U. S. DEPARTMENT OF AGRICULTURE WEATHER BUREAU

CLIMATOLOGICAL SERVICE

DISTRICT No. 11. CALIFORNIA

PROF. ALEXANDER G. McADIE DISTRICT EDITOR

REPORT FOR JULY, 1911

Prepared under direction of WILLIS L. MOORE, Chief U. S. Weather Bureau



WASHINGTON
GOVERNMENT PRINTING OFFICE

CLIMATOLOGICAL DATA FOR JULY, 1911.

DISTRICT No. 11, CALIFORNIA.

Prof. ALEXANDER G. McAdie, District Editor.

GENERAL SUMMARY.

With the exception of a period of about 10 days during the first half of July, 1911, the month was cool. In other portions of the United States, particularly the central and eastern portions, the month will long be remembered for high temperatures and protracted heat. In a special bulletin it was stated that—

An examination of the weather conditions in the United States during the past 40 years does not disclose another period in the late spring and early summer when the temperatures have been so uniformly high for so long a period and over such a large portion of the country.

Doubtless in the separate reports published in this issue of the Monthly Weather Review attention is called by the various editors to this condition of excessive heat. So far as the Pacific coast is concerned, the condition has been just the opposite. The spring months have been marked by cool weather and the summer thus far, with the exception of the one short period referred to above, has also been cool. At San Francisco, where the range in temperature is small and departures are seldom noticeable, the month was the coolest since 1901. In fact, along the coast north of Point Conception low temperatures and fog were so much in evidence that instead of favorable comment on cool conditions there was general remark on the unpleasant and disagreeable character of the weather. Along the coast south of Point Conception, however, while there was much high fog, the temperatures were moderate and at most points above normal. In the interior there were few excessively hot days, and on the whole the summer has been a pleasant one.

Little rain fell, and what did was in the form of afternoon showers in the Sierra and southern mountains of the State. Water was plentiful, and, while streams fell gradually, there was no lack of fresh running water in the foothills and mountains and no apprehension of scarcity for irrigation or power. The season has been a good one for all interests. Fruit ripened nicely and there was no damage by hot north winds or dry periods. The soil contained plenty of water and the snow disappeared from the 7,000-foot level by July 10. This date, however, is later by at least two weeks than the normal. July was an unusually favorable month for travel in the mountains. Tourists and pleasure seekers were able to enjoy full streams and magnificent effects in waterfalls, owing to the large volume of water from the heavy snow cover of the higher levels. Usually this condition is restricted to the month of June, and often a noticeable reduction in the volume of water occurs before the middle of that month.

One of the features of the month was a period of thunderstorm frequency, July 15 to 17. Elsewhere are given details of damage done by lightning in these mountain storms. Frequent thunderstorms were reported also in southeastern California, one especially severe in

Imperial County on July 15.

From an engineering point of view the most interesting feature of the month's weather was the abundance of water for power purposes. July, 1911, was in marked contrast with July, 1910, in this respect. Then the section reports foreshadowed a scarcity of water early in the season. There was less snow in sight than at any previous similar date since the settlement of the country and water courses contained little water. This year the run-off is excessive and streams are carrying a full head. Taken together the two months furnish important data bearing on the question of the influence of forested areas upon rainfall and run-off. The marked deficiency in run-off last summer and the marked excess this summer afford a definite and clear demonstration that in the main variations in rainfall and run-off are not controlled by or materially affected by such artificial conditions as deforestation or settlement of area, but are primarily and effectually determined by natural causes acting over large areas. It is plain that there was no change in the forest conditions or in the reclamation of land during the two years, and yet we have the extreme conditions of run-off, and rainfall or snowfall.

TEMPERATURE.

The mean temperature for the State was 74.1°, or slightly above the normal. This mean value, however, gives no indication of the unusually cool condition prevailing in the coast counties north of Point Conception during most of the month. Also it gives no clew to the generally cool character of the month in certain parts of the interior.

The following table gives the means and departures for each July from 1897 to 1911, inclusive:

Years. ,	Mean.	Depar- ture.	Years.	Mean.	Depar- ture.
1897. 1898. 1899. 1990. 1901. 1901. 1902. 1903. 1904.	°F. 74.5 81.4 77.9 75.9 76.0 72.8 71.2 72.2	°F. +0.9 +7.8 +4.3 +2.3 +2.4 8 -2.4 -1.4	1905. 1906. 1907. 1908. 1909. 1910.	°F. 74.8 76.8 73.1 76.4 71.2 75.5 74.1	°F. +1.2 +3.2 -5 +2.8 -2.4 +1.9 + .5

The highest temperature reported at any station was 117°, which occurred at Indio on the 15th and Palm Springs on the 30th. This was 2° lower than the highest temperature recorded during July, 1910. The lowest temperature was 28° at Tamarack on July 1. This was 6° warmer than the lowest temperature recorded during July, 1910.

PRECIPITATION.

The average monthly precipitation for the State was 0.10 of an inch. This is slightly above the normal.

The following table gives the average and departure from the normal for each July from 1897 to 1911, inclusive:

Years.	Mean.	Depar- ture.	Years.	Mean.	Depar- ture.
1897	Inches. 0.01 T. T. 0.03 .01 .70 .03	Inches0.0506060305 +.6403 +.03	1905 1906 1907 1908 1909 1910 1910	Inches. 0.01 .04 .03 .04 .05 .10	Inches0.0000000000 +.00 +.00

The greatest monthly rainfall was 2.50 inches, at Mammoth Tank. One-half of the stations reporting had no rainfall during the month. The distribution of the rain geographically was far from uniform. Afternoon thundershowers in the mountains and a few misting rains along the north coast made up the rainfall.

Snowfall.—No snow was reported at any station in California. There probably were, however, some light falls at elevations above 10,000 feet.

SUNSHINE.

The following table gives the total hours of sunshine and percentages of the possible:

Stations.	Hours.	Percent- age of possible.	Stations.	Hours.	Percentage of possible.
Eureka. Fresno Los Angeles Mount Tamalpais. Red Bluff.	163 421 315 435 424	36 94 72 97 93	Sacramento	414 251 264 361 295	92 57 59 81 67

THUNDERSTORMS.

Lightning struck Glacier Point in the Yosemite Valley during the afternoon of July 16 and killed 9 out of 18 horses tethered under a tree near the hotel. Over a score of tourists were in the hotel and had just dismounted. The storm was severe in the Wawona section, and the rainfall was so heavy that the Merced River rose to a height of 12 feet and did some damage in the Mariposa Big Tree Grove. On July 14 another thunderstorm and heavy rainfall raised the Merced River 4 feet, causing, it is said, greater flood conditions than during June, when melting snow caused an overflow over a portion of the valley. The flume carrying water to the electric-light station was put out of commission, crippling the power plant and leaving the Valley hotel and camp in darkness on July 14 and until repairs could be made.

On July 15, at El Centro, a storm of some violence,

On July 15, at El Centro, a storm of some violence, moving from the southeast, struck the section about 3.20 p. m. While the storm lasted only a few minutes, it damaged property to the extent of \$30,000. Two lives were lost by falling walls. Many people were injured. The First Presbyterian Church was entirely demolished; the warehouse of the California Cotton Co. collapsed, burying beneath its heavy timbers three Hindoolaborers, two of whom subsequently died. A feed and fuel shed collapsed and several storage and drying sheds and small

office buildings, together with some residences, were destroyed

At Campo thunderstorms and at Sonora rains prevailed from the 3d to the 29th. On the morning of the 27th a severe electrical storm from Campo west to the coast foothills knocked down telegraph poles, killed two mules, and stunned children leaning on fences. In the afternoon a similar storm occurred from Campo east, causing heavy rain in the valleys to the east and on the desert.

At Downieville on the 15th a severe thunderstorm north and northeast was reported, with a cloudburst at Bassetts, causing a rise in the South Fork of the Yuba of about 2 feet.

At Hornbrook on the 24th a heavy thunderstorm with 2 inches of rain occurred, and on the 25th a thunderstorm with a trace of rain.

EARTHQUAKES.

