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A REGIONAL GEOGRAPHICAL STUDY OF GUANO VALLEY
A SECTION OF THE BASIN RANGE AREA
OF SOUTHEASTERN OREGON

By

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A Thesis

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CLIMATOLOGY

The climate of the Basin Range area, during Pleistocene time, seems to have been much more humid than at present. During the times of general ice advance the climate was probably colder and in the interglacial periods it was probably somewhat warmer.

Lake Terrace Evidence: During the Pleistocene great lakes formed in the Basin Range province; Lake Lahontin was just south of Guano Valley, and Lake Bonneville was somewhat farther to the south and east. Warner and Surprise Valleys were filled with water, as were Guano and Catlow Valley, but these had no connection with the larger lakes.

There was no glaciation around Guano Lake nor in the immediate neighborhood, although both Steens Mountain and the Warner Mountains were somewhat glaciated. This glaciation and the apparent heavier concentration of precipitation in this area at that time may be the explanation for the existence of the large lakes.

In Surprise Valley, California, the highest beaches are nearly three hundred feet above the present valley floor. At the north end of Surprise Valley is a small lake known as Lake Annie, which was cut off from the main lake by a bar. The top of this bar is

approximately three hundred feet above the present floor of Surprise Valley.

In Warner Valley, Oregon, the highest lake terraces are two hundred and fifteen feet above the present valley floor. A well, drilled in the southern end of Warner Valley, was sunk over five hundred and eighty-five feet without passing out of the lake sediments. The drill passed through a well-preserved juniper log at this depth. This gives over eight hundred feet as the known depth of the lake. The lake, however, probably never had eight hundred feet of water in it at any one time. As the lake bottom filled with silt, which would rapidly happen under conditions of increased rainfall in this region, the surface of the water would rise higher and higher on the sides of the basin, the upper terrace being the highest point at which water stood for any length of time when the lake floor was approximately at its present level. Also, the filling in of the lake floor probably did not occur during just one long period of lake existence, since the evidence, as will be brought out later, points to alternate periods of lake and of desert--periods of heavy and light precipitation. At the present time the floor of this valley is composed partly of sediments and partly of peat bog.

Guano Valley, on the other hand, seems to not have had such amounts of water present in it. There

are no wave-cut terraces on the talus slopes and cliffs, the water seeming to have covered little more than the bottom of the lake. Guano Lake drained out to the north through a canyon approximately fifty feet deep and seventy-five yards wide, cut through forty miles of the basalt flows of the region. This canyon, known as Guano Slough, eventually flows northeast, and empties into Catlow Valley. Such a condition would indicate that much water had flowed through Guano Valley, and had it been a deeper basin, there probably would have been wave cut terraces, or notches, high on the valley walls. The depth of sediments in Guano Valley is unknown.

That the recent lake was shallow and only covered part of the Valley floor is shown by a series of extremely well-defined sand beaches around its lowest portion. Archeologically, these late beaches were very important, because it was on these that the Indians camped, and because many of the artifacts illustrating the culture of the region were gathered here. In fact, so important archeologically was the most recent of these beaches, that its course was accurately mapped in reference to the western scarp; it was then entered on the topographic map made by the University of Oregon and Stanford University Archeological Expedition, in 1934.

Recent Historical Evidence: The earliest records of white man in the region tend to indicate that during Recent Time there has been an alternation of periods of wet and dry. Geese

Lake, about fifty miles directly west of Guano Lake, was dry, or nearly so, in 1845, and subsequently, when the Applegate Immigrant road, or "Old South Road",[1] was in use. Then, about 1874, Goose Lake filled up again, reaching its maximum during the 1890's. During this time, the old road made by the pioneers was completely covered by water, and its exact position, and for that matter, even its existence at Goose Lake, was disputed. During the early 1900's, the lake gradually decreased in size, until it finally went dry in 1925. At this time, the old immigrant road was rediscovered. There was water in Guano Lake between 1870 and about 1907, but, being smaller, it went dry sooner than did Goose Lake; otherwise, its history was similar.

