

U. S. DEPARTMENT OF AGRICULTURE, WEATHER BUREAU.

CALIFORNIA SECTION.

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VOL. XX. SAN FRANCISCO, DECEMBER, 1916. No. 12.

GENERAL SUMMARY.

December, 1916, was the fourth consecutive month with a mean temperature below the normal in California. No December during the past 20 years has been colder, taking the State as a whole. The mean temperature, 41.8°, was 4.9° below the normal. At no less than 14 stations in the State subzero temperatures were recorded at some time during the month, the lowest being -25°, which occurred at Bridgeport on the 27th. Except along the immediate coast, freezing weather occurred throughout the entire State. Cold, northerly winds prevailed. As in the preceding month, frosts occurred with extraordinary frequency in the agricultural regions, San Jose reporting frosts on 19 days, Red Bluff on 13 days, Sacramento on 16 days, Fresno on 19 days, and Los Angeles on 10 days. The average precipitation for the State was 5.81 inches, or 1.78 inches more than the normal. The snowfall in the mountains was decidedly above the normal for December, and at many stations it was more than twice the normal in amount.

During the first five days of the month a general storm gave moderately heavy precipitation throughout the central and northern portions of the State, the rainfall of December 2-3 being especially heavy. Preceded by relatively warm weather, this storm was followed by abnormally cold weather which persisted unbroken for two weeks. This period was rainless and almost entirely cloudless. While the daylight hours were mild and pleasant, with an abundance of warm sunshine, the nights were cold, and numerous destructive frosts were caused by the accelerated radiation. From the 21st to the 28th the second storm of the month brought wide-spread precipitation. The rainfall was excessively heavy in southern California on December 23-24, when during a period of 24 hours more than five inches of rain fell throughout a large region. At one station, Tujunga Canon, 11.60 inches of rain fell within this period. In spite of this torrential downpour, streams did not reach flood stages, as the soil had previously become so thoroughly parched that most of the water was absorbed as it fell. Though no more rain fell during the last three days of the month, the weather remained cloudy and unsettled.

From an agricultural viewpoint, the rains were beneficial, but the cold weather and the attendant frosts were harmful. On the cattle ranges in the north portion of the State, grass has grown but slowly on account of the subnormal temperatures. Grazing stock has suffered materially from lack of feed, as well as from the cold, raw winds. On the other hand, the abundant rainfall in southern California has not only dispelled the drought, but the increased moisture has tended to offset the harmful effect of the severe frosts which have been so frequent of late. However, unharvested citrus fruit was seriously injured, and in some restricted districts was entirely destroyed. This was particularly true in the lowlands of the San Joaquin Valley, where December frosts have largely destroyed that part of the unharvested crop which had survived the severe weather experienced during November. A considerable amount of frost-bitten fruit has dropped from the trees, and in certain districts young trees are shedding their leaves. Winter-growing crops in the central portion of the State have made a good start. The fine weather which characterized the middle decade of the month was used to good advantage in the performance of the varied duties which mark the close of one crop-growing season and which precede the beginning of the next.

A. H. P.

PRESSURE.

The monthly mean atmospheric pressure for the State, reduced to sea level, was 30.07 inches.

The highest was 30.56 inches at Red Bluff on the 11th.

The lowest was 29.25 inches at Red Bluff on the 24th.

The range for the State was 1.31 inches.

TEMPERATURE.

The monthly mean temperature for the State was 41.8 degrees, which is 4.9 degrees below the normal.

The highest monthly mean was 56.5 degrees, at King City; and the lowest was 20.9 degrees, at Bridgeport.

The highest temperature, 88 degrees, occurred at King City on the 21st; and lowest, -25 degrees, occurred at Bridgeport, on the 27th.

The range for the State was 113 degrees.

PRECIPITATION.

The average precipitation for the State was 5.81 inches, or 1.78 inches above the normal.

The greatest monthly amount was 18.52 inches, at Deer Creek. 2 stations reported no precipitation.

The greatest amount in 24 hours was 11.60 inches at Tujunga Canon, on the 24th.

RELATIVE HUMIDITY.—(Per Cent.)

