

The greatest monthly rainfall was 21.35 inches at Nellie, and none occurred at Bagdad. The greatest 24-hour rainfall was 5.84 inches at Newhall. Other heavy rainfalls were 5.20 inches at Stirling, 3.41 inches at Magalia, 3.64 inches at Mono Ranch, 3.80 inches at Kennett; and 3.22 inches at Cuyamaca.

Snowfall.—March, 1912, was a month of moderately heavy snowfall in the mountains. The prospects for water were very poor at the beginning of the month, but were much improved at the close. The run-off was light and the streams were unusually low. This condition was in marked contrast with March, 1911, when the snow cover was unusually deep and all the streams were running bank full.

Summit.—The following table shows the depth of snow on the ground at Summit on given dates in March during the period 1907 to 1912:

	Mar. 1.	Mar. 15.	Mar. 31.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
1907.....	104	191	262
1908.....	116	130	60
1909.....	201	196	191
1910.....	65	38	68
1911.....	222	276	138
1912.....	26	81	53

SUNSHINE.

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

Station.	Hours.	Percentage of possible.	Station.	Hours.	Percentage of possible.
Eureka.....	179	48	Sacramento.....	194	52
Fresno.....	219	59	San Diego.....	178	48
Los Angeles.....	204	55	San Francisco.....	158	43
Mount Tamalpais.....	172	46	San Jose.....	196	53
Red Bluff.....	225	61	San Luis Obispo.....	134	36

NOTES ON THE RIVERS OF THE SACRAMENTO AND SAN JOAQUIN WATERSHEDS DURING MARCH, 1912.

By N. R. TAYLOR, Local Forecaster.

Sacramento watershed.—All streams in this watershed averaged lower than for any corresponding month of which there is a record, except that the Sacramento River at Red Bluff was lower in March, 1898.

For the fourth consecutive month, which covers a period during which high stages are almost invariably maintained, with occasional floods and freshets, the rivers have remained unprecedentedly low, the average at many points on the Sacramento and other streams since December 1, 1911, showing but little departure from that of the summer months.

There were substantial rises in the Sacramento River from Redding to the mouth of the Feather River between the 7th and 15th, and a slight swell at points below Vernon between the 15th and 20th. There was practically no rain after the middle of the month, and by the 15th the river was falling at all points above Colusa, and by the 21st a general fall was in progress.

The rivers of the Feather-Yuba territory responded slightly to the rainfall, but there were no rises much in excess of 2 feet at any point along these streams, all of which averaged from 2 to 3 feet below the March normal stages and much below the lowest averages previously recorded in March.

The American River averaged 1.3 feet below the previous lowest average for the month. It rose slowly during the first few days of the month and culminated in a stage of 6.3 feet on the 7th. After this date it fell steadily.

The occurrence of snowfall in the mountains was practically coincident with the rains in the valleys, and at some points over a foot of snow fell as low as the 2,000-foot level. The effect of melting snow on stream flow was barely appreciable at any time during the month.

The water supply now in sight in the Sacramento watershed is probably the most limited that has ever before been known at this season of the year, and there is every indication that record breaking low-water stages will be reached during the coming summer and fall in all streams and that there will be an unusual scarcity of water for agricultural and mining purposes.

Lower San Joaquin watershed.—The rainfall of the San Joaquin drainage basin, like that of the Sacramento, was mostly confined to the first half of the month. It was, however, more copious, and along many of the streams the normal for the month was exceeded. This was notably so in the upper reaches of the San Joaquin and in the headwaters of the Mokelumne, Tuolumne, and Stanislaus. In the lower Mokelumne and in the Calaveras and the San Joaquin below Lathrop the rainfall was deficient. While all streams in this watershed showed the effects of the rainfall there was in no case a rise greater than 2 feet. From the 18th to the end of the month the rivers fell steadily, and the average for all streams is the lowest on record for the month.

There will probably be a marked shortage of water at all points in this watershed during the late summer and fall and an absence of the usual June freshets.

NOTES ON THE STREAMS OF THE UPPER SAN JOAQUIN WATERSHED.

By W. E. BONNETT, Local Forecaster.

As might be expected in the driest of recent years, the streams in the upper San Joaquin watershed were lower than they have been for many years. Notwithstanding precipitation during the month was considerably in excess of the normal for March, there was very little run-off and but little change in the streams.

In the Kaweah, the range from lowest to highest water was only 0.3 foot; in the Kings, 0.5; in the San Joaquin at Friant, 1.5 feet; and at Firebaugh, 1.2. At Merced Falls on the Merced there was a range of 1.8 feet. The highest water in the upper San Joaquin occurred at Friant on the 7th and at Firebaugh on the 9th. The highest stages in the Merced and Kings occurred a few days later than this, while the Kaweah apparently was not affected by the several storms of the month as its stage remained remarkably uniform throughout. All streams in the district except the Kaweah fell during the latter half of the month.

WEATHER CONDITIONS AT LOS ANGELES, CAL.

By A. B. WOLLABER, Local Forecaster.

The drought which prevailed in southern California during the closing months of 1911 and January and February, 1912, and which was the most severe of any on record since the establishment of this station, was effectually broken by the copious rains which fell over this section from March 1 to 13, inclusive, and which resulted in over 6 inches of rain in Los Angeles, and correspondingly generous amounts in the outlying districts south of the Tehachapi.