July 1, San Francisco: A severe shock occurred at 2.00:05 p.m. to 2.00:25 p.m., one hundred and twentieth meridian time. It was felt in the Weather Bureau office and the time noted by Observers Scholl and Rogers. No tremulous motion was felt before the principal disturbance, and there was no rocking motion at the end. There were two well-marked vibrations, with an interval of about five seconds. The vertical motion was perceptible, the apparent direction from west to east, and the duration of sensible motion was about 20 seconds. The intensity was No. 7 on the Rossi-Forel scale. No sounds were heard and few objects were overturned.

San Jose, July 1 (Mr. Maurice Connell, observer), reports that one of the severest shocks since the memorable quake of 1906 occurred at 2.00:30 p.m. The movement seemed to be entirely vertical, which would indicate that the locus of the disturbance centered near San Jose. There was a loud roaring-like noise, but the period of active disturbance lasted not over 10 seconds. Damage was not great, plastering being loosened and some brick walls cracked.

Santa Clara, July 1, seismographic station of the Jesuit seismologic service, Rev. J. S. Rickard, S. J., director; Mr. A. J. Newlin, assistant: Most severe shock since April 18, 1906. Tracer thrown off paper, but quickly replaced. Apparently little damage done in this vicinity.

Dr. A. O. Leuschner, professor of astronomy and director of the Students' Observatory, and Mr. Strula Einarsson, instructor in practical astronomy in the University of California, Berkeley, issued a report on the earthquake of July 1, of which the following is a part:

The earthquake began without preliminary tremor at $2^h\,00^m\,28^s\pm$. The period of vertical vibration was approximately 3 seconds, indicating that the center of the earthquake was not as close as one might be tempted to suspect.

The total duration of the motion as shown by the records was roughly 27 minutes, of which 18 minutes were marked by perceptibly strong motion, 10 minutes as heavy motion, and 5 minutes by great intensity. The intensity was 5 on the Rossi-Forel scale; it was a smart shock, generally felt; furniture was shaken, and some clocks were stopped, notably the time clock of the Students' Observatory, this for the first time since the earthquake of April 18, 1906.

NOTE ON EARTHQUAKE OF JULY 1, 1911, AT MOUNT HAMILTON.

The earthquake of July 1, 1911, was in some respects the most severe one experienced since the observatory was founded. The amplitude of vibration was less than in the shock of April 18, 1906, and the duration was much less, but the motion was more violent.

Fortunately the telescopes and other instruments of the observatory suffered no injury, with the exception of the Riefler clock. The steel springs in the pendulum support of this clock were broken, allowing the pendulum to fall and break the airtight glass case. The 36-inch telescope was moved about three-quarters of an inch to the south, the great base plate slipping on the masonry pier. The telescope was put into position again promptly and without difficulty and has suffered no harm whatever .--Prof. R. G. Aitken, Acting Director, Lick Observatory.

NOTES ON THE RIVERS OF THE SACRAMENTO AND SAN JOAQUIN WATERSHEDS.

By N. R. TAYLOR, Local Forecaster.

SACRAMENTO WATERSHED.

There was a gradual diminution in the run-off of all streams in this watershed during the month, but all of the important watercourses carried more water than for any corresponding month during the past five years.

In the Sacramento River, above Red Bluff, there was only a slight range between the highest and lowest stages of the month, and in many of the reaches above Redding the river was practically stationary during the last half of the month. From Knights Landing, however, to the tide limits the difference between the stages of the 1st and those of the 31st of the month were more or less marked.

In the Feather-Yuba territory the rivers averaged from 2 to 2.5 feet higher than during the preceding July, and the Yuba River at Marysville was higher than in any July

The American River averaged about 1 foot above the usual July stage and was the highest for any like month since 1907. It receded gradually from the 1st to the 31st with a range of 3 feet.

SAN JOAQUIN WATERSHED.

Except the Stanislaus, Mokelumne, and the San Joaquin, in the vicinity of Lathrop, all rivers in this watershed carried more water than for any July since the establishment of Weather Bureau gaging stations in the San Joaquin Valley. The San Joaquin in the vicinity of Firebaugh and Mendota continued above the flood stage until the 8th, but fell rapidly after this date and by the last of the month had fallen nearly 6 feet. Some lands in the vicinity of Mendota were flooded, but all interests were amply protected by the river forecasts from day to day.

PRECIPITATION AND ALTITUDE IN THE SIERRA.

By Mr. CHARLES H. LEE.

Note.—This article is published by courtesy of the editor of the Journal of Electricity, Power, and Gas. Mr. Lee, as one of the engineering staff of the Los Angeles Aqueduct, has carried on extensive measurements of rainfall and depth of snow on the eastern side of the high Sierra, in Inyo County, in the watershed of the Owens River. Mr. Lee has been in touch with the Weather Bureau throughout the period covered by these measurements and has in every way tried to further its work.

Precipitation studies made by the Los Angeles Aqueduct officials in connection with a general investigation of water supply conditions in the Owens Valley have led to some interesting results regarding the relation of precipitation and altitude in the Sierra Nevada. The portion of the range considered extends from Lake Tahoe to the Mojave Desert. Data gathered and published by the United States Weather Bureau were used where available and were supplemented on the east slope of the Sierra adjacent to the Owens Valley with records kept by the aqueduct officials. The investigations were carried on by the writer under the direction of William Mulholland,

chief engineer of the Los Angeles Aqueduct.

The phenomenon of increase of precipitation with altitude is fully recognized by hydraulic engineers who have had occasion to investigate the subject of precipitation. As a basis for engineering computations the relation is often assumed to be a simple ratio, which may be applied without regard to any factor but difference of elevation. As a matter of fact, however, topography, prevailing winds, latitude, and conditions of the atmosphere have a marked effect upon the geographic distribution of rainfall as well as altitude. The straight line relation, even when used as a convenient approximation, has a limited use, and should not be employed indiscriminately, as is shown by the studies herewith presented.

The general area within which precipitation data were considered is shown by the accompanying map. Upon this are indicated the principal rivers and their drainage area, stream gaging and precipitation stations, and isohyets or lines of equal annual rainfall. The isohyets are those of the Water and Forest Association as amended in 1908 by Edwin Duryea, jr. The dotted isohyets in the southeastern portion of the area are revisions proposed by the writer, based on all data available to date. The southern and eastern extension of the 30-inch and 20-inch isohyets is the most radical change, and is justified by the aqueduct observations in Owens Valley.

The relations of precipitation and topography are shown in a general manner by the position of the isohyets. A more instructive method is by graphical study of observations made in and near cross sections of the Sierra, laid out at right angles to the trend of the range. Five such were chosen and are shown on the map as the Central Pacific, Mokelumne, Taboose, Oak, and Bairs sections. There are sufficient observations taken along the two most northerly of these to indicate the relations upon both slopes of the range, but records applying to the

three southerly sections are confined to the east slope.

A list of stations along the Central Pacific and Mokelumne sections is given in Table 1, together with elevation, distance from the Great Valley, length of record, observed and computed mean seasonal precipitations, and observed precipitations during the season 1909-10. The stations selected were all within 12 miles of the sections, and their elevations were such that they lay in the average profile of ground surface. (See diagrams 3 and 6.) Of stations in the Central Pacific group, Sacramento, Newcastle, Iowa Hill, Reno (1888–89 to 1909–10) and Wadsworth (1890–91 to 1909-10) are maintained by the Weather Bureau. Observations at other stations are made by agents of the Southern Pacific Co. Stations in the Mokelumne group are all maintained by the Weather Bureau. Elevations are those published in Weather Bureau reports, and where possible were compared with those given on Government topographic sheets. Distances from the Great Valley were scaled from the Government topographic or from the general land office map of California. Observed mean seasonal precipitation was computed for the season, September 1 to August 31. The observed means are for periods of differing length, and to obtain values more strictly comparable the records were computed so as to apply to a single definite period. That selected for the Central Pacific group extended over the

40 seasons, 1870-71 to 1909-10; and for the Mokelumne group, the 28 seasons, 1882-83 to 1909-10. The method of correcting a short record was the common one of comparison with an adjacent station having a complete record.

parison with an adjacent station having a complete record. Stations in the Taboose, Oak, and Bairs groups were established and maintained by the aqueduct officials. They are listed on Table 3 with elevation, distance from the Sierra crest, with observed and computed mean seasonal precipitation. The gages were located on or near the sections at the approximate crossings of 500foot contours. The immediate surroundings were selected with respect to accessibility from roads and trails, and the recognized requirements for good exposure were observed. The highest level on the slope of the Sierra which can be reached from the Owens Valley after the winter snowstorms is approximately the 6,500-foot contour. Gages were distributed between this contour and the valley floor, which, near Independence, has an average elevation of 3,800 feet. The type of gage used was the ordinary 8-inch cylindrical gage of the Weather Bureau. The funnel-shape receiver, however, was dispensed with, so that the catch fell directly into the 8-inch cylinder. The mounted observer carried the inner tube and cedar measuring stick and poured the catch from the container into the small tube for measuring. Snow was reduced to equivalent water by weighing the catch with a spring balance. The gages were visited after each storm, an observer being detailed to each group, and snowshoes were part of the necessary equipment in winter. The exact elevation and location of the gages were determined by ordinary engineering methods. Distances from the Sierra crest were scaled from the Mount Whitney quadrangle of the United States Geological Survey. The 26-year record at Independence, which was used as a basis for computing long-term means, is given in Table 4. The portion of this record from September, 1866, to August, 1877, was obtained under the direction of United States Army officers stationed at Fort Independence, and under conditions sufficiently similar to permit

of its being combined with the more recent Weather Bureau record at the present town of Independence.