Stations.	5 a. m.	5 p. m.	Mean.
Eureka	93	87	90
Fresno	86	64	75
Los Angeles	67	60	64
Mount Tamalpais	70	72	71
Red Bluff	82	60	71
Sacramento	92	70	81
San Diego	78	73	75
San Francisco	83	67	75
San Jose	91	68	80
San Luis Obispo	81	63	72

SUNSHINE AND CLOUDINESS.

Stations.	Actual hours of sunshine.	Per cent of the possible.
Eureka	131	45
Fresno	191	64
Los Angeles	185	60
Mount Tamalpais	161	67
Sacramento	177	61
Red Bluff	135	46
San Diego	192	62
San Francisco	176	60
San Jose	151	50
San Luis Obispo	172	56

WIND MOVEMENT.—(Miles.)

Stations.	Total movement for month.	Average hourly velocity.	Maximum velocity.	Direction.	Date.
Eureka	4,509	6.1	40	w.	23
Fresno	4,096	5.5	40	nw.	24
Los Angeles	4,763	6.4	42	s.	23
Mount Tamalpais	17,155	23.1	74	nw.	20
Point Reyes	14,388	19.3	72	s.	2
Red Bluff	4,420	5.9	27	se.	23
Sacramento	6,110	8.2	39	se.	2
San Diego	4,244	5.7	40	w.	25
San Francisco	5,502	7.4	43	sw.	23
San Jose	4,578	6.2	36	se.	2
San Luis Obispo	3,025	4.1	22	n.	10

The prevailing direction of the wind for the State was north.

Climatological Data for December, 1916.

Table with columns: Stations, Counties, Elevation, Length of record, Mean, Departure from normal, Highest, Date, Lowest, Date, Greatest daily range, Total, Departure from normal, Greatest in 24 hours, Snowfall, Precipitation, Number of days (Clear, Partly cloudy, Cloudy), Prevailing direction of wind, Observers.

Climatological Data for December, 1916.-Continued.

Table with columns: Stations, Counties, Elevation, Length of record, Temperature (Mean, Departure from normal, Highest, Date, Lowest, Date, Greatest daily range), Precipitation (Total, Departure from normal, Greatest in 24 hours, Snowfall, Precipitation of inch or more, Clear, Partly cloudy, Cloudy), Number of days, Prevailing direction of wind, Observers.

Climatological Data for December, 1916.—Continued.

Stations.	Counties.	Elevation, feet.	Length of record, years.	Temperature, in degrees Fahr.						Precipitation, in inches.				Number of days.			Observers.			
				Mean.	Departure from the normal.	Highest.	Date.	Lowest.	Date.	Greatest daily range.	Total.	Departure from the normal.	Greatest in 24 hours.	Snowfall (unmelted).	Precipitation 40 inch or more.	Clear.		Partly cloudy.	Cloudy.	Prevailing direction of wind.
Ukiah	Mendocino	620	23	41.4	-3.7	63	12	23	8	37	7.92	+1.27	1.37	3.0	15	13	7	11	nw.	Dr. George McCowen.
Vacaville	Solano	175	28	44.4	-3.0	63	4	27	8	31	8.73	+3.55	2.65	0	12	19	3	9	n.	J. E. Bassford.
Valyermo	Los Angeles	3,750																		U. S. Forest Service.
Visalia	Tulare	334	28	44.0	-2.2	66	3	21	14	39	2.36	+0.88	0.68	0	8	16	3	12	nw.	Santa Fe Co.
Walnut Creek	Contra Costa	149	2								5.94	+1.27	1.45	0	11					R. L. Nongaret.
Warner Springs	San Diego	3,165	8	44.7		76	112	20	9	51	2.09	1.07	4.0	6	18	6	7			J. A. Ream.
Wasco	Kern	336	16	42.2	-2.3	69	5	19	9	34	1.96	+1.55	0.92	0	5	19	0	12	se.	Santa Fe Co.
Watsonville	Santa Cruz	23	20	48.1	-2.8	72	112	29	25	38	6.21	+2.77	1.67	0	11	14	5	12	s.	Spreckels sugar Co.
Weaverville	Trinity	2,162	4	34.5		57	19	7	25	34	5.46	-1.81	1.14	27.0	16	15	6	10		U. S. Forest Service.
Weitchpec	Humboldt	1,700	6	36.2		55	114	21	25	26	14.14		2.73	44.5	17	8	3	20	nw.	U. S. Forest Service.
West Branch	Butte	3,216	2	37.1		65	14	11	25	36	14.39		4.18	30.0	12	11	9			C. S. Garnett.
Wheatland	Yuba	84	29	43.2	-1.8	58	15	27	25	26	4.80	+1.12	1.28	0	10	14	9	8	s.	Pacific Gas & Electric Co.
Willows	Glenn	136	37	44.2	-3.0	76	4	26	18	38	2.69	-0.35	0.61	5.0	10	22	0	9	n.	Wm. Lombard.
Yorba Linda	Orange	405	2	50.3		78	15	29	26	33	3.50		2.28	0	7	6	12	13		F. E. Barnhouse.
Yosemite	Mariposa	3,960	12	39.9		52	7	3	27	35	7.83	+2.05	2.80	46.0	12	13	6	12	s.	S. J. Walker.
Yreka	Siskiyou	2,625	27	29.2		53	19	-1	28	34	2.23		0.50	19.6	11	1	13	17	ne.	Supt. National Park.
Means and Extremes				41.8	-4.9	88	21	-25	27	66	5.81	+1.78	11.60		9	15	5	11	n.	U. S. Forest Service.