One of the most severe rain and wind storms that has visited this section in many years occurred on the night of the 9th and early morning of the 10th, the wind along the coast and at sea blowing a gale for many hours, causing a great deal of damage to coastwise shipping, piers, docks, etc., along the southern coast. At Newport Beach the wind swept up the harbor during the entire night, wrecking a number of power launches and other small craft, and sinking a steam dredger belonging to the Collins Commercial Co. Among the launches to suffer damage were the *Emily*, *Rover*, *Charlotte*, and *Tommae*. The old Southern Pacific wharf was blown to pieces, as well as the bulkhead along the ocean front below Balboa. The greatest damage to property occurred at Long Beach, where the pleasure pier, built some 7 years ago at a cost of several hundred thousand dollars, was partially destroyed.

The waves dashed over the pier all Saturday night and by Sunday morning the beach was strewn with wreckage. The entire outer part of the pier, approximately 100 by 80 feet in size was washed away, up to the south wall of what is known as the "sun parlor." The loss is estimated at about \$30,000. Two lives are known to have been lost during the storm, both men being fishermen. The steamer *Yosemite* arrived in Los Angeles harbor about 2 p. m. Sunday, after having battled with the storm for hours Saturday night. She had a propeller shaft broken, and lost much of her deck load of lumber in the storm. The captain and crew of the vessel report the most severe gale they have experienced in years. All incoming shipping report terrific winds at sea Saturday night, and all arrived in a more or less damaged condition.

Electric light, telephone, and telegraph wires suffered from the high winds, while several small dwellings in the course of erection were blown down. Storm warnings were displayed well in advance of the storm.

Notwithstanding the long dry spell, the heavy rains caused a rapid rise in the San Gabriel River, and some minor washouts occurred at several places, but no serious damage resulted. Heavy rain warnings were sent out to the transportation and water companies to prepare for a rapid rise in all streams.

The storm moved in from the ocean over southern California, causing the lowest barometer reading in this section of which there is a record. At Los Angeles the lowest pressure reading, reduced to sea level, was 29.26.

Mr. T. S. Manning, storm warning displayman at Avalon, Catalina Island, commenting on the storm writes as follows:

It rained hard all day of the 9th, with wind from east to northeast. Barometer fell steadily, the last reading taken at 10 p. m., being 29.28, a drop of 66 points from 5 o'clock Friday. Wind shifted to SE, by going around to NW, W, and S. Precipitation for the storm 3 inches. Gales from southeast all night blowing down some 50 trees. No damage in harbor, as wind was off shore. Capt. Matthews of the *Comfort* reports his glass at 29.20 at 2 a. m., of the 10th. The steamer *Cabrillo* unable to face the storm Sunday morning, was forced to turn back to San Pedro.

Following closely the storm of the 9th-10th came the one which moved inland over northern California on the night of March 11, and while the rainfall was heavy in southern California, the winds did not attain as high velocity over the inland sections as during the previous blow. The storm was severe along the coast and at sea, however, and all incoming steamers reported heavy seas and high winds outside. The oil steamer *Rosecrans* was wrecked near Gaviota, Cal., at 4 a. m., on the morning of the 12th, resulting in the loss of the vessel and two of the crew. Storm warnings were displayed for this storm.

Special rain warnings were issued to transportation and water companies to prepare for high water in the several rivers of the south. No damage resulted from high water.

THE SEVERE COLD OF DECEMBER 25-26, 1911, IN THE CITRUS DISTRICTS OF SOUTHERN CALIFORNIA, AND METHODS ADOPTED FOR FRUIT PROTECTION.

By A. B. WOLLABER, Local Forecaster, Los Angeles, Cal.

The fall and early winter of 1911 stand out prominently among recent years as particularly disastrous to the citrus-fruit interests of southern California, a continued cold period of about 50 days, culminating on December 25 and 26 in a freeze among the most severe ever experienced in this locality. The freeze was much more widespread than that of two seasons ago, and while some groves that were badly frozen in 1908 and 1909 escaped practically without injury this year, many sections hitherto considered immune from frost suffered greatly during the present cold spell. The damage was about equally distributed over the high and low lands, orchards on the higher levels suffering quite as much in places as those in the valleys below.

As the conditions which preceded the cold spell undoubtedly contributed largely to the damage which resulted, a consideration of these conditions may help to a more intelligent discussion of the subject. From November 1 to December 31, 1911, there were only three fairly well-defined storms which entered the North Pacific States and moved southward over the Pacific slope, these movements taking place on November 10, December 17, and 27. All of these caused light precipitation at scattered places in southern California, but all moved too far inland to effectually break the long continued drought prevailing in this section at the time.

There was, however, a well-defined storm movement from the Gulf of California northeastward over the Colorado River Valley, the storms remaining in that locality from 24 to 36 hours, then moving eastward or northeastward to points where they ceased to be a factor in the weather of the Southwest. During most of the time under consideration the pressure was high over the Pacific Northwest and the northern Rocky Mountain region, which caused a general drift of the surface air from the north over southern California. It is said by old residents that there was more cold north wind in this section during the months of November and December, 1911, than had been known for a great many years. This statement is in a measure verified by the actual wind movement in Los Angeles, the only point in the vicinity of the fruit belt where a record of the velocity of the wind is made. The prevailing direction for both months in Los Angeles was from the northeast, with an average hourly velocity of 6.1 miles an hour for November and 7.5 miles for December. The average hourly velocity in this city for November and December, taken from all records (35 years), is 4.1 and 4.4 miles, respectively. The total movement of the wind in miles for November was 4,419, almost breaking the record, and 5,614 for December, the greatest number of miles ever recorded for this month since the establishment of the station in 1877.

In nearly all sections of the fruit belt the wind was almost constantly from the north, with unusually high velocities in many places, the continued cold north wind causing the soil to dry out and lose much of its accumulated heat. A fairly good idea of the extreme dryness prevailing at the time of the severe freeze may be had