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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 188.

B. T. GALLOWAY, *Chief of Bureau.*

DRY FARMING IN RELATION TO RAINFALL AND EVAPORATION.

BY

LYMAN J. BRIGGS,

PHYSICIST IN CHARGE OF PHYSICAL INVESTIGATIONS,

AND

J. O. BELZ,

ASSISTANT IN PHYSICAL INVESTIGATIONS.

ISSUED NOVEMBER 5, 1910.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1910.

Class SB 110

Book B 7

THE INSTRUMENT INCLOSURE AT THE HAYS EXPERIMENT FARM, HAYS, KANS.

The evaporation tank is shown in the foreground, with the recording evaporation gauge on the right. The rain gauge and hail gauge are shown in the center of the picture. The other instruments shown are for recording the temperature of the air and of the soil and the velocity of the wind.

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ISSUED NOVEMBER 5, 1910.

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GOVERNMENT PRINTING OFFICE.
1910.

1911 ✓

SB 110
B7

BUREAU OF PLANT INDUSTRY.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF CHIEF OF BUREAU,
Washington, D. C., June 9, 1910.

SIR: I have the honor to transmit herewith and to recommend for publication as Bulletin No. 188 of the series of this Bureau the accompanying manuscript, entitled "Dry Farming in Relation to Rainfall and Evaporation," by Dr. L. J. Briggs and Mr. J. O. Belz, of the Office of Physical Investigations of this Bureau.

This manuscript has been prepared for the guidance of prospective settlers in regions of limited rainfall, and contains a discussion of the relation of the quantity and character of the rainfall and of the evaporation to crop production under dry-farming methods in various sections of the Western States. Tables showing the normal rainfall for these States have also been compiled from the numerous publications of the Weather Bureau, and are appended for the convenience of prospective settlers. The writers desire to express their obligations to the United States Weather Bureau, and particularly to Mr. P. C. Day, of the Climatological Division, for assistance in the preparation of these tables. The illustrations, 24 in number, consisting mainly of state rainfall maps, have been specially prepared by the writers in order that the distribution of the rainfall in each State may be more readily understood.

Respectfully,

G. H. POWELL,
Acting Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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DRY FARMING IN RELATION TO RAINFALL AND EVAPORATION.

INTRODUCTION.

This bulletin contains a discussion of dry farming in relation to the amount and character of the rainfall and evaporation in the western United States. Usually in discussing dry-farming conditions the annual precipitation is the only feature of the rainfall that receives attention. But there are other factors in connection with the rainfall that have much to do with the successful production of crops. The seasonal distribution of the rain, the rate at which the rain falls, and the amount of rain that is lost through run-off from the surface all have an important part in determining the percentage of the total rainfall that is really available for the use of crops. Finally, the amount of evaporation which takes place during the growing season determines to some extent the amount of rain that is needed to produce a crop, and this varies greatly in different localities. Prospective settlers in these regions are apt to give very little attention to climatic features other than the total rainfall. They often do not even assure themselves that the figures given for a region represent the normal rainfall and not simply the rainfall for a single year. They ignore almost completely the seasonal distribution of the rain, the frequency of torrential rains, the loss of water through surface run-off, the occurrence of hail, and the amount of evaporation. It is the object of this paper to bring the importance of these factors to the attention of prospective settlers in regions of limited rainfall.

Tables are also appended showing the normal rainfall for practically every station in these regions where precipitation records are available. Accurate information regarding the precipitation in many sections of the West is now available as the result of the extended observations of the United States Weather Bureau. These records, which are often complete for many years and so become of great value to the prospective settler, have been used in computing the rainfall tables which are given in the concluding pages of this bulletin. The precipitation tables are also supplemented by state maps which show at a glance the distribution of the rainfall in the State. Lines showing points of equal annual rainfall have been

drawn on these maps where sufficient observations were available. Maps of this kind have not before been available for these Western States.

CLASSIFICATION OF DRY-FARMING REGIONS.

Dry-farming regions are naturally classified on the basis of rainfall. In this country dry farming is usually considered to be confined to those regions in which the annual rainfall is less than 20 inches and more than 10 inches. This classification must be considered as only a rough approximation, since dry-farming districts can not be outlined on the basis of the annual rainfall alone on account of the great influence of the evaporation and the monthly distribution of the rain in growing dry-farm crops. Furthermore, it is impossible to say just where ordinary methods of farming leave off and dry-farming methods begin. Dry-farming methods are usually understood to mean those which lead to the conservation of moisture, but the conception of what these methods actually are varies greatly in different sections of the country. The dry farmer in the Great Plains, where the rainfall is from 15 to 20 inches, usually gets his best results with annual cropping methods combined with good tillage. On the other hand, the dry farmers in that part of the Great Basin where the rainfall is less than 15 inches follow the method of alternate cropping and summer tillage almost exclusively. Between these two classes there is a third operating under conditions where summer tillage may be necessary to insure returns on every crop, but where it frequently pays to take chances on producing a crop on the land each year.

The method of alternate cropping and summer tillage is generally recognized as the most highly developed dry-farming method because it gives better returns with a lower annual rainfall than other methods. There are considerable areas in central Utah that are cultivated in this way where the annual rainfall does not exceed 13 inches. It must be remembered, however, that this is a region of winter rainfall, and that the method of alternate cropping and summer tillage is particularly adapted for such regions, as we shall show later. Therefore, while the method of alternate cropping and summer fallowing is recognized as the most highly developed dry-farming method, it does not follow that it is the best method for all dry-farming regions or that it will always give the best returns. In dry-farming sections where the rainfall is not so limited as in Utah, and especially in regions having a summer rainfall, other methods give as good or better returns.

IMPORTANCE OF KNOWING THE NORMAL RAINFALL.

The rainfall in all parts of the United States is subject to wide fluctuations from year to year. The West does not appear to be more subject to these changes than the East, but the fluctuations

are felt more by the dry farmers because they are working upon a closer margin. Crops in the East are often lost through drought and not infrequently under conditions where the up-to-date dry farmer would have produced a good crop. On account, then, of the fluctuations in rainfall in any locality from year to year, it is necessary in judging the rainfall of a region to know the average annual rainfall, or, as it is called, the normal rainfall. This is the only safe basis upon which the rainfall of any region can be judged, and the longer the records the greater is the dependence that can be placed upon the normal. While two years' or three years' observations are safer than a single year's records, it is not uncommon for two or three wet years or for two or three dry years to follow one another in succession, so that the yearly rainfall obtained at such times would be too high or too low. Records for at least five years, and preferably for ten years, are necessary to obtain the normal rainfall of a region, and the longer the records the more reliable will be the result obtained.

MANY RAINFALL STATIONS NECESSARY ON ACCOUNT OF LOCAL VARIATIONS IN RAINFALL.

In studying the rainfall of a region too much dependence must not be placed upon the records of a single station, especially if this station is located in a mountainous region. Under such conditions marked differences in the annual rainfall are often found between stations located on the highlands and those in the valleys. The cooling of the moisture-laden air through expansion as it rises over a range of hills causes precipitation, so that the windward sides of mountains have a greater rainfall than the leeward sides. This is well illustrated in the very heavy rains which occur all along the west slope of the Cascade Range in Washington, Oregon, and northern California, while the rainfall on the east side is very much less. (See the rainfall maps for Washington, fig. 22, and Oregon, fig. 17; also the chart shown as fig. 1.) This is also well illustrated in Riverside and San Bernardino counties in southern California (see map, fig. 7), where a great change in rainfall occurs as we go eastward a few miles.

These sudden changes in normal rainfall are not, however, confined to the mountainous regions; marked instances of this kind occur in the Great Plains, where changes in elevation are comparatively slight. For example, the rainfall in the district around Aberdeen, in Brown County, S. Dak., is nearly 5 inches above that of the surrounding sections. (See the South Dakota rainfall map, fig. 18.) This difference is based upon observations extending over twenty years or more; and the effect upon the crops has been so marked that the farmers generally recognize that good crops may be found in this section when the surrounding regions are suffering from drought. It is important, then, to have as many rainfall stations as possible in order to measure accurately the annual precipitation.

THE DISTRIBUTION OF THE ANNUAL RAINFALL IN DRY-FARMING REGIONS.

The accompanying chart (fig. 1) shows the annual rainfall in the western United States, and has been prepared by the writers with particular reference to dry-farming regions.^a The region repre-

FIG. 1.—Chart showing the distribution of the annual rainfall in the dry-farming sections of the United States.

sented in the chart has been divided into zones, the boundaries of the zones being represented by lines along which the rainfall is uniform. For example, the heavy curved line marked 20, starting in the north-

^a This chart is based upon the state rainfall maps (see pp. 33 to 45), which include the available rainfall records of the Weather Bureau to January, 1910.

eastern corner of North Dakota and passing southward through central South Dakota, central Nebraska, western Kansas, and the Panhandle of Texas, passes through points in these States where the normal annual rainfall is 20 inches. The average annual rainfall of the country lying to the east of this line is in general more than 20 inches and to the west of this line less than 20 inches. This line, representing points having a normal annual rainfall of 20 inches, is about 4° of longitude, or approximately 200 miles, farther west in Texas than in North Dakota.

The line representing an average annual rainfall of 15 inches extends west in North Dakota nearly to the western boundary, then bends eastward and passes through the center of South Dakota, then runs westward through the southwestern corner of Wyoming, and making a detour in the mountainous region of Colorado passes through the eastern part of that State and southward through the central portion of New Mexico. The country lying between this line of 15 inches annual rainfall and the line of 20 inches annual rainfall to the east has, then, an annual rainfall of 15 to 20 inches, the rainfall becoming greater as the 20-inch line is approached. A second region in which the annual rainfall is between 15 inches and 20 inches is shown in central Montana and northwestern Wyoming. A third region having this rainfall is to be found in northwestern Wyoming and central Idaho and northeastern Oregon. Similar areas exist in northern Utah, in the mountainous part of Arizona, and in northeastern California.

The line representing 10 inches of annual rainfall passes north and west through the central part of California and through extreme western Nevada, southeastern Oregon, and western Idaho, then bends sharply southward, making a great loop in the State of Utah, then runs through southwestern Wyoming, extreme western and southwestern Colorado, northwestern New Mexico, and northern and western Arizona. The unshaded area lying within this boundary has an annual rainfall of less than 10 inches. This area as a whole has not sufficient rainfall to make dry farming profitable, as it is carried on at the present time. The conditions are much more severe in the southern part of this area, owing to the higher evaporation. It is possible that grain may eventually be produced along the extreme northern border, particularly where other conditions are especially favorable.

In southern Washington a second region is to be found in which the annual rainfall is less than 10 inches. The evaporation in this region is much lower than in the sections just mentioned. It has been found possible to produce wheat successfully within the borders of this region on an annual rainfall of about 9 inches, using the method of alternate cropping and summer tillage.

Those areas which are included between the 10-inch and 20-inch lines of annual rainfall serve, then, to represent in a general way the dry-farming areas of the United States so far as they may be defined through rainfall. It must be constantly borne in mind, however, that conditions are more severe in the southern part of the region than in the northern part, owing to the high temperature and greater evaporation; so that regions having the same rainfall are by no means equally well adapted to the production of crops.

COMPARISON OF THE MONTHLY DISTRIBUTION OF RAINFALL IN THE GREAT PLAINS, INTERMOUNTAIN, AND PACIFIC COAST REGIONS.

The monthly distribution of the rainfall in the western United States can be divided roughly into three types—the summer rainfall

FIG. 2.—Chart showing the monthly distribution of the rainfall at representative stations in the Great Plains, Intermountain, and Pacific coast regions. The length of the black lines in each diagram represents the monthly precipitation at that place, beginning with January on the left. The scale in inches given on the right of each diagram can be used to find the actual amount of the monthly rainfall. For example, the average monthly rainfall at Bismarck, N. Dak., for June is seen to be $3\frac{1}{2}$ inches, while for July it is only a little more than 2 inches. It will be noted that in the Pacific coast region the rain comes principally during the first and last months of the year, that is, in the winter, while in the Great Plains the rain comes principally during the middle of the year, that is, in the summer months.

of the Great Plains, the winter and spring rainfall of the Intermountain district, and the winter rainfall of the Pacific coast region. These three types are illustrated in figure 2, which shows the monthly rainfall for three stations in each of these regions. It will be noted that for Bismarck, N. Dak., North Platte, Nebr., and Amarillo, Tex., which are typical Great Plains stations, the rain occurs principally during the months of June, July, and August, and that the winter

months are very dry. In fact, about three-fourths of the total rainfall of the year at these stations occurs during the six summer months, from April to September, inclusive.

In the Pacific coast region, on the other hand, the rainfall occurs almost entirely during the winter months, and it will be seen from the chart that the summer months are very dry. The rainfall distribution in the Pacific coast region is, then, exactly opposite to that found in the Great Plains. In the Intermountain region the maximum precipitation occurs during the late winter and spring months. Thus there is here a distribution intermediate between that of the winter precipitation of the Pacific slope and the summer precipitation of the Great Plains.

The monthly distribution of the rainfall over the western portion of the United States is presented diagrammatically on the map shown as figure 1, which has been adapted from Bulletin N of the United States Weather Bureau. The change from a summer rainfall in the Great Plains to a winter rainfall on the Pacific coast is very marked, and the intermediate types are shown in the intervening country. In Arizona we find that the rainfall is divided into two periods during a year, a rainy season occurring during the winter months and a second rainy season in July and August, the latter being the greater.

THE RELATION OF MONTHLY DISTRIBUTION OF RAINFALL TO FARM PRACTICE.

In regions where the annual rainfall is low the monthly distribution of the rainfall determines to a large extent the farm practice of the region. A comparison of the systems of dry farming employed in the Great Basin and in the Great Plains will make this clear. In Utah and in a large part of the Great Basin country the precipitation comes largely in the winter and early spring. In consequence, spring wheat is not a successful crop in this region for two reasons: (1) The land can not be fitted for sowing until late in the season, owing to the spring rains, and (2) the driest part of the season occurs just when the spring-wheat crop would be maturing. On the other hand, the conditions in this region are almost ideal for growing winter wheat on summer-tilled land. The land is plowed in the fall so as to be left in the best condition for holding the snow and the winter and spring rains. It is then kept well tilled during the summer and contains sufficient moisture to start the crop in the fall. If a fall rain occurs about seeding time conditions are especially favorable. The fall-sown crop is then able to take advantage of the winter and spring precipitation and matures before the driest part of the season is reached. Clean summer fallowing (summer tillage) is considered absolutely necessary in this region in order to be sure of a successful

crop on account of the low rainfall in the autumn months and for the purpose of supplementing the low annual rainfall.^a

In the Great Plains the monthly distribution of the rainfall is quite different from that of the Intermountain region, the greatest monthly rainfall occurring in June, July, and August. Summer tillage for moisture conservation is not so well adapted to this region. The frequent rains during the summer months repeatedly pack the surface mulch on the summer-tilled land. This requires frequent cultivation in order to avoid the loss of water by evaporation, and so increases the expense of maintaining the mulch. Owing to the high evaporation in the Great Plains during the summer months, very little water will be stored in the summer-fallowed land unless the mulch is carefully kept up by thorough cultivation after every rain. The higher annual precipitation in the Great Plains and the increased cost of maintaining a good mulch on summer-tilled land have thus combined to make summer fallowing in this region much less popular than in the Great Basin country. Furthermore, the blowing of the dry surface mulch of the summer fallow sometimes becomes very serious in the Great Plains owing to high winds.

For the above reasons annual cropping is largely used in preference to summer tillage in the Great Plains, although in some parts of the area summer-tillage methods are considered necessary to insure sufficient moisture, even at the cost of the increased labor necessary to maintain the surface mulch. Spring grains are generally used under the annual cropping method, since the crop escapes the dry fall and winter, and the land, having been recently worked, is in the best condition to absorb the summer rainfall. The shade of the growing crop partially protects the ground from excessive loss of water by evaporation, while the small summer showers that are useless on summer-tilled land always help the growing crop. Thus we have a radically different system of farm practice in the Great Plains from that found in the Intermountain country, owing in part to the difference in the distribution of the monthly rainfall of the two regions and in part to the greater rainfall in the Great Plains.

THE RELATION OF THE CHARACTER OF RAINFALL TO ITS USEFULNESS.

The way in which the rain comes has a great deal to do with its usefulness. Summer-fallowing methods, for example, are not well adapted to regions in which the rainfall comes largely in the form of little showers from one-tenth to one-half inch. Rains of this kind penetrate the soil only a few inches, and the water is practically all

^a See "Arid Farming in Utah," by Widtsoe and Merrill, Bulletin 91, Utah Agricultural Experiment Station; also "Dry Farming in the Great Basin," by C. S. Scofield, Bulletin 103, Bureau of Plant Industry, U. S. Department of Agriculture.

FIG. 3.—CHART SHOWING THE AVERAGE MONTHLY PRECIPITATION AT DIFFERENT POINTS IN THE WESTERN UNITED STATES. THE LENGTH OF THE BLACK LINES IN THE LITTLE DIAGRAMS ON THE MAP SHOWS THE MONTHLY PRECIPITATION, BEGINNING WITH JANUARY ON THE LEFT. A SCALE IN INCHES IS GIVEN ON THE RIGHT OF EACH LITTLE DIAGRAM.

FIG. 3.—CHART SHOWING THE AVERAGE MONTHLY PRECIPITATION AT DIFFERENT POINTS IN THE WESTERN UNITED STATES. THE LENGTH OF THE BLACK LINES IN THE LITTLE DIAGRAMS ON THE MAP SHOWS THE MONTHLY PRECIPITATION, BEGINNING WITH JANUARY ON THE LEFT. A SCALE IN INCHES IS GIVEN ON THE RIGHT OF EACH LITTLE DIAGRAM.

lost through subsequent evaporation even when the surface of the soil is cultivated after the rain, since the rainfall does not penetrate below the depth of the mulch. These small rains are, however, usually sufficient to pack the mulch and form a surface crust, which must be broken by cultivation as soon as possible; otherwise, evaporation will go on so rapidly from the surface of the soil that far more moisture will be lost than was gained through the rain. At North Platte, Nebr., during the month of August, 1908, the total rainfall was 1.9 inches, which came in the form of nine showers. None of these rains was sufficient to wet thoroughly the mulch on the summer fallow and all were useless so far as storing water in the soil was concerned, and yet they necessitated a good deal of work in order to keep the mulch in good condition. Such rains are, of course, useful to growing crops that cover the ground, but for storing water in the soil showers of one-half inch or more are necessary.

RUN-OFF DURING TORRENTIAL RAINS.

If the rainfall is of a torrential character, the rain falling at the rate of an inch or more per hour, the loss through run-off becomes very serious. These torrential rains occur occasionally in all parts of the West. The records of the Weather Bureau show that they occur more frequently in the southern part of the region. It is important for the dry farmer to study the best methods of handling his land so as to absorb as much of these torrential rains as possible. Our recent fieldwork has shown that even on summer-fallowed land provided with a good mulch the loss through run-off during a torrential rain may be very great.

Measurements made by Mr. F. D. Farrell at the Nephi substation, Utah, in 1908, showed that during a heavy rain of 2.5 inches in four hours summer-tilled land absorbed only 0.5 inch of water, while near-by wheat stubble land, which was very dry and contained many surface cracks, absorbed 1.5 inches. In other words, the run-off on the summer-tilled land was 80 per cent of the total water falling, while the loss on the stubble was 40 per cent. The high loss on the summer-tilled land was probably due to the driving rain, which packed the fine surface soil so that it would not absorb the water freely. Similar measurements by one of the writers (Belz) at the experiment farm of the Office of Dry-Land Agriculture Investigations, at Dalhart, Tex., in 1909, showed that during a torrential rain of 2 inches the run-off from cultivated plats was from 20 to 60 per cent of the total rain falling. In another instance, with a rainfall of 1.1 inches, the average loss through run-off from seven cultivated plats amounted to 35 per cent of the total rainfall. All of these measurements were made on practically level land.

These results indicate that a fine surface mulch on summer-tilled land, while ideal in preventing evaporation, packs during a torrential rain and so fails to absorb the water freely. A rough, uneven, lumpy surface, including stubble, with finer soil beneath, is preferable under such conditions to a fine surface mulch. The rough surface material, combined with the finer soil below, still makes an effective mulch. During windy, dry weather, the rough, lumpy surface will protect the soil from blowing. During a torrential rain the rough surface will tend to prevent the soil from washing, and by holding the water to some extent will make the soil below absorb more. The treatment of the land so as to absorb all of the rain that falls is a matter of great importance to the dry farmer. This subject is now being given special attention at the experimental farms of the Office of Dry-Land Agriculture Investigations.^a

HAIL.