Tree Ring Evidence: These general fluctuations seem to be borne out to some extent by the trees of the region. Tree ring growth charts made by the United States Forest Service,[2] and by Professor A. E. Douglass,[3] both

1. Applegate, Lindsay, "Notes and Reminiscences of Laying out and Establishing the Old Immigrant Road into Southern Oregon in the Year 1846." Quarterly of the Oregon Historical Society, Vol. 22 (1921)

2. Meyer, Walter H., "Growth in Selectively Cut Ponderosa Pine Forests of the Pacific Northwest". United States Department of Agriculture Technical Bulletin No. 407, April, 1934.

3. Douglass, A. E., "Climatic Cycles and Tree-Growth." Carnegie Institution of Washington Publication 289, Vol. II (1928)

for himself and for Dr. Isiah Bowman,[1] show these general trends, but not enough is known about the relationship between tree rings and climates to permit pushing the climate sequence back on this basis.[2]

There appear to be four main causes of variation of tree ring thickness which may have affected the thickness of the recent rings, so that the rings may not truly represent the climate. For example, three inches of rainfall occurring during the growing season will have more effect on the thickness of the tree rings than three or four times that amount of precipitation during the rest of the year. Also, summer thunder showers, especially those occurring in the early summer, the last part of the normal growing season, will cause the trees to show excessive growth and the tree rings to indicate a much heavier precipitation than actually occurred, although they may not add greatly to the total annual precipitation. Then too, if in the Fall, a rain occurs followed by a hard freeze and then snow, nearly all of the melting snow will become run-off in the Spring and no water will soak into the ground because the ice formed at the time of the first hard freeze will have sealed all the pores. Trees which recently have been

1. Bowman, Isaiah, "Our Expanding and Contracting Deserts". Geographical Review. January, 1935.

2. See Appendix.

favorably exposed to sunlight as a result of selective cutting grow faster, and the tree rings would not accurately express the climatic conditions. Even if the conditions are right for the proper fluctuations of tree ring thickness--neither too much water nor a constance supply such as is afford by a stream, and with none of the above variable conditions--tree rings would only show the relative dryness to wetness, not the absolute amounts of precipitation. Taken all in all, therefore, tree rings may be excellent for dating, but as yet they are not sufficiently well understood to afford a basis for determination of climate.

Range Grass Evidence: The range grass in the Goose Lake area is reported to have been best between the years of about 1895 and 1910, and the situation was probably the same in Guano Valley, with perhaps the later date being somewhat earlier in Guano Valley, because of the earlier drying up of the water in that lake.

Guano Lake Evidence: As has been stated before, Guano Lake became dry about 1907, and has remained dry to the present time. During the last few years the region has been experiencing a severe drought, with a consequent lowering of the water table. Thus, many of the springs have either dried up completely, or have been greatly reduced in volume; the spring at Desert Lake has completely dried up, for example, and those on the northern and western sides of Beattie's Butte

have been so reduced in volume that there is scarcely enough water for the range cattle. Wells, also, have dried up, as at Ryepatch ranch, which was abandoned for for this reason. Other wells have had to be deepened and cleaned out, as was the case with the wells at the Shirk ranch, and the MC ranch in the summer of 1934.

The lowering of the water table has also had the effect of killing many of the plants, particularly the trees, growing on the edge of the desert.

Climate: The climate, based on Köppen's[1] classification, as worked out for this region by Ruth E. Hopson[2] using Leighly's chart,[3] falls under the BWk or desert type.

Since there were no weather records available for Guano Valley, records from the nearest stations were utilized. The climate at Guano Valley probably most closely resembles that at Blitzen, Oregon.

The following averages were compiled from "Summary of the Climatological Data for the U. S., by Sections", United States Department of Agriculture Weather Bureau, Section 18 (Eastern Oregon), and from

1. Köppen, W., and Geiger, R., Klimakarte der Erde. Gotha: Justus Perthes. (1923)

2. Hopson, Ruth E., Climates of Oregon. Thesis in preparation. University of Oregon. (1936)

3. Lieghly, John B., "Graphic Studies in Climatology". University of California Publications in Geography. Vol. 2 No. 3 pp. 55-71 (1926)

their yearly reports for the years from 1920 to 1933:

Blitzen: BWk

Mean Annual Temperature	44.99°F.
Mean Annual Precipitation	8.52 in.
January Mean Precipitation	24.60°F.
July Mean Temperature	67.00°F.
January Mean Precipitation	0.96 in.
August Mean Precipitation	0.37 in.