The relations of precipitation, altitude, and topographic position, and also profiles of ground surface, are based on United States Geological Survey topographic maps and are shown for each of the accompanying charts. The values represented by numbered points are those given in Tables 1, 2, and 3. The points at the upper end of curves for Taboose, Oak, and Bairs sections need further explanation, however. As previously noted, it was not practical to make complete precipitation observations above the 6,500-foot contour in Owens Valley. An attempt has been made, however, to arrive at approximate values for precipitation along the adjacent Sierra crest from computations based on measured stream flow. Data available were the true run-off from the east slope of the Sierra, measured at mouths of canyons, and an approximate value of the run-off factor. The mean seasonal discharge per square mile of mountain drainage areas crossed by the Taboose and Oak sections is 1.75 second-feet, and by the Bairs section, 1.36 second-feet. The run-off factor for Kings River, which is adjacent to Owens Valley drainage on the west, is 0.59. Computations for the latter are based on the isohyets of Plate 1; observed variation in precipitation at Merced, Fresno, Sanger, Selma, Visalia, and Summerdale, and the discharge measurements of Kings River at Red Mountain, covering 20 seasons. Run-off factors for the small drainage areas tributary to Owens Valley are probably larger than for Kings River, for the following reasons: The greater average elevation of drainage areas tributary to Owens Valley; nonporous character of the granite bedrock; the universal occurrence of deep cirques and canyons which favor the collection of snow in protected drifts; the snow dust carried over the Sierra crest into the cirque basins by prevailing west and northwest winds; and the absence of lake surfaces or extensive areas supporting vegetation. All of these characteristics tend to make the run-off greater than for Kings River by decreasing evaporation and percolation losses. A value of 0.75 is thought to correctly represent run-off conditions for the Owens Valley streams.

Table 1.—DESCRIPTION AND MEAN PRECIPITATION FOR STATIONS IN CENTRAL PACIFIC GROUP.

gage.		Floretian	Distance	Tonoth of	Observed	Computed mean seasonal pre	cipitation.		Observed
No. of g	Station.	Elevation above sea level.	from Sac- ramento.	Length of record years.	mean sea- sonal pre- cipitation.	Base station.	Number of years cov- ered.	Precipita- tion.	precipita- tion, 1909–10.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Sacramento Rocklin New Castle Auburn Colfax. Iowa Hill Gold Run Towle (Alta). Blue Canyo. Emigrant Gap Cisco. Summit Truckee. Boca. Reno Wadsworth (Fernley).	249 956 1, 363 2, 421 2, 825 3, 222 3, 612 4, 695 5, 230 5, 939 7, 017 5, 820 5, 531	Miles. 18. 9 26. 3 30. 0 42. 1 46. 8 48. 8 52. 8 52. 8 61. 7 67. 9 78. 6 85. 8 92. 0 110. 1 133. 4	61 8 15 - 40 40 31 111 40 111 30 40 39 39 38 39 35	49. 01 52. 64 54. 49 49. 15 72. 82 53. 50 51. 96	Auburndododo		Inches, 19. 36 24. 65 28. 20 34. 93 49. 91 50. 53 43. 05 49. 15 57. 55 54. 50 51. 96 47. 60 27. 65 20. 47 7. 05 4. 59	Inches. 12. 18 21. 06 26. 92 36. 12 49. 69 50. 68 48. 34 53. 02 64. 11 56. 28 58. \$5 37. 00 27. 01 25. 01 25. 03 7. 52 5. 17

Stations 1 to 12, inclusive, seasonal totals (Sept. 1 to Aug. 31). Stations 13 to 16, inclusive, calendar year totals, except last column.

 $^{^{\}rm 1}$ The editor is under the impression that this is the Marvin density bucket, which was furnished to Mr. Lee by the San Francisco office.

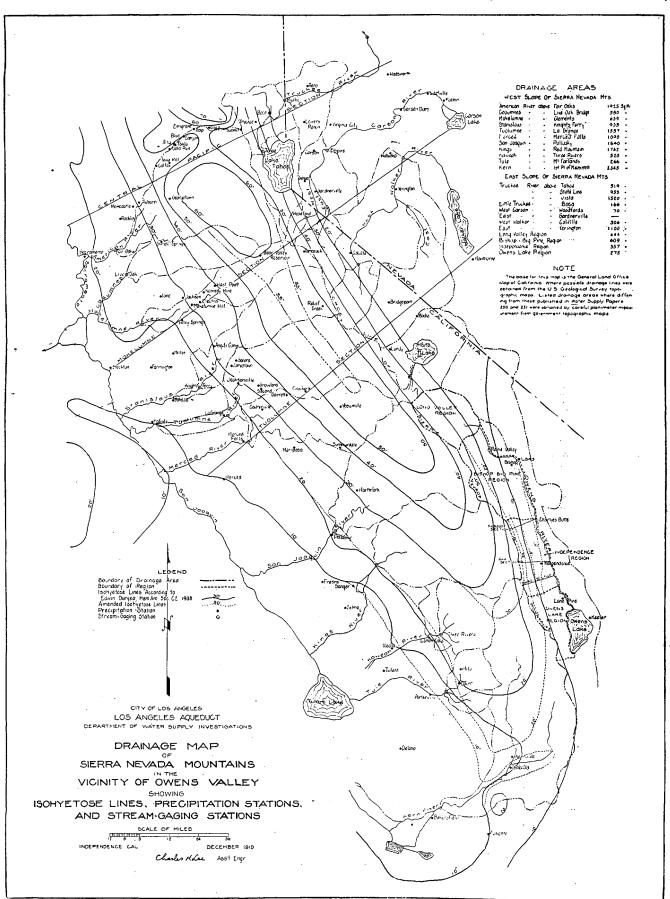


TABLE 2.—DESCRIPTION AND MEAN PRECIPITATION FOR STATIONS IN MOKELUMNE GROUP.

age.		Elevation	Distance	Length of	Observed	Computed mean seasonal pred	eipitation.		Observed
No. of g	Station.	above sea level.	from Stockton.	record years.	mean sea- sonal pre- cipitation.	Base station.	Number of years cov- ered.	Precipita- tion.	precipita- tion, 1909-10.
1 2 3 4 5 6 7 8 9 10 11	Stockton Farmington Ione: Valley Springs Jackson Mokelumne Hill West Point. Bear Valley Reservoir Tamarack. Gardnerville Wabuska.	111 287 673 1,200 1,550 2,800	Miles. 13.0 33.0 31.2 40.0 41.0 52.8 72.5 89.5 108.5	60 33 32 22 20 28 16 7 11 11		do	. 28 28 20 28 28 28 28 28	Inches. 14. 82 16. 73 21. 33 24. 18 33. 19 32. 53 41. 15 57. 65 54. 73 9. 08	Inches 13. 81 15. 91 20. 39 23. 28 32. 93 39. 56 48. 94 16. 57 3. 49

TABLE 3.—PRECIPITATION STATIONS IN OWEN VALLEY.