Hail is one form of precipitation that is the dread of every dry farmer. Hailstorms are likely to occur in almost any portion of the Great Plains during the summer months and frequently do great damage to standing grain. These storms take place somewhat more frequently in the southern parts of the area, and in some districts seem to occur more often along the river courses and valleys than upon the table-lands. They do occur, however, on the table-lands and divides, and their path is generally narrow and very sharply defined, the hail sometimes completely destroying standing grain in part of a field and leaving the remainder uninjured. About the only precaution that the prospective settler can take is to try to avoid locating in regions which are known to be in the track of such storms. The grain should also be cut at the earliest possible date. Otherwise, the dry farmer must take his chances upon the occurrence of hail just as he must upon the occurrence of unusually dry weather. Many new settlers who feel that they can not afford to risk the loss of their crop insure against hail just as they insure against loss by fire. Established farmers as a rule find that it pays to carry their own insurance.

EVAPORATION IN DRY-FARMING SECTIONS.

The rate at which evaporation takes place in any given region has a marked influence upon the quantity of rainfall necessary for successful dry farming. The accompanying map (fig. 4) shows the evaporation taking place from a freely exposed water surface during the six summer months in different parts of the United States. The

^a See article entitled "Dry-Land Farming in the Great Plains Area," by E. C. Chilcott, Yearbook of the U. S. Dept. of Agriculture, 1907.

figures on the chart represent the total evaporation in inches from April to September, inclusive.

The circles represent stations where dry-farming experiments are being conducted by the Bureau of Plant Industry. The figures for these stations can be compared directly, since they have all been obtained from tanks exposed in the same way. Most of these tanks are 8 feet in diameter and 2 feet deep, and are sunk in the ground so that the top of the tank is 4 inches above the surface of the ground. (See Pl. I, frontispiece.) The water level is kept about 4 inches from the top of the tank. The amount of water that has to be added to keep the water at this height, together with the rain that falls into the tank, gives the total evaporation for any required time.

FIG. 4.—Chart showing the evaporation in inches during the six summer months from April to September, inclusive, for various points in the United States. The circles show stations where evaporation measurements are being made in connection with the field experiments of the Bureau of Plant Industry. The evaporation at these stations is measured in the same way and can be directly compared.

Three years' records have been obtained for some of these stations, and there is little change in the evaporation from year to year. These figures representing the evaporation for equal periods then become very useful in comparing the conditions in different sections of the country from a dry-farming standpoint.

Table I presents the results from which the accompanying map (fig. 4) was prepared and shows the total evaporation which took place from tanks during the six months from April to September, inclusive, for a number of points in the United States. The figures have been obtained from widely scattered sources, and the measurements were made with tanks of different sizes and exposed in different ways.

All of the results are not, therefore, directly comparable. The measurements at stations printed in heavy-faced type have been made as a part of the physical investigations carried on at the dry-farming stations of the Bureau of Plant Industry and can be directly compared.

TABLE I.—*Evaporation from a tank during the six summer months from April to September, inclusive, at various points in the United States.*

[The figures given represent the total number of inches evaporated during this period.]

State.	City or town.	Number of years.	Date.	Evaporation.
Arizona.....	Tucson.....	3	1892-3-4.....	<i>a</i> 54.2
	Yuma.....	3	1903..... ^b 57.8	56.0
			1904..... ^c 53.9	
			1907..... ^d 56.4	
California.....	Calexico.....	1	1903-4.....	<i>d</i> 71.8
	Kingsburg Bridge.....	4	1882-3-4-5.....	<i>e</i> 49.2
	Lakeport.....	2	1901, 1902.....	<i>f</i> 25.3
	Lake Tahoe.....	2	1900..... ^g 20.7	21.1
			1901..... ^h 21.6	
	Pomona.....	1	1903-4.....	<i>d</i> 44.4
	Sweetwater.....	5	1889-90-91-92, 1897.....	<i>i</i> 39.0
	Tulare.....	1	1903-4.....	<i>d</i> 56.6
Colorado.....	Akron.....	2	1908 to 1909, inclusive.....	45
	Fort Collins.....	15	1887 to 1902.....	<i>j</i> 29.3
	Grand Valley.....	1	1901.....	<i>k</i> 36.5
	Rocky Ford.....	1	1901.....	<i>l</i> 61.6
Kansas.....	Hays.....	3	1907 to 1909, inclusive.....	45.2
	Garden City.....	2	1908 to 1909, inclusive.....	59.9
Massachusetts.....	Boston:			
	Beacon Hill.....			<i>m</i> 25.8
	Chestnut Hill.....			<i>n</i> 28.6
Michigan.....	Detroit.....	4	1861 to 1864, inclusive.....	<i>o</i> 32.1
	Monroe.....	5	1863 to 1867, inclusive.....	<i>o</i> 30.9
	Thunder Bay.....	4	1862 to 1865, inclusive.....	<i>o</i> 30.2
Montana.....	Judith Basin.....	1	1909.....	32.6
Nebraska.....	Lincoln.....	11	1899 to 1909, inclusive.....	<i>p</i> 34.8
	North Platte.....	3	1907 to 1909, inclusive.....	41.3
Nevada.....	Fallon.....	2	1908 to 1909, inclusive.....	51.0
	Reno.....	2	1894..... ^q 37.5	39.9
			1900..... ^r 42.3	
			1900-1901..... ^s 29.1	
New Jersey.....	New Brunswick.....	2	1901-2..... ^t 29.9	29.5
New Mexico.....	Carlsbad.....	1	1899.....	<i>u</i> 54.6
	Las Cruces.....	3	1899, 1900, 1901.....	<i>v</i> 40.1
New York.....	Rochester.....	5		<i>w</i> 26.7
North Dakota.....	Dickinson.....	3	1907 to 1909, inclusive.....	31.4
	Edgeley.....	3	1907 to 1909, inclusive.....	29.8
	Williston.....	1	1909.....	30.0

a Arizona Agricultural Experiment Station Bulletin 27.

b Engineering News, vol. 51, p. 248.

c Water-Supply Papers, No. 133, p. 32.

d Engineering Record, vol. 51, p. 430.

e Water-Supply Papers, No. 81, p. 27.

f Idem, p. 32.

g Idem, p. 21.

h First Annual Report Reclamation Service, 1902, p. 230. Estimated from 5 months' record.

i Colorado Agricultural Experiment Station Bulletin 45, p. 26.

j Fifteenth Annual Report Colorado Agricultural Experiment Station, p. 205.

k Report Irrigation Investigations, Office of Experiment Stations, 1901, p. 284.

l Idem, p. 31.

m Transactions American Society of Civil Engineers, vol. 15, p. 606 (1888 omitted, the records for that year not being complete).

n Idem, p. 618.

o Report Chief of Engineers, U. S. Army, 1868, p. 978 (May 4 to October 5).

p Nebraska Agricultural Experiment Station. Data furnished by Prof. E. G. Montgomery.

q Water-Supply Papers, No. 81, p. 22 (May 11 to October 30).

r Report Irrigation Investigations, Office of Experiment Stations, 1900, p. 151 (May 4 to October 24).

s Report Irrigation Investigations, Office of Experiment Stations, 1901, p. 353 (April 4 to November 30).

t Report Irrigation Investigations, Office of Experiment Stations, 1902, p. 247.

u Idem, p. 31 (May 1 to November 11).

v New Mexico Agricultural Experiment Station Bulletin 59, p. 43.

w Colorado Agricultural Experiment Station Bulletin 45, p. 27.

TABLE I.—*Evaporation from a tank during the six summer months from April to September, inclusive, at various points in the United States—Continued.*

State.	City or town.	Number of years	Date.	Evaporation.
Ohio.....	Cleveland.....	6	1862 to 1867, inclusive.....	<i>a</i> 24.6
South Dakota.....	Bellevue.....	2	1908 to 1909, inclusive.....	38.0
	Highmore.....	1	1907.....	33.7
Texas.....	Amarillo.....	3	1907 to 1909, inclusive.....	52.4
	Dalhousie.....	2	1908 to 1909, inclusive.....	51.6
	San Antonio.....	3	1907 to 1909, inclusive.....	45.7
Utah.....	Corinne.....	1	1901.....	<i>b</i> 40.1
	Fort Douglas.....	3	1890-1-2.....	<i>c</i> 30.7
	Logan.....	1	1901.....	<i>d</i> 34.3
	Nephi.....	2	1908 to 1909, inclusive.....	42.0
Washington.....	Prosser.....	2	1900.....	24.6 } <i>b</i> 27.6
			1901.....	30.6 }
Wisconsin.....	Milwaukee.....	5	1863 to 1867.....	<i>e</i> 26.9
	Stevens Point.....	2	1901.....	28.2 } 28.8
			1902.....	29.4 }
Wyoming.....	Laramie.....	7	1893-1898, 1901.....	<i>h</i> 39.4

a Report Chief of Engineers, U. S. Army, 1868, p. 978.

b Report Irrigation Investigations, Office of Experiment Stations, 1901, p. 31 (May 18 to November 9). (The records for Prosser are for 1900, May 9 to October 29, and 1901, April 22 to October 28.)

c Water-Supply Papers, No. 7, p. 20.

d Utah Agricultural College Bulletin 80, 1901, p. 77.

e Report Chief of Engineers, U. S. Army, 1868, p. 978.

f Report Irrigation Investigations, Office of Experiment Stations, 1901, p. 335 (estimated from 3 months' records).

g Report Irrigation Investigations, Office of Experiment Stations, 1902, p. 232 (estimated from 4 months' records).

h For records 1893 to 1898, inclusive, see Water-Supply Papers, No. 81, p. 21.

1893.....37.1 inches (estimated from records April 24 to September 30).

1894.....38.5 inches (estimated from records April 26 to September 30).

1895.....37.1 inches (estimated from records April 17 to September 30).

1896.....40.5 inches (estimated from records June 1 to September 30).

1897.....42.0 inches (estimated from records April 24 to September 30).

1898.....42.3 inches (estimated from records April 15 to September 30).

For records of 1901, see Wyoming Agricultural Experiment Station Bulletin 52, p. 50.

1901.....38.2 (estimated from records May 9 to September 30).

The rate of evaporation from a wet soil surface is about the same as from a freely exposed water surface in a tank.^a Consequently, if the surface of the soil were kept constantly wet the evaporation from the soil would be approximately equal to that found by means of the tank. The fact that we find the evaporation as measured by the tank to be so much greater than the rainfall shows how efficient our methods of cultivation must be in order that we may have any water at all left for the use of the crop. In a region having an evaporation during the six summer months of 45 inches and a rainfall of 18 inches, most of which occurs during the summer, we are able through cultivation to cut the evaporation from the soil down to approximately

^a This statement must, of course, be considered as only approximate. Very wet, dark-colored soils freely exposed in the sun will usually lose water by evaporation more rapidly than a free water surface, since the dark soil surface absorbs a larger proportion of the energy from the sun than the free water surface does. The evaporation from light-colored soils when wet agrees more closely with that taking place from a free water surface of equal area. As the soils dry out the rate of evaporation gradually decreases. This shows the advantage in using a clean, freely exposed water surface in measuring evaporation, which avoids the errors arising from changes in the nature of the evaporating surface.

half the rainfall and so save the remainder of the rainfall for the use of the crop. In establishing a mulch it is necessary to sacrifice all of the moisture in the surface layer of soil that is used to form the mulch. Any rain, then, that simply wets the surface mulch is of no value in storing moisture in summer-tilled land, since it must all be evaporated in order to establish the mulch again.

EVAPORATION AS INFLUENCING AGRICULTURE IN THE GREAT PLAINS.

The increase in evaporation is very marked as we proceed southward through the Great Plains, the seasonal evaporation in the Panhandle of Texas being 54 inches, or about double that in North Dakota. The influence of this increased evaporation upon the agricultural operations is seen by comparing the agricultural operations along the line of 20-inch annual rainfall in the two States. This line in North Dakota passes through the head of the Red River valley, where the rainfall has been ample for the successful growing of wheat upon the same land year after year. In Texas the 20-inch line passes through a country which is still largely grazing land and where agriculture is confined to the most drought-resistant crops, such as kafir and milo. It is evident, then, that in dry-farming sections having equal rainfall the North has a decided advantage over the South owing to the lower evaporation.

Dr. H. L. Shantz, of the Bureau of Plant Industry, finds that the distribution of a native grass is a good index of the rainfall required in different sections of the Great Plains. Short grass, which consists chiefly of buffalo grass and grama grass, is well suited for this purpose, since it occurs from Montana to Texas. In each section the grass grows as far west as the opposing influences of rainfall and evaporation will permit. Its growth to the east is checked by competition with the prairie grasses. Thus we have a strip of short grass extending from Montana to Texas, limited on the west side by drought and on the east by competition with other grasses. Therefore the increase in the annual rainfall as we go from north to south in the short-grass region represents the additional amount of rain needed to offset the increased evaporation. In Montana, short grass unmixed with other grasses occurs in districts having an annual rainfall of approximately 14 inches; in Colorado, in regions having a rainfall of 17 inches; and in the Panhandle of Texas, in regions having an annual rainfall of 21 inches.^a

The same type of native grass requires in Texas 7 inches more of rain a year than in Montana. This gives us at once a measure of

^a The authors are indebted to Doctor Shantz for this preliminary account of his investigations on the distribution of the vegetation of the Great Plains, which will shortly appear as a bulletin of the Bureau of Plant Industry.

the additional amount of rain required for a grain crop in Texas as compared with Montana. Furthermore, the evaporation in Texas during the six summer months exceeds that in Montana by about 20 inches. Therefore, if the summer evaporation at one place in the Great Plains exceeds that at another by 3 inches a corresponding increase in the summer rainfall of approximately 1 inch at the first place is needed to offset the increased evaporation. A rainfall of 21 inches in the Panhandle of Texas is therefore really no better for growing crops than 15 inches in Montana or Dakota, owing to the greatly increased evaporation on the Texas plains.

The influence of the amount of evaporation in different sections of the Great Plains upon the effectiveness of the rainfall in crop production is illustrated in the accompanying chart (fig. 5). The heavy curved line marked "20" passes through points in the Great Plains States having an annual average rainfall of 20 inches. From what has already been said, it is evident that the conditions determining crop production become more and more severe as we pass southward along this line, owing to the increase in the evaporation. It would therefore be necessary to move more and more to the eastward from the line representing an annual rainfall of 20 inches as we go southward through the Great Plains, in order to find conditions that are equally favorable for crop production so far as rainfall is concerned. The broken line which is coincident with the line of 20 inches annual rainfall in the northern part of North Dakota and which becomes more and more separated from it as we move southward through the Great Plains passes through points having a rainfall equivalent to 20 inches in North Dakota. The actual rainfall along this line increases as we go south through the area until the lowlands of Texas are reached, but owing to the increased evaporation it is no more effective in growing crops than is 20 inches in North Dakota or Montana.

To the west of the line of 20 inches annual rainfall will be found a second line which passes through points having an average annual rainfall of 15 inches. In connection with this line of 15 inches annual rainfall there is given on the map a second broken line which passes through points having a rainfall equivalent to 15 inches in North Dakota or Montana. It will be noted that through southwestern Nebraska and northwestern Kansas this broken line is practically coincident with the line of 20 inches annual rainfall. In other words, 15 inches of rainfall in Montana or Dakota are equivalent to 20 inches of rainfall in southwestern Nebraska or western Kansas. In southwestern Kansas, eastern Oklahoma, and in Texas this line lies wholly to the east of the line representing 20 inches annual rainfall. Throughout this latter section, then, more than 20 inches of rainfall

would be required in order to be equivalent to 15 inches of rainfall along the Canadian boundary. These lines of equivalent rainfall have been established from a consideration of the distribution of the short grass through the Great Plains and from a study of the evapo-

FIG. 5.—Outline map of the States in the Great Plains region, showing the lines of equal rainfall and lines of equivalent rainfall. The solid lines marked 15 and 20 pass through points of equal rainfall; the corresponding dotted lines pass through points having a rainfall which is equivalent to 15 and 20 inches, respectively, on the Canadian boundary.

ration. Their position should be considered as only approximate, but they serve to emphasize the great influence of the increased evaporation upon the amount of water required for crop production.

RELATION OF YIELD TO RAINFALL.

In order that the prospective settler may form an idea of the yields that he can reasonably expect to obtain in regions of limited rainfall, there is given in the following pages a summary of the yields obtained at a number of experimental farms conducted under state and federal supervision.

RELATION OF YIELD TO RAINFALL IN THE GREAT BASIN.

During the years 1904, 1905, and 1906 the Utah Agricultural Experiment Station conducted experiments at six dry-farming stations in Utah.^a The following table shows the average yield of wheat obtained by summer-fallowing methods at these stations during the three years. The table shows the yearly precipitation, the precipitation that occurred during the growing season from April 1 to July 20, and the corresponding yield.^b The location of the counties may be seen by referring to the Utah precipitation map, page 44.

TABLE II.—*Relation of precipitation to yield of Lofthouse wheat on summer-fallowed lands at six dry-farming stations in Utah.*

[From Bulletin No. 100, Utah Agricultural Experiment Station.]

County and year.	Yearly precipitation, August 1 to July 31.	Seasonal precipitation, April 1 to July 20.	Yield of wheat per acre.
Iron:	<i>Inches.</i>	<i>Inches.</i>	<i>Bushels.</i>
1904.....	13.4	3.8	6
1905.....	9.9	2.8	0
1906.....	15.9	3.2	7
Juab:			
1904.....	15.4	3.9	20
1905.....	11.3	3.1	15
1906.....	18.4	6.3	31
Tooele:			
1904.....	18.5	4.6	13
1905.....	12.4	3.2	11
1906.....	13.0	4.5	16
Sevier:			
1904.....	13.2	6.0	8
1905.....	11.5	4.1	5
1906.....	15.5	4.6	8
Washington:			
1904.....	13.4	2.2	2
1905.....	10.9	2.9	4
1906.....	16.6	4.1	9
San Juan:			
1904.....	6.6	2.8	0
1905.....	19.0	5.3	21
1906.....	20.0	4.8	29

^a Bulletin 100, Utah Agricultural Experiment Station, by W. M. Jardine.

^b The writers are indebted to Mr. W. M. Jardine for assistance in compiling the yields given in this table. The figures are based upon the average yields of Lofthouse wheat plats and represent in most cases the average of the Lofthouse wheat yields in the variety tests, in the depth-of-plowing tests, and in the time-of-seeding tests, 3 to 5 plats in all. In the depth-of-plowing tests the yield of the plat plowed 8 inches deep was taken when possible, and in the other cases the average of the yields from the plats plowed 5 inches deep and 10 inches deep was used. In the time-of-seeding tests the yields of the plats sown on dates recommended in the bulletin were used. These figures, therefore, represent the yields of wheat grown under conditions generally advocated in the region, viz, on land plowed 8 inches deep and summer-fallowed.

The cost of producing an acre of wheat on summer-fallowed land in Utah, including seed and harvesting, is about \$7,^a which with wheat at 75 cents would be equivalent to about 9 bushels of wheat per acre. On this basis wheat production proved profitable during the three years in Juab and Tooele counties. In San Juan County in 1904 the rainfall was less than 7 inches and the crop was a failure. During the next two years, however, the rainfall was about 20 inches and good yields were obtained. The yields at the other three stations during the three years do not cover the cost of growing the crop. The records of Juab County show clearly the influence of the amount of rain on the yield, the yields varying from 15 bushels with a rainfall of 11 inches in 1905 to 31 bushels with a rainfall of 18 inches in 1906. Jardine emphasizes the importance of having at least 4 inches of rain during the growing season from April 1 to July 20.

To summarize, in Tooele and Juab counties, Utah, profitable yields were obtained when the rainfall exceeded 13 inches. At the other stations in Iron, Sevier, and Washington counties a rainfall of 15 inches was not sufficient to produce profitable crops. The evaporation from a freely exposed tank of water has been found to be about 42 inches during the six summer months in Juab County. We may conclude, then, that with this amount of evaporation an annual rainfall of 13 inches represents about the minimum under which farming can be profitably carried on in the Great Basin.^b

MINIMUM RAINFALL NECESSARY FOR WHEAT PRODUCTION IN THE COLUMBIA BASIN.