Valley Falls: BSk

Mean Annual Temperature	47.19°F.
Mean Annual Precipitation	11.12 in.
January Mean Temperature	30.12°F.
July Mean Temperature	66.86°F.
January Mean Precipitation	1.01 in.
August Mean Precipitation	0.34 in.

Lakeview: Ds

Mean Annual Temperature	45.69°F.
Mean Annaul Precipitation	13.86 in.
January Mean Temperature	27.27°F.
July Mean Temperature	66.40°F.
January Mean Precipitation	1.93 in.
August Mean Precipitation	0.27 in.

Both the fauna and the flora are of the steppe type--Upper Sonoran and Transition life zones, as appears on page 36.

the MC entering only rather recently, as a cow camp for the mainranch in Warner Valley.

The manner in which ranches are laid out often reflects both the influence of the country in which they occur and the country from which the settlers came. This may have been true in Guano Valley in the early days, but at the present time, no two ranches are alike. The reason for this is that, as the ranches prospered, the ranchers hauled in lumber from the outside and built more pretentious dwellings, larger and more modern barns, and better bunkhouses. This lumber was often hauled many miles, much of that used in both Catlow Valley and Guano Valley coming from Winnemucca, Nevada. At the Shirk ranch, for example, the blacksmith shop, the wagon shed, the shearing pens, the barn, and the ranchhouse, are made entirely of lumber which was hauled in. The lower walls of an old barn and the well-house, however, are made of stone set in mortar, a situation reflecting the early lack of wood for construction.

Archaeology: In considering special human responses in Guano Valley, we must include a discussion of the Indians aswell as the whites. Of the earliest Indians, we have only a very slight amount of archaeological evidence. The finds consist mainly of surface material, including stoneware and chipped implements, most of which were found on the most recent of the lake

beaches surrounding the now dry deepest part of the valley floor. Many other artifacts were found around the various springs, both flowing and dry, which exist in the neighborhood, as well as in areas providing large surface concentrations of both obsidian and water. In the small Long Lake depression, mentioned previously, the entire southern rim is literally covered with petroglyphs. There are several series of these, some being superimposed over others which are so old as to be almost obliterated. Only one cave has been found which showed signs of more than casual occupation. This cave is about four and a half miles south of the Shirk ranch, on the western rim. In it were found stoneware, fragments of basketry, split bones, shredded sagebrush bark, twine, and fire sites. The Indians seem to have been nomadic hunters, wintering probably in Catlow Valley, and possibly in Warner Valley, ranging over the scarps and uplands and Guano Valley during the seasons for hunting and gathering food, and camping on the beaches of the lakes within the region. Aside from the one cave mentioned above, which was apparently occupied permanently for only a short time, there seems to be no sign of any early or late permanent habitation in Guano Valley.

Ethnology: The Indians who were occupying the country when the whites first entered it seem to have been of somewhat similar habits. That is, they were a nomadic

On One of the Recent Beaches

Rock Shelter

Close-up, Showing Petroglyphs

people living mainly on the proceeds of the chase and whatever else they could gather. These Indians, however, were able to range farther than their precedessors, because of their acquisition of the horse about 1750. The earlier Indians seemed to have been closely allied to the southwest culture area, as they had pottery and the muller and metate. Their arrow point type resembles that of the Basin Range culture areas rather than that of the Columbia River or other areas. Petroglyphs, also, were made in this area, rather than the pictographs as are common north of the Basin Range province. The later Indians were more of the Plains type; they had the horse, and with it adopted much of the plains type of dress, buckskin shirt and leggings, for example, as well as other traits.