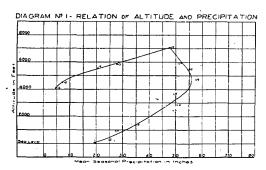
No. o	Grann	Elevation	Distance from	Observed pre	elpitation, in nes.	Computed mean seasonal precipitation
gage.	Group.	above sea level.	Nevada Mountains.	Season 1908-9.	Season 1909–10.	based on 26- year record at Independence.
2 3 4 4 5 6 6 117 7 8 8 8 9 10 11 12 12 13 14 15 16	Taboose	Feet. 4, 070 4, 460 5, 040 5, 550 6, 190 3, 735 3, 735 3, 735 3, 740 4, 500 5, 530 6, 120 4, 100 5, 500 6, 100	Miles. 8. 1 6. 9 5. 5 4. 7 4. 2 13. 8 12. 5 9. 6 8. 4 8. 0 6. 6 5. 7 4. 8 10. 2 9. 0 7. 7 6. 6. 6 5. 7	9. 09 10. 40 11. 74 16. 53 23. 24 7. 22 9. 24 11. 35 14. 47 21. 04 4. 28 6. 09 7. 63 11. 63 11. 34	6. 65 7. 61 8. 69 9. 26 6 12. 94 3. 15 4. 25 4. 45 5. 27 6. 42 7. 67 10. 19 3. 74 4. 3. 63 5. 34 5. 34 7. 24	6. 56 7. 51 8. 53 10. 48 14. 09 3. 25 4. 38 4. 78 6. 37 5. 43 7. 22 8. 94 12. 51 3. 40 3. 197 5. 38 7. 78 8. 68

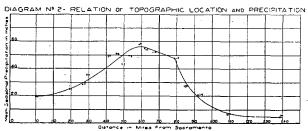
TABLE 4.—PRECIPITATION, IN INCHES, AT INDEPENDENCE, CAL.

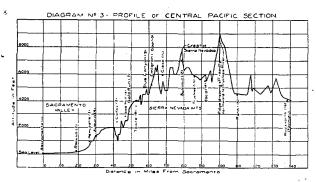
1865–1877, United States War Department, Fort Independence. Elevation, 3,930 feet. 1892–1895 and 1898–1910, United States Weather Bureau, Independence. Elevation, 3,920 feet.

Season.	Septem- ber	October.	Novem- ber.	Decem- ber.	January.	February.	March.	April.	May.	June.	July.	August.	Total.
1865-66	0 .07	.32	0 0 .21 .44	. 65 2. 27 12. 19 1. 17	2. 42 0 5. 46 . 16	1.63 0 0	0 4.76 0 .32	. 16 . 53 . 40		0 0	. 01 . 10 . 03	1. 15	11. 48 19. 46 3. 33
1869-70 1870-71 1871-72 1872-73	0 0 0 0	0 1. 10 0 0	$.14 \\ 0 \\ .65 \\ 0$	0 1.00 4.70 1.18	. 20 0 0 0	1.36 1.28 .30 .40	$^{0}_{0}$	$\begin{array}{c} .21 \\ 0 \\ .55 \\ 0 \end{array}$.27 0 .18	.30 0 0	. 35 0 . 28 0	. 10 0 . 12 . 05	2. 68 3. 68 7. 06 1. 63
1873-74 1874-75 1875-76 1870-77 1891-92	.10 .40 .01 .16	.80 0 .26	.40 .66 0	3.40 0 .62 0	2. 40 1. 73 1. 51 . 76	1.00 0 .70 0	0 0 .87 0 .62	0 0 0 . 59	0 0 0 .69 .96	$\begin{array}{c} .01 \\ 0 \\ .15 \\ 0 \\ .07 \end{array}$. 15 0 . 19 0 T.	0 0 .56 0	7.06 3.33 5.27 2.46
1892-93 1893-94 1894-95 1895-96 1896-97	T. T. T.	.35 0 0 .83	.23 .10 .67	1. 61 . 75 1. 89 . 08	1.51 .12 1.24 1.67	2.91 .42 1.18 0	.98 .09 .12	T. 02 T.	T. .10 .01	T. 11	. 77 . 12 T.	T. .51 .04	8.3 2.3 4.4
1897-98 1898-99 1899-1900 1900-1901	.20 T. .75	.30 .01 .65	. 10 . 85 1. 34 . 22	.20 .56 .13	. 54 . 31 2. 81 . 04	T. .05 .64 1.69	.01 .67 .05 1.05	. 16 . 02 . 62 T.	. 23 . 03 . 22 . 36 . 04	T. .37 .04 0 .01	T. .01 .08 .10	.11 .06 T. .32	1. 5 3. 7 6. 5 4. 2
1902-3 1903-4 1904-5 1906-6	T. T. .32 .25	. 08 . 42 . 06 . 0	T. 0 .43 .02		.71 T. .54 2.89 .95	.27 1.20 .73 .13	.34 .95 2.08 1.86 1.10	T. T. T. . 36	T. .02 .25 .42 .01	.02 0 0 .10 .55	T. 0 .31	T. 04 04	2.0 2.6 3.9 6.7 4.1
1907-8 1908-9 1909-10 26-year mean	.84 .07	2. 12 . 03 . 01	T. .01 .19	. 42 . 20 3. 90 1. 43	1. 63 3. 27 . 25 1. 12	.98 2.73 T.	.14 .16 .10	T. .12 .31	T. T. 0	T. T. 0	.26 0 .27	. 46 . 25 0	6. 6 7. 6 5. 1

CENTRAL PACIFIC GROUP OF PRECIPITATION GAGES.

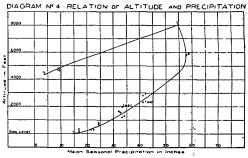


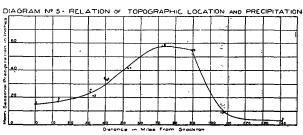


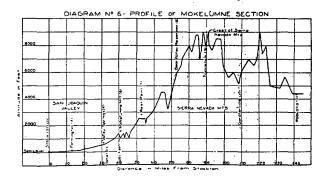


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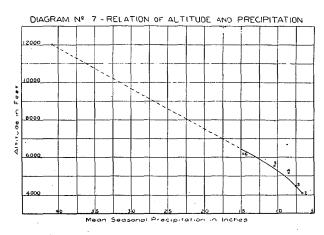
MOKELUMNE GROUP OF PRECIPITATION GAGES.

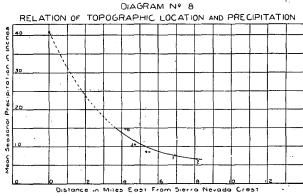


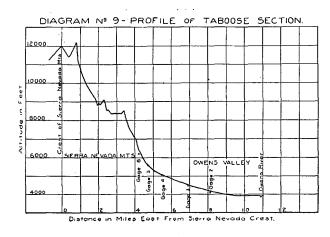




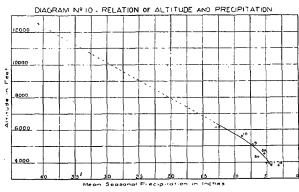
TABOOSE GROUP OF PRECIPITATION GAGES.

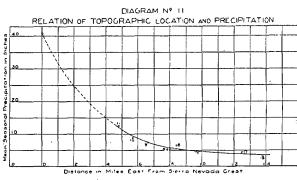


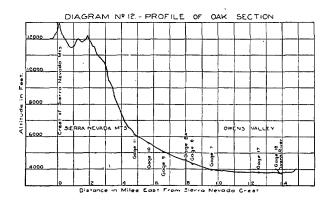




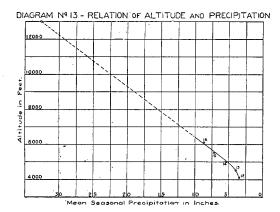
OAK GROUP OF PRECIPITATION GAGES,

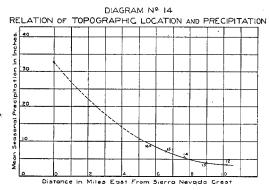


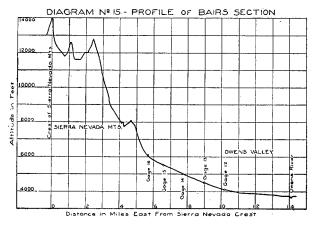




BAIRS GROUP OF PRECIPITATION GAGES.