There is probably no other region in the United States where dry farming is successfully conducted with so low a rainfall as in the Columbia Basin, in southern Washington and northern Oregon. This is the result of a combination of favorable conditions. The evaporation is considerably lower than in the Great Basin, the rains come mainly during the winter season and are not torrential, and the basaltic soils absorb the rainfall readily. As we have already seen, the system of alternate cropping and summer fallow is especially

^a Grace Brothers, who operate a large farm in Juab County, Utah, find the average cost of growing wheat on summer-fallowed land to be \$6.85 per acre. This figure includes all charges except an interest charge for the land. (See Second Annual Report Dry-Farming Congress, p. 170.)

The cost of growing spring wheat on fall-plowed land in Minnesota, as given by E. C. Parker and T. P. Cooper, ranges from \$4.30 (on a large farm) to \$6.40 per acre. These figures do not include land rental or the cost of hauling the grain to market. Other things being equal, it is to be expected that wheat production under the system of alternate cropping and summer fallowing would be somewhat more expensive than under the annual cropping system, as in Minnesota, owing to the increased cost of maintaining the summer fallow.

^b Prof. L. A. Merrill, of the Utah station, places the minimum annual rainfall for profitable dry farming in that section at 12 inches.

adapted to such conditions and is the method uniformly followed in that part of the Columbia Basin where the rainfall is light. Summer tillage of the fallow land is also carried on quite generally throughout the region.^a The rainfall records in the drier portions of the Columbia Basin are very broken, so that it is not possible at the present time to determine the relation of yield to rainfall with exactness. Hunter,^b who has made a special study of the conditions in this region, states that while wheat is being produced on an average annual rainfall as low as 8.5 inches, 10 inches is about the minimum for successful wheat production. A great deal of wheat is grown around Ella, in Morrow County, Oregon, and in other parts of the northern tier of counties in Oregon where the rainfall is no greater than that of Ella. The average annual precipitation at Ella, Oreg., during the last ten years has been 9.5 inches. During this period the rainfall has varied from 12.8 inches in 1906 to 5.2 in 1908. During a year of heavy rainfall the yield of the wheat crop grown on summer-fallowed land at Ella is from 20 to 30 bushels per acre, or even more. When the rainfall is 6 or 7 inches the crop is sometimes not worth cutting and the yields are frequently only 6 or 7 bushels per acre. No wheat is grown in the driest part of the basin in the vicinity of Pasco, Wash., where the annual rainfall is only about 6 inches.

It appears to be established, then, that wheat is being grown at a profit in this region by summer-fallowing methods on an annual rainfall of 10 inches. The minimum rainfall necessary for a wheat crop that will return more than the cost of production appears to be about 8.5 inches, although actual yields in connection with rainfall records are not yet available to establish this minimum definitely. The yields on the same rainfall of course vary considerably according to the methods and care employed in the production of the crop.

RELATION OF YIELD TO RAINFALL IN THE GREAT PLAINS.

The Office of Dry-Land Agriculture Investigations of the Bureau of Plant Industry has been conducting extensive investigations since 1906 to determine the cultural methods and systems of crop rotation best adapted to the conditions in the Great Plains. The following table has been compiled from the results of these experiments, which are now available to the end of the season of 1909.^c The results of the

^a For a description of the methods of tillage used in this section, see the paper by Byron Hunter, entitled "Farm Practice in the Columbia Basin Uplands," Farmers' Bulletin 294, U. S. Dept. of Agriculture, 1907.

^b The writers desire to acknowledge their indebtedness to Mr. Byron Hunter, of the Office of Farm Management of the Bureau of Plant Industry, for the information relative to wheat yields in the Columbia Basin.

^c See "A Study of Cultivation Methods and Crop Rotations for the Great Plains Area," by E. C. Chilcott and members of the field staff of Dry-Land Agriculture Investigations, Bulletin 187, Bureau of Plant Industry, U. S. Dept. of Agriculture, 1910.

work cover experiments at eleven stations, extending from Montana to the Panhandle of Texas.

TABLE III.—*Variation in yield of spring-sown wheat with rainfall in the Great Plains.*

[Based upon the field experiments of the Office of Dry-Land Agriculture Investigations.]

Station and year.	Ordinary meth-ods.	Conser-vation meth-ods.	Sum-mer til-lage.	Rota-tions, average of 7 plats.	Aver-age yield of 10 plats.	Rain-fall, April-July, inclu-sive.	Rain-fall for the year.	Rainfall for the year.		Rainfall for the season.	
								Above normal.	Below normal.	Above normal.	Below normal.
Judith Basin, Mont., 1909.....	<i>Bush.</i> 33.0	<i>Bush.</i> 33.4	<i>Bush.</i> 34.0	<i>Bush.</i> 34.6	<i>Bush.</i> 34.3	<i>In.</i> 14.0	<i>In.</i> 25.6	<i>In.</i> 10.4	.....	<i>In.</i> 1.4	.....
Dickinson, N. Dak.:.....											
1908.....	24.3	17.7	33.8	28.1	27.3	10.5	19.5	4.5	.....	2.3	.....
1909.....	26.8	25.2	35.7	36.4	34.3	11.2	20.9	5.9	.....	3.0	.....
Edgeley, N. Dak.:.....											
1907.....	4.1	7.0	9.9	11.1	9.9	6.7	11.5	.....	8.0	.....	4.8
1908.....	13.3	15.3	16.0	17.1	16.4	9.2	17.1	.....	2.5	.....	2.3
1909.....	28.3	23.3	27.0	29.7	28.7	10.8	15.6	.....	4.1	.....	.7
Highmore, S. Dak.:.....											
1907.....	28.8	29.7	30.0	28.2	28.6	11.1	17.3	.....	.1	.1	.....
1908.....	26.3	19.7	30.7	25.3	25.4	12.5	22.4	5.0	.....	2.1	.....
Bellefourche, S. Dak., 1909.....	23.8	23.3	32.2	29.1	28.3	7.9	(a)	.....	.....	.....	.....
North Platte, Nebr.:.....											
1907.....	24.5	26.0	31.8	23.7	24.8	12.3	19.1	1.0	.....	1.2	.....
1908.....	22.7	27.3	40.5	28.9	29.3	12.8	20.0	1.1	.....	1.7	.....
1909.....	23.0	15.3	18.0	20.1	19.7	13.7	18.9	.....	.....	2.6	.....
Akron, Colo., 1909.....	14.3	10.3	18.5	17.0	16.2	10.2	22.4	3.3	.....	.....	.....
Hays, Kans., 1908.....	1.2	4.5	4.2	3.8	3.7	14.2	25.3	1.9	.....	1.8	.....
Garden City, Kans., 1909.....	2.1	3.2	6.7	3.0	3.3	11.3	22.0	3.3	.....	0.1	.....
Dalhart, Tex., 1909.....	.0	.0	10.5	1.1	1.8	8.3	16.0	.....	.....	.....	.....
Amarillo, Tex.:.....											
1908.....	17.0	14.0	16.0	10.5	12.1	12.6	19.1	.....	3.5	1.3	.....
1909.....	.0	2.8	10.5	1.4	2.3	8.5	18.4	.....	4.1	.....	2.9

a Year not complete.

The first column of the table shows the station and State in which the field work was conducted and the year in which the experiments were carried on; the second column gives the yield of spring wheat in bushels per acre under ordinary methods of cultivation—that is, shallow spring plowing and no harrowing of the grain after planting; the third column, headed “Conservation methods,” gives the yields of spring wheat on land plowed 8 inches deep in the fall, put in good tilth in the spring before planting, and harrowed after the grain was up in order to conserve moisture; the fourth column, headed “Summer tillage,” gives the yield of spring wheat grown on land summer tilled the preceding year; the fifth column, headed “Rotations,” gives the average yield of wheat in seven different rotations carried on at each of the stations; all of the methods employed and the yields obtained are described in detail in the bulletin referred to. In the sixth column is given the average yield of wheat from the ten plats previously considered, namely, the seven rotation plats and three

tillage plats; in the seventh column is given the rainfall from April to July, inclusive, in inches. This period is selected as coinciding most nearly with the average growing season at the different stations. The eighth column gives the total rainfall for the year, while the last four columns show the amount that the total rainfall for the year and the season was above or below the normal for that station.

Referring to the last columns of the table, it will be seen that for the 18 series of experiments reported the rainfall for the year in 9 instances was above the normal and in 6 instances below the normal. While the yields in the greater number of cases have been obtained during wet years, very trying conditions were encountered at some of the stations. At Judith Basin, Mont., and at Dickinson, in the western part of North Dakota, the rainfall has been unusually high, ranging from 5 to 10 inches above the normal. The effect of this is well exemplified in the yields at Judith Basin, ordinary methods of cultivation giving as good yields with a bountiful rainfall as either conservation or summer-tillage methods. At Dickinson somewhat higher yields were obtained with summer tillage, but not enough to justify this method if the bountiful rains could have been foreseen.

At Edgeley, in the southeastern part of North Dakota, three dry seasons were encountered. In the first less than 7 inches of rain fell during the growing season. The yield on spring-plowed land was 4 bushels per acre; on summer-fallowed land, 10 bushels. In 1908, with a rain of 9 inches during the growing season, the yields were 13 and 16 bushels, respectively; and in 1909, with 11 inches of rain during the growing season, the yields were 28 and 27 bushels per acre. The effect of a slightly increased rainfall during the growing season upon the yield is very marked at this station. In 1907, with a seasonal rainfall of 7 inches, the average yield was about 10 bushels per acre; in 1909, with a seasonal rainfall of 11 inches, the yield was about 29 bushels per acre, or a gain in yield of 19 bushels for an increase in rainfall of 4 inches.

The results at Edgeley show an increased production on summer-tilled land during 1907, which was very dry. It is important to note, however, that the average yield from the rotation plats was even higher than from the summer-tilled land at this station during this dry year. In fact, the rotations gave better yields than summer-tillage methods for each of the three years during which experiments have been conducted at this station. This indicates that summer tillage is not profitable on the soils of the Edgeley district even during years of deficient rainfall.

An average yield of about 28 bushels was obtained at the Highmore station in South Dakota during the season of 1907 under a normal rainfall. In 1908 an average yield of 25 bushels per acre was

obtained at this station. The rainfall during this year was 5 inches above the normal, but it will be seen from the table that the rainfall during the growing season was only 1.4 inches above that in 1907. The lower yield at Highmore in 1908 is probably to be explained by the fact that the last three weeks of July and the first week of August were very dry, less than 1 inch of rain falling during this time. These results show the necessity of knowing the seasonal rainfall when studying the relation of yield to rainfall in the Great Plains. Frequently, as in this case, a knowledge of the monthly rainfall is not even sufficient, but the daily distribution must be known to determine the influence of the precipitation upon the yield.

At Bellefourche, in western South Dakota, in 1907, a yield of 24 bushels was obtained on spring-plowed land as compared with 32 bushels on summer-tilled land and 29 bushels as the average yield on the rotation plats. These yields were obtained with a rainfall of about 8 inches during the growing season. It will be noted that while summer tillage gave the highest yields, the yield from the rotation plats was nearly as high. Therefore, on the heavy gumbo soils represented by the Bellefourche district, with a seasonal rainfall of 9 inches, the results indicate that crop rotations will give much better returns than summer tillage, considering the fact that a crop on summer-tilled land is obtained only once in two years.

At North Platte, Nebr., the seasonal precipitation has been very uniform for the three years during which experiments have been conducted, varying from 12 to 14 inches. The yield of wheat during these three years, based upon an average of 10 plats, varied from 20 to 29 bushels. We will consider briefly the cause of this fluctuation in yield.

The soil at North Platte is a silt loam of loess formation and absorbs water readily. The season of 1906 was very wet, so that the season of 1907 opened with a good supply of moisture in the soil. Consequently, good yields were obtained in 1907, although the influence of a rather dry spring is shown in the lower yields of the spring-plowed plat.

The fall of 1907 and the spring of 1908 at North Platte were very dry, only 3.5 inches of precipitation occurring from October 1 to May 1. In May, June, and July there was abundant rain. It is under such conditions that moisture-conservation methods become most effective. The moisture stored in the soil by conservation methods is sufficient to carry the crop through a dry spring, and when supplemented by abundant summer rains is sufficient for the production of large crops. Thus, during 1908 a yield of 40.5 bushels was obtained from summer-tilled land as compared with 22.7 bushels from wheat sown on spring-plowed land.

In 1909, on the other hand, the highest yield of wheat at North Platte was obtained from spring-plowed land. The seasonal rainfall was the highest of any of the three years. But the rainfall was not the factor which controlled the yields during this season. There was abundant moisture for all the crops. In this case the temperature was the controlling factor. The wheat sown on the conservation plats encountered freezing weather for five days just as it was coming up. In the spring-plowed plats, where conditions were not so favorable, the germination was retarded and the plants were not injured during this cold weather. More freezing weather occurred a week later, which injured the more advanced grain to such an extent that it never recovered, and the wheat sown on spring-plowed land consequently gave better yields.

The stations so far considered are located in the central and northern part of the Great Plains, where the conditions are not so severe owing to the lower evaporation. The remaining stations are located in a section subject to high winds, hail, and high evaporation.

At Akron, Colo., in 1909 the spring was cold and wet. Under these conditions we would not expect marked differences between spring-plowing and summer-tillage methods. The average yield at the station was about 16 bushels, with a seasonal rainfall of 10 inches.

At Hays, Kans., in 1908 the average yield was only about 4 bushels with a seasonal rainfall of 14 inches. This low yield was due to high winds and dry weather in the spring months. The crop in 1909 was destroyed by hail.

At Garden City, Kans., in 1909 the average yield of wheat was 3 bushels per acre, with a seasonal rainfall of 11 inches. There was 2 inches of precipitation in March, which provided sufficient moisture for the germination of the wheat, but there was practically no precipitation during April and the first half of May, which so weakened the crop that the later rains could not be utilized.

The crop at Dalhart, Tex., in 1908 was destroyed by drought. In 1909 the spring was very dry, less than 3 inches of water falling from September 1 to May 1. Wheat grown on summer-tilled land was the only plat that was able to withstand this weather. A hailstorm on June 19 completed the destruction of those crops that had been weakened by the drought, and injured the wheat on the summer-tilled plat, which, however, gave a yield of 10.5 bushels per acre, with a seasonal rainfall of only 8 inches.

Spring wheat at Amarillo, Tex., during the season of 1907 was a failure, owing to the extremely dry weather of the spring and early summer, combined with the severe hailstorm of June 3. The average yield was only about 2 bushels per acre. In 1908 an average yield of about 12 bushels was obtained on a seasonal rainfall of 12.6 inches. March was very dry during this season, but good rains were

recorded in April and May, which explains the equality in yield of the spring-plowed and summer-fallowed plats. In 1909, April and May were very dry, while good rains fell in June. Here again we find the conditions under which conservation methods become especially effective, namely, a dry spring followed by timely summer rains. The wheat sown on spring-plowed land at Amarillo during this season was a failure, while the wheat on summer-tilled land gave a yield of 10.5 bushels on a seasonal rainfall of 8.5 inches.

In comparing the seasonal rainfall with the yields for all the stations it will be seen that when the rainfall from April to July, inclusive, is less than 8 inches the yields are hardly sufficient to cover the expense of producing the crop. With a seasonal rainfall of 8 to 10 inches the yield of wheat grown on summer-tilled land is generally considerably higher than wheat grown on spring-plowed land. When, however, the seasonal precipitation is above 10 or 12 inches, the increased returns from the method of alternate cropping and summer tillage do not exceed the returns from wheat grown in rotation or on spring plowing by an amount sufficient to offset the increased cost of summer tillage.

YIELD IN RELATION TO RAINFALL IN SOUTHERN TEXAS.

THE THREE YEARS' RECORD AT SAN ANTONIO.

Field experiments have also been conducted by the Office of Western Agricultural Extension of the Bureau of Plant Industry, during the past three years, at San Antonio, Tex. The normal rainfall of this region is about 26 inches, but the evaporation is equal to that on the high plains of Texas during the summer months, which, combined with the irregularity of the rainfall, often results in drought. The following table shows the yields of some of the standard crops of this region during three years in which there was a marked variation in the seasonal rainfall.

TABLE IV.—*Relation of yield to rainfall at San Antonio, Tex.*

Crop and year.	Yield per acre.	Seasonal rainfall.	Annual rainfall.
		<i>Inches.</i>	<i>Inches.</i>
Corn:			
1907.....	17.5 bushels.....	9.3	26
1908.....	27.4 bushels.....	10	27
1909.....	9.9 bushels.....	4.4	13
Cotton:			
1907.....	377 pounds.....	13	26
1908.....	1,096 pounds.....	17.7	27
1909.....	640 pounds.....	9.3	13
Sorghum:			
1907.....	3.1 tons.....	11.3	26
1908.....	13 tons.....	16.4	27
1909.....	1.9 tons.....	8.2	13

Referring to Table IV, it will be seen that the total rainfall for the year 1909 was only one-half that of either of the two preceding

years, in which the rainfall was about normal. The rain which fell each year during the growing season of each crop is given in the column headed "Seasonal rainfall."

The seasonal rainfall for corn is taken from March 1 to July 1; for cotton, from March 1 to October 1; for sorghum, from April 1 to October 1. The cotton yields include weight of both seed and fiber. The sorghum (Sumac) was grown in drills for forage, and two cuttings were made, the total yield being given in the table. The figures in all cases represent the average of a number of plats, varying from 8 to 46 in number each year in the case of the corn and cotton crops and from 3 to 4 in the case of the sorghum.

It will be noted that the yields increase with the seasonal rainfall in every instance except that of the cotton crop of 1907. The low yield in this case is due to an extremely dry August and September, only about 1 inch of rain falling during this time, which is a critical period in the growth of cotton in this region. The effect of the rainfall on the growth of sorghum is especially marked, the yield varying from 1.9 tons with a seasonal rainfall of 8 inches in 1909 to 13 tons per acre with a seasonal rainfall of 16 inches in 1908. This latter yield, which is extremely high, was the average of four plats, of which the lowest gave a yield of over 12 tons per acre. All of these four plats were cropped to either sorghum or cotton the previous year, and were plowed the preceding fall in time to take advantage of heavy fall and winter rains. The water which was stored in the soil as the result of the fall plowing, amounting probably to 6 or 8 inches of rainfall, was thus available to the crop in addition to the seasonal rainfall of 16 inches. But even granting that the sorghum had 24 inches of water during its growing period and assuming that the forage contained 20 per cent of water when weighed, this crop still shows the remarkable efficiency of 1 pound of dry material produced for every 260 pounds of water used.

SUMMER TILLAGE AT SAN ANTONIO.

The increased yield obtained on summer-tilled land during a dry season is strikingly illustrated in the results given in Table V, which were obtained at the San Antonio Experiment Farm in 1909.

TABLE V.—*Comparison of yields from crops grown on summer-tilled land and on land cropped the preceding year at San Antonio, Tex., 1909.*

Crop.	On land cropped in 1908.	On land summer tilled in 1908.
Cotton.....	596 pounds.....	783 pounds.
Corn.....	3.3 bushels.....	22.6 bushels.
Sorghum.....	1.9 tons.....	5 tons.
Oats.....	0.0 ton.....	1.25 tons.

Table V shows a comparison of yields obtained on summer-tilled land and on land cropped the preceding year. With the exception of the cotton crop, the increased yield resulting from summer tillage is very marked. The cotton on cropped land was greatly helped by seasonal rains during July and August, a critical period with this crop. The yield of corn on the cropped land was only one-sixth and of sorghum one-third that on summer-tilled land. Oats grown as a hay crop during the winter months were a failure except on the summer-tilled land. These results were obtained during an exceedingly dry year. Usually the rainfall of this region is sufficient to make crop rotations practicable, although cultivated crops should be used as far as possible.

NORMAL PRECIPITATION OF THE WESTERN UNITED STATES.

Table VI has been specially compiled for this bulletin, principally from the numerous reports of the United States Weather Bureau, and includes the rainfall records available to January, 1910. The table gives the station, the county in which the station is located, the elevation of the station above sea level, the normal precipitation^a—that is, the average annual precipitation for a number of years—and the number of years of records upon which the normal is based, ending with the year given in the table.