The departures from the normal temperature and precipitation are computed only for such stations as have ten or more years of record, but all complete reports are used in determining section or division means.

** 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.

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

COMPARATIVE DATA FOR DECEMBER.

MEAN MONTHLY TEMPERATURE FOR THE STATE.

1897	44.4	1907	48.3
1898	44.4	1908	43.2
1899	45.8	1909	43.3
1900	47.3	1910	47.8
1901	47.4	1911	43.3
1902	46.6	1912	44.7
1903	48.0	1913	44.8
1904	47.2	1914	41.8
1905	45.3	1915	45.7
1906	47.3	1916	41.8

AVERAGE PRECIPITATION FOR THE STATE.

1897	1.75	1907	5.41
1898	1.20	1908	2.33
1899	3.03	1909	6.92
1900	1.68	1910	1.87
1901	1.45	1911	2.05
1902	2.96	1912	1.58
1903	1.44	1913	7.04
1904	3.04	1914	5.00
1905	1.55	1915	5.56
1906	8.42	1916	5.81

ERRATA. OCTOBER, 1916.

Angiola, page 118, mean temperature, 57.3°, should be 57.2°.
Yosemite, pages 120 and 123, total precipitation, 8.71, should be 10.71.

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Head Dam, page 130, mean temperature, 47.5°, should be 47.2°.
Independence, page 130, mean temperature, 42.9°, should be 42.7°.
San Jose, page 131, mean temperature, 50.7, should be 50.6.
Santa Monica, page 131, mean temperature, 53.2°, should be 52.4°.

DELAYED REPORTS.

Stations.	Month.	Temperature.					Total precipitation.
		Mean.	Max.	Date.	Min.	Date.	
Livermore	September.	66.4	102	19	41	19	0.44
Glenn Ranch	October.						4.91
Livermore		57.6	83	25	34	24	0.50
El Cajon	November.	56.4	88	9	25	14	0.00
Georgetown	"						5.10
Glenn Ranch	"						0.00
Helen Mine	"						6.20
Santa Ana River	"	53.7	86	1	30	13	0.10

DATES OF MISCELLANEOUS PHENOMENA.

Thunderstorms.—Crescent City, 22, 23; Dudleys, 24; Eureka, 22, 23; Happy Camp, 23; Lindsay, 24; Livermore, Mills College, 23; Oakland, 22; Red Bluff, 5, 22; San Francisco, Santa Cruz, 23; Weitchpec, 22.

Earthquakes.—Bishop, 7; Calexico, 7, 18; San Luis Obispo, 2; Santa Maria, 1.