The shape of many of the mountain drainage areas tributary to the Owens Valley is that of an isosceles triangle with apex at canyon mouth and base lying along the Sierra crest. Measuring from the Sierra crest and assuming a uniform rate of change of precipitation from crest to canyon mouth, as indicated by the observations in the Central Pacific and Mokelumne sections, the average precipitation over one of these triangles equals the true precipitation at one-third the distance between these two points. The observed precipitation at canyon mouths being available, it is therefore a matter of simple proportion to compute that at the crest. The average depth of precipitation over drainage areas having run-off factors of 0.75 and discharges per square mile of 1.75 and 1.36 second-feet is 31.7 and 24.6 inches, respectively. Employing the method of computation outlined

above, the values for precipitation at the Sierra crest are 40.8 inches for the Taboose and Oak sections and 32.7 for the Bairs section. These are the points not numbered on diagrams 7, 8, 10, 11, 13, and 14.

The study of the data presented in Tables 1, 2, and 3

involves a graphical analysis of the relation of: (1) Precipitation to altitude; and (2) horizontal position to precipitation in connection with topography. See diagrams 1, 4, 10, 13 and diagrams 2, 3, 5, 6, 8, 9, 11, 12,

In general the shape of the curves which fit the platted points is similar throughout each set of diagrams. Examining the precipitation and altitude curves in detail it appears that there is an increase of precipitation with altitude from the floor of the Great Valley up the western slope of the Sierra to about the 5,000-foot level. The rate of increase for this portion of the curve is greatest in the lower foothills and steadily decreases with increase of elevation. Above 5,000 feet there is a moderate decrease in precipitation with increase of altitude,

the rate being practically constant.¹
East of the Sierra crest precipitation decreases rapidly with decrease in altitude, mainfaining a constant rate to the 5,000-foot level and a decreasing rate below this elevation. The distance and precipitation curves conform to the profile in general shape, except that their maxima are west of the topographic crest, occupying the same relative position with respect to the Great Valley as the 5,000-foot level. They have a tendency to become horizontal over the level portion of the profile, to rise over western slopes below the 5,000-foot contour, to fall over western slopes above this, and to fall over eastern slopes. In other words, the general slope of the country seems to have more to do with the amount of precipitation than does altitude.

Precipitation upon the plains of northern India and the southern slope of the Himilayas exhibits a similar variation. An empirical equation giving the relation of precipitation and elevation has been developed from observations in that region, as follows: $R = 1 + 1.92 \text{ h} - 0.40 \text{ h}^2 + 0.02 \text{ h}^3$, in which R represents the amount of rain and h the relative height in units of a thousand feet above an assumed plane, which was itself 1,000 feet above sea level. The critical elevation was 4,160 feet above sea level and observations were sufficient to determine that the form of the curve above this elevation was similar to that below, the complete curve approximating a cubic parabola whose axis is the line represented by the critical elevation.

The curves on diagrams 1 and 4 suggest a similar relation for the west slope of the Sierra, with a critical elevation of about 5,000 feet. The relatively low crest of the latter range, however, breaks the relation just above the critical elevation, so that the upper arm of the curve is incomplete and a discontinuity is introduced. The relation of precipitation to elevation upon the Sierra is therefore not unique, but conforms to some general law.

The condition met with is the broad slope of a long mountain range presented to a prevailing moisture-laden wind. The movement of a body of moist air up such a slope results in expansion and cooling of the air. When the temperature reaches the dew point condensation of the aqueous vapor occurs. The latent heat thus liberated tends to warm the air and raises its temperature

¹ Reference should be made to various papers by McAdie and Willson, in Monthly Weather Review and Climatology of California; also to papers by Lippincott, Clapp, and others in various Water Supply Papers.

above the dew point. The descent on the leeward slope of the range is accompanied by a rapid compression and rising temperature of a body of air. Hence, precipitation is greatest along the lower windward slopes of the Sierra and reaches its maxima at the lower cloud limit, the 5,000-foot contour, decreasing slowly from here to the crest of the range and decreasing rapidly down the leeward slope to the desert. It is, therefore, not increasing elevation alone which causes increase in precipitation; but broad rising slopes which give an upward movement to bodies of moist air driven by prevailing winds.

The conclusions from this study which can be applied

in practical computations are as follows:

1. The precipitation upon the west slope of the Sierra between the Yuba and Tuolumne Rivers increases at a variable rate, which, expressed as an average, is 0.85 inch per hundred-foot rise from the floor of the Great Valley to the 5,000-foot contour.

2. Above the 5,000-foot contour it decreases approximately at the rate of 0.40 inch per hundred-foot rise to

the crest of the Sierra.

3. Precipitation upon the east slope of the Sierra decreases at differing rates, depending upon the elevation of the crest and depth of precipitation at the summit. The rate is constant above the 5,000-foot contour, and for the sections studied is as follows:

Central Pacific, 1.74 inches per hundred foot fall. Mokelumne, 1.43 inches per hundred foot fall. Taboose and Oak, 0.46 inch per hundred foot fall.

Bairs, 0.34 inch per hundred foot fall.

Mr. Fred G. Plummer, in a bulletin on chaparral, No. 85, of the Forest Service, gives the following estimate of the average annual precipitation over the chaparral area in southern California:

At sea level	13 inches.
At 2,000 feet:	
West and south slopes, 25 East and north slopes, 9	17 inches
	17 inches.
At 5,000 feet:	
West and south slopes, 43 East and north slopes, 27	25 inches
East and north slopes, 27	oo menes.
At 8,000 feet:	•
West and south slopes, 61\ East and north slopes, 45\	53 inches
East and north slopes, 45	oo menes.

DISTRICT No. 11. CLIMATOLOGICAL SUMMARY.

Table 1.—Climatological data for July, 1911. District No. 11, Oregon.