In the state rainfall maps (figs. 6-23) each number on the map represents the normal rainfall at the station located at that point. These maps, which were prepared from the figures given in the tables, show the distribution of the rainfall in each State. The heavy curved lines drawn through the maps pass through points having approximately the same rainfall. The amount of rainfall in inches represented by each line is shown by the numbers at the ends of the line. These lines have been drawn when possible to represent differences of 5 inches in the rainfall. For example, in the Kansas map one line passes through points having an annual rainfall of 20 inches, another line through points where the rainfall is 25 inches, and so on. In some States there are found separated regions which have the same rainfall, as in Colorado. These lines have been located by means of the figures given on the map, so that the figures are to be considered rather than the lines. The county boundaries in each State have been revised to date from the maps of the Post-Office Department. The precipitation tables and maps will be found arranged alphabetically according to States.

^a The term "precipitation" is used so as to include both rain and snow. The snow that falls into the gauge in the winter is melted, and the water is measured and treated in the records as rain. The records, then, include the total precipitation for the year, whether rain or snow, but measured always as rain.

FIG. 6.—Rainfall map of Arizona. The figures show the average annual rainfall in inches.

FIG. 7.—Rainfall map of California. The figures show the average annual rainfall in inches.

FIG. 8.—Rainfall map of Colorado. The figures show the average annual rainfall in inches.

FIG. 9.—Rainfall map of Idaho. The figures show the average annual rainfall in inches.

FIG. 10.—Rainfall map of Kansas. The figures show the average annual rainfall in inches.

FIG. 11.—Rainfall map of Montana. The figures show the average annual rainfall in inches.

FIG. 12.—Rainfall map of Nebraska. The figures show the average annual rainfall in inches.

FIG. 13.—Rainfall map of Nevada. The figures show the average annual rainfall in inches.

FIG. 14.—Rainfall map of New Mexico. The figures show the average annual rainfall in inches.

FIG. 17.—Rainfall map of Oregon. The figures show the average annual rainfall in inches.

FIG. 18.—Rainfall map of South Dakota. The figures show the average annual rainfall in inches.

FIG. 20.—Rainfall map of Texas, western part. The figures show the average annual rainfall in inches.

FIG. 21.—Rainfall map of Utah. The figures show the average annual rainfall in inches.

FIG. 22.—Rainfall map of Washington. The figures show the average annual rainfall in inches.

FIG. 23.—Rainfall map of Wyoming. The figures show the average annual rainfall in inches.

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States.

ARIZONA.

Station.	County.	Eleva- tion.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Allaires Ranch.....	Cochise.....	4,184	12	1908	11.6
Arizona Canal Dam.....	Maricopa.....	1,372	16	1908	9.2
Aztec.....	Yuma.....	492	10	1908	4.3
Benson.....	Cochise.....	3,523	24	1908	9.0
Bisbee.....	do.....	5,500	18	1908	17.7
Bonita.....	Graham.....	4,916	28	1908	13.3
Bowie.....	Cochise.....	3,756	9	1908	10.8
Buckeye.....	Maricopa.....	980	17	1908	7.8
Casagrande.....	Pinal.....	1,396	21	1906	7.1
Clifton.....	Graham.....	3,610	16	1907	13.8
Cline.....	Gila.....	2,300	9	1908	15.9
Cochise.....	Cochise.....	4,219	10	1908	10.5
Columbia.....	Yavapai.....	1,900	10	1908	15.4
Congress.....	do.....	3,688	12	1908	13.2
Crittenden, Camp.....	Pima.....	2,000	5	1872	16.5
Date Creek, Camp.....	Yavapai.....	3,726	6	1873	14.2
Douglas.....	Cochise.....	3,930	6	1908	13.4
Dragoon.....	Cochise.....	4,611	9	1902	12.5
Dudleyville.....	Pinal.....	2,360	20	1908	14.0
Experiment Station Farm.....	Maricopa.....	1,092	15	1907	7.3
Flagstaff.....	Coconino.....	6,907	17	1908	23.2
Florence.....	Pinal.....	1,553	9	1890	9.5
Fort Apache.....	Navajo.....	5,200	29	1908	18.1
Fort Bowie.....	Cochise.....	4,781	23	1890	15.4
Fort Defiance.....	Apache.....	6,950	8	1905	13.5
Fort Grant.....	Graham.....	4,916	23	1903	14.9
Fort Huachuca.....	Cochise.....	5,100	23	1908	18.0
Fort Lowell.....	Pima.....	2,400	19	1890	12.4
Fort McDowell.....	Maricopa.....	1,250	24	1890	10.4
Fort Mohave.....	Mohave.....	604	15	1904	5.1
Fort Thomas.....	Graham.....	2,700	10	1890	11.8
Fort Verde.....	Yavapai.....	3,160	22	1890	13.1
Gila Bend.....	Maricopa.....	737	18	1908	5.4
Globe.....	Gila.....	3,525	6	1908	16.5
Holbrook.....	Navajo.....	5,069	19	1908	8.8
Jerome.....	Yavapai.....	4,743	12	1908	18.3
Kingman.....	Mohave.....	3,326	7	1908	11.8
Maricopa.....	Pinal.....	1,186	26	1908	6.0
Mesa.....	Maricopa.....	1,244	13	1908	8.8
Mohawk Summit.....	Yuma.....	538	7	1907	3.7
Mount Huachuca.....	Cochise.....	5,000	12	1902	18.3
Natural Bridge.....	Gila.....	4,990	18	1908	21.7
Oracle.....	Pinal.....	4,500	13	1906	17.1
Oro.....	Graham.....	3,610	11	1904	12.3
Pantano.....	Pima.....	3,536	10	1900	12.3
Parker.....	Yuma.....	345	10	1905	4.4
Peoria.....	Maricopa.....	1,200	9	1900	8.0
Phoenix.....	do.....	1,108	14	1908	7.9
Phoenix (A).....	do.....	1,092	18	1908	7.5
Pinal Ranch.....	Pinal.....	4,520	14	1908	24.9
Prescott.....	Yavapai.....	5,660	29	1908	17.3
Roosevelt.....	Gila.....	1,983	4	1908	21.2
St. Michael.....	Apache.....	6,950	12	1908	13.5
San Carlos.....	Gila.....	2,456	21	1908	12.8
San Simon.....	Cochise.....	3,609	19	1908	6.4
Sentinel.....	Maricopa.....	685	10	1908	3.6
Showlow.....	Navajo.....	.....	^a 8	1902	15.8
Signal.....	Mohave.....	1,652	16	1908	7.4
Strawberry.....	Coconino.....	5,875	5	1901	21.5
Texas Hill.....	Yuma.....	353	11	1899	3.5
Tombstone.....	Cochise.....	4,550	10	1908	14.2
Tuba.....	Coconino.....	.....	7	1906	6.0
Tucson.....	Pima.....	2,390	29	1908	10.7
Vail.....	do.....	3,241	10	1908	5.8
Walnut Grove.....	Yavapai.....	3,649	14	1908	12.3
Wickenburg.....	Maricopa.....	1,400	7	1885	9.9
Willcox.....	Cochise.....	4,164	27	1908	8.5
Williams.....	Coconino.....	6,750	7	1908	21.5
Yarnell.....	Yavapai.....	4,700	11	1908	18.9
Yuma.....	Yuma.....	141	28	1908	3.1

^a Except for December.

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

CALIFORNIA.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Agnew.....	Santa Clara.....	30	7	1898	13.9
Alosta.....	Los Angeles.....	600	6	1886	25.4
Alta.....	Placer.....	3,612	16	1885	42.1
Anaheim.....	Orange.....	134	27	1904	11.5
Angiola.....	Tulare.....	208	6	1905	5.6
Antioch.....	Contra Costa.....	46	29	1907	12.6
Aptos.....	Santa Cruz.....	102	24	1908	25.6
Athlone.....	Merced.....		5	1890	11.3
Auburn.....	Placer.....	1,360	38	1908	33.5
Azuza.....	Los Angeles.....	540	11	1908	13.9
Bagdad.....	San Bernardino.....	784	6	1908	4.5
Bakersfield.....	Kern.....	404	29	1908	4.8
Barstow.....	San Bernardino.....	2,105	6	1908	4.1
Benicia Barracks.....	Solano.....	64	36	1890	16.3
Berendo.....	Madera.....	256	11	1899	10.1
Berkeley.....	Alameda.....	317	22	1908	26.4
Big Dry Creek.....	Fresno.....	435	7	1878	16.6
Biggs.....	Butte.....	98	10	1908	21.8
Bishop.....	Inyo.....	4,450	13	1907	4.7
Blue Canyon.....	Placer.....	4,095	10	1908	64.1
Boca.....	Nevada.....	5,551	35	1904	20.1
Bodie.....	Mono.....	8,248	12	1906	13.0
Borden.....	Fresno.....	328	16	1890	9.0
Boulder Creek.....	Santa Cruz.....	470	11	1899	59.6
Bowmans Dam.....	Nevada.....	5,500	25	1903	71.4
Branscomb.....	Mendocino.....	2,000	9	1908	88.8
Brentwood.....	Contra Costa.....	80	29	1899	13.5
Brighton.....	Sacramento.....	53	13	1890	17.2
Byron.....	Contra Costa.....	33	26	1905	13.0
Cabazon.....	Riverside.....	1,779	13	1908	9.6
Caliente.....	Kern.....	1,290	33	1908	10.6
Calistoga.....	Napa.....	363	37	1908	35.0
Campbell.....	Santa Clara.....	217	32	1908	13.2
Castroville.....	Monterey.....	17	11	1899	17.0
Cedarville.....	Modoc.....	4,675	15	1908	13.9
Central Point.....	Merced.....	117	7	1886	9.7
Cherokee.....	Butte.....		11	1884	44.9
Chico.....	do.....	189	39	1908	22.4
Chino.....	San Bernardino.....	714	16	1908	13.2
Cisco.....	Placer.....	5,939	39	1908	49.7
Claremont.....	Los Angeles.....	1,200	17	1908	16.0
Cloverdale.....	Sonoma.....	340	7	1908	47.9
Colegrove.....	Los Angeles.....	300	8	1890	21.3
Colfax.....	Placer.....	2,421	39	1908	46.6
Colton.....	San Bernardino.....	965	28	1904	10.5
Colusa.....	Colusa.....	60	26	1908	16.6
Corning.....	Tehama.....	277	23	1908	20.8
Craftonville.....	San Bernardino.....	1,759	17	1908	13.1
Crescent City.....	Del Norte.....	50	18	1907	70.2
Crystal Springs.....	San Mateo.....	220	9	1884	38.2
Cuyamaca.....	San Diego.....	4,677	10	1908	37.4
Davisville.....	Yolo.....	51	37	1908	16.5
Delano.....	Kern.....	319	33	1908	6.1
Delta.....	Shasta.....	1,138	26	1908	60.1
Dinuba.....	Tulare.....	335	6	1899	8.6
Drytown.....	Amador.....	790	13	1904	29.6
Dunnigan.....	Yolo.....	65	32	1908	19.1
Dunsmuir.....	Siskiyou.....	2,285	20	1908	56.3
Durham.....	Butte.....	160	25	1908	23.7
East Brother (L. H.).....	Contra Costa.....	63	15	1890	8.3
Edmonton.....	Plumas.....	4,730	10	1902	70.7
El Cajon.....	San Diego.....	482	9	1908	8.5
El Dorado.....	Eldorado.....	1,609	15	1903	37.2
Ellis.....	San Joaquin.....	76	8	1878	8.9
Elmira.....	Solano.....	75	18	1903	22.3
Elmwood.....	Stanislaus.....	126	8	1907	10.3
Elsinore.....	Riverside.....	1,234	14	1908	11.0
El Verano.....	Sonoma.....	104	10	1899	36.4
Emigrant Gap.....	Placer.....	5,230	35	1908	51.7
Escondido.....	San Diego.....	657	21	1908	13.5
Eureka.....	Humboldt.....	64	23	1908	45.9
Exeter.....	Tulare.....	392	7	1899	9.5
Fall Brook.....	San Diego.....	700	28	1903	17.3
Farallon Island.....	San Francisco.....	30	6	1908	18.9
Farmington.....	San Joaquin.....	111	31	1907	16.3

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

CALIFORNIA—Continued.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Felton.....	Santa Cruz.....	275	10	1899	50.6
Fernando.....	Los Angeles.....	1,066	26	1903	14.2
Firebaugh.....	Fresno.....	150	14	1886	8.8
Florence.....	Los Angeles.....	153	10	1899	13.2
Folsom.....	Sacramento.....	252	27	1908	23.6
Fordyce Dam.....	Nevada.....	6,500	14	1908	70.7
Fort Bidwell.....	Modoc.....	4,640	24	1890	20.8
Fort Gaston.....	Humboldt.....	397	29	1890	55.4
Fort Humboldt.....	do.....	50	13	1866	34.6
Fort Ross.....	Sonoma.....	100	33	1908	50.7
Fort Yuma.....	Imperial.....	276	28	1883	3.2
Fresno.....	Fresno.....	293	22	1908	9.0
Fruito.....	Glenn.....	624	20	1908	20.9
Galt.....	Sacramento.....	49	31	1908	18.2
Georgetown.....	Eldorado.....	2,650	36	1908	57.1
Gilroy.....	Santa Clara.....	193	35	1908	19.5
Girard.....	Kern.....	3,302	11	1899	12.1
Giendora.....	Los Angeles.....		5	1899	27.6
Gold Run.....	Placer.....	3,222	10	1908	51.3
Gonzales.....	Monterey.....	127	10	1908	10.3
Goshen Junction.....	Tulare.....	286	21	1899	7.5
Grand Island.....	Colusa.....	65	6	1899	23.0
Grass Valley.....	Nevada.....	2,090	25	1899	50.8
Grayson.....	Stanislaus.....	55	14	1884	11.9
Greenville.....	Plumas.....	3,600	15	1908	40.9
Guadalupe.....	Santa Barbara.....		6	1899	11.9
Guinda.....	Yolo.....	350	11	1908	19.6
Hanford.....	Kings.....	249	9	1908	8.2
Haywards.....	Alameda.....	75	9	1899	21.1
Healdsburg.....	Sonoma.....	52	16	1908	40.9
Helen Mine.....	Lake.....	2,750	8	1908	93.5
Hollister.....	San Benito.....	284	35	1908	12.3
Hornbrook.....	Siskiyou.....	2,154	19	1907	14.4
Humboldt (L. H.).....	Humboldt.....	8	15	1890	33.8
Huron.....	Fresno.....	367	11	1902	4.6
Idyllwild.....	Riverside.....	5,250	8	1908	23.8
Independence.....	Inyo.....	3,907	13	1908	5.6
Indio.....	Riverside.....	—20	31	1908	2.4
Ione.....	Amador.....	287	31	1908	19.9
Iowa Hill.....	Placer.....	2,825	30	1908	52.2
Isabella.....	Kern.....	2,500	7	1905	7.8
Jackson (near).....	Amador.....	1,900	19	1902	32.8
Jamestown.....	Tuolumne.....	1,471	6	1908	38.4
Jolon.....	Monterey.....		15	1899	19.2
Keeler.....	Inyo.....	3,620	24	1908	2.6
Keene.....	Kern.....	2,705	21	1899	14.5
Kennedy Gold Mine.....	Amador.....	1,500	11	1902	41.9
Kernville.....	Kern.....	2,600	5	1899	8.3
King City.....	Monterey.....	333	22	1908	10.9
Kingsburg.....	Fresno.....	301	20	1899	8.7
Knights Landing.....	Yolo.....	45	29	1906	18.2
Kono Tayee.....	Lake.....	1,325	21	1902	29.5
La Grange.....	Stanislaus.....	250	23	1890	16.6
Lakeport (near).....	Lake.....	1,325	22	1903	22.8
La Porte.....	Plumas.....	5,000	15	1908	78.1
Lathrop.....	San Joaquin.....	25	21	1899	12.5
Laurel.....	Santa Cruz.....	910	11	1899	51.7
Le Grand.....	Merced.....	255	9	1908	12.2
Lemon Cove.....	Tulare.....	600	10	1908	12.5
Lemoore.....	Kings.....	227	20	1899	7.5
Lick Observatory.....	Santa Clara.....	4,209	28	1908	32.2
Livermore.....	Alameda.....	485	38	1908	15.3
Lodi.....	San Joaquin.....	45	21	1908	19.8
Los Angeles.....	Los Angeles.....	293	32	1908	17.3
Los Banos.....	Merced.....	121	36	1908	7.6
Los Gatos.....	Santa Clara.....	600	24	1908	32.4
Mammoth Tank.....	Imperial.....	257	31	1908	1.8
Manzana.....	Los Angeles.....	2,850	8	1901	5.8
Martinez.....	Contra Costa.....	10	21	1899	19.2
Marysville.....	Yuba.....	67	38	1908	17.5
Mendota.....	Fresno.....	177	14	1907	5.9
Menlo Park.....	San Mateo.....	64	31	1908	16.4
Merced.....	Merced.....	173	35	1908	10.3
Milton.....	Calaveras.....	660	19	1908	22.4
Modesto.....	Stanislaus.....	90	38	1908	9.9

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

CALIFORNIA—Continued.

Station.	County.	Elevation. Feet.	Number of years recorded.	Record ended—	Normal precipitation. Inches.
Mojave.....	Kern.....	2,751	31	1907	4.8
Mokelumne Hill.....	Calaveras.....	1,550	16	1908	31.2
Montague.....	Siskiyou.....	2,450	30	1908	10.4
Monterey.....	Monterey.....	15	51	1908	15.6
Monterio.....	Kern.....	4,500	9	1907	16.8
Mount Hamilton.....	Santa Clara.....	4,440	10	1890	34.3
Mount Tamalpais.....	Marin.....	2,375	10	1908	28.9
Mountain View.....	Santa Clara.....		13	1899	16.4
Napa City.....	Napa.....	20	31	1908	25.5
Napa (S. H.).....	do.....	60	32	1908	25.2
Needles.....	San Bernardino.....	477	15	1906	2.8
Nevada City.....	Nevada.....	2,580	38	1908	55.8
New Almaden.....	Santa Clara.....	340	12	1899	23.4
Newark.....	Alameda.....	25	10	1899	17.7
Newcastle.....	Placer.....	970	16	1908	28.8
Newhall.....	Los Angeles.....	1,200	32	1908	15.6
Newman.....	Stanislaus.....	91	20	1908	11.2
Nicolaus.....	Sutter.....	42	12	1889	18.6
Niles (near).....	Alameda.....	87	21	1906	19.4
Nordhoff (near).....	Ventura.....	3,210	8	1905	15.8
North Bloomfield.....	Nevada.....	3,200	27	1908	53.5
North Hill Vineyard.....	Calaveras.....	660	13	1902	22.5
North Ontario.....	San Bernardino.....	1,750	6	1902	16.1
North San Juan.....	Nevada.....	2,130	7	1903	47.5
Norwalk.....	Los Angeles.....	95	10	1899	11.1
Oakdale.....	Stanislaus.....	156	15	1908	15.4
Oakland.....	Alameda.....	36	35	1908	25.0
Ogilby.....	Imperial.....	354	14	1903	1.1
Oleta.....	Amador.....	1,510	10	1901	37.0
Ontario (near).....	San Bernardino.....	860	11	1904	12.8
Orland.....	Glenn.....	254	27	1908	17.0
Orleans.....	Humboldt.....	520	6	1908	59.9
Oroville (near).....	Butte.....	250	25	1908	27.0
Pajaro.....	Monterey.....	22	25	1899	19.1
Palermo.....	Butte.....	213	18	1908	23.1
Palm Springs.....	Riverside.....	584	20	1908	3.7
Pasadena.....	Los Angeles.....	828	6	1899	14.5
Paso Robles.....	San Luis Obispo.....	800	22	1908	15.0
Peachland.....	Sonoma.....	190	13	1908	37.4
Petaluma.....	do.....	10	19	1890	23.8
Pigeon Point.....	San Mateo.....	150	13	1888	17.8
Pilarcitos.....	do.....	620	20	1884	54.8
Pilot Creek.....	Eldorado.....	4,000	5	1899	64.7
Pine Crest.....	Santa Barbara.....	1,000	11	1908	17.3
Placerville.....	Eldorado.....	1,875	32	1908	45.6
Pleasanton.....	Alameda.....	353	21	1899	17.2
Point Ano Nuevo (L. H.).....	San Mateo.....		15	1890	23.0
Point Arena (L. H.).....	Mendocino.....	156	15	1890	30.8
Point Bonita (L. H.).....	Marin.....	124	15	1890	24.2
Point Conception (L. H.).....	Santa Barbara.....	258	14	1890	13.4
Point Lobes.....	San Francisco.....	250	16	1908	19.1
Port Los Angeles.....	Los Angeles.....	25	6	1899	8.7
Point Montara (L. H.).....	San Mateo.....		15	1890	23.8
Point Reyes.....	Marin.....	490	17	1908	25.8
Pollasky.....	Fresno.....	1,200	6	1902	10.5
Pomona.....	Los Angeles.....	860	9	1902	14.3
Porterville.....	Tulare.....	464	20	1908	8.4
Poway.....	San Diego.....	460	25	1908	13.3
Princeton.....	Colusa.....	57	14	1887	15.2
Puente.....	Los Angeles.....	320	10	1899	14.0
Quincy.....	Plumas.....	3,400	14	1908	43.2
Ravenna.....	Los Angeles.....	2,262	19	1899	10.5
Red Bluff.....	Tehama.....	307	32	1908	26.1
Redding.....	Shasta.....	552	34	1908	36.1
Redlands.....	San Bernardino.....	1,352	16	1908	14.7
Reedley.....	Fresno.....	347	9	1908	10.3
Represa.....	Sacramento.....	305	12	1904	26.4
Rings Station.....	San Bernardino.....	4,300	8	1882	22.5
Riverside.....	Riverside.....	851	27	1908	10.0
Rio Vista.....	Solano.....	28	14	1906	17.6
Rocklin.....	Placer.....	249	38	1908	20.8
Rosewood.....	Tehama.....	865	10	1903	25.9
Sacramento.....	Sacramento.....	71	32	1908	20.9
Sacramento (2).....	do.....	35	59	1908	19.4

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

CALIFORNIA—Continued.

Station.	County.	Elevation. <i>Feet.</i>	Number of years recorded.	Record ended—	Normal precipitation. <i>Inches.</i>
Salinas.....	Monterey.....	40	35	1908	15.0
San Andreas Reservoir.....	San Mateo.....	377	16	1884	46.0
San Ardo.....	Monterey.....	236	28	1902	9.7
San Bernardino.....	San Bernardino.....	1,054	38	1908	15.8
San Diego.....	San Diego.....	93	38	1908	10.5
San Francisco.....	San Francisco.....	207	38	1908	24.2
San Gabriel.....	Los Angeles.....	452	10	1899	15.3
San Geronimo Pass.....	San Bernardino.....	2,560	10	1887	20.7
San Jacinto.....	Riverside.....	1,550	16	1908	11.7
San Jose.....	Santa Clara.....	95	34	1908	14.8
San Leandro.....	Alameda.....	50	12	1906	22.4
San Luis Obispo.....	San Luis Obispo.....	201	14	1908	21.5
San Mateo.....	San Mateo.....	22	35	1908	21.7
San Miguel.....	San Luis Obispo.....	616	22	1908	10.6
San Miguel Island.....	Santa Barbara.....	500	8	1901	10.9
San Pedro.....	Los Angeles.....	10	10	1899	11.0
San Rafael.....	Marin.....	56	1	1904	37.5
Sanger.....	Fresno.....	371	20	1908	10.7
Santa Ana.....	Orange.....	137	14	1902	12.1
Santa Barbara.....	Santa Barbara.....	130	41	1908	16.6
Santa Clara.....	Santa Clara.....	90	27	1908	16.1
Santa Cruz.....	Santa Cruz.....	20	31	1908	27.0
Santa Margarita.....	San Luis Obispo.....	996	20	1908	26.4
Santa Maria.....	Santa Barbara.....	220	23	1908	13.1
Santa Monica.....	Los Angeles.....	110	24	1908	13.4
Santa Paula.....	Ventura.....	350	15	1903	14.8
Santa Rosa.....	Sonoma.....	181	20	1908	30.7
Scott Valley.....	Siskiyou.....	2,570	30	1889	25.2
Selma.....	Fresno.....	311	23	1908	8.0
Shasta.....	Shasta.....	1,049	13	1908	49.9
Shingle Springs.....	Eldorado.....	1,415	10	1899	34.4
Sierra Madre.....	Los Angeles.....	1,400	12	1908	17.4
Sisson.....	Siskiyou.....	3,555	20	1908	36.1
Smartville.....	Yuba.....	800	9	1880	30.7
Soledad.....	Monterey.....	188	35	1908	9.0
Sonoma.....	Sonoma.....	30	18	1906	26.7
South Vallejo.....	Solano.....	23	18	1890	15.9
Spadra.....	Los Angeles.....	705	15	1890	12.8
Stockton (S. H.).....	San Joaquin.....	23	59	1908	15.4
Storey.....	Madera.....	296	9	1908	9.8
Suisun.....	Solano.....	20	29	1908	19.9
Summerdale.....	Mariposa.....	5,270	12	1907	48.8
Summit.....	San Bernardino.....	7,017	38	1908	46.6
Sumner.....	Kern.....	422	14	1888	5.1
Susanville.....	Lassen.....	4,195	20	1908	22.9
Tehachapi.....	Kern.....	3,964	30	1906	10.5
Tehama.....	Tehama.....	220	38	1908	18.5
Tejon Rancho.....	Kern.....	1,500	7	1905	9.6
Templeton.....	San Luis Obispo.....	773	12	1899	17.2
Tennant.....	Santa Clara.....	335	7	1885	21.4
Tequisquita Rancho.....	do.....	244	8	1906	14.7
Towle.....	Placer.....	3,704	23	1908	51.7
Tracy.....	San Joaquin.....	64	29	1908	10.1
Traver.....	Tulare.....	291	13	1899	8.7
Tropico.....	Los Angeles.....	428	11	1899	14.8
Truckee.....	Nevada.....	5,819	38	1908	26.9
Tulare (near).....	Tulare.....	274	15	1908	7.7
Turlock.....	Stanislaus.....	106	21	1899	10.2
Ukiah.....	Mendocino.....	620	32	1908	34.9
Upland.....	San Bernardino.....	1,750	12	1908	16.1
Upper Lake.....	Lake.....	1,350	24	1908	26.1
Upper Mattole.....	Humboldt.....	244	17	1903	63.7
Vacaville.....	Colano.....	175	29	1908	27.9
Valley Springs.....	Calaveras.....	673	20	1908	23.2
Ventura.....	Ventura.....	50	14	1905	21.1
Vina.....	Tehama.....	213	14	1902	21.5
Visalia.....	Tulare.....	334	21	1908	9.9
Volcano Springs.....	Imperial.....	220	17	1905	1.6
Walnut Creek.....	Contra Costa.....	75	10	1899	19.6
Wasco.....	Kern.....	336	9	1908	4.9
Watsonville.....	Santa Cruz.....	23	13	1908	23.8
Weaverville.....	Trinity.....	2,142	16	1885	38.3
Westley.....	Stanislaus.....	90	20	1908	10.6
West Butte.....	Sutter.....	90	10	1889	16.0
West Point.....	Calaveras.....		6	1899	40.5

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

CALIFORNIA—Continued.

Station.	County.	Elevation. <i>Feet.</i>	Number of years recorded.	Record ended—	Normal precipitation. <i>Inches.</i>
Wheatland.....	Yuba.....	84	22	1908	21.0
Whittier.....	Los Angeles.....	239	14	1902	12.2
Williams.....	Colusa.....	89	29	1905	12.9
Willow.....	Glenn.....	136	30	1908	15.5
Winters.....	Yolo.....	136	15	1903	23.6
Wire Bridge.....	Placer.....	565	8	1901	33.8
Woodland.....	Yolo.....	63	36	1908	17.7
Yerba Buena (L. H.).....	San Francisco.....	345	12	1890	19.4
Yreka.....	Siskiyou.....	2,635	29	1901	16.8
Yuba City.....	Sutter.....	70	11	1902	22.0

COLORADO.

Akron.....	Washington.....	4,650	6	1908	19.1
Alford.....	Larimer.....		11	1905	17.8
Alma.....	Park.....	10,228	10	1896	14.1
Ashcroft.....	Pitkin.....	9,483	9	1909	19.7
Blaine.....	Baca.....	3,935	18	1909	15.7
Boulder.....	Boulder.....	5,347	14	1909	18.2
Box Elder.....	Larimer.....		12	1902	16.6
Breckenridge.....	Summit.....	9,536	19	1908	25.5
Burlington.....	Kit Carson.....	4,160	7	1909	20.4
Cannon City.....	Fremont.....	5,329	21	1909	12.2
Castle Rock.....	Douglas.....	6,220	18	1909	17.2
Cedar Edge.....	Delta.....	6,175	11	1902	11.3
Cheesman.....	Jefferson.....	6,890	7	1909	14.3
Cheyenne Wells.....	Cheyenne.....	4,279	16	1909	16.6
Clear View.....	Las Animas.....	9,500	17	1906	22.9
Collbran.....	Mesa.....	6,000	17	1909	15.0
Colorado Springs.....	El Paso.....	6,098	30	1909	14.3
Cope.....	Washington.....		13	1909	19.5
Cripple Creek.....	Teller.....	9,396	9	1909	17.2
Crook.....	Logan.....	3,695	7	1899	15.9
Delta.....	Delta.....	4,965	20	1909	8.1
Denver.....	Denver.....	5,272	38	1909	14.0
Dumont.....	Clear Creek.....	8,000	10	1900	18.6
Durango.....	La Plata.....	6,534	17	1909	17.8
Fort Collins.....	Larimer.....	4,985	28	1909	14.8
Fort Garland.....	Costilla.....	7,937	22	1883	12.7
Fort Lewis.....	La Plata.....	8,500	10	1890	17.2
Fort Lyon.....	Bent.....	4,000	20	1889	11.1
Fort Massachusetts.....	Huerfano.....	8,365	6	1858	17.2
Fort Morgan.....	Morgan.....	4,319	12	1909	12.3
Fox.....	Yuma.....		12	1903	16.6
Fruita.....	Mesa.....	4,510	11	1909	10.3
Garnett.....	Costilla.....	7,576	17	1909	6.6
Georgetown.....	Clear Creek.....	8,550	8	1909	12.5
Gilman.....	Eagle.....	8,500	14	1903	19.2
Glen Eyrie.....	El Paso.....	6,500	18	1909	15.9
Glenwood Springs (near).....	Garfield.....	5,823	11	1908	13.1
Grand Junction.....	Mesa.....	4,608	19	1909	8.5
Grand Valley.....	Garfield.....	5,089	18	1909	12.6
Greeley.....	Weld.....	4,637	19	1909	12.3
Gunnison.....	Gunnison.....	7,670	17	1909	9.3
Hamps.....	Elbert.....	5,400	17	1909	14.0
Hermosa.....	La Plata.....	6,700	7	1882	14.3
Hoehne (near).....	Las Animas.....	5,700	18	1909	13.9
Holly.....	Prowers.....	3,386	15	1909	14.8
Holyoke.....	Phillips.....		7	1902	15.2
Hugo.....	Lincoln.....	5,068	7	1901	16.5
Husted (near).....	El Paso.....	6,596	18	1904	15.8
Idaho Springs.....	Clear Creek.....	7,543	10	1909	15.1
Lake Moraine.....	El Paso.....	10,265	16	1909	25.1
Lamar.....	Prowers.....	3,592	20	1909	16.0
La Porte.....	Larimer.....	5,069	19	1909	15.6
Las Animas.....	Bent.....	3,899	42	1909	11.7
Lay.....	Routt.....	6,162	16	1909	12.5
Leadville.....	Lake.....	10,248	14	1909	13.8
Le Roy (near).....	Logan.....	4,380	21	1909	16.5
Longmont.....	Boulder.....	4,935	8	1896	15.2
Longs Peak (near).....	Larimer.....	8,600	13	1908	19.0
Manitou.....	Montezuma.....	6,960	11	1909	17.9

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

COLORADO—Continued.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Meeker.....	Rio Blanco.....	6,182	18	1909	17.1
Minneapolis.....	Baca.....	3,935	9	1899	17.0
Montrose.....	Montrose.....	5,811	21	1909	9.5
Moraine.....	Larimer.....	7,775	17	1906	16.9
Pagoda.....	Routt.....	6,500	19	1909	18.3
Paonia.....	Delta.....	5,694	15	1909	12.1
Parachute.....	Garfield.....	5,105	10	1904	11.0
Pikes Peak.....	El Paso.....	14,134	15	1888	28.7
Platte Cannon.....	Jefferson.....	5,492	6	1908	15.4
Pueblo.....	Pueblo.....	4,734	22	1909	12.1
Rangeley.....	Rio Blanco.....	5,050	11	1909	9.7
Red Cliff.....	Eagle.....	8,500	7	1896	23.0
Rico.....	Dolores.....	8,737	6	1896	22.8
Rocky Ford (near).....	Otero.....	4,177	21	1909	13.1
Rogers Mesa.....	Delta.....	5,345	10	1903	9.8
Ruby.....	Gunnison.....	10,000	8	1902	50.0
Saguache.....	Saguache.....	7,745	17	1907	11.7
Salida.....	Chaffee.....	7,035	11	1909	7.2
San Luis.....	Costilla.....	7,794	19	1909	11.4
Santa Clara.....	Huerfano.....	8,500	11	1909	27.2
Seibert.....	Kit Carson.....	4,705	10	1901	15.0
Sheridan Lake.....	Kiowa.....	4,065	9	1909	14.9
Silt (near).....	Garfield.....	5,441	12	1906	12.2
Smoky Hill Mine.....	Boulder.....	7,800	9	1898	24.6
Springfield.....	Baca.....	4,400	8	1899	19.0
Stamford.....	Las Animas.....	9,500	9	1898	24.6
Steamboat Springs.....	Routt.....	6,683	7	1909	18.8
Sugar Loaf.....	Boulder.....	7,800	13	1903	24.4
Surface Creek.....	Delta.....	6,175	6	1897	11.9
Thon.....	Elbert.....	6,500	9	1896	12.1
Trinidad.....	Las Animas.....	5,994	12	1906	17.2
Twin Lakes.....	Lake.....	9,200	9	1902	14.7
T. S. Ranch.....	Mesa.....	5,200	15	1901	11.3
Vilas.....	Baca.....	4,155	19	1909	14.1
Wagon Wheel Gap.....	Mineral.....	8,434	8	1906	11.9
Walden.....	Jackson.....	.....	6	1901	9.6
Wallet.....	Kit Carson.....	.....	8	1902	17.9
Waterdale.....	Larimer.....	5,206	15	1909	16.0
Westcliff.....	Custer.....	7,864	16	1909	16.1
White Pine.....	Gunnison.....	9,500	9	1909	17.7
Wray.....	Yuma.....	3,512	15	1908	18.0
Yuma.....	do.....	4,128	19	1909	17.9

IDAHO.

Albion.....	Cassia.....	.....	5	1904	13.1
American Falls.....	Oneida.....	4,341	16	1908	14.1
Atlanta.....	Elmore.....	7,000	5	1899	28.6
Blackfoot.....	Bingham.....	4,503	13	1908	9.7
Blue Lakes.....	Lincoln.....	3,225	2	1904	11.9
Boise.....	Ada.....	2,770	23	1908	12.7
Buhl.....	Twin Falls.....	3,800	2	1908	12.3
Burnside.....	Fremont.....	5,500	11	1903	10.4
Caldwell.....	Canyon.....	2,372	3	1907	11.2
Cambridge.....	Washington.....	2,651	13	1908	20.1
Chesterfield.....	Bannock.....	5,424	12	1908	12.3
Dent.....	Nez Perces.....	1,350	2	1908	27.7
Downey.....	Bannock.....	5,425	6	1901	9.3
Ellerslie.....	Elmore.....	3,500	3	1907	12.6
Emmett.....	Canyon.....	2,350	2	1908	11.4
Forney.....	Lemhi.....	.....	12	1908	18.2
Garnet.....	Elmore.....	2,575	9	1908	7.3
Grangeville.....	Idaho.....	3,500	5	1904	26.8
Gray.....	Bingham.....	.....	3	1899	11.4
Hailey.....	Blaine.....	5,347	4	1901	14.0
Hotspring.....	Owyhee.....	2,752	3	1908	10.4
Idaho Falls.....	Bingham.....	4,742	14	1908	14.6
Kellogg.....	Shoshone.....	2,330	3	1907	29.5
Kootenai.....	Bonner.....	1,750	8	1900	25.0
Lake.....	Fremont.....	6,700	16	1908	17.3
Lakeview.....	Bonner.....	2,250	12	1908	28.7
Landore.....	Washington.....	5,300	5	1908	37.9

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

IDAHO—Continued.

Station.	County.	Eleva- tion.	Number of years recorded.	Record ended—	Normal precipi- tation.
		<i>Feet.</i>			<i>Inches.</i>
Lardo.....	Boise.....	5,050	4	1908	29.6
Lewiston.....	Nez Perces.....	757	15	1908	13.5
Lost River.....	Blaine.....	5,700	14	1908	9.4
Meadows.....	Washington.....	3,950	6	1908	21.2
Milner.....	Twin Falls.....	4,097	5	1908	11.0
Moscow.....	Latah.....	2,748	16	1908	22.6
Mountainhome.....	Elmore.....	3,150	3	1908	11.3
Murray.....	Shoshone.....	2,750	15	1908	37.6
Murtaugh.....	Twin Falls.....		2	1908	15.4
Oakley.....	Cassia.....	4,191	16	1908	9.3
Ola.....	Boise.....	3,100	11	1905	21.0
Orofino.....	Nez Perces.....	1,027	5	1908	28.4
Paris.....	Bear Lake.....	5,946	12	1908	12.2
Payette.....	Canyon.....	2,159	16	1908	12.0
Pocatello.....	Bannock.....	4,483	9	1908	12.9
Pollock.....	Idaho.....	2,050	9	1904	14.3
Poplars.....	Canyon.....	2,425	8	1908	10.3
Porthill.....	Bonner.....	1,665	16	1908	23.0
Priest River.....	do.....	2,078	8	1905	23.5
Riddle.....	Owyhee.....	6,200	3	1903	12.1
Roosevelt.....	Idaho.....	7,250	4	1906	23.4
Rupert.....	Lincoln.....	4,204	2	1908	15.1
St. Maries.....	Kootenai.....	2,062	12	1908	28.7
Salem.....	Fremont.....	5,000	3	1907	16.0
Salmon.....	Lemhi.....	4,040	3	1908	10.4
Soldier.....	Blaine.....	5,140	14	1908	14.9
Standrod.....	Cassia.....		3	1908	17.3
Swan Valley.....	Bingham.....	5,434	5	1899	15.8
Twin Falls.....	Twin Falls.....	3,825	3	1908	12.4
Vernon.....	Fremont.....		12	1908	14.5
Weston.....	Oneida.....	4,460	8	1905	13.1

KANSAS.

Abilene.....	Dickinson.....	1,157	21	1907	29.7
Achilles.....	Rawlins.....	2,827	12	1904	20.9
Agricultural College.....	Riley.....	1,100	50	1908	30.2
Altoona.....	Wilson.....	815	10	1901	31.4
Anthony.....	Harper.....	1,329	11	1907	26.6
Ashland.....	Clark.....	1,951	22	1908	21.9
Atchison.....	Atchison.....	973	23	1907	37.4
Baker.....	Brown.....	1,182	8	1908	34.9
Beloit.....	Mitchell.....	1,383	10	1903	26.7
Burlington.....	Coffey.....	1,010	15	1908	37.4
Clay Center.....	Clay.....	1,203	7	1908	35.5
Colby.....	Thomas.....	3,138	22	1908	19.4
Coldwater.....	Comanche.....	2,090	11	1908	22.0
Columbus.....	Cherokee.....	898	19	1908	44.5
Concordia.....	Cloud.....	1,398	24	1908	27.5
Coolidge.....	Hamilton.....	3,346	11	1908	15.8
Cunningham.....	Kingman.....	1,680	24	1907	25.5
Dodge City.....	Ford.....	2,513	34	1908	20.8
Dresden.....	Decatur.....	2,731	14	1908	23.0
Eldorado.....	Butler.....	1,291	6	1908	34.0
Ellinwood.....	Barton.....	1,788	22	1908	24.5
Emporia.....	Lyon.....	1,138	25	1908	33.3
Englewood.....	Clark.....	1,955	14	1906	21.0
Enterprise.....	Dickinson.....	1,141	6	1908	28.8
Eureka.....	Greenwood.....	1,093	14	1908	38.6
Fall River.....	do.....	925	12	1908	36.5
Farnsworth.....	Lane.....	2,850	8	1908	20.3
Fort Leavenworth.....	Leavenworth.....	788	50	1905	32.6
Fort Riley.....	Geary.....	1,070	4	1898	25.9
Fort Scott.....	Bourbon.....	857	16	1908	42.4
Frankfort.....	Marshall.....	1,146	14	1908	36.6
Garden City.....	Finney.....	2,836	22	1908	18.8
Gibson.....	Trego.....	2,475	10	1899	17.5
Gove.....	Gove.....	2,750	22	1908	20.4
Grenola.....	Elk.....	1,116	21	1908	32.2
Harrison.....	Jewell.....	1,804	7	1908	30.9
Hays.....	Ellis.....	2,000	39	1908	23.5
Horton.....	Brown.....	1,188	19	1908	33.1

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

KANSAS—Continued.