Daily Precipitation for December, 1916.

Table with columns for Stations, Day of Month (1-31), and Total. Rows list various locations such as Abbotts, Aguanga, Alturas, American Camp, Anziola, etc., with their respective precipitation values for each day and a total for the month.

Daily Temperature for December, 1916.

Table with columns for Stations, 1-31, and Mean. Rows list various California locations such as Alturas, Bakersfield, Barstow, etc., with their corresponding daily temperature data for December 1916.

SNOWFALL IN THE MOUNTAINS.

On December 1, 1916, the only snow in the mountains of California was that above the 5,000-foot level in the Sierra Nevada, where about 10 inches of snow still remained. During the first six days of the month a general storm gave moderately heavy precipitation throughout the State. Owing to the high temperatures prevailing at the time, the precipitation in the mountains of southern California was entirely in the form of rain, except upon the high peaks, where light snow fell. In the Coast Ranges only a small portion of the precipitation was in the form of snow, and that melted rapidly upon reaching the ground. In the Sierra, however, considerable snow accumulated on the ground, even at the low levels. Above the 5,000-foot level 15 to 20 inches of new snow was added during the storm, most of it falling December 2-3, when the precipitation was unusually heavy throughout the northern and eastern portions of the State. No more snow was added between the 7th and 20th, which was a rainless period. Though the mean temperatures remained low during these two weeks, the sunshine on clear days was sufficiently warm to melt a considerable portion of the snow in exposed places. On December 20th there was no snow below the 5,000-foot level of the Sierra, while at the very crest of the divide only a foot of snow remained unmelted. On the 21st the second general storm of the month arrived, and between that date and the 28th a considerable amount of precipitation fell everywhere in California. Relatively low temperatures accompanied this storm, and as a result, most of the precipitation in the mountain regions of the State fell in the form of snow. During this storm 20 to 25 inches of snow accumulated on the ground in the more elevated portions of the Coast Ranges and in the mountains of southern California. Excessively heavy snow fell in the Sierra Nevada. The snowfall of December 23-24 was extraordinary. During these two days 65 inches of snow fell at the summit, or 7,000-foot level, of the range, while 35 inches fell at the 5,000-foot level. Even in the lower foot-hills several inches of snow accumulated, while measurable amounts were recorded at many stations in the Sacramento and San Joaquin valleys. As the last three days of the month were cloudy and unsettled, little melting occurred, except at low levels. At the close of the month there was a foot or more of unmelted snow in the higher portions of the Coast Ranges and in the mountains of southern California, while at the crest of the Sierra more than 75 inches of snow still remained. For the month as a whole the snowfall in the mountains of California was decidedly above the normal for December, and at many stations it was more than twice the normal in amount.

A. H. P.

COMPARATIVE SNOWFALL DATA FOR DECEMBER.

(Amount on the Ground.)

	FORDYCE DAM.			SUMMIT.			TAMARACK.		
	1st.	15th.	End of mo.	1st.	15th.	End of mo.	1st.	15th.	End of mo.
1906.....	2	60	60	5	70	46	55	101	125
1907.....	0	30	72	0	42	87	0	39	74
1908.....	11	27	21	24	32	21	29	43	32
1909.....	2	25	43	2	24	45	26	52	65
1910.....	4	2	0	7	4	4	8	21	24
1911.....	4	1	44	1	2	66	3	5	45
1912.....	6	22	30	T.	14	19	3	29	42
1913.....	35	35	60	31	24	80	35	41	110
1914.....	8	40	31	12	46	26	10	31	27
1915.....	9	57	45	6	67	40	3	67	48
1916.....	15	42	74	14	16	77	.....	.....	.....

Snowfall Data. [In inches.]