Referring to the Paiutes--the later Indians--Miss Isabel T. Kelly, in her paper on the Surprise Valley Paiutes,[1] says:

"The band of Northern Paiute known as Gidü takid or Groundhog eaters, with whom this paper is primarily concerned, lived in the northeastern corner of California, and the adjacent parts of Oregon and Nevada, along the western fringe of the Great Basin. Their territory included the whole of Surprise Valley and considerable of the hill country immediately to the east. Statements as to the eastern extension are extremely vague, but their holdings include Coleman Valley and probably Long Valley, running well toward Summit Lake in Nevada."[2]

1. Kelly, Isabel T., "Ethnography of the Surprise Valley Paiute", University of California Publications in American Archeology and Ethnology. Vol. 31 No. 1

2. Ibid. p. 70

"To the north the Gidü takid ranged more or less continuously through Adel and Plush in Warner Valley, the northern extension of Surprise. They seem not to have wintered north of Plush, but in summer probably reached the head of the valley. To the north, south and east they were bordered by other Paiutes, although most of the country between Plush and Burns is said to have been alkali and uninhabited."[1]

Miss Kelly's informant, in giving a list of the various Paiute bands and their approximate locations, names several in the region under consideration besides those in Warner Valley--one "east of Steens Mountain", one in the Burns-Malheur region, and one at McDermitt, the country north of which being reported as uninhabited. The statement that the region north of McDermitt was uninhabited is probably incorrect, as artifacts and petroglyphs are found on the north and west sides of the area, and Indians were reported in this region by the early settlers. The band in the Burns-Malheur region must be quite recent--since the acquisition of the horse--for the evidence is, as has been shown, that the culture area ends approximately at the northern edge of the Basin Range physigraphic province. This border-line is south of the Burns-Malheur region. After the Paiutes adquired the horse they ranged much farther north.

Guano Valley, Catlow Valley, and the Steens Mountain country are thus left uninhabited by the informant, a situation which is obviously erroneous, one

1. Ibid. p. 72

which is disproved by the archaeological evidence. Guano Valley and the highland west of it are linked archaeologically with Catlow Valley rather than Warner Valley. That there was a certain amount of overlap in occupation of the highland is indicated by the petroglyph type at Long Lake, on its Western edge. These petroglyphs at Long Lake are similar, in part, to those at Stone Bridge, in Warner Valley.

Settlement by White Man: The first permanent settlers were the cattle men, D. L. Shirk having been the first to acquire title to land in Catlow Valley, in 1877. Both previous to and subsequent to the filing on land the settlers had trouble with the Indians. For example, in concluding an account of an Indian uprising D. L. Shirk summarized as follows:

> "In September (1878) following the close of the war we began rounding up our stock in order to ascertain the amount of losses suffered. We found our losses were not so great as we had reason to expect, especially those who, like myself, remained at home and prepared to protect their property. All of the homes and ranches vacated were burned to the ground, their contents being taken or destroyed. Of course, in remaining we took desperate chances of losing our lives, but the man who has not the courage to defend his own, sooner or later goes to the wall. This was especially true in the early days in the occupation and settlement of the Great West. Then, every man was a measure a law unto himself, and in order to prosper, must protect his own."[1]

He also says:

> "During the Bannack raid, numbering near two thousand warriors I lost about seventy-five head of horses. Others lost more heavily, both in horses

1. Shirk, D.L., Life and Adventures of David Lawson Shirk. Private Publication. p. 132 (1920)

APPENDIX

The earliest records of white man in the region tend to indicate that during Recent Time there has been an alternation of periods of wet and dry. Goose Lake, about fifty miles directly west of Guano Lake, was dry, or nearly so, in 1845, and subsequently, when the Applegate immigrant road, or "Old South Road",[1] was in use. Then about 1847, Goose Lake filled up again, reaching its maximum during the 1890's. During this time, the old road made by the pioneers was completely covered by water, and its exact position was disputed. During the early 1900's the lake gradually decreased in size until it finally went dry in 1925. At this time the old immigrant road was rediscovered. There was water in Guano Lake between 1870 and about 1907, but being smaller it went dry sooner than did Goose Lake; otherwise, its history was similar.

These general fluctuations seem to be borne out to some extent by the trees of the region. Tree ring growth charts made by the United States Forest

1. Applegate, Lindsay, "Notes and Reminiscences of Laying out and Establishing the Old Immigrant Road into Southern Oregon in the Year 1846". Quarterly of the Oregon Historical Society, Volume 22 (1921)

Service,[1] and by Professor A..E. Douglass,[2] both for himself and for Dr. Isaiah Bowman,[3] show these general trends, but not enough is known about the relationship between tree rings and climates to permit pushing the climate sequence back on this basis.

There are a number of factors influencing individual growth rates of trees. For example, there is a variation of growth rate with age. Trees grow faster in their youth than during any other period of their life. Corrections, however, can be rather easily made for this. Then, in using stumps for records, flaring at the base may cause inaccuracies, as will eccentricity of growth of one part of the tree. Under certain conditions trees will produce a double ring for one year, or may produce none. Abundant seed production will cause a decrease in growth which will produce a period of close-set rings indicating unfavorable conditions when these conditions may actually be unusually good. Defoliation and topping may also produce the appearance of unfavorable conditions. Variations in precipitation produce variations in ring growth. Three inches of rain in the growing season will have more effect on the ring growth than will three or four times that much precipitation at other times of the year. An early freeze following a rain will seal the pores in the ground so that all of the melting snow in the Spring will become runoff. Early Summer thunder show-

ers, while not affecting the total amount of precipitation greatly, may affect tree growth out of all proportion. If the precipitation is great and the temperature low, the ring growth will remain low, thus not properly recording the amount of rainfall. Sun radiation falling on trees which have been shaded cause a rapid growth out of all proportion to the rainfall, which eventually dies down to the normal growth. This increase might easily be interpreted as increased precipitation, when none actually occurred. There are at present no corrections for these variations, and they are greatly in evidence when the growth charts are examined.

Growth charts for Baker and Klamath Falls, Oregon, worked out by Dr. Douglass, have been reproduced here. A recent chart for the Harney Basin, worked out by L. T. Jessup,[4] is also included, as are those worked

1. Meyer, Walter H., "Growth in Selectively Cut Ponderosa Pine Forests of the Pacific Northwest". United States Department of Agriculture Technical Bulletin No. 407, April, 1934.