Station.	County.	Eleva- tion.	Number of years recorded.	Record ended—	Normal precipi- tation.
		<i>Feet.</i>			<i>Inches.</i>
Hoxie.....	Sheridan.....	2,700	11	1908	20.9
Hutchinson.....	Reno.....	1,535	18	1908	28.4
Independence.....	Montgomery.....	816	36	1908	37.4
Iola.....	Allen.....	984	3	1908	35.2
Jetmore.....	Hodgeman.....	2,268	7	1908	19.1
Kansas City (Mo.).....	Jackson.....	1,029	21	1908	37.3
Lacrosse.....	Rush.....	2,061	6	1908	21.9
Lawrence.....	Douglas.....	874	41	1908	36.3
Lebo.....	Coffey.....	1,138	22	1908	38.3
Lakin.....	Kearney.....	2,993	18	1908	16.4
Larned.....	Pawnee.....	2,090	13	1907	22.8
Lebanon.....	Smith.....	1,812	10	1908	24.9
McPherson.....	McPherson.....	1,495	18	1908	32.6
Macksville.....	Stafford.....	2,032	15	1908	22.7
Madison.....	Greenwood.....	1,074	7	1908	40.7
Manhattan.....	Riley.....	1,014	18	1908	32.1
Marion.....	Marion.....	1,310	15	1908	30.6
Medicine Lodge.....	Barber.....	1,475	13	1905	23.7
Minneapolis.....	Ottawa.....	1,259	19	1908	24.7
Moran.....	Allen.....	1,098	13	1908	40.0
Mount Hope.....	Sedgwick.....	1,410	11	1908	27.4
Newton.....	Harvey.....	1,454	11	1908	30.3
Norton.....	Norton.....	2,284	10	1908	22.6
Norwich.....	Kingman.....	1,496	12	1908	28.3
Oberlin.....	Decatur.....	2,539	21	1907	23.6
Olathe.....	Johnson.....	1,032	14	1908	37.8
Osage City.....	Osage.....	1,081	11	1908	35.2
Osborne.....	Osborne.....	1,557	21	1904	25.8
Oswego.....	Labette.....	899	19	1908	39.5
Ottawa.....	Franklin.....	926	14	1908	39.5
Phillipsburg.....	Phillips.....	1,939	22	1908	22.6
Pleasanton.....	Linn.....	862	6	1908	39.9
Pratt.....	Pratt.....	1,950	13	1908	22.1
Republic.....	Republic.....	1,495	6	1908	31.8
Rome.....	Sumner.....	1,218	22	1908	28.3
Russell.....	Russell.....	1,834	6	1908	23.8
Salina.....	Saline.....	1,227	24	1908	27.4
Sedan.....	Chautauqua.....	834	23	1908	34.9
Topeka.....	Shawnee.....	992	22	1908	33.8
Toronto.....	Woodson.....	1,040	11	1908	38.1
Tribune.....	Greeley.....	3,650	.....	1900	16.1
Ulysses.....	Grant.....	3,027	11	1908	16.6
Valley Falls.....	Jefferson.....	913	9	1908	31.1
Viroqua.....	Morton.....	3,215	12	1904	17.6
Wakeeney (near).....	Trego.....	2,456	7	1907	26.1
Wallace.....	Wallace.....	3,303	39	1908	16.9
Walnut.....	Crawford.....	940	6	1908	44.0
Wamego.....	Pottawatomie.....	1,002	14	1908	33.9
Wichita.....	Sedgwick.....	1,377	21	1908	30.6
Winfield.....	Cowley.....	1,124	11	1908	33.5
Yates Center.....	Woodson.....	1,068	27	1908	35.2

MONTANA.

Adel.....	Cascade.....	5,200	9	1907	17.9
Agricultural College.....	Gallatin.....	4,700	11	1908	17.2
Anaconda.....	Deer Lodge.....	5,300	7	1908	12.9
Augusta.....	Lewis and Clark.....	4,071	10	1908	15.8
Billings.....	Yellow Stone.....	3,115	9	1908	14.9
Boulder.....	Jefferson.....	4,904	12	1905	9.6
Bozeman.....	Gallatin.....	4,700	5	1897	17.5
Busby.....	Rosebud.....	.....	6	1908	14.8
Butte.....	Silver Bow.....	5,716	15	1908	13.1
Canyon Ferry.....	Lewis and Clark.....	3,644	10	1908	12.1
Chinook.....	Chouteau.....	2,502	9	1906	13.1
Chouteau.....	Teton.....	.....	6	1897	15.5
Columbia Falls.....	Flathead.....	3,098	3	1908	22.2
Crow Agency.....	Rosebud.....	3,041	26	1908	14.5
Culbertson.....	Valley.....	1,927	6	1906	13.5
Dayton.....	Flathead.....	.....	5	1908	15.3
Dearborn Canyon.....	Lewis and Clark.....	4,590	6	1898	15.6
Dillon.....	Beaverhead.....	5,147	9	1908	18.3

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

MONTANA—Continued.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Fort Benton.....	Chouteau.....	2,630	29	1908	13.2
Fort Keogh.....	Custer.....	2,350	22	1899	12.1
Fort Logan.....	Meagher.....	6,000	15	1902	12.3
Fort Shaw.....	Cascade.....	3,500	22	1908	10.4
Glasgow.....	Valley.....	.....	7	1900	12.0
Glendive.....	Dawson.....	2,069	19	1907	15.4
Great Falls.....	Cascade.....	3,350	18	1908	14.3
Hamilton.....	Ravalli.....	3,575	6	1908	11.2
Havre.....	Chouteau.....	2,505	29	1908	13.7
Helena.....	Lewis and Clark.....	4,110	29	1908	12.8
Hogan.....	do.....	4,590	6	1897	15.6
Kalispell.....	Flathead.....	2,965	10	1908	16.9
Kipp.....	Teton.....	4,472	6	1899	20.2
Lewistown.....	Fergus.....	4,010	11	1908	19.4
Livingston.....	Park.....	4,488	12	1908	14.0
Martinsdale.....	Meagher.....	4,800	11	1901	16.2
Marysville.....	Lewis and Clark.....	5,370	13	1906	18.6
Miles City.....	Custer.....	2,371	17	1908	13.2
Missoula.....	Missoula.....	3,225	28	1907	15.6
Ovando.....	Powell.....	4,207	8	1907	18.2
Philipsburg.....	Granite.....	5,273	5	1908	15.0
Plains.....	Sanders.....	2,473	10	1908	13.0
Poplar.....	Valley.....	2,020	24	1908	13.3
Red Lodge.....	Carbon.....	5,548	8	1908	21.1
Renova.....	Jefferson.....	4,383	10	1908	11.1
Springbrook.....	Dawson.....	.....	7	1908	19.2
St. Pauls.....	Chouteau.....	4,150	9	1904	15.1
St. Peter.....	Cascade.....	4,500	5	1905	18.7
Troy.....	Lincoln.....	1,881	14	1908	21.9
Twinbridge.....	Madison.....	4,650	4	1905	24.1
Two Dot.....	Meagher.....	4,800	12	1902	16.0
Utica.....	Fergus.....	5,000	15	1908	15.3
Virginia City.....	Madison.....	5,880	18	1897	15.1
Yale.....	Fergus.....	3,990	11	1905	12.2

NEBRASKA.

Agate.....	Sioux.....	.....	7	1906	15.7
Agee.....	Holt.....	.....	12	1903	23.9
Albion.....	Boone.....	1,747	11	1906	26.6
Alliance.....	Boxbutte.....	3,968	11	1906	16.4
Alma.....	Harlan.....	1,939	12	1909	24.0
Anoka.....	Boyd.....	.....	3	1909	26.9
Ansley.....	Custer.....	2,307	15	1904	22.5
Arapahoe.....	Furnas.....	2,173	7	1901	20.4
Arberville.....	York.....	.....	11	1902	27.4
Arcadia.....	Valley.....	2,186	10	1909	26.2
Ashland.....	Saunders.....	1,120	26	1909	30.3
Ashton.....	Sherman.....	2,061	15	1908	23.8
Auburn.....	Nemaha.....	1,051	17	1909	35.8
Aurora.....	Hamilton.....	1,792	13	1908	28.8
Bartley.....	Redwillow.....	2,325	6	1904	19.6
Bassett.....	Rock.....	2,323	6	1896	20.1
Beatrice.....	Gage.....	1,247	18	1909	30.2
Beaver City.....	Furnas.....	2,147	18	1909	21.9
Bellevue.....	Sarpy.....	1,210	27	1909	29.9
Benkelman.....	Dundy.....	2,968	9	1903	19.3
Blair.....	Washington.....	1,122	14	1909	32.2
Bluehill.....	Webster.....	1,967	14	1908	27.9
Bradshaw.....	York.....	1,715	11	1909	37.5
Bridgeport.....	Morrill.....	3,800	13	1909	16.1
Brokenbow.....	Custer.....	2,477	14	1909	25.2
Burchard.....	Pawnee.....	1,377	14	1908	32.9
Burwell.....	Garfield.....	2,180	17	1907	23.1
Callaway.....	Custer.....	2,555	12	1906	22.7
Cambridge.....	Furnas.....	2,258	2	1900	20.5
Central City.....	Merrick.....	1,708	11	1900	23.9
Columbus.....	Platte.....	1,441	16	1909	27.0
Creighton.....	Knox.....	1,600	11	1899	24.5
Crete.....	Saline.....	1,368	26	1909	29.2
Culbertson.....	Hitchcock.....	2,505	21	1908	19.7
Curtis.....	Frontier.....	2,553	10	1905	23.5

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

NEBRASKA—Continued.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
David City.....	Butler.....	1,607	20	1902	30.1
Dawson.....	Richardson.....	945	16	1909	34.0
Duff.....	Rock.....	.....	10	1908	25.5
Edgar.....	Clay.....	1,722	15	1909	29.2
Ericson.....	Wheeler.....	2,029	14	1904	22.4
Ewing.....	Holt.....	1,888	17	1909	23.4
Fairbury.....	Jefferson.....	1,316	34	1909	30.4
Fairmont.....	Fillmore.....	1,641	16	1909	29.6
Franklin.....	Franklin.....	1,817	18	1909	23.8
Fremont.....	Dodge.....	1,203	29	1909	30.5
Fort Robinson.....	Dawes.....	3,764	25	1909	16.9
Fullerton.....	Nance.....	1,629	7	1909	31.2
Geneva.....	Fillmore.....	1,633	19	1909	30.1
Genoa.....	Nance.....	1,584	34	1909	27.9
Gering.....	Scottsbluff.....	3,902	18	1908	15.4
Gosper.....	Gosper.....	7	7	1909	22.3
Gothenburg.....	Dawson.....	2,557	15	1909	23.5
Grand Island.....	Hall.....	1,861	18	1909	29.7
Greeley.....	Greeley.....	2,021	14	1909	23.6
Guidedock.....	Webster.....	1,546	9	1909	30.0
Haigler.....	Dundy.....	3,256	11	1902	17.8
Halsey.....	Thomas.....	2,695	7	1909	23.4
Hartington.....	Cedar.....	1,309	18	1909	29.0
Harvard.....	Clay.....	1,799	20	1909	27.3
Hastings.....	Adams.....	1,932	19	1909	27.7
Hayes Center.....	Hayes.....	.....	16	1909	22.8
Hay Springs.....	Sheridan.....	3,821	22	1909	20.1
Hebron.....	Thayer.....	1,458	24	1909	29.6
Holbrook.....	Furnas.....	.....	5	1906	25.8
Holdrege.....	Phelps.....	2,324	17	1909	25.9
Hooper.....	Dodge.....	1,228	12	1909	32.9
Imperial.....	Chase.....	3,278	19	1909	20.9
Kearney.....	Buffalo.....	2,147	19	1909	26.9
Kennedy.....	Cherry.....	.....	16	1906	23.0
Kimball.....	Kimball.....	4,697	20	1909	15.7
Kirkwood.....	Rock.....	.....	14	1909	25.2
Lexington.....	Dawson.....	2,385	20	1909	23.0
Lincoln.....	Lancaster.....	1,189	30	1909	27.5
Lodgepole.....	Cheyenne.....	3,820	8	1903	14.1
Loup.....	Sherman.....	2,067	15	1909	28.6
Lynch.....	Boyd.....	.....	14	1908	23.7
McCook.....	Redwillow.....	2,506	13	1907	20.8
McCool Junction.....	York.....	1,575	12	1909	30.9
Madison.....	Madison.....	1,585	15	1908	27.3
Madrid.....	Perkins.....	3,294	9	1901	14.4
Marquette.....	Hamilton.....	1,830	30	1909	27.0
Mason City.....	Custer.....	2,257	9	1909	27.5
Minden.....	Kearney.....	2,162	32	1909	31.3
Monroe.....	Platte.....	1,525	12	1909	28.4
Nebraska City.....	Otoe.....	961	31	1908	31.5
Nesbit.....	McPherson.....	.....	7	1901	17.9
Norfolk.....	Madison.....	1,532	26	1909	28.3
North Loup.....	Valley.....	1,961	21	1909	24.7
North Platte.....	Lincoln.....	2,821	35	1909	18.9
Oakdale.....	Antelope.....	1,722	22	1909	25.2
Odell.....	Gage.....	1,278	15	1909	33.0
Omaha.....	Douglas.....	1,103	39	1909	30.7
Ord.....	Valley.....	2,062	15	1909	24.8
O'Neill.....	Holt.....	1,975	11	1901	22.2
Ough.....	Dundy.....	.....	6	1896	15.7
Palmer.....	Merrick.....	1,796	18	1904	25.4
Palmyra.....	Otoe.....	1,142	14	1908	30.2
Pawnee City.....	Pawnee.....	1,175	14	1909	33.1
Plattsmouth.....	Cass.....	968	31	1904	31.6
Plymouth.....	Jefferson.....	1,419	5	1909	31.3
Purdum.....	Blaine.....	.....	9	1909	23.2
Ravenna.....	Buffalo.....	2,028	32	1909	25.7
Redcloud.....	Webster.....	1,687	17	1909	25.6
Republican.....	Harlan.....	1,939	6	1900	21.8
Rulo.....	Richardson.....	842	5	1900	34.7
St. Liberty.....	Howard.....	1,887	15	1909	29.3
St. Paul.....	do.....	1,813	15	1909	28.5
Santee.....	Knox.....	.....	21	1909	25.0
Schuyler.....	Colfax.....	1,357	16	1909	28.8

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

NEBRASKA—Continued.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Scottsbluff.....	Scottsbluff.....	4,662	3	1909	16.5
Seneca.....	Thomas.....	2,971	7	1900	14.8
Seward.....	Seward.....	1,435	19	1909	31.2
Sidney.....	Cheyenne.....	4,090	^a 17	1909	15.0
Springview.....	Keyapaha.....	.....	16	1909	21.4
Stanton.....	Stanton.....	1,472	18	1909	27.5
Stratton.....	Hitchcock.....	2,804	12	1907	19.7
Superior.....	Nuckolls.....	1,570	24	1908	27.2
Syracuse.....	Otoe.....	1,059	32	1909	30.8
Tekamah.....	Burt.....	1,060	19	1909	32.3
Tablerock.....	Pawnee.....	1,023	21	1909	31.5
Tecumseh.....	Johnson.....	1,114	31	1909	32.1
Turlington.....	Otoe.....	1,224	17	1909	30.4
University Farm.....	Lancaster.....	.....	24	1909	28.9
Valentine.....	Cherry.....	2,859	21	1909	22.5
Wahoo.....	Saunders.....	1,187	7	1909	35.3
Wakefield.....	Dixon.....	1,387	15	1909	28.9
Wauneta.....	Chase.....	.....	11	1909	21.5
Weepingwater.....	Cass.....	1,080	32	1909	30.5
Westpoint.....	Cuming.....	1,313	23	1909	29.6
Whitman.....	Grant.....	3,588	11	1901	13.3
Wilber.....	Saline.....	1,325	15	1909	32.8
Wilsonville.....	Furnas.....	2,298	7	1901	21.6
Winnebago.....	Thurston.....	.....	5	1905	30.0
Wisner.....	Cuming.....	1,380	14	1909	32.5
Wymore.....	Gage.....	1,222	6	1903	30.1
York.....	York.....	1,633	20	1909	29.1

NEVADA.

Austin.....	Lander.....	6,594	15	1903	11.6
Battle Mountain.....	do.....	4,843	35	1905	7.1
Belmont.....	Nye.....	8,132	13	1904	10.5
Beowawe.....	Eureka.....	4,695	32	1902	6.4
Camp Halleck.....	Elko.....	5,671	14	1886	15.0
Camp McDermitt.....	Humboldt.....	4,700	21	1888	13.2
Candelaria.....	Esmeralda.....	5,783	15	1904	5.0
Carlin.....	Elko.....	4,897	30	1900	6.5
Carson City.....	Ormsby.....	4,660	27	1906	12.3
Cedar Pass.....	Elko.....	.....	7	1877	12.5
Cranes Ranch.....	do.....	5,350	17	1904	10.0
Elko.....	do.....	5,063	31	1901	6.9
Ely.....	White Pine.....	6,000	18	1908	12.3
Fernley.....	Lyons.....	4,200	2	1908	5.6
Golconda.....	Humboldt.....	4,697	30	1908	6.0
Halleck.....	Elko.....	5,631	16	1908	9.4
Harthorne.....	Esmeralda.....	4,569	17	1904	4.4
Hot Springs.....	Churchill.....	4,072	20	1889	3.5
Humboldt.....	Humboldt.....	4,236	35	1906	5.5
Iron Point.....	do.....	4,375	8	1877	7.4
Lewers Ranch.....	Washoe.....	5,500	21	1908	26.1
Lovelock.....	Humboldt.....	3,977	10	1901	2.4
Martins Ranch.....	Douglas.....	4,830	6	1904	12.0
Mill City.....	Humboldt.....	4,225	17	1905	5.2
Otego.....	Elko.....	.....	8	1886	8.0
Palisade.....	Eureka.....	4,821	21	1902	8.0
Palmetto.....	Esmeralda.....	6,780	18	1907	14.6
Pioche.....	Lincoln.....	6,110	9	1890	11.2
Potts.....	Nye.....	6,990	16	1908	7.5
Reno.....	Washoe.....	4,532	38	1908	10.4
Tecoma.....	Elko.....	4,812	31	1908	6.5
Tonopah.....	Nye.....	6,690	2	1908	10.2
Toano.....	Elko.....	5,975	33	1902	8.3
Tybo.....	Nye.....	6,500	10	1901	9.5
Verdi.....	Washoe.....	4,895	12	1901	15.8
Wadsworth.....	Washoe.....	4,077	32	1903	4.3
Wells.....	Elko.....	5,623	30	1901	9.1
Winnemucca.....	Humboldt.....	4,432	30	1908	8.4

^a Except the months of January and February.

58 DRY FARMING IN RELATION TO RAINFALL AND EVAPORATION.

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

NEW MEXICO.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Agricultural College.....	Dona Ana.....	3,863	22	1908	9.1
Alamogordo.....	Otero.....	4,338	8	1908	10.9
Albert.....	Union.....	4,700	19	1908	16.3
Albuquerque.....	Bernalillo.....	5,200	33	1908	7.8
Alma.....	Socorro.....	5,500	11	1905	14.1
Aztec.....	San Juan.....	5,590	6	1900	8.4
Bell Ranch.....	San Miguel.....	4,500	10	1908	15.8
Bernalillo.....	Sandoval.....	5,200	5	1899	8.2
Bloomfield.....	San Juan.....	5,500	12	1908	8.5
Bluewater.....	Valencia.....	6,200	7	1902	9.5
Cambray.....	Luna.....	4,215	9	1908	8.4
Camp Burgwin.....	Taos.....	7,900	6	1860	8.6
Carlsbad.....	Eddy.....	3,120	14	1908	14.6
Chama.....	Rio Arriba.....	7,848	12	1908	23.3
Cliff.....	Grant.....	4,470	11	1908	14.9
Cloudcroft.....	Otero.....	8,650	7	1908	25.1
Deming.....	Luna.....	4,333	26	1908	8.9
Dorsey.....	Colfax.....	6,000	6	1908	15.4
Eagle Rock Ranch.....	Union.....	6,000	10	1907	18.3
East Las Vegas.....	San Miguel.....	6,450	14	1901	19.4
Eddy.....	Eddy.....	3,122	5	1898	12.8
Elk.....	Chaves.....		11	1908	21.6
Engle.....	Sierra.....	4,750	7	1901	10.4
Espanola.....	Rio Arriba.....	5,590	12	1908	9.5
Folsom.....	Union.....	6,000	5	1902	18.3
Fort Bayard.....	Grant.....	6,152	34	1908	14.6
Fort Craig.....	Socorro.....	4,619	24	1884	10.8
Fort Fillmore.....	Dona Ana.....	3,937	10	1861	8.0
Fort Selden.....	do.....	3,937	16	1890	8.6
Fort Stanton.....	Lincoln.....	6,231	30	1908	17.2
Fort Thorn.....	Dona Ana.....	4,500	6	1858	14.5
Fort Union.....	Mora.....	6,835	49	1908	19.4
Fort Wingate.....	McKinley.....	6,997	46	1908	14.3
Fruitland.....	San Juan.....	4,800	15	1908	5.1
Gage.....	Luna.....	4,486	10	1908	8.5
Galisteo.....	Santa Fe.....	6,074	8	1901	13.3
Gallinas Springs.....	San Miguel.....	5,272	18	1902	15.6
Gila.....	Grant.....	4,040	5	1899	14.6
Hillsboro.....	Sierra.....	5,224	14	1908	13.1
Las Cruces.....	Dona Ana.....	3,500	9	1897	8.8
Las Vegas.....	San Miguel.....	6,384	22	1908	19.3
Lava.....	Socorro.....	4,703	6	1890	10.8
Lordsburg.....	Grant.....	4,245	27	1908	8.5
Los Lunas.....	Valencia.....	4,900	18	1908	10.3
Lower Penasco.....	Chaves.....	5,250	5	1900	17.6
Lyons Ranch.....	Grant.....	4,040	6	1900	14.6
Mesilla Park.....	Dona Ana.....	3,868	21	1907	8.9
Mountainair.....	Torrance.....	6,547	7	1908	16.9
Puerto de Luna.....	Guadalupe.....	5,350	6	1898	17.2
Raton.....	Colfax.....	6,622	10	1904	12.7
Rincon.....	Dona Ana.....	6,031	11	1908	7.6
Roswell.....	Chaves.....	3,578	14	1908	15.8
San Marcial.....	Socorro.....	4,554	3	1899	8.5
San Rafael.....	Valencia.....	6,509	12	1908	11.9
Santa Fe.....	Santa Fe.....	7,013	36	1908	14.5
Shattucks.....	Eddy.....	6,000	3	1899	22.4
Socorro.....	Socorro.....	4,600	17	1908	10.7
Springer.....	Colfax.....	5,857	17	1908	13.9
Strauss.....	Dona Ana.....	4,080	8	1907	10.3
Taos.....	Taos.....	6,983	14	1908	12.7
White Oaks.....	Lincoln.....	6,470	4	1900	17.3
Winsors.....	San Miguel.....	8,200	13	1908	22.4

NORTH DAKOTA.

Amenia.....	Cass.....	954	12	1908	21.2
Ashley.....	McIntosh.....	2,007	13	1905	18.3
Berlin.....	Lamoure.....	1,470	14	1905	20.6
Berthold Agency.....	McLean.....	2,082	13	1908	16.0
Bismarck.....	Burleigh.....	1,674	34	1908	17.6
Bottineau.....	Bottineau.....	1,638	14	1908	15.7
Buxton.....	Traill.....	930	5	1902	16.5
Cando.....	Towner.....	1,488	7	1907	17.1

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

NORTH DAKOTA—Continued.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Churchs Ferry.....	Ramsey.....	1,458	10	1904	23.0
Coal Harbor.....	McLean.....	1,901	13	1908	16.9
Devils Lake.....	Ramsey.....	1,482	4	1908	20.2
Dickinson.....	Stark.....	2,543	17	1908	15.0
Donnybrook.....	Ward.....	1,760	9	1907	12.3
Dunseith.....	Rolette.....	.....	12	1908	14.9
Edgeley.....	Lamoure.....	1,468	8	1908	19.5
Ellendale.....	Dickey.....	1,449	12	1904	16.3
Fargo.....	Cass.....	903	15	1906	19.4
Forman.....	Sargent.....	1,249	12	1905	19.4
Fort Yates.....	Morton.....	1,670	26	1907	16.3
Fullerton.....	Dickey.....	1,439	11	1908	22.1
Gallatin.....	Griggs.....	.....	9	1902	17.7
Glenullin.....	Morton.....	2,070	10	1905	13.3
Grafton.....	Walsh.....	827	16	1906	16.8
Hamilton.....	Pembina.....	824	9	1905	22.0
Jamestown.....	Stutsman.....	1,390	22	1908	20.0
Larimore.....	Grand Forks.....	1,134	11	1905	17.2
McKinney.....	Ward.....	1,640	15	1908	15.4
Mayville.....	Trails.....	975	13	1908	21.1
Medora.....	Billings.....	2,225	13	1908	13.2
Melville.....	Foster.....	1,590	12	1908	16.0
Milton.....	Cavalier.....	1,586	10	1902	16.8
Minot.....	Ward.....	1,557	11	1908	16.5
Minto.....	Walsh.....	820	16	1908	18.8
Minnewaukon.....	Benson.....	1,459	7	1904	17.6
Moorhead, Minn.....	Clay.....	940	29	1908	24.9
Napoleon.....	Logan.....	1,955	18	1908	19.1
New England.....	Hettinger.....	2,400	13	1908	12.7
Oakdale.....	Dunn.....	.....	12	1906	16.1
Pembina.....	Pembina.....	789	11	1908	19.8
Portal.....	Ward.....	1,954	13	1906	14.2
Power.....	Richland.....	1,020	17	1908	20.6
Steele.....	Kidder.....	1,857	13	1907	15.7
University.....	Grand Forks.....	830	17	1908	20.5
Wahpeton.....	Richland.....	962	13	1904	27.3
Williston.....	Williams.....	1,875	29	1908	15.1
Willow City.....	Bottineau.....	1,471	15	1907	14.5
Woodbridge.....	Cavalier.....	.....	10	1902	22.7

OKLAHOMA.

Arapaho.....	Custer.....	1,575	15	1908	29.0
Ardmore.....	Carter.....	872	4	1908	38.9
Beaver.....	Beaver.....	2,500	9	1908	19.7
Blackburn.....	Pawnee.....	800	8	1908	46.5
Burnett.....	Pottawatomie.....	1,200	11	1902	33.0
Chandler.....	Lincoln.....	865	7	1908	38.5
Chickasha.....	Grady.....	1,091	9	1908	31.9
Cloud Chief.....	Washita.....	1,400	7	1908	32.0
Dacoma.....	Woods.....	1,337	11	1908	28.7
Durant.....	Bryan.....	643	7	1908	43.3
Enid.....	Garfield.....	1,269	10	1908	32.5
Fairland.....	Ottawa.....	839	9	1908	42.2
Fort Reno.....	Canadian.....	1,400	21	1908	30.4
Fort Sill.....	Comanche.....	1,200	37	1908	30.9
Fort Smith (Ark.).....	Sebastian.....	457	28	1908	44.7
Gage.....	Ellis.....	2,136	6	1908	28.2
Guthrie.....	Logan.....	1,000	16	1908	33.2
Harrington.....	Roger Mills.....	.....	5	1908	30.7
Hartshorne.....	Pittsburg.....	700	10	1908	44.3
Healdton.....	Carter.....	900	18	1908	37.1
Hennessey.....	Kingfisher.....	1,166	12	1908	31.5
Hobart.....	Kiowa.....	1,396	6	1908	31.7
Holdenville.....	Hughes.....	900	8	1908	43.2
Hopeton.....	Woods.....	.....	2	1899	29.4
Jefferson.....	Grant.....	1,062	15	1908	30.4
Jenkins.....	Woods.....	1,337	8	1905	27.0
Kenton.....	Cimarron.....	4,000	8	1908	15.0
Kingfisher.....	Kingfisher.....	1,046	11	1908	35.8
Lehigh.....	Coal.....	593	8	1900	34.9
McAlester.....	Pittsburg.....	698	13	1908	46.0
McComb.....	Pottawatomie.....	1,200	17	1908	34.0

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TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

OKLAHOMA—Continued.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Mangum.....	Greer.....	1,585	17	1908	28.2
Marlow.....	Stephens.....	1,292	8	1908	37.1
Meeker.....	Lincoln.....	1,030	15	1908	34.6
Muskogee.....	Muskogee.....	614	10	1908	38.0
Newkirk.....	Kay.....	1,149	11	1908	36.4
Norman.....	Cleveland.....	1,180	14	1908	33.6
Oklahoma.....	Oklahoma.....	1,247	18	1908	32.8
Oklmulgee.....	Oklmulgee.....	752	7	1908	41.2
Pawhuska.....	Osage.....	918	10	1908	42.3
Perry.....	Noble.....	920	9	1908	36.1
Prudence.....	Major.....		6	1900	32.9
Ravia.....	Johnston.....	796	6	1908	42.1
Sac and Fox Agency.....	Lincoln.....	900	16	1908	34.5
Shawnee.....	Pottawatomie.....	1,041	7	1908	38.9
South McAlester.....	Choctaw Nation.....	698	13	1905	45.3
Stillwater.....	Payne.....	880	16	1908	35.2
Temple.....	Comanche.....	925	6	1908	34.5
Tulsa (1).....	Tulsa.....	700	20	1908	35.9
Tahlequah.....	Cherokee.....	790	9	1902	42.5
Taloga.....	Dewey.....		4	1903	24.4
Vinita.....	Craig.....	698	6	1908	45.3
Vittum.....	Logan.....	940	8	1900	30.0
Wagoner.....	Wagoner.....	588	12	1908	39.0
Waukomis.....	Garfield.....	1,258	12	1908	31.6
Weatherford.....	Custer.....	1,639	8	1908	28.9
Webbers Falls.....	Muskogee.....	479	11	1908	40.7
Whiteagle.....	Kay.....	945	6	1908	41.9
Winnview.....	Blaine.....		7	1899	28.1
Woodward.....	Woodward.....	2,300	6	1901	18.2

OREGON.

Albany.....	Linn.....	214	32	1908	44.7
Alpha.....	Lane.....	250	7	1906	87.1
Arlington.....	Gilliam.....	855	14	1904	9.1
Ashland.....	Jackson.....	1,940	21	1908	20.1
Astoria.....	Clatsop.....	11	49	1908	74.5
Aurora.....	Marion.....	144	10	1901	46.7
Baker City.....	Baker.....	3,464	20	1908	12.8
Bandon.....	Coos.....	55	27	1899	68.6
Bay City.....	Tillamook.....	225	14	1908	108.3
Bend.....	Crook.....		6	1907	13.7
Beulah.....	Malheur.....	3,269	14	1905	10.7
Blalock.....	Gilliam.....	237	10	1908	10.4
Brownsville.....	Linn.....	346	11	1902	36.9
Buckhorn Farm.....	Josephine.....	1,300	10	1908	70.3
Bull Run.....	Clackamas.....	719	10	1907	76.3
Burns.....	Harney.....	4,157	19	1908	10.5
Cascade Locks.....	Hood River.....	100	30	1908	79.0
Comstock.....	Douglas.....	473	11	1902	36.8
Coquille River Light-House.....	Coos.....	13	10	1907	57.5
Corvallis.....	Benton.....	319	20	1908	41.8
Dayville.....	Grant.....	1,500	14	1908	12.5
Doraville.....	Columbia.....	600	7	1908	49.4
Drain.....	Douglas.....	300	6	1908	47.8
Ella.....	Morrow.....		11	1909	9.0
Eugene.....	Lane.....	449	18	1908	37.9
Fairview.....	Coos.....	142	11	1908	70.8
Falls City.....	Polk.....	355	11	1907	82.7
Forest Grove.....	Washington.....	220	17	1906	49.0
Gardiner.....	Douglas.....	72	20	1908	79.3
Glenora.....	Tillamook.....	575	17	1908	117.6
Gold Beach.....	Curry.....	40	6	1908	88.5
Government Camp.....	Clackamas.....	3,580	11	1906	89.3
Grants Pass.....	Josephine.....	956	20	1908	44.8
Happy Valley.....	Harney.....	4,200	10	1899	13.2
Hare.....	Curry.....	1,342	10	1901	99.7
Headworks.....	Clackamas.....	719	10	1908	82.2
Heppner.....	Morrow.....	1,950	20	1908	15.5
Hood River.....	Hood River.....	243	24	1907	36.4
Huntington.....	Baker.....	2,110	7	1907	12.9
Irvington.....	Multnomah.....	75	12	1899	32.5
Jacksonville.....	Jackson.....	1,640	20	1908	27.2

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

OREGON—Continued.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Joseph.....	Wallowa.....	4,400	19	1908	18.2
Junction City.....	Lane.....	353	11	1902	33.6
Klamath Falls.....	Klamath.....	4,250	14	1908	14.0
Lafayette.....	Yamhill.....	182	11	1902	42.9
La Grande.....	Union.....	2,784	21	1908	19.5
Lakeview.....	Lake.....	4,825	23	1907	16.9
Langlois.....	Curry.....	250	9	1899	101.8
Lone Rock.....	Gilliam.....	3,114	18	1905	14.6
McKenzie Bridge.....	Lane.....	1,400	8	1908	72.2
McMinnville.....	Yamhill.....	180	21	1908	47.8
Marshfield.....	Coos.....	12	6	1907	66.7
Merlin.....	Josephine.....	934	10	1901	34.9
Miramonte Farm.....	Clackamas.....	195	17	1908	43.5
Monmouth.....	Polk.....	221	11	1902	39.6
Monroe.....	Benton.....	350	11	1908	39.9
Mount Angel.....	Marion.....	485	23	1908	46.0
Nehalem.....	Tillamook.....	10	13	1907	111.9
Newberg.....	Yamhill.....	193	9	1902	47.9
New Bridge.....	Baker.....	1,900	9	1900	9.6
Newport.....	Lincoln.....	69	19	1908	56.3
Pendleton.....	Umatilla.....	1,272	19	1908	14.2
Placer.....	Josephine.....	—	4	1901	39.2
Pompeii.....	Clackamas.....	3,580	13	1908	85.4
Portland.....	Multnomah.....	57	37	1908	46.0
Prineville.....	Crook.....	3,000	11	1907	8.8
Riddle.....	Douglas.....	733	11	1902	29.8
Riverside.....	Malheur.....	—	5	1901	8.7
Roseburg.....	Douglas.....	523	32	1908	34.0
Salem.....	Marion.....	120	17	1908	40.5
Sheridan.....	Yamhill.....	207	11	1902	43.0
Silver Lake.....	Lake.....	4,700	12	1907	10.4
Silverton.....	Marion.....	255	11	1902	45.2
Siskiyou.....	Jackson.....	4,135	11	1902	29.2
Sparta.....	Baker.....	4,150	15	1906	23.9
Springfield.....	Lane.....	476	9	1900	39.1
Stafford.....	Clackamas.....	—	13	1908	32.4
The Dalles.....	Wasco.....	112	34	1908	14.2
Toledo.....	Lincoln.....	50	19	1908	79.4
Umatilla.....	Umatilla.....	340	22	1908	8.6
Vale.....	Malheur.....	2,450	17	1908	10.2
Vernonia.....	Columbia.....	1,238	11	1899	62.1
Wallowa.....	Wallowa.....	2,935	7	1909	17.2
Warm Springs.....	Crook.....	1,600	6	1907	11.5
West Fork.....	Douglas.....	1,046	11	1901	41.2
Weston.....	Umatilla.....	1,800	19	1908	24.5
Williams.....	Josephine.....	1,368	15	1906	33.5

SOUTH DAKOTA.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
Aberdeen.....	Brown.....	1,300	19	1908	26.9
Academy.....	Charles Mix.....	—	10	1908	22.5
Alexandria.....	Hanson.....	1,352	22	1908	24.6
Armour.....	Douglas.....	1,521	14	1908	24.6
Ashcroft.....	Harding.....	3,192	17	1908	14.0
Bowdle.....	Edmunds.....	1,995	14	1908	19.3
Brookings.....	Brookings.....	1,636	20	1908	20.0
Canton.....	Lincoln.....	1,248	12	1906	26.3
Centerville.....	Turner.....	1,229	12	1908	27.1
Chamberlain.....	Brule.....	1,363	12	1908	17.9
Chandler (Academy).....	Charles Mix.....	—	1	1899	19.8
Cherry Creek.....	Armstrong.....	—	13	1907	14.0
Clark.....	Clark.....	1,779	17	1908	22.6
De Smet.....	Kingsbury.....	1,726	16	1907	21.7
Ella Point.....	Union.....	1,127	8	1906	29.0
Farmingdale.....	Pennington.....	3,000	11	1905	13.9
Faulkton.....	Faulk.....	1,595	14	1908	19.5
Flandreau.....	Moody.....	1,565	19	1908	24.5
Forestburg.....	Sanborn.....	1,231	16	1907	21.2
Forest City.....	Potter.....	—	6	1899	15.7
Fort Meade.....	Meade.....	3,624	28	1907	19.8
Gann Valley.....	Buffalo.....	—	8	1905	20.7
Gary.....	Deuel.....	1,484	9	1900	22.6
Grand River School.....	Corson.....	—	2	1901	14.5

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

SOUTH DAKOTA—Continued.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Greenwood.....	Charles Mix.....	.....	15	1908	23.7
Harney.....	Pennington.....	5,000	9	1898	18.4
Hartman.....	Minnehaha.....	1,474	4	1901	20.9
Highmore.....	Hyde.....	1,890	16	1908	17.4
Hotch City.....	Lyman.....	.....	13	1905	14.5
Hot Springs.....	Fall River.....	3,447	4	1900	12.5
Howard.....	Miner.....	1,564	17	1908	21.8
Howell.....	Hand.....	.....	7	1908	18.2
Huron.....	Beadle.....	1,306	27	1908	21.1
Ipswich.....	Edmunds.....	1,530	11	1907	22.6
Kidder.....	Marshall.....	1,295	5	1908	22.4
Kimball.....	Brule.....	1,788	23	1908	19.3
La Delle.....	Spink.....	1,400	12	1908	26.2
Leola.....	McPherson.....	1,587	6	1905	19.7
Marion.....	Turner.....	1,447	8	1908	26.5
Melette.....	Spink.....	1,300	14	1908	20.3
Menno.....	Hutchinson.....	1,325	12	1908	24.4
Milbank.....	Grant.....	1,148	18	1908	22.4
Mitchell.....	Davison.....	1,812	15	1908	23.2
Mound City.....	Campbell.....	.....	1	1901	24.8
Nowlin.....	Stanley.....	.....	4	1898	9.7
Oelrichs.....	Fall River.....	3,339	18	1908	19.4
Parker.....	Turner.....	1,348	9	1900	22.9
Pierre.....	Hughes.....	1,572	17	1908	16.6
Pine Ridge.....	Shannon.....	.....	1	1901	13.1
Plankinton.....	Aurora.....	1,528	15	1908	21.1
Ramsey.....	McCook.....	1,474	8	1905	23.1
Rapid City.....	Pennington.....	3,251	21	1908	18.7
Redfield.....	Spink.....	1,295	11	1908	20.1
Rosebud.....	Meyer.....	2,600	15	1908	18.3
St. Lawrence.....	Hand.....	1,580	4	1901	18.7
Silver City.....	Pennington.....	5,000	9	1903	20.6
Sioux Falls.....	Minnehaha.....	1,400	18	1908	25.1
Sisseton Agency.....	Roberts.....	.....	5	1904	25.5
Spearfish.....	Lawrence.....	3,647	19	1908	22.6
Stephan.....	Hyde.....	1,840	15	1908	18.1
Tyndall.....	Bonhomme.....	1,418	14	1906	23.6
Vermillion.....	Clay.....	1,420	8	1908	29.7
Watertown.....	Codington.....	1,735	15	1908	22.6
Waubay.....	Day.....	1,813	3	1901	21.3
Wentworth.....	Lake.....	.....	16	1908	22.6
Wessington Springs.....	Jerauld.....	1,335	8	1899	20.2
White Swan.....	Charles Mix.....	.....	5	1898	20.9
Wolsey.....	Beadle.....	1,353	15	1907	20.1
Yankton.....	Yankton.....	1,234	35	1908	25.4

TEXAS.