		years.	Tem	perature	, in c	legre	es Fah	renhe	eit.	Prec	pitation	, in inc	ches.	iays, re.		Sky.		direc-	
Stations, Counties.	Elevation, feet.	Length of record, years	Mean.	Departure from the normal.	Highest.	Date.	Lowest.	Date.	Greatest daily range.	Total.	Departure from the normal.	Greatest in 24 hours.	Total snowfall, unmelfed.	Number of rainy c	Number of clear days.	Number of part-	Number of cloudy days.	Prevailing wind d tion.	Observers.
Oregon. Klamath Agency. Klamath. Klamath Falls do Lakeview Lake. Merrill. Klamath. Yonna do Culifornia.	4,825 4,070 4,146	3 22 28 5 4	65. 4 64. 4			716 16	33 28	8	43 58	0.17 0.13		0. 15 0. 12	0 0	2 2	25 16	5 10	1 5	w,	Edson C. Watson. W. H. Heileman. Bert Rice. Mrs. Agnes Ritchson. Jacob Ruecke.
Alameda Alameda Alameda Alameda Alameda Alameda Alameda Alameda Antios Angiola Tulare Contra Costa Aptos Arrowhead Springs Santa Cruz Arrowhead Springs San Bernardino Bagdad San Bernardino Basersfield Kern Barstow San Bernardino Baredeley Alameda Biggs Butte Bisnop Inyo Bishop Creek Bisnop Bishop Creek Bisnop Blythe Branscomb Brawley Brush Creek Burney Shasta Calexico Calexico Calexico Calexico Calexico Calexico Chino Ch	208 466 102 2,000 1,360 784 404 2,105 8,500 1,700 4,695 2,140 3,300 1,700 3,500 4,675 189 600 714 4,675 189 600 714 4,675 189 600 714 4,000 1,138 126 1,650 2,285 1,234 5,230 6,550 6,500 1,650 2,935 1,234 5,230 6,550 6,500 1,650 2,828 1,234 5,230 6,550 2,828 1,234 5,230 6,550 2,828 1,234 5,230 6,550 2,828 1,234 5,230 6,550 2,828 1,234 1,254	240 1 1 9 8 8 222 8 8 224 16 1 15 11 2 2 11 11 2 2 1 11 1 2 1 1 1 2 1 1 1 1 2 1	84. 6 61. 8 80. 6 61. 8 80. 6 61. 8 80. 6 61. 8 80. 6 61. 8 80. 6 61. 8 80. 6 61. 8 80. 6 61. 8 80. 6 61. 8 80. 6 61. 8 80. 6 61. 8 80. 6 61. 8 80. 6 61. 8 80. 6 61. 8 61. 8 80. 6 61. 8	- 0.5 - 1.6 - 1.7 - 1.8 - 1.7 - 1.8 - 1.7 - 1.8 - 1.7 - 1.8 - 1.7 - 1.8 - 1.7 - 1.8 - 1.7 - 1.8 - 1.7 - 1.8	102 103 104 104 106 107 107 108 108 109 109 109 109 109 109 109 109	1 16 16 16 16 17 17 16 16 16 16 16 16 16 16 16 16 16 16 16	48 48 51 46 63 52 39 45 58 64	$\begin{array}{c} 1 + 1 \\$	38 48 42 41 52 55 55 33 38 31 42 25 48 47 46 45 45 45 45 45 45 45 46 45 47 48 49 40 40 40 40 40 40 40 40 40 40	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.01 0.00 0.01 0.02 0.00 0.00	T. 0.55 0.000 0.00		0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	311 310 202 288 266 222 231 324 246 266 226 229 229 229 229 229 229 229 231 331 242 27 27 28 29 29 29 29 29 29 29 29 29 29 29 29 20 21 21 21 21 21 21 21 21 21 21 21 21 21	19 10 0 0 0 8 0 1 10 0 0 13 0 0 4 4 0 0 0 0 9 5 5 1 1 10 0 6 2 1 1 5 5 4 3 3 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		D. S.	Chas. E. Sears. Prof. C. B. Towle. Santa Fe Co. Southern Pacific Co. Do. Dr. E. Seegaard. Southern Pacific Co. T. S. Seegaard. Southern Pacific Co. T. S. Manning. A. P. Griffith. Santa Fe Co. Do. E. L. White. State University. Southern Pacific Co. W. A. Chalfant. Paul E. Lodge. Victor Hope. Southern Pacific Co. Ray W. Ward. A. J. Haun. M. D. Witter. Cal. Gas. & Elec. Co. Mrs. M. D. Chambers. J. E. Peck. Southern Pacific Co. Do. F. M. Righter. Cal. Gas. & Elec. Co. T. H. Johnstone. G. H. Stephenson. O. I. Westerburg. Southern Pacific Co. Do. F. P. Brackett. John O. Ogle. Southern Pacific Co. C. D. McCormish. Southern Pacific Co. C. D. McCormish. Southern Pacific Co. L. L. Macquarie. D. L. Wishon. S. H. Beckett. Cal. Gas. & Elec. Co. H. R. Warner. Southern Pacific Co. Southern Pacific Co. Southern Pacific Co. A. L. Dudley. Southern Pacific Co. A. E. Schult. Southern Pacific Co. A. F. Schult. Southern Pacific Co. A. F. Schult. Southern Pacific Co. Do. R. W. Durham. H. H. Kessler. Cal. Gas & Elec. Co. A. F. Schult. Southern Pacific Co. Do. A. F. O. Hutton. E. E. Roening. A. J. Burgt. U. S. Weather Bureau. Southern Pacific Co. F. O. Hutton. E. E. Roening. A. J. Burgt. U. S. Weather Bureau. Southern Pacific Co. F. O. Hutton. E. E. Roening. A. J. Burgt. U. S. Weather Bureau. Southern Pacific Co. F. R. Hull. C. H. Likely. Southern Pacific Co. Santa Fe Co. F. S. Kinley. H. D. Ellmaker. C. J. Booth. E. W. Brown. J. N. Thompson. Southern Pacific Co. Santa Fe Co. F. J. Kinley. H. D. Ellmaker. C. J. Booth. E. W. Brown. J. N. Thompson. Southern Pacific Co. U. S. Forest Service. T. H. Betterton.

Table 1.—Climatological data for July, 1911. District No. 11—Continued.

			ears.	Tem	peratur	e, in	degre	es Fah	rent	neit.	Prec	ipitation	, in in	ches.	days, ore.		Sky		direc-	
Stations.	Counties.	Elevation, feet.	Length of record, y	Mean.	Departure from the normal.	Highest.	Date.	Lowest.	Date.	Greatest daily range.	Total.	Departure from the normal.	Greatest in 24 hours.	Total snowfall, unmelted.	ainy or m	Number of clear days.	Number of part-	Number of	ਰ	Observers.
California—Continued. King City. Lake Eleanor. La Porte. Le Grand Lemon Cove Lick Observatory Livermore. Lodi Lone Pine. Long Valley Los Angeles. Los Banos ** Los Gatos. McCloud Macdoel. Madeline. Magalia. Mammoth Tank Marysville. Mecca. Menlo Park ** Merced. Mill Creek (1) Milton (near). Modesto ** Mojave. Molor Park ** Mojave. Monlo Park ** Mored. Monterey ** Monterey ** Monterey ** Monterey ** Monter y** Monter	Monterey. Tuolumne. Plumas. Merced. Tulare. Santa Clara. Alameda. San Joaquin. Inyo. Lassen. Los Angeles. Merced. Santa Clara Siskiyoudo. Lassen. Butte. Imperial. Yuha. Riverside. San Mateo Merced. Amador. Calaveras. Stanislaus. Kern. Calaveras Stanislaus. Kern. Marin. Napado. San Bernardino. San Diego. Nevada. Placer. Los Angeles. Stanislaus. Butte. Nevada. Madera. Stanislaus. Butte. Nevada. Matera. Stanislaus. San Diego. Alameda. San Diego. Alameda. San Diego. Alameda. San Diego. Ventura Glenn. Humboldt. Buttedo. San Francisco. Marin. Tulare. Plumas. Tehama. Shasta. San Bernardino. Presno. San Bernardino. San Bernardino. San Bernardino.	333 4,700 5,000 255 600 4,298 4,400 29,321 600 3,410 4,258 644 173 600 2,751 67 185 641 173 600 2,755 641 173 600 2,755 641 173 600 2,755 641 173 600 2,755 641 173 600 2,755 641 173 600 2,755 641 173 600 2,755 600 3,210 2,321 1,550 2,321 1,550 2,321 1,550 2,321 1,550 2,321 1,550 2,321 1,550 2,350 1,550 2,350 1,550 2,350 1,550 2,350 1,550 2,350 1,550 2,350 1,550 2,350 1,550 2,350 1,550 2,350 1,550 2,350 1,550 1,550 2,350 1,550 1,550 2,350 1,550 2,350 1,550 2,350 1,550 3,200 3,000 3,000 1,550 2,550 3,000 3,000 1,550 2,550 3,000 3,000 1,550 2,550 3,000 3	Steat 'probable that a state of the steat of	69.0 66.0 86.1 71.9 73.7 7 73.7 8 66.8 86.6 4 88.6 4 87.8 84.8 79.8 87.8 84.1 71.9 85.7 72.2 86.4 86.4 86.4 86.4 86.4 86.4 86.4 86.4	+ 3.5 3.5 4.5 4.2 8.8 4.1 1.3 1.3 1.4 1.4 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1	95 95 95 1100 1115 107 1000 98 88 88 88 1056 68 93 102 107 1000 94 1111 1000 1000 1000 1000 1000 1	15 19 15† 16 15 15 16 15 16 15 16 15 15 16 16 16 16 16 16 16 16 16 16 16 16 16	411 488 488 488 488 488 488 488 488 488	1 1 3 2 2 2 2 1 1 9 9 2 8 3 0 1 1 1 7 2 2 2 2 1 2 2 1 2 2 1 2 2 1 1 2 4 1 1 2 4 1 1 1 1	### 150 144 142 147 147 148 14	T. T. 0.00 0.00 T. T. T. T. C.00 0.00 0.	- 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	Ut T. 0.00 0.00 1.25 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Total snowfall, unmelted.	ainy or m	229 300 25, 27 300 119 126 131 266 167 300 27 27 300 31 16 31 16 28 27 30 31 16 13 30 26 29 13 16 16 31 16 28 27 30 31 17 30 26 29 17 18 20 20 20 20 20 20 20 20 20 20 20 20 20	0 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 PAPROP 11112 11000 11344 0 0 0 5 6 6 1 3 1 1 1 0 1 0 0 0 0 0 2 2 0 0 0 0 9 0 0 1 1 1 1 4 0 6 0 0 1 0 1 2 2 2 0 1 0 0 0 1 1 1 1 4 0 6 0 0 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	S. N. W. S. S. S. S. S. W. S. S. S. W. S.	Southern Pacific Co. O. J. Todd. Chas. W. Hendel. Santa Fe Co. G. W. Sandidge. The Director. E. G. Still. Ezra Fiske. G. F. Marsh. A. G. Evans. U. S. Weather Bureau. Southern Pacific Co. F. H. McCullagh. F. F. Spencer. Butte Valley Land Co. J. H. Williams. Butte Co. R. R. Co. Southern Pacific Co. Do. E. A. Palmer. Southern Pacific Co. Cal. Gas & Elec. Co. J. H. Southwick. Southern Pacific Co. John C. R. R. Co. Southern Pacific Co. John C. Knecht. U. S. Weather Bureau. Alex. Hull. W. H. Martin. Santa Fe Co. T. O. Bailey. Southern Pacific Co. John C. Knecht. U. S. Weather Bureau. Alex. Hull. W. H. Martin. Santa Fe Co. T. O. Bailey. Southern Pacific Co. E. S. Wangenheim. Cal. Gas & Elec. Co. J. R. McIntosh. U. S. Forest Service. Southern Pacific Co. E. S. Wangenheim. Cal. Gas & Elec. Co. J. R. McIntosh. U. S. Forest Service. Southern Pacific Co. E. S. Wangenheim. Cal. Gas & Elec. Co. J. R. McIntosh. U. S. Forest Service. Southern Pacific Co. E. D. Fairchild. Western Pacific Co. Southern Pacific Co. Southern Pacific Co. F. T. Hale. E. D. Fairchild. Western Pacific Co. Southern Pacific Co. E. D. Sorver. D. F. W. Sawyer. E. H. Parnell. Tuolumne W. P. Co. A. Baring-Gould. John Hyslop. U. S. Weather Bureau. E. J. Bassett. P. W. Moore. Southern Pacific Co. S
Sacramento (2). St. Helena. Salinas. San Bernardino. San Diego. San Francisco. San Jacinto. San Jacinto. San Jose. San Luis Obispo. San Luis Obispo. San Mareo **. San Miguel **. San Miguel Island. Sanger **. Santa Clara. Santa Clara. Santa Margarita **. Santa Margarita Rosa. Santa Rosa. Santa Rosa. Selma **. Seven Oaks.	Monterey San Bernardino San Diego San Francisco Riverside Santa Clara Alameda San Luis Obispo San Luis Obispo Santa Barbara Fresno Santa Barbara Santa Clara Santa Clara Santa Clara Santa Barbara Santa Clara Santa Barbara Los Angeles Sonoma Fresno San Bernardino	255 400 1, 054 93 207 1, 550 95 48 201 22 616 500 90 90 90 90 20 992 110 181 311 5,000	38 37 19 40 40 18 36 16 16 22 27 22 23 22 23 26 22 25 1 15	80. 2 82. 3 64. 8 66. 1 61. 4 79. 6 67. 2 61. 2 63. 6 85. 7 67. 3 82. 4	- 5.6 - 0.3 + 3.1 - 2.5 + 8.9 + 2.8 - 8.7 - 3.6	101 90 84 94 92 103 83 75 96 106 89 114	15† 24 15 14 8 26† 1 15† 16 31 16 31 16 31 16 31 16 31 16 15	51 52 45 45 51 59 49 52 46 43 48 57 55 55 50 42 70 39 50 54	23† 10 3 2† 22 8† 22 20 20 4 12 22 9† 1† 15† 7 128 1	53 34 52 30 30 46 43 40 41 29 49 46 27 25 46	T. 0.00 T. T. 0.00 T. T. 0.00 T. T. 0.00 T. T. T.	- 0.03 - 0.00 - 0.01 - 0.01 - 0.02 - 0.00	0.00 T. 0.05 T. 0.00 0.00 T. 0.00 0.00 T. 0 T.		0 0 0 0 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	29 20 17 15 11 20 29 26 15 8 25 10 30 23 23 228 24 24 27 30	2 2 3 3 11 12 16 4 2 1 14 23 6 21 1 6 5 5 0 4 6 6 1 7 2 2 0	0 8 3 4 4 7 7 0 4 4 2 2 0 0 0 2 3 3 3 1 1 2 7 2 1	S. SW. NW. W. W. NW. NW. NW. NW. NW. S. W. W. SW. NW. SW. NW. SW. SW. SW. SW. SW. SW. SW. SW. SW. S	S. H. Gerrish. Frank Kettlewell. Miss E. Ruth Abbott. Dr. A. K. Johnson. U. S. Weather Bureau. Do. E. T. Tanner. U. S. Weather Bureau. Frank Jones. U. S. Weather Bureau. Southern Pacific Co. Do. Capt. W. G. Waters. Southern Pacific Co. G. W. Russell. Santa Clara College. W. R. Springer. Southern Pacific Co. Edwin Morris. N. D. Ingham. M. L. McDonald, jr. Southern Pacific Co. M. Lewis. Dr. T. J. Edgecomb. Mrs. A. C. Gregory.

Table 1.—Climatological data for July, 1911. District No. 11—Continued.

			years.	Tem	perature	e, in o	legre	es Fab	renh	eit.	Prec	ipitation	, in in	ches.	days,		Sky.		direc-	
Stations.	Counties.	Elevation. feet.	Length of record, years	Mean.	Departure from the normal.	Highest.	Date.	Lowest.	Date.	Greatest daily range.	Total.	Departure from the normal.	Greatest in 24 hours.	Total snowfall, unmelted.	Number of rainy days, 0.01 inch or more.	Number of clear days.	ber of pa	Number of	ing wind tion.	Observers.
California—Continued.	Sierra	5,000	1	65.0		93	16	32	22	55	0.30		0.12	0	3	25	1	5		C. D. Johnson.
SissonSoledad **	Siskiyou Monterey	3,555 188	22 37	67. 8 66. 2	- 1.9 + 0.1	94 85	12† 7	42 52	22 22	46	0. 72 0. 00	+ 0.67 0.00	0. 60 0. 00	0	0	25 28 31	0	3 0	n.	Southern Pacific Co. Do.
Southeast Farallon Sonora Squirrel Inn Stirling City Stockton (S. H.) Storey	San Joaquin Madera	30 1,825 5,280 3,525 23 296	8 23 1 7 40 11	78.6 66.4 74.3	•	104 88 101 98	16 30 16 25	53 52 51 51	1† 1† 21 20	42 35 40 40	T. 0.00	- 0.02 - 0.02	0. 00 T. 0. 00 0. 00	0 0 0 0	0 0 0 0	30 31 28 31	1 0 2 0	0 0 1 0	sw. s. se. nw.	U. S. Weather Bureau. Chas. P. Jones. A. D. Frantz. Butte County R. R. Co. State Hospital. Santa Fe Co.
Suisun **. Summerdale. Summit. Susanville. Tamarack. Tehachapi ***.	LassenAlpine Kern	20 5,270 7,017 4,175 8,000 3,964	31 15 38 22 5 34	58.8 68.2 55.8 81.3	+ 1.5 - 2.2 - 3.6 + 4.9	96 80 96 86 99	15 16 17 18 16	43 36 39 28 69	1 25 1† 1† 23†	45	0. 00 0. 00 0. 77 0. 83 0. 00	- 0.03 - 0.20 + 0.65 - 0.01	0. G0 0. 00 0. 42 0. 22 0. 00	0 0 0 0	0 0 3 8 0	26 29 19 17	5 0 12 14	0 2 0 0	sw.	Southern Pacific Co. Mrs. J. E. Lowry. Southern Pacific Co. James Branham. William Bennett. Southern Pacific Co.
Tehama ** Tejon Rancho Three Rivers Towle Tracy **	Tehama Kern Tulare Placer San Joaquin	220 1,500 870 3,704 64	40 9 1 25 31	86.8 78.3 81.4 69.9	+ 2.7 - 1.2 + 5.0	111 95 108 93 105	16 17 16 8 16	70 55 54 39 64	1 1 1 4 20	24 45 44	0.00 T. T. T. 0.00	- 0.08 - 0.11 - 0.01	0.00 T. T. T. 0.00	0 0 0 0	0 0 0	29 23 19 30 26	1 7 10 1 5	1 1 2 0 0	n. n. sw. sw. nw.	Do. S. E. Bailey. E. D. Barton. Southern Pacific Co. Do.
Ukiah Upland Upper Lake Vacaville Valley Springs *** Visalia	Solano Calaveras Tulare	1,350 175 673 334	18 14 26 23 22 23 3	74. 2 77. 4 74. 6 80. 4 79. 4	+ 1.1 + 4.3 - 1.8	110 104 108 106 109 107	16 25 15 16 16 16	43 49 49 43 58 52	21 7 1 26 20 22	58 44 46 62 44	0.00 0.00 0.00 0.00 0.00 T.	- 0.03 - 0.01 - 0.03 0.00 - 0.03 - 0.03	0.00 0.00 0.00 0.00 0.00 T.	0 0 0 0 0	0 0 0 0 0	31 29 30 27 31 26	0 2 1 4 0 4	0 0 0 0 0	sw. nw.	Dr. Geo. McCowen. A. P. Harwood. C. M. Hammond. G. O. Coburn. Southern Pacific Co. Santa Fe Co.
Warner Springs Wasco Watsonville Weitchpec Westley ** Wheatland	Santa Cruz Humboldt Stanislaus Yuba	336 23 1,700 90 84	11 15 1 22 24	71. 2	- 4.1 - 1.5 + 0.2	97 82 102 108 106	30 1 16 16 16	39 41 60 52	1† 1 7 24 20	41 43 42 40	0. 14 0. 00 0. 03 0. 00 T.	0.00 - 0.03 - 0.01	0. 14 0. 00 0. 03 0. 00 T.	0 0 0 0	0 1 0 0 0	19 5 29 31 27	7 25 1 0 3	1 1 0 1	n.	Mrs. F. S. Sandford. Santa Fe Co. Spreckels Sugar Co. M. E. Lathrop. Southern Pacific Co. Wm. Lumbard.
WillowsYosemite		136 3,945	32 7	1			13†	42	···i	50	0.39		0.37	0	····2	26	5	0	s.	L. C. Stiles. J. P. Kelly.

a, b, c, etc., indicate respectively 1, 2, 3, etc., days missing from the record.

** Temperature extremes are from observed readings of the dry bulb; means are computed from observed readings.

† Also on other dates.

T. Precipitation is less than 0.01 inch rain or melted snow.

Table 2.—Daily precipitation for July, 1911. District No. 11, Oregon.

Stations.	Watershed.														1	Эау (of mo	onth.														
. Stations.	watersned.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Oregon.																												i				
amath Agency	Klamath			ļ	·						ļ			ļ												ļ	ļ		ļ			
amath Falls keview	do Pitt																					l::::										
ng Valley	do Interior	····		ļ						:			T.	T.				. 34	. 15			·					T,	ļ				
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DISTRICT No. 11. CLIMATOLOGICAL SUMMARY.

Table 2.—Daily precipitation for July, 1911. District No. 11—Continued.

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Table 2.—Daily precipitation for July, 1911. District No. 11—Continued.

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Table 2.—Daily precipitation for July, 1911. District No. 11—Continued.

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^{*} Precipitation included in that of the next measurement.

‡ Separate dates of falls not recorded.

¶ Precipitation for the 24 hours ending on the morning when it is measured.

T. Precipitation is less than 0.01 inch rain or melted snow.

Table 3.—Maximum and minimum temperatures for July, 1911. District No. 11, California.

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	Max.	Miņ.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1 2 3 4 5			80 89 87 92 96	34 34 43 44 46	95 98 100 98 100	67 67 69 65 70	84 86 87 89 90	46 47 47 51 58	96 101 107 108 110	74 69 69 73	92 95 93 94 95	68 61 65 61 59	57 56 61 59 60	49 50 50 52 50	95 100 102 101 104	61 65 66 66 66			73 71 75 76 79	59 59 58 58 58	82 77 80 79 81	63 66 61 63 69	91 91 92 96 96	45 48 49 49 50	90 100 101 103 103	55 56 56 65 67	93 98 97 100 102	66 70 67 67 68
6 7 8 9 10			93 87 82 90 94	47 45 37 35 40	106 105 106 106 100	70 73 73 62 70	90 86 93 95 87	55 57 58 47 55	107 107 105 106	73 74 69 71	92 90 96 94 94	61 58 70 63 60	58 57 58 59 59	51 49 46 47 48	103 100 98 104 95	68 62 68 68			78 74 74 72 68	59 58 59 57 58	83 73 82 83 78	65 61 62 66 59	97 95 93 92 94	52 47 43 51 50	102 100 98 103 99	68 62 63 64 64	98 97 96 102 102	69 69 68 74 66
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16 17 18 19 20			101 94 90 89 89	53 54 49 50 47	111 100 108 103 102	83 83 73 69 71	98 93 86 80 84	65 63 47 40 39	113 108 102 102	82 80 78 84	105 100 90 84 84	73 67 62 55 51	57 57 57 58 57	49 50 50 50 50 52	111 106 98 99 95	78 79 74 66 61			*90 80 81 77 75	66 62 62 60 60	94 81 74 69 70	79 67 63 53 52	102 98 92 91 90	61 63 59 51 46	110 105 103 100 99	77 82 75 68 62	111 102 98 91 92	83 82 72 66 59
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26 27 28 29 30			88 92 93 90 89 90	46 46 45 56 44 40	104 101 107 106 109 108	69 71 70 67 73 70	93 90 95 95 96 90	60 49 51 54 60 53	105 99 104 110 114 113	75 72 72 73 79 83	99 91 89 94 96 96	66 60 57 57 60 59	57 56 58 57 57 55	53 51 51 50 49 51	106 101 101 102 105 104	68 70 65 65 64 67			77 83 76 80 88 . 92	58 58 55 59 59 65	87 80 78 83 87 83	75 64 64 67 72 72	95 95 92 92 96 95	51 49 51 49 47 49	107 104 102 104 105 104	71 72 62 66 65 64	101 98 96 98 102 101	76 70 66 66 68 68
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16 17 18 19 20	101 95 93 89 90	75 69 66 61 60	98 81 80 75 77	66 59 56 51 51	71 67 68 72 68	64 62 62 62 63	60 58 58 60 59	50 52 51 51 51	81 73 72 70 68	55 56 53 53 54	80 75 72 70 68	53 54 53 52 51	73 78 76 70 72	59 60 58 58 57	78 70 70 68 72	50 51 50 49 50	91 92 94 87 86	59 50 49 49 50	97 87 87 87 87	68 53 60 53 51	80 79 74 72 72	52 55 53 51 49	92 96 88 88 88 84	57 63 53 54 50	98 97 95 92 92	57 57 60 53 51
21	83 89 94 99 105	60 61 59 58 64	77 87 86 90 98	51 53 52 52 58	66 70 70 69 72	62 62 60 60 62	59 60 60 65 70	51 51 50 51 50	70 77 74 75 87	51 46 53 55 55	70 73 74 78 77	52 48 52 51 51	70 70 72 80 73	57 55 57 57 58	75 79 74 79 93	47 43 50 51 50	87 94 .88 89 90	49 48 47 48 50	81 89 87 91 98	51 54 53 53 58	71 72 68 65 71	42 40 42 44 36	83 82 91 90 85	45 44 51 50 52	90 90 90 98 98	46 45 47 48 50
26	100 95 99 99 105 105	64 60 58 62 62 68	100 83 87 91 98 94	64 55 52 56 58 62	70 72 70 73 76 88	62 62 62 61 61 61	61 58 60 60 64 62	51 51 51 50 49 52	81 77 76 80 86 85	54 53 55 53 53 49	77 73 80 76 80 90	50 52 52 52 52 50 49	74 68 71 75 82 84	56 54 55 53 59	S1 70 73 78 87 85	50 52 49 48 47 43	90 86 86 85 90 83	46 47 49 51 50 47	95 85 88 95 96 95	62 58 54 55 58 63	72 73 61 73 74 71	43 48 41 42 40	85 85 88 88 85 85	51 47 52 51 50 46	94 93 94 97 96 96	49 49 48 50 50 47
Means	94.2	60.5	88.7	57.3	71.1	61.2	61.9	50.9	78.6	52.9	74.8	51.5	73.0	56.5	78.5	48.6	86.0	49.5	90.6	57.2	71.9	45.6	86.3	50.2	93.6	50.1

s, b, c, etc., indicate respectively 1, 2, 3, etc., days missing from the record.
§ Data are from standard instruments not supplied by the U. S. Weather Bureau.
§§ Instruments are read in the morning; the maximum temperature then read is charged to the preceding day, on which it almost always occurs.

