

Summary of the Month

by Bill Mork

California Department of Water Resources

A mean upper level trough of low pressure in the eastern Pacific insured enough onshore flow for mostly near to a little above normal July temperatures in California. Preliminary data show the statewide average temperature in July to be 72.4 degrees, 0.6 degree above normal. Area average temperatures ranged from 0.2 degree below normal on the Central Coast to 1.7 degrees above normal in the Sacramento drainage basin.

Cities with the greatest average temperature departures from normal were mostly in Northern California and include plus 4.3 degrees at Burney, plus 3.1 degrees at Adin and Yreka, plus 2.9 degrees at Mount Shasta, plus 2.8 degrees at Quincy, and plus 2.0 degrees at Fresno. Cities with average temperatures well below normal include minus 2.7 degrees at the Santa Barbara Airport, minus 2.5 degrees at Kentfield, and minus 2.2 degrees at the Oakland Museum. June Gloom conditions on the South Coast continued in much of July with 22 days of below normal temperatures in downtown Los Angeles and an average temperature of 1.2 degrees below normal. Riverside had only three days with 100 degrees or higher and an average July temperature of 1.5 degrees below normal. Death Valley recorded the highest temperature for the month on the 26th with 122, still 5 degrees shy of the record for the date.

Very few California cities received any precipitation in July with a statewide average of 0.03 inch, about 11 percent of normal.

WEATHER continued on page 2.

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Who's to blame: irrigation or climate change?

By Laura Edwards

Fresh fruits and vegetables are "cropping" up at local farmers markets. Yes, it's summertime in California. What else does that mean? Water for irrigation is in high demand. With irrigation in water-starved fields come thoughts of climate change, and its effects on irrigation practices. Or is it irrigation that is effecting climate change?

With some of North America's largest areas of irrigated land in California's Central Valley, it is important to study the links between irrigation farming and climate.

Traditional studies in the United States

have focused on the effects of climate change on irrigation and how we can adjust for these effects in long- and short-term water and crop planning. Most climate forecasts are showing rising average temperatures in California. These forecasts can help determine how much water will be needed, as well as when and where. Temperatures also have a strong connection with choice of crop type and crop rotations.

Irrigation adds water vapor to the atmosphere, which results in changes to temperature, precipitation and radiation. The evaporation of the added water vapor increases the greenhouse effect and absorbs more solar radiation. This cools the surface and heats up the atmosphere. This same additional water vapor may also condense and trigger precipitation or convection. The spin is that these results of excess water vapor are not necessarily occurring at the location of irrigation, but may affect another location downwind. This can be particularly important for California, where the natural environment receives little or no rain in the summer season. Gordon Bonan of National Center for Atmospheric Research (NCAR) said, "We are having a bigger impact on the environment through our local and regional land practices than through the standard global greenhouse reponse." (4)

IRRIGATION continued on page 2.



Photo courtesy of USDA:

<http://www.usda.gov/oc/photo/85c0114.jpg>

INSIDE THIS ISSUE: Fire Outlook for August, Monthly Station Data & Climate Maps

WEATHER (continued from page 1):

The Northern Sierra 8-Station Precipitation Index in July picked up 0.04 inch, 20 percent of normal. At the end of July, the Index stood at 46.8 inches, 90 percent of normal to date for the water year ending September 30. This represents 94 percent of the water year normal of 50 inches.

On the first three days of July, an upper level low triggered thunderstorms in the Sierra and northern mountains with 0.56 inch at Manzanita Lake and Yreka, 0.45 inch at Lodgepole, 0.27 inch at Mineral, 0.12 inch at Chester, and 0.06 inch at Bowman Lake. The summer monsoon began on July 8, five days later than average, according to the National Weather Service Office in Tucson AZ. The first good surge of monsoonal moisture plus moisture from dissipated Tropical Storm Blas brought heavy rains to portions of Arizona and to a few locations in Southern California on July 14 - 15. Southland rainfall for that period included 1.02 inches at Descanso in San Diego County, 0.45 inch at Forest Falls in San Bernardino County, and 0.41 inch at Idyllwild in Riverside County with 0.20 inch in 8 minutes. Moisture from Tropical Storm Blas also brought showers to the Central Coast on July 16 with amounts less than a tenth of an inch.

IRRIGATION (continued from page 1):

Recently, however, some scientists have begun to investigate the potential of large-scale irrigation to change the local or regional climate.

A recent paper by Boucher et al. (1) investigated the direct relationships among irrigation, atmospheric water vapor and climate. They conclude that irrigation and vegetation changes are “dominating factors of direct anthropogenic influence on the atmospheric water vapour content”.

Dr. John Christy at the University of Alabama-Huntsville has done some early studies on possible irrigation-induced warming in the Central Valley (3). Looking at 35 stations in the Fresno region, he has found that minimum temperatures are increasing while maximum temperatures are staying relatively constant, with no significant change up or down. This means that the average temperature is increasing overall. He found this is true mainly in the San Joaquin Valley, not in the foothills or higher elevations on the east or west side of the valley.

