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THE DATE OF THREE TURKEY HOUSE

HAROLD S. COLTON

During the summer of 1938, Richard Van Valkenburgh of the U. S. Indian Service called the attention of members of the staff of the Museum of Northern Arizona to a cliff dwelling in a canyon 15 miles south of the Canyon de Chelly in eastern Arizona which indicated that it had never been entered by white men. The cliff dwelling (N. A. 3467) is located in Red and White Canyon, a tributary of Naslini Wash and is situated 50 feet above the canyon floor. In November, 1938, an expedition led by the author, which included Milton Wetherill, Ernest Hogan, J. Ferrell Colton and Hugh Bradwell, with the aid of ladders, reached the dwelling.

Inscriptions written in pencil on the kiva wall showed that the ruin had been entered previously by W. E. "Hiddinn" (inscription not clear), in 1898; S. E. Day, Jr., and C. L. Day in 1900.

This cliff dwelling is composed of 18 rooms and a circular kiva, all in almost perfect condition. The indiginous decorated pottery is Mesa Verde white ware. A more complete description of the cliff dwelling will be published in the near future.

Three large beams were discovered, two in the kiva and one in one of the rooms. These were bored, a core extracted, and the hole plugged. The cores were given to John C. McGregor who reported as follows: One of the kiva beams proved too complacent to date, the other, F 4391, gave a bark date of 1266 A. D. The third core from Room 15 gave a date of 1276 A. D.[1] A complete record follows:

Site	Piece Number	Outs. Dated Ring	Inside Dated Ring	Approx. Radius in mm.	Kind of Wood	Type of Specimen	Sap-Heart Date	Rings Lost at Outside	No. Absent	Est. Bark Date
N. A. 3467	4391	1266	1182	58	D. F.	Core	1244	Prob. 0	0	1266
N. A. 3467	4393	1276	1188	51	Fir	Core	1240	Prob. 0	1	1276

(1) Dates confirmed by A. E. Douglass.

OBJECTIVES AND METHODS IN NEW ENGLAND TREE-RING STUDIES

By CHARLES J. LYON

The science of tree-ring measurement and analysis has been extended from its natural home where plant growth is very dependent upon annual rainfall into a few other areas with suitable trees and restricted water supply. During the past decade, workers have made serious attempts to carry the method into the well forested regions, in spite of the many new factors that could be expected to influence tree growth where the water supply is generous and fairly dependable. Humid New England in particular, with its highly variable temperatures, winds, humidities, soils and growing seasons, seems a hopeless place to find useful tree-ring data. Experience shows that the area is far from hopeless provided the objectives are re-defined and the working methods adapted to overcome the technical difficulties.

At first the objective was little more than a search for consistency in the data and for the most promising species to use. With the basic principle of cross-identification as a guide and the apparent fitness of the conifers implied by their general use elsewhere, even the first attempts with a few hemlocks and pines proved that at least part of our conifers have kept a record of something common to the area. With edaphic factors eliminated through use of scattered sites, on various types of soil, some climatic effect was clearly indicated. But the main objective cannot be climatology in the usual sense. Our trees keep records chiefly for their short growing seasons, reflecting almost nothing that happens about the late summer and autumn except as the effect may appear during the following season. Correlation with annual rainfall or other yearly summations is ruled out at the start, due to extremely variable run-off except in winter when the run-off is practically complete.

Since the tree-ring aid to true climatology elsewhere has been limited to climates dominated by water supply problems, it has not been surprising to find that the New England trees record the physiological dryness of our climate. Until other relations are demonstrated in the data, all the objectives of ring studies will center on this point. Drouths and wet seasons as extremes are especially important even when they are only relatively severe. Our oldest trees are providing records of growing conditions for the past three, sometimes four, centuries and from them we may learn of the future as well. Related problems of an economic or sociological nature may gain some help. All sciences that make use of practical knowledge about rates of tree growth will draw considerable information concerning the water supply needs of individual species. Minor problems in dating unrecorded events or settling contested issues form another application differing only in degree from the archaeological successes in the Southwest.

METHODS AND MATERIALS

As elsewhere, the working methods for New England trees are guided by the principle of obtaining a reliable index of the rate of secondary growth each year. Thus it is essential to remove all doubts about ring dates and sequences by obtaining perfect solutions for the problems caused by "doubles" and "wedging-out". A partial compensation for the difficulties incurred by the need for following these principles, the New England trees from relatively low altitude provide rings so wide that they can be measured accurately with simple apparatus. It may be too early to speak of methods for handling the data but it appears now that they can be treated as elsewhere except for the limitations imposed by the relatively short sequences of years, the rapid changes in growth rate due to age of tree, and by the objectives that emphasize relative in place of absolute growth rates. The problems are simple but the techniques are exacting and laborious.

Stated in approximate order of suitability, the species thus far tested and found to cross-identify well are: Eastern hemlock, red spruce, white pine, red oak, Norway spruce, Austrian pine, Scotch pine and European larch. White ash shows the effects of severe drouths only. American elms give some promise but field specimens have not been tested yet. It is possible, from the work of Adams in Vermont, that Jack pine should be included in the list. Except for those growing in swamps, probably any species can be used for limited purposes but the hemlock gives the longest records and the highest correlation coefficients from site to site, with pines and spruces definitely valuable.

The European larch cross-identifies easily but is placed low on our list because it fails to agree well with the evergreen conifers on dates of notable drouths and good years. It usually misses by one year, but occasionally the species indicate a "new" drouth effect; the data are being compared with rainfall and temperature records, fortunately available for the exact site. A specific relationship with the climate of some one month or two is suspected.

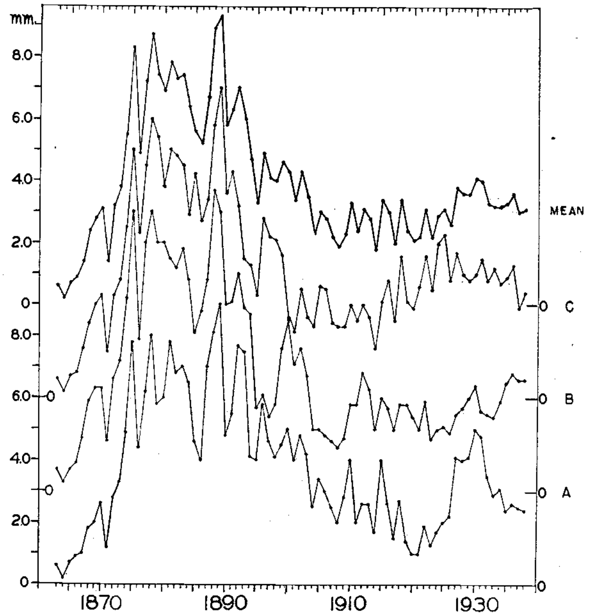
Most analyses have been made from stump or butt log sections, for practical reasons. These have indicated the reliability of measurements from this height in comparison with others. So far as possible, trees with pronounced buttress effects have not been used and flares are avoided when measurements are made. Sections are not cut of trees with strongly eccentric growth but it can rarely be avoided entirely. It seems more important to select trees growing in soil of average depth where the drainage of the roots is typical of the site as a whole. Except for a few tests made of trees rooted on a southern slope, studies by the writer have been confined to material from other exposures; wooded southern slopes are less common and probably have different water supply factors including solar radiation effects.

A section of the tree trunk large enough to allow measurements along three widely divergent average radii is considered essential for analyses of climatic effects and advisable for all cross-identification work. When the measurements have been tabulated it is sometimes apparent that some one radius would show the same sequence of ring widths as the average (mean) of all three but such a radius cannot be located by visual inspection. More often no one radius is entirely satisfactory (see figure). Trees on ridges and sites with variable depths of shallow soil are more likely to produce this result by growing faster on first one side of the tree and then another but the behavior is so unpredictable that an average of three radii seems the only reliable method to use.

Another reason for seeking full sections of the trees is the opportunity they provide to correct doubts and errors caused by doubles, wedging-out and indistinct rings. A double effect usually disappears at some point around the ring. A ring indistinct on one radius is commonly much wider on the other side of the tree. Cracks and checks in dried sections interfere seriously with the correction of all such efforts; they can be minimized by cutting sections at least two inches thick and storing them in cool, moist air.

The accuracy of measurements is governed in part by the widths of rings being used. A hand lens and rule marked in millimeters is sufficient for pine in good soil. The most dependable and efficient equipment for indoor use on all species is a 10X dissecting binocular provided with a graduated scale in one ocular and a jointed arm to hold the lens system over the wood section. The divisions of the scale may vary with the maker but they usually provide for a unit equivalent to about one-tenth mm. with an opportunity to estimate one-fiftieth mm. when slow growth is being measured.

Strong illumination of the wood is needed and a clean cut surface is required for accurate measurements. We have used paraffin oil to bring out the boundaries except on dark wood. A safety razor blade, held by hand and used in the field of the binocular, cuts a smooth, thin slice from soft wood but a steel scalpel with replaceable blade is needed for most hard woods.



Agreement in ring widths along three radii in average specimen, Eastern White Pine (at Hanover, N. H.)

ORGANIZATION OF DATA

The data must be handled with special consideration to origin. With so much control of absolute growth rate dependent upon age of tree, depts of soil, mass of crown, etc., each width is relative and significant only as less or greater than that of rings beside it (see figure). Correlation studies require a smooth trend line through plotted points. These lines can seldom be straight—more often they are curved to follow the obvious changes in rate due to non-climatic factors. Release from partial suppression is very common and the change in trend often requires sharp curvatures in the line from which deviations are calculated. When the graphed data represent mean values of a group of trees, it is best to use an even-aged stand, if possible, but other groups of trees can be used if the age effects are corrected by the trend line.

For correlations between ring width and climatic factors, it is obviously necessary to make preliminary tests and estimates with all reasonable possible combinations of weather records. Anatomical studies of limiting dates for secondary growth of the species used form an excellent basis for this work but such information is still lacking for many species. Preliminary estimates can probably be based with some certainty upon the relations between climatic factors and growth for the "critical years"—those with relatively narrow or wide rings. The results we have previously reported for hemlock and white pine (see Ecology 17: 457-478. 1936 and 18: 406-415. 1937) were obtained entirely from such comparisons but work now in progress will permit us to re-state and amplify the relations with the aid of correlation coefficients.

RESULTS

A considerable amount of new data is now ready for use in conjunction with those first reported for this area. One set in particular has just been obtained from six species of trees growing no further than a hundred yards from a weather records station. From other measurements it has been established that groups of coniferous trees from widely scattered sites, certain to have somewhat different weather conditions, nevertheless give significant correlation coefficients when compared with each other, year by year. The best correlations appear between tree groups of the same species (notably hemlock) because the growth of a single species is apparently controlled by physiological dryness for one period of weeks or months while another species is governed by the same general physiological conditions for a slightly different time period. As the relations of new species are brought out, their relative values as recorders of physiological climate will become evident, with the deciduous trees certain to differ from the evergreens. Similar differences among tree species could probably be found in other forested areas but it seems especially important to work them out for a humid section; there is no other basis for judgment concerning dependence on climate or any one of its constituent elements.

Simple inspection of the raw data does show one common denominator for all the species—a list of drouth years since 1850 with a less accurate list for the two preceding centuries. Years that gave narrowed rings for all or most of the species used must have been dry for the greater part of the spring and early summer. Subject to minor corrections later, this list includes the following for the past century: 1849-50, 1859, 1864, 1876-77, 1884-85, 1895, 1911, 1914, 1920, 1923, 1934. In the same way, the following years were more favorable than average to tree (and crop) growth: 1851, 1863, 1867, 1875, 1894, 1898, 1910, 1916, 1921-22.

Further statements about tree-ring records of climate in New England, other than those already published, must await an intensive analysis of accumulated data.

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A METHOD OF OBTAINING A PLANE SURFACE ON CHARCOAL

E. T. HALL, Jr.

Photographing charcoal specimens distinctly is of primary importance to the dendrochronologist since the majority of material available for dating is charcoal.

A fractured surface is perfectly workable for dating, but will not ordinarily photograph well unless a long focus lens is used. [1] In the case of pinyon records that are highly compressed it is necessary to use a short focus lens in order to obtain higher magnifications. Photographing specimens magnified from five to twenty-five times requires a perfectly plane surface, and, at the same time, preservation of cell structure. The writer has found the following method satisfactory in obtaining a legible razor-cut surface.

1. Cut an absolutely plane surface with a **sharp** razor, or, grind a surface with the side of a grindstone, (a 45 degree cut is preferable).
2. Boil the specimen in paraffin long enough to assure thorough penetration into all cells, 30 minutes is usually sufficient. Do **not** use a gasoline solution.
3. Allow specimen to cool completely so that paraffin will become solid. This requires two to six hours, and will then support the cell walls when they are cut.
4. Cut a new surface with the sharpest blade available. Very little shaving is required to clear the old surface of pulverized material which has filled the interstices of the cells. This surface is highly reflective and cannot be photographed at this stage of preparation.
5. Subject the surface to heat sufficiently intense to expel paraffin. Hold the surface next to a hot-plate, turned up on its side, to allow the melted paraffin to drip away. This process must be repeated once or twice since paraffin keeps working out from inside the specimen and clouding the surface.

When all the paraffin has been expelled from the cells the resulting surface is very similar to that of wood prepared with a razor. If great care is not exercised in the final shaving of the surface and in expelling paraffin, the whole process will have to be repeated.

In photographing, do not subject the specimen to too great heat from the lights as the surface will have a tendency to cloud after several minutes, and will only clear on cooling.

This method may also be used on rotten wood if the following procedure is followed:

Char the wood by heating it in an air-tight container, a coffee can will serve. It is well to dry the specimen thoroughly beforehand, and to char it very slowly since the drying undergone in this process induces shrinkage which, if too great, causes excessive fracture. If the specimen is already cracked it is likely to fracture during the process. After the specimen has become charcoal it may be handled in the same way as any charcoal. Almost any rotted specimen may be treated in this manner, which permits surfacing by fracture or cutting, providing that the rotting has not gone so far as to destroy the cell structure in the specimen.

Santa Fe, New Mexico.

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(1) Photograph Of A Charcoal Specimen. H. F. Davis, Tree-Ring Bulletin, Vol. II,

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