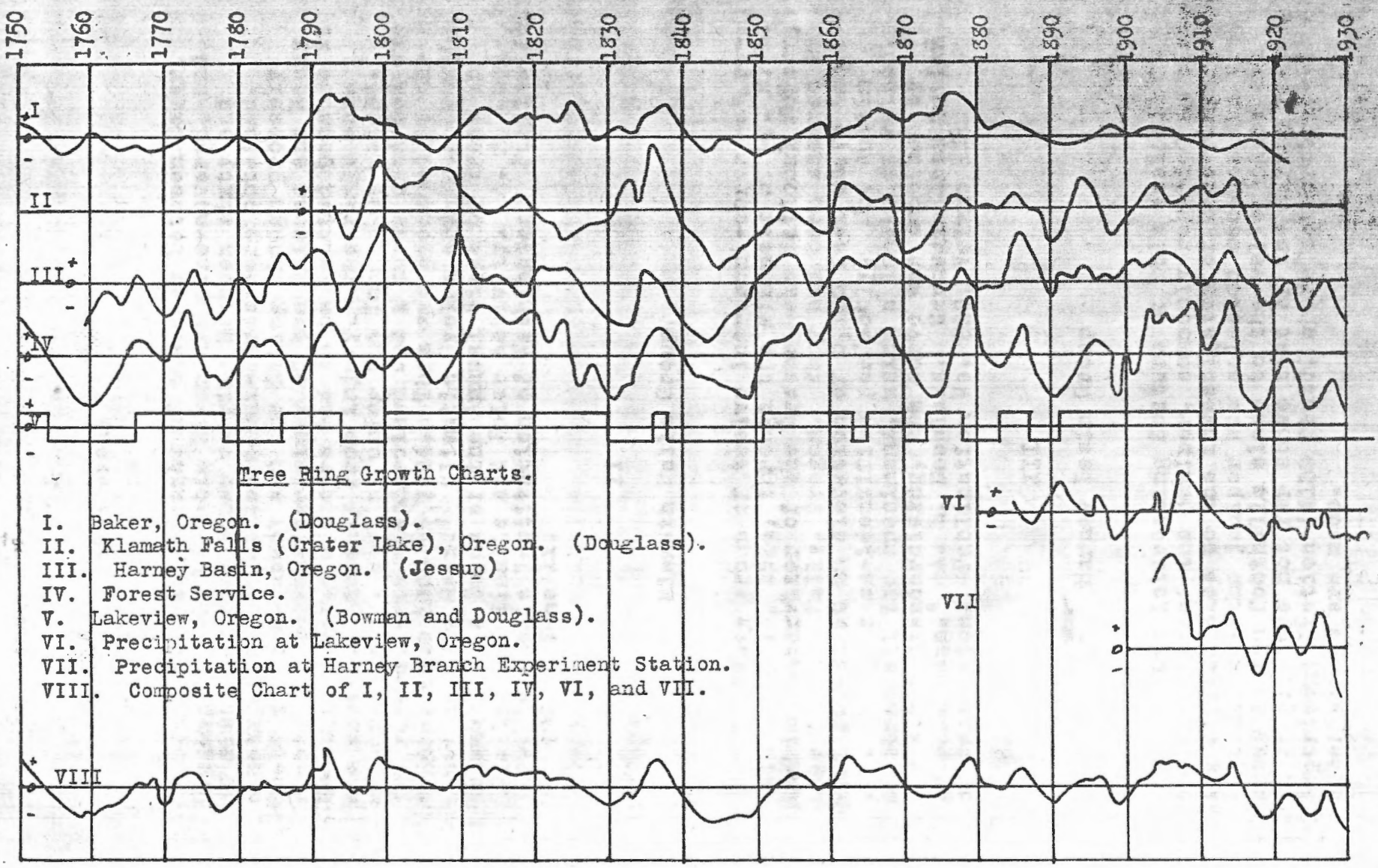
2. Douglass, A. E., "Climatic Cycles and Tree-Growth". Carnegie Institution of Washington Publication 289. Vol. II (1928)

3. Bowman, Isaiah, "Our Expanding and Contracting Deserts". Geographical Review. January, 1935.

4. Jessup, L. T., "Precipitation and Tree Growth in the Harney Basin, Oregon", Geographical Review. April, 1935.

out by the Forest Service and by Dr. Douglass for Isaiah Bowman. There is seen to be a general correlation between them, but the individual differences are pronounced. Weather records have also been charted for Lakeview and for the Harney Branch Experiment Station. These correlate with the growth charts about as well as the growth charts correlate with themselves.

While the trees in any one area will show the local peculiarities of climate variation, a composite chart of a number of localities within a larger area will largely eliminate local variations, and reveal the variations due to the climate. The local variations will compensate each other to a large extent. Such a composite growth chart, using all of the localities except the one of Bowman's, around Lakeview, has been constructed. It shows the present day period closely, as well as the one between 1840 and 1850. This, with the intervening period of wet climate, corresponds closely to the records of Goose Lake. Since there is such a close correlation here, we may push the record back to 1750. Goose Lake was probably dry between the years 1760 and 1790, and probably contained water between 1790 and 1840 or 1845. If sufficient records from trees were obtainable for earlier dates, the climate of Eastern Oregon could undoubtedly be pushed even farther back.



Tree Ring Growth Charts.

I. Baker, Oregon. (Douglass).
II. Klamath Falls (Crater Lake), Oregon. (Douglass).
III. Harney Basin, Oregon. (Jessup)
IV. Forest Service.
V. Lakeview, Oregon. (Bowman and Douglass).
VI. Precipitation at Lakeview, Oregon.
VII. Precipitation at Harney Branch Experiment Station.
VIII. Composite Chart of I, II, III, IV, VI, and VII.

I

Baker Group

"The higher parts of the pass between Baker, Oregon, and the Columbia River are pine-covered, and at distances from Baker varying between sixty and ninety miles, eight increment-cores were obtained. These are complacent and the dating though probably right, has not the certainty of the Arizona and Rocky Mountain pines. One core had to be omitted because it was erratic, probably from injury. The rings were measured by Mr. Austin, using the long-plot method. The records were standardized and a curve produced extending from 1660 to 1924. This was smoothed by the usual graphic Hann." Climatic Cycles and Tree Growth. Volume II. A Study of the Annual Rings of Trees in Relation to Climatic and Solar Activity. A. E. Douglass. Carnegie Institution of Washington. Publication No. 289, Volume II.

II

Klamath Falls Group

"This group of twelve increment-cores was received May 12, 1924, through the kindness of Mr. H. B. Rankin, Supervisor of the Crater Lake National Forest, near Klamath Falls, Oregon. They had been secured in that forest at an elevation of 5,100 feet above the sea. They cross-identified perfectly. Mr. Austin measured all the specimens, using a long-plot method, and after standardizing, the curve was smoothed by graphic Hann." A. E. Douglass. Carnegie Institution of Washington. Publication No. 289, Volume II.

III

Harney Basin Group

"One interesting feature of this analysis is the use made of the juniper, commonly regarded as offering difficulties to the investigator of tree-ring records. In this case the juniper was selected because the tree grows on the foothills close to the valley floor and at an altitude not far above that of the Harney Branch Experiment Station (4139 feet), where meteorological observations are made.

"The species of juniper growing in the Harney Basin tend to branch near the ground and the trunks of the mature trees to become lobate in cross section, so that they have flutings. In many trees the several lobes grow at somewhat different rates, so that the width of a particular annual ring may not be constant. Also, the older trees generally have extensive decayed sections, particularly at the heart or core. For these reasons a considerable number of trees were examined, but sections of only four were found satisfactory for study. These were full sections taken from isolated trees growing well above the bottom of any draw or depression and located as follows:

"1. Burns, 6 miles northwest of, on road to Izee. Near rock ledge on steep slope with southern exposure; altitude 4750 feet.

"2. Burns, 21 miles west of, on highway to Bend. Sandy soil on flat ridge; altitude 4450 feet.

"3. Frenchglen, 1½ miles southwest of, on road to Blitzen. Near the pass from Blitzen Valley into Catlow Valley, on rocky shelf; altitude 4840 feet.

"4. Frenchglen, 5 miles north of, or road to Narrows. On steep rocky slope with western exposure on west side of Blitzen Valley; altitude 4600 feet."
L. T. Jessup, Precipitation and Tree Growth in the Harney Basin, Ore. Geographical Review, April, 1935.

IV

Ponderosa Pine Forests of the Pacific Northwest

"In searching for evidence of growth cycles in the ponderosa pine region of the Pacific Northwest it was impossible to cover all the available data, taken from some 8,000 increment-cores; it was therefore decided to choose arbitrarily 24 localities representative of the region and in each of these to select a few cores of mature trees, usually 10, for examination.

"The locations of the areas on which the increment-core data were taken are as follows:

"1, Pokegama, Oregon; 2, Odessa, Oregon; 3, Lakeview, Oregon; 4, Lakeview, Oregon; 5, Lakeview, Oregon; 6, Lakeview, Oregon; 7, Silver Lake, Oregon; 8, Fort Rock, Oregon; 9, Sisters, Oregon; 10, Prineville, Oregon; 11, Ochoco National Forest, Oregon; 12, Malheur National Forest, Oregon; 13, Austin, Oregon;

14, Sumpter, Oregon; 15, North Powder, Oregon; 16, Starkey, Oregon; 17, Heppner, Oregon; 18, Yakima, Oregon; 19, Wenas, Washington; 20, Ole Elum, Washington; 21, Wenatchee, Washington; 22, Wenatchee Lake, Washington; 23, Chelan, Washington; 24, Knowlton, Washington."

V

Goose Lake Group

"In order to check the historical record, there were assembled from localities in the general region of Goose Lake several scores of cross sections of trees showing annual rings of growth, and these have been analyzed by assistants of Dr. A. E. Douglass of Tuscon." Isaiah Bowman, Our Expanding and Contracting Deserts, Geographical Review, January, 1935.