

GEOLOGY

XXVI. A PRELIMINARY DIVISION OF OKLAHOMA INTO MAJOR AND MINOR PROVINCES ON THE BASIS OF RAINFALL ADEQUACY

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The Rainfall Utilization Problem of Oklahoma

Agriculture is favored in Oklahoma by a long frostless season and an abundance of heat and sunshine. Much of this heat and sunshine is wasted, however, because there is not a corresponding abundance of soil moisture to meet the requirements of growing plants. This deficiency of soil moisture is largely due to variability of rainfall and to large evaporation losses rather than to an actual deficiency of annual precipitation. Twenty inches of annual rainfall is frequently considered adequate for agriculture, yet only seven of the seventy-seven counties of the state have less than 25 inches. All counties east of the longitude of Oklahoma City have more than 30 inches of annual precipitation, while the mountain areas in the eastern part of the state average more than 40 inches. Investigations dealing with rainfall in relation to agriculture are needed if a maximum of precipitation is to be utilized and the losses incident to the trial and error method as agricultural adjustment are to be avoided.

The studies herein described are only preliminary. The period studied, only 10 years, 1911 to 1920, is too short to give normal figures, moreover, moisture losses resulting from low Relative Humidity and the rather high wind velocities in Oklahoma are not separately taken into consideration, nor is allowance made for the effect which excessive rainfall of a given month has in mitigating rainfall deficiencies of succeeding months.

Modifications of Older Classification

Oklahoma has been described by Newell¹ as lying within three moisture provinces: (1) humid, consisting of the half of the state lying east of the longitude of Oklahoma City, (2) semi-arid, consisting of the western half of the State with the exception of the western half of the panhandle, and (3), arid, consisting of Cimarron County and western Texas County. These divisions

¹Salisbury, Barrows, & Tower. "Elements of Geography, p. 200.

have a general agricultural significance but they are too generalized to serve as the foundation for a detailed study of the agricultural geography of the state. Moreover, the writer believes that east central Oklahoma is not sufficiently well supplied with rainfall to be described as humid, while west central Oklahoma has too much rainfall to be described as semi-arid.

In the present classification three major types or divisions, viz., humid, semi-humid, and semi-arid, are recognized. These major divisions are based on the frequency of occurrence of months between February and November with an amount of rainfall which it is believed will give adequate moisture for the average crop growing on the average soil. The major provinces have been divided into subprovinces or districts based on the percentages of months rated "adequate" during spring and early summer, March to June inclusive, which is, with the possible exception of the "Panhandle," the chief period of crop growth in Oklahoma.

Method of Investigation

Each frostless month of each year for each of 65 stations for which actual monthly rainfall and temperature data were available for the decade 1911-1920 was rated as adequate or inadequate according to the following table:

Table I: Showing minimum Monthly rainfall rated as adequate at various temperatures.

Mean Monthly Temperature F.

Over 80° F. -----	Over 4.00 inches
70—80 -----	Over 3.33 inches
60—70 -----	Over 2.66 inches
50—60 -----	Over 2.00 inches
Under 50 -----	Over 1.33 inches

Temperature was given much weight in evaluating the adequacy of the rainfall of a given month both because of the large losses of moisture by evaporation when temperatures are high and because of its effect in increasing the moisture requirements than because of increased transpiration. The values were chosen somewhat arbitrarily. However, when monthly temperatures are as high as 80° F. it probably requires 4 inches to supply adequate moisture for the growth of the average crop on the average soil. It is perhaps noteworthy that rain forests are not generally developed in constantly hot and moist equatorial regions where the annual rainfall is under 48 inches which is an average of 4 inches per month. If the influence of the temperature factor is

quate at the mean monthly temperature of the station. See Table II.

Table II: Rainfall Types are determined by percentage of months rated as having adequate rainfall, 1911-1920.

Type: Percentage of Months rated adequate

Humid: Over 62½%

Semi-Humid: 37½—62½%

Semi-Arid: Under 37½%

Major and Minor Divisions

Only two districts were humid for the decade 1911-1920 according to the above standards: (1) The northern Ozarks with a westward projection, including the cities of Wagoner, Claremore, and Tulsa (See Fig. 1), and (2) The Ouachita Mountains. The rainfall in the Ouachitas is locally over 50" per year and this region undoubtedly is Humid. However, the lack of climatic data for this part of Oklahoma makes it impossible to indicate accurately the extent of the area. It probably includes most of the mountains and has been so represented.

The Semi-Humid Province includes most of the remainder of the state with the exception of the "Pan Handle" and Harper, Ellis, Roger Mills, and Woodward Counties. Because of the large area in this type, it has been subdivided into two parts, viz., an eastern moist semi-humid area in which over 50% of the forestless months have "adequate" rainfall and dry semi-humid, in which less than 50% of these months were so rated. The dividing line corresponds approximately with Rock Island Railroad passing through Duncan, Chickasha, Kingfisher and Enid.

In a large area including Oklahoma City, Guthrie, Cushing, Meeker, and Bristow, the percentage falls below 50% being only 43% at Oklahoma City which has the lowest percentage in the district.

Sub-Provinces

The "Humid" Province has not been sub-divided on the basis of spring rainfall, March to June inclusive, as the records available do not show important variations from place to place while statistics are not available for the Ouachita Mountains. In the northern humid area over 75% of the spring and early summer months have "adequate" rainfall.

The Moist Semi-Humid Division has been divided into three districts according to the relative frequency of occurrence of

months of "adequate" rainfall. These districts are (1) a relatively moist area in which over 75% of the spring and early summer months had "adequate" rainfall during the decade. This district consists of a C-shaped area including the Southern Ozarks and most of Okmulgee, Hughes and Pittsburg Counties; a relatively dry area, under 62½% of the months adequate, including Kay, Eastern Grant, and Northwestern Osage Counties; and (3) two areas which are intermediate in character, viz. (a) the Arkansas Valley and (b) an irregular area in southeastern, south-central and northeast central Oklahoma.

The Dry Semi-Humid Division consists of all of Oklahoma west of the Rock Island except the "Pan Handle" and semi-arid northwestern counties. (see Fig. 1) An eastern district of this division including a western projection around the Wichita Mountains has more than 50% of the spring and early summer months with "adequate" rainfall.

In the area classed as semi-arid, less than 37½% of the frostless months have adequate rainfall. Rainfall in this province is very unevenly distributed and the preponderance of spring months with adequate rainfall such as characterize the rest of Oklahoma is lacking, particularly in the Pan Handle Portion. At Goodwell, Texas County, elevation 3300 feet, September was the only month with adequate rainfall such as characterizes the rest of Oklahoma in consecutive months (June to September inclusive) with adequate rainfall in 1915. At Hurley in Cimarron County, 50 miles farther west and at an elevation of 4200 feet, 45% of the growing season months, according to records for the decade had "adequate" rainfall. If the record is correct it would seem to indicate more adequate rainfall than at Woodward in the eastern part of the province. However, it should be noted that at Woodward, 70% of the spring and early summer months (March to June inclusive) had "adequate" rainfall while at Hurley the corresponding months are, on the average, only 50% adequate.