Abilene.....	Taylor.....	1,738	24	1908	24.7
Albany.....	Shackelford.....	1,429	15	1908	27.2
Alvin.....	Brazoria.....	49	8	1905	52.1
Amarillo.....	Potter.....	3,676	17	1908	22.6
Arthur City.....	Lamar.....	590	15	1905	36.1
Austin.....	Travis.....	650	23	1908	34.4
Ballinger.....	Runnels.....	1,637	14	1908	25.0
Beaumont.....	Jefferson.....	29	12	1908	41.9
Beeville.....	Bee.....	225	13	1908	29.6
Big Springs.....	Howard.....	2,396	7	1908	20.4
Blanco.....	Blanco.....	1,350	12	1907	29.6
Boerne.....	Kendall.....	1,412	16	1907	29.8
Bonham.....	Fannin.....	566	6	1908	47.6
Booth.....	Fort Bend.....	81	8	1908	43.3
Bowie.....	Montague.....	1,113	9	1908	27.9
Brazoria.....	Brazoria.....	25	18	1908	47.5
Brenham.....	Washington.....	350	20	1908	41.5
Brighton.....	Nueces.....	12	13	1908	23.3
Brownsville.....	Cameron.....	38	20	1908	27.1
Brownwood.....	Brown.....	1,342	12	1903	27.5
Burnet.....	Burnet.....	1,295	15	1904	28.3
Childress.....	Childress.....	1,809	15	1907	21.4
Coleman.....	Coleman.....	1,710	15	1908	27.6
College Station.....	Brazos.....	360	19	1907	38.4
Colorado.....	Mitchell.....	2,066	18	1908	22.0

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

TEXAS—Continued.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Columbia.....	Brazoria.....	34	20	1908	43.8
Corpus Christi.....	Nueces.....	20	22	1908	27.2
Corsicana.....	Navarro.....	495	23	1908	37.9
Cuero.....	Dewitt.....	177	20	1908	34.1
Dallas.....	Dallas.....	466	10	1908	35.5
Danevang.....	Wharton.....	145	13	1908	45.9
Del Rio.....	Valverde.....	952	3	1908	26.8
Dialville.....	Cherokee.....	575	7	1904	41.6
Dublin.....	Erath.....	1,466	14	1908	29.2
Duval.....	Travis.....	820	20	1908	30.8
Eagle Pass.....	Maverick.....	800	20	1908	21.6
El Paso.....	El Paso.....	3,762	30	1908	9.8
Estelle.....	Dallas.....	614	11	1904	32.1
Forestburg.....	Montague.....	.....	6	1903	33.9
Fort Brown.....	Cameron.....	57	16	1905	20.6
Fort Clark.....	Kinney.....	1,050	22	1908	22.7
Fort Davis.....	Jeff Davis.....	5,000	10	1905	14.0
Fort McIntosh.....	Webb.....	5,460	22	1907	17.8
Fort Ringgold.....	Starr.....	230	20	1905	16.8
Fort Stockton.....	Pecos.....	3,050	26	1908	15.9
Fort Worth.....	Tarrant.....	670	13	1908	26.9
Fredericksburg.....	Gillespie.....	1,742	20	1908	28.4
Gainesville.....	Cooke.....	738	20	1908	37.3
Galveston.....	Galveston.....	69	38	1908	47.1
Grapevine.....	Tarrant.....	670	19	1908	36.3
Georgetown.....	Williamson.....	750	14	1908	35.5
Greenville.....	Hunt.....	550	9	1908	42.1
Hale Center.....	Hale.....	3,000	12	1905	21.2
Hallettsville.....	Lavaca.....	235	18	1908	33.2
Haskell.....	Haskell.....	1,553	14	1905	21.6
Hearne.....	Robertson.....	305	17	1905	24.1
Henrietta.....	Clay.....	915	11	1905	26.9
Hewitt.....	McLennan.....	664	15	1908	36.7
Hondo City.....	Medina.....	901	13	1908	28.1
Houston.....	Harris.....	53	20	1908	48.4
Huntsville.....	Walker.....	400	21	1908	45.2
Kaufman.....	Kaufman.....	448	7	1908	44.4
Kent.....	El Paso.....	.....	12	1903	12.2
Kerrville.....	Kerr.....	1,650	14	1908	29.8
Kopperl.....	Bosque.....	576	18	1908	33.5
Lampasas.....	Lampasas.....	1,026	18	1908	29.5
La Para.....	Live Oak.....	.....	.....	1903	21.9
Llano.....	Llano.....	1,040	17	1907	22.4
Longview.....	Gregg.....	336	20	1908	47.1
Luling.....	Caldwell.....	418	20	1908	29.2
McKinney.....	Collin.....	612	6	1904	32.8
Menardville.....	Menard.....	1,900	16	1904	21.9
Mount Blanco.....	Crosby.....	2,750	23	1908	21.3
Nacogdoches.....	Nacogdoches.....	271	10	1908	51.2
New Braunfels.....	Comal.....	720	18	1906	29.4
Palestine.....	Anderson.....	510	27	1908	43.0
Panter.....	Hood.....	1,000	17	1905	32.5
Paris.....	Lamar.....	592	20	1908	34.6
Port Lavaca.....	Calhoun.....	20	8	1908	41.1
Rhineland.....	Knox.....	.....	11	1906	23.4
Rock Island.....	Colorado.....	254	8	1906	41.3
Runge.....	Karnes.....	308	14	1908	30.2
San Antonio (1).....	Bexar.....	701	24	1908	26.8
San Marcos.....	Hays.....	588	16	1908	31.3
San Saba.....	San Saba.....	1,712	5	1908	23.4
Santa Gertrudes.....	Nueces.....	.....	7	1908	24.1
Sherman.....	Grayson.....	728	15	1907	34.2
Sonora.....	Sutton.....	2,200	6	1908	23.6
Sugarland.....	Fort Bend.....	79	11	1908	44.2
Sulphur Springs.....	Hopkins.....	530	16	1907	39.0
Taylor.....	Williamson.....	583	8	1908	35.5
Temple (1).....	Bell.....	630	15	1908	34.9
Texarkana.....	Bowie.....	295	10	1905	37.2
Tulia.....	Swisher.....	3,501	11	1908	27.0
Tyler.....	Smith.....	531	17	1905	38.4
Victoria.....	Victoria.....	187	17	1908	36.5
Waco.....	McLennan.....	424	20	1908	36.9
Waxahachie.....	Illis.....	556	13	1908	35.4
Weatherford.....	Parler.....	864	20	1908	31.2
Wichita Falls.....	Wichita.....	958	14	1904	28.8

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

UTAH.					
Station.	County.	Eleva- tion.	Number of years recorded.	Record ended—	Normal precip- itation.
		<i>Feet.</i>			<i>Inches.</i>
Alpine.....	Utah.....	4,900	9	1905	16.4
Aneth.....	San Juan.....	4,800	5	1905	6.7
Annabelle (near).....	Sevier.....	5,250	4	1909	13.7
Beaver.....	Beaver.....	6,000	6	1909	13.6
Black Rock.....	Millard.....	4,872	4	1904	8.4
Blue Creek.....	Boxelder.....	4,387	26	1903	8.4
Brigham.....	do.....	4,379	5	1899	18.8
Camp Douglas.....	Salt Lake.....	4,800	22	1890	17.4
Castle Dale.....	Emery.....	5,500	10	1909	7.4
Castle Rock.....	Summit.....	6,244	6	1909	16.1
Coalville.....	do.....	5,630	8	1882	13.7
Corinne.....	Boxelder.....	4,240	39	1909	12.3
Deseret.....	Millard.....	4,541	15	1909	7.9
Emery.....	Emery.....	6,260	8	1908	4.1
Escalante.....	Garfield.....	5,700	9	1909	11.2
Farmington.....	Davis.....	4,267	9	1903	21.0
Fillmore.....	Millard.....	5,100	19	1909	14.1
Fort Duchesne.....	Uinta.....	5,000	21	1909	7.1
Frisco.....	Beaver.....	7,318	15	1909	8.1
Garrison.....	Millard.....	.....	6	1909	6.6
Giles.....	Wayne.....	4,000	10	1905	5.1
Government Creek.....	Tooele.....	5,277	9	1909	14.0
Grantville (near).....	do.....	.....	4	1909	13.6
Grayson.....	San Juan.....	5,750	5	1909	20.9
Green River.....	Emery.....	4,080	11	1908	4.7
Grover (near).....	Wayne.....	5,800	8	1903	6.8
Heber.....	Wasatch.....	5,606	16	1909	17.0
Henefer.....	Summit.....	5,301	10	1909	18.2
Hite.....	Garfield.....	3,000	10	1909	6.7
Huntsville.....	Weber.....	5,100	14	1909	20.4
Kelton.....	Boxelder.....	4,230	31	1909	6.2
Levan.....	Juab.....	5,010	19	1909	16.0
Loa.....	Wayne.....	7,000	17	1909	6.6
Logan.....	Cache.....	4,507	18	1909	15.5
Manti.....	Sanpete.....	5,575	15	1909	12.0
Marion.....	Summit.....	6,750	5	1909	21.6
Marysvale (near).....	Piute.....	6,180	10	1909	11.6
Meadowville.....	Rich.....	6,200	10	1907	14.7
Millville.....	Cache.....	4,848	14	1909	18.0
Minersville.....	Beaver.....	5,070	10	1907	9.7
Moab.....	Grand.....	4,000	20	1909	8.3
Modena.....	Iroh.....	5,479	9	1909	10.2
Morgan.....	Morgan.....	5,080	6	1909	20.2
Mount Nebo.....	Utah.....	4,650	8	1909	10.0
Mount Pleasant.....	Sanpete.....	5,859	12	1904	12.4
Nephi.....	Juab.....	6,059	6	1909	17.2
Nephi (near).....	do.....	.....	.....	1909	18.1
Ogden (1).....	Weber.....	4,310	8	1909	21.0
Ogden (2).....	do.....	4,310	38	1908	13.9
Pahreah.....	Kane.....	4,000	5	1899	9.6
Park City.....	Summit.....	7,800	5	1901	19.0
Parowan.....	Iron.....	5,970	18	1909	12.4
Payson.....	Utah.....	4,637	6	1909	20.1
Pinto.....	Washington.....	5,907	12	1909	15.1
Promontory.....	Boxelder.....	.....	21	1890	7.6
Provo.....	Utah.....	4,532	17	1909	13.4
Ranch.....	Kane.....	6,700	8	1909	23.1
Randolph.....	Rich.....	6,442	6	1909	11.2
Richfield.....	Sevier.....	5,350	19	1909	7.4
St. George.....	Washington.....	2,880	22	1908	6.8
Salt Lake City.....	Salt Lake.....	4,366	35	1909	16.0
Scipio.....	Millard.....	5,260	14	1909	14.7
Snowville.....	Boxelder.....	4,360	18	1908	10.9
Soldiers Summit.....	Utah.....	7,474	12	1904	14.1
Terrace.....	Boxelder.....	4,550	34	1903	4.7
Thistle.....	Utah.....	5,075	16	1908	12.9
Tooele.....	Tooele.....	4,900	13	1909	15.7
Tropic.....	Garfield.....	7,000	12	1909	10.2
Vernal (near).....	Uinta.....	5,050	14	1909	9.5
Woodruff.....	Rich.....	6,500	10	1907	8.5

TABLE VI.—*Normal precipitation of stations in the western United States grouped according to States—Continued.*

WASHINGTON.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Aberdeen.....	Chehalis.....	162	17	1907	86.9
Anacortes.....	Skagit.....	60	15	1908	28.0
Ashford.....	Pierce.....	1,775	12	1906	71.8
Bellingham.....	Whatcom.....	60	14	1908	31.5
Blaine.....	do.....	53	12	1908	42.8
Bremerton.....	Kitsap.....		10	1908	43.9
Brinnon.....	Jefferson.....	80	8	1906	75.5
Cedonia.....	Stevens.....	3,000	12	1905	20.4
Centralia.....	Lewis.....	212	16	1908	46.6
Cheney.....	Spokane.....	2,351	10	1908	17.2
Clearwater.....	Jefferson.....	135	12	1907	127.6
Cle Elum.....	Kittitas.....	1,930	10	1908	26.7
Colfax.....	Whitman.....	2,300	20	1908	23.0
Colville.....	Stevens.....	1,635	9	1908	17.8
Conconully.....	Okanogan.....	2,300	9	1908	16.7
Coupeville.....	Island.....	150	13	1908	21.7
Crescent.....	Lincoln.....	2,250	8	1907	17.8
Cusick.....	Stevens.....	2,050	7	1905	23.9
Dayton.....	Columbia.....	1,700	23	1908	23.2
East Sound.....	San Juan.....	500	14	1908	31.8
Ellensburg.....	Kittitas.....	1,571	21	1908	9.9
Fort Canby.....	Pacific.....	179	30	1898	54.1
Fort Simcoe.....	Yakima.....		11	1898	9.3
Fort Spokane.....	Lincoln.....	1,400	15	1898	13.9
Grand Mound.....	Thurston.....	162	9	1903	52.6
Granite Falls.....	Snohomish.....	397	6	1905	60.3
Hooper.....	Whitman.....	1,083	5	1903	12.4
Hunters.....	Stevens.....		5	1898	20.4
Kennewick.....	Benton.....	367	12	1906	6.7
La Center.....	Clarke.....	250	12	1908	55.0
Lakeside.....	Chelan.....	1,116	18	1908	12.7
Lapush.....	Clallam.....	15	5	1898	85.8
Lind.....	Adams.....	1,700	9	1905	11.8
Loomis.....	Okanogan.....	1,200	9	1905	13.7
Lyle.....	Klickitat.....	600	15	1907	26.3
Madrone.....	Kitsap.....	75	21	1898	44.5
Mayfield.....	Lewis.....	300	9	1902	65.9
Mottingers Ranch.....	Benton.....	307	9	1908	9.3
Mount Pleasant.....	Skamania.....	650	9	1908	55.5
Moxee (North Yakima).....	Yakima.....	1,000	17	1908	8.9
Neah Bay.....	Clallam.....	20	1901		116.7
North Head.....	Pacific.....	211	7	1908	45.8
North Port.....	Stevens.....	1,950	10	1908	20.8
Olga.....	San Juan.....	50	19	1908	30.3
Olympia.....	Thurston.....	200	31	1908	55.2
Pasco.....	Franklin.....	360	1	1901	6.5
Pomeroy.....	Garfield.....	1,500	15	1908	19.0
Port Crescent.....	Clallam.....	259	14	1908	42.2
Port Townsend.....	Jefferson.....	80	19	1908	20.6
Pullman (Agricultural College).....	Whitman.....	2,550	17	1908	22.4
Republic.....	Ferry.....	2,628	9	1908	18.0
Ritzville.....	Adams.....	1,825	10	1909	9.8
Rosalia.....	Whitman.....	2,375	16	1907	20.2
Seattle.....	King.....	123	18	1908	36.7
Sedro-Woolley.....	Skagit.....	38	12	1908	46.8
Silvana.....	Snohomish.....	35	10	1903	36.4
Snohomish.....	do.....	50	14	1907	45.2
Snoqualmie Falls.....	King.....	667	10	1908	59.5
South Bend.....	Pacific.....	16	14	1908	90.5
South Ellensburg.....	Kittitas.....	1,570	11	1904	9.3
Spokane.....	Spokane.....	1,943	28	1908	18.9
Sprague.....	Lincoln.....	1,908	6	1904	15.1
Sunnyside.....	Yakima.....	764	12	1906	6.6
Tacoma.....	Pierce.....	213	23	1908	45.4
Tatoosh.....	Clallam.....	86	23	1908	88.8
Twin.....	do.....	6	2	1900	66.5
Union City.....	Mason.....	10	14	1906	83.4
Vancouver.....	Clarke.....	100	34	1908	38.7
Vashon Island.....	King.....	110	20	1908	42.0
Walla Walla.....	Wallawalla.....	1,000	23	1908	17.7
Waterville.....	Douglas.....	2,624	18	1907	13.2
Wenatchee (near).....	Chelan.....	1,169	10	1908	15.5
Whatcom.....	Whatcom.....	60	9	1903	31.9
Wilbur.....	Lincoln.....	2,203	10	1908	15.2

TABLE VI.—Normal precipitation of stations in the western United States grouped according to States—Continued.

WYOMING.

Station.	County.	Elevation.	Number of years recorded.	Record ended—	Normal precipitation.
		<i>Feet.</i>			<i>Inches.</i>
Afton.....	Uinta.....	6,200	4	1906	18.2
Alcova.....	Natrona.....	5,366	6	1904	9.4
Barnum.....	Johnson.....	5,500	3	1907	12.0
Basin.....	Big Horn.....	3,862	11	1909	5.8
Bedford.....	Uinta.....	5,906	9	1907	18.4
Border.....	do.....	6,085	8	1909	14.1
Buffalo.....	Johnson.....	4,635	16	1907	10.9
Centennial.....	Albany.....	8,700	4	1902	16.9
Cheyenne.....	Laramie.....	6,088	39	1909	13.6
Chugwater.....	do.....	5,282	9	1909	16.0
Clark.....	Park.....	4,320	3	1907	11.6
Daniel.....	Uinta.....	6,740	11	1909	11.6
Elk Mountain.....	Carbon.....		3	1907	18.8
Evanston.....	Uinta.....	6,860	14	1909	14.0
Fort Laramie.....	Laramie.....	4,270	33	1909	12.2
Fort Washakie.....	Fremont.....	5,462	22	1905	12.3
Fourbear.....	Big Horn.....	6,500	11	1903	11.3
Granite Canon.....	Laramie.....	7,373	3	1907	16.9
Granite Springs Reservation.....	do.....		2	1907	16.8
Green River.....	Sweetwater.....	6,083	3	1907	8.5
Griggs.....	Johnson.....	4,700	7	1907	14.4
Iron Mountain.....	Laramie.....	6,605	4	1902	11.6
Kaycee.....	Johnson.....		8	1908	14.8
Kirtley.....	Converse.....		4	1907	16.3
Lander.....	Fremont.....	5,372	18	1909	13.9
Laramie.....	Albany.....	7,188	19	1909	10.2
Leo.....	Carbon.....	6,878	9	1909	9.8
Lolabama Ranch.....	Park.....	7,052	5	1906	11.8
Lusk.....	Converse.....	5,007	20	1909	14.0
Moorcroft.....	Crook.....	4,211	5	1907	15.1
Moore.....	Albany.....	6,000	7	1907	14.8
Pathfinder.....	Natrona.....	5,735	4	1909	9.7
Phillips.....	Laramie.....	4,900	6	1908	17.4
Pine Bluff.....	do.....	5,038	9	1908	15.0
Rawlins.....	Carbon.....	6,744	8	1907	11.3
Rock Springs.....	Sweetwater.....	6,500	8	1902	6.9
Saratoga.....	Carbon.....	7,300	11	1907	13.5
Sheridan (1).....	Sheridan.....	3,790	15	1909	15.0
Sheridan (2).....	do.....	3,738	15	1909	15.0
Soldiers' Home.....	Johnson.....	4,635	18	1909	11.3
South Pass City.....	Fremont.....	7,873	6	1905	14.8
Thayne.....	Uinta.....	5,900	7	1905	14.8
Thermopolis.....	Fremont.....	4,700	5	1903	12.1
Wells.....	Uinta.....	7,785	3	1906	17.7
Wheatland.....	Laramie.....	4,741	12	1906	13.1
Yellowstone Park.....	National Park.....	6,200	22	1909	18.8

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