Pine Lawn	DF	.60	.49	.62	.57
Pine Lawn	PP	.35	.45	.74	.51
Pine Lawn	PNN	.43	.44	.66	.51

[1]PP—ponderosa pine; DF—Douglas fir; PNN—pinyon pine.
[2]1900-1938.
[3]1900-1945.

All of the Gila mean growth curves have at least as close a relation to Mesa Verde as that found between the latter and Flagstaff (coefficient 0.46 —see Tree-Ring Bulletin 14:24, 1948).

To summarize: Within the time range of the central Pueblo master chronology and on the basis of the characters above noted, ruin dating as determined by the average specimen may be expected to be progressively more difficult at Mesa Verde, Forestdale, Point of Pines, and Pine Lawn. Individual specimens of great simplicity are to be found at all stations with decreasing frequency in the suggested order. As indicated in the Figure, even the Pine Lawn sites, given sufficient archaeological specimens within the range of the master chronology, must be subject to certain dating.