WATERSHED, COUNTY, STATION.	Elevation, feet.	Total snow-fall.	Compr'd with normal.	Am't on ground 15th.	Am't on ground end mo.
Klamath Watershed.					
<i>Siskiyou County.</i>					
Yreka.....	2,625	20	.....	0	10
<i>Trinity County.</i>					
Hayfork.....	2,300	.....	.....	.....	.....
Ruth.....	2,925	.....	.....	.....	.....
<i>Humboldt County.</i>					
Weitchdec.....	1,700	44	+30	0	20
Mountain Lakes.					
<i>Modoc County.</i>					
Cedarville.....	4,675	18	+7	6	12
Fort Bidwell.....	4,375	24	.....	2	12
<i>Lassen County.</i>					
Eagle Lake.....	5,000	23	+5	0	9
Madeline.....	5,270	17	+6	0	12
Susanville.....	4,175	.....	.....	.....	.....
<i>Nevada County.</i>					
Boca.....	5,531	23	-2	0	.....
Truckee.....	5,817	59	+26	6	18
<i>Mono County.</i>					
Bridgeport.....	6,500	13	.....	0	8
<i>Placer County.</i>					
Tahoe.....	6,230	63	.....	1	4
<i>Inyo County.</i>					
Bishop Creek.....	8,500	56	+28	0	26
Lone Pine.....	3,728	2	.....	0	0
Wells Meadow.....	5,280	33	.....	0	16
Sacramento Watershed.					
<i>Siskiyou County.</i>					
Dunsmuir.....	2,285	34	+22	0	.....
McCloud.....	3,270	39	+10	0	18
Sison.....	3,555	30	+6	0	14
<i>Modoc County.</i>					
Alturas.....	4,400	11	+4	1	8
<i>Shasta County.</i>					
Burney.....	3,300	17	-1	0	12
<i>Plumas County.</i>					
Bucks.....	5,515	112	+55	12	52
Canon Dam.....	4,570	32	.....	2	20
Chester.....	4,550	38	+9	6	20
Clover Valley.....	5,700	38	+22	2	14
La Porte.....	5,000	62	+25	6	34
Portola.....	4,832	27	.....	0	20
Quincy.....	3,400	32	+22	0	17
<i>Butte County.</i>					
De Saba.....	2,500	26	+16	0	12
Inskib.....	4,975	64	+23	10	42
Stirling City.....	3,525	38	+22	0	17
West Branch.....	3,216	30	+9	0	21
<i>Yuba County.</i>					
Camptonville.....	3,500	38	+25	0	22
<i>Sierra County.</i>					
Downieville.....	3,150	36	+19	0	17
Sierra City.....	4,300	46	+19	0	22
Sierraville.....	5,000	18	0	0	14
Table Rock.....	5,980	104	+54	21	66
<i>Nevada County.</i>					
Deer Creek.....	3,700	70	+47	0	34
Fordyce Dam.....	6,500	106	+53	42	74
Lake Spaulding.....	4,600	78	+24	3	39
<i>Placer County.</i>					
Blue Canon.....	4,695	65	+36	0	42
Emigrant Gap.....	5,230	83	+44	2	48
Summit.....	7,017	100	+28	16	77
San Joaquin Watershed.					
<i>Alpine County.</i>					
Tamarack.....	8,000	.....	.....	.....	.....
<i>Tuolumne County.</i>					
Center Ranger Station.....	3,850	.....	.....	.....	.....
Hetch Hetchy.....	3,665	23	+16	0	12
Lake Eleanor.....	4,700	54	+30	0	38
<i>Mariposa County.</i>					
Yosemite.....	3,945	46	+29	0	36
<i>Fresno County.</i>					
Cascada.....	4,900	46	.....	0	24
Huntington Lake.....	6,950	74	.....	3	37
Stevenson Creek.....	4,250	40	.....	0	.....
<i>Tulare County.</i>					
Hot Springs.....	3,300	0	-2	0	0
Springville.....	4,000	38	+26	0	21
Mountains of Southern California.					
Bear Valley Dam.....	6,700	.....	.....	.....	.....
Converse Nursery.....	6,000	34	.....	0	25
Squirrel Inn.....	5,280	23	+12	0	20
Seven Oaks.....	5,000	23	+11	0	16
Nellie.....	5,350	11	.....	0	8
Julian.....	4,222	16	.....	0	6
Valyermo.....	3,750	.....	.....	.....	.....