Fire Forecast for August

The National Interagency Fire Center (NIFC) forecasts above average fire potential in most of the state, particularly in the northern regions. August is typically a very active month for wildfires, and they expect the same this year. In northern California, fuels are drier than normal for this time of year and are especially prone to ignition. Low relative humidity and warm temperatures associated with high pressure weather systems are expected for the month, favoring wildfire development. Coastal areas have normal fire potential for August, and the rest of the season.

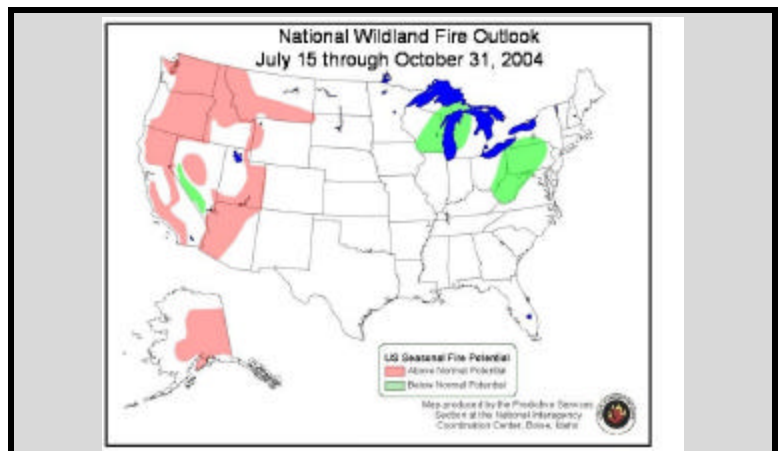
Water vapor from irrigation sources has been shown to enhance precipitation, but the jury is still out on whether or not it induces deep convection, such as thunderstorms (5). Climatologically speaking, summertime in the Central Valley has very little, if any, precipitation, so the net effect of the added water vapor is questionable in this region.

The radiative consequences of adding water vapor to the atmosphere include loss of low-level clouds, which reflect radiation back out to space, resulting in surface cooling for the farmland or nearby area. Another indirect effect is an increase in cloud liquid water content, but whether this is driving climate change or a result of it is as yet undecided.

The Earth’s climate system is complicated, as can be seen through some studies of “simply” adding water vapor to the atmosphere. Temperature, precipitation and radiation can change locally or regionally based on irrigation. The degree to which these occur are still under investigation in California, but can have important effects on how the state manages its water resources and plans for its future in irrigation farming.

References & Resources:

1. Boucher, O., G. Myhre and A. Myhre, 2004. Direct human influence of irrigation on atmospheric water vapour and climate. *Climate Dynamics*, **22**, 597-603.
2. Segal, M., Z. Pan, R. W. Turner, and E. S. Takle, 1998. On the potential impact of irrigated areas in North America on summer rainfall caused by large-scale systems. *J. of Applied Meteorology*, **37**, 325-331.
3. Christy, J. R. and W. B. Norris, 2004. Irrigation-induced warming in central California? 14th Conference on Applied Climatology, AMS annual meeting, session J1.2.
4. Couzin, J, 1999. Landscape changes make regional climate run hot and cold. *Science*, vol. **283**, issue 5400, p. 317-319.
5. Segal, M., R. Avissar, M. McCumber, and R. A. Pielke, 1988. Evaluation of vegetation cover effects on the generation and modification of mesoscale circulations. *J. Atmos. Sci.*, **45**, 2268-2292.

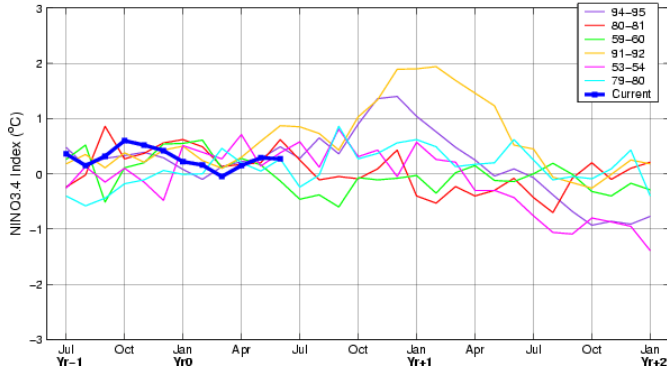


CLIMATE FORECASTS & OUTLOOKS

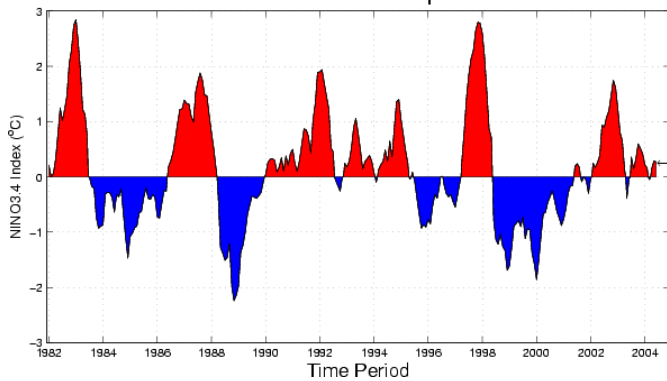
ENSO August forecast:

The latest ENSO predictions show increasing positive sea-surface temperature anomalies in the tropical Pacific, which are usually indicators of an ENSO-warm, or El Nino, event. The current forecast is for a weak El Nino event. It is early yet to confidently determine the conditions for this winter.

Current Condition vs. Similar Conditions



Historical Sea Surface Temperature Index



Based on sea surface temperature departures from the long-term average over the "Nino 3.4" region (120-170W, 5S-5N).

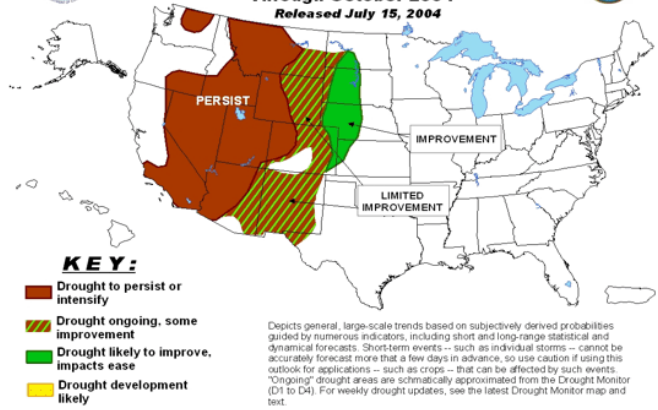
<http://iri.columbia.edu/climate/ENSO/currentinfo/QuickLook.html>

Drought conditions:

Hydrological drought is continuing in the West, with southern California experiencing some agricultural drought as well. There does not appear to be any relief soon with the seasonal dry weather expected during August and fall season.

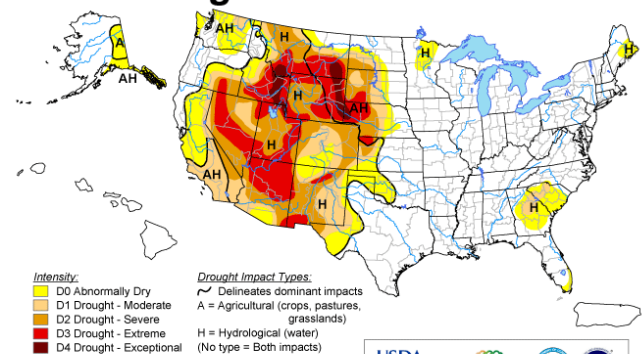
U.S. Seasonal Drought Outlook Through October 2004

Released July 15, 2004



U.S. Drought Monitor June 29, 2004

Valid 8 a.m. EDT



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://drought.unl.edu/dm>

Released Thursday, July 1, 2004
Author: David Miskus, JAWF/CPC/NOAA

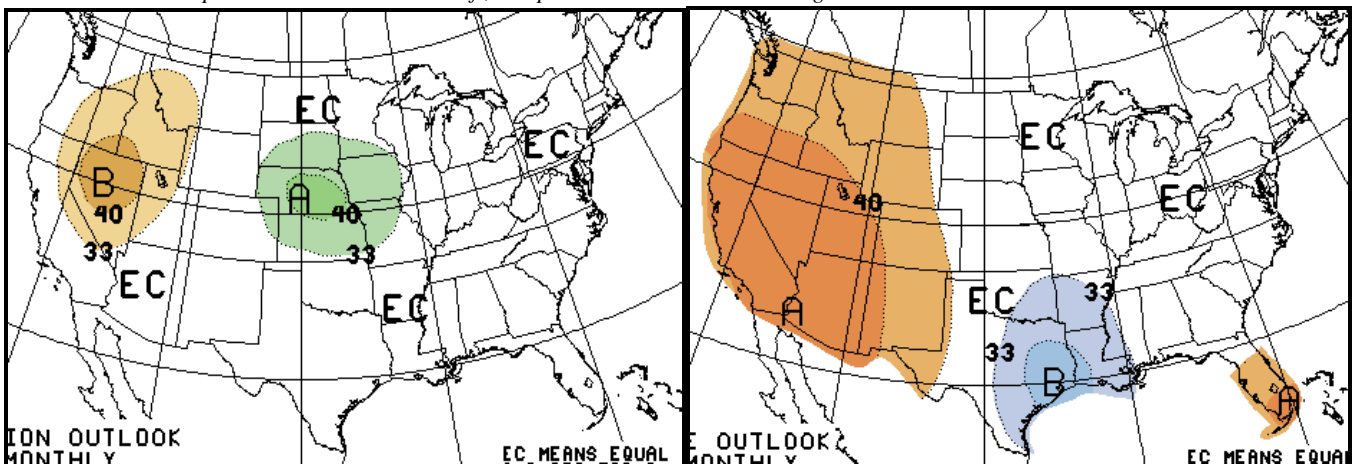
Credit: CPC/NCEP &

<http://www.drought.unl.edu/dm/monitor.html>

Precipitation and Temperature Outlooks:

The state of California has a 40% chance of having above normal temperatures for the month of August, with near-normal precipitation for the same period. East of the Sierra Nevada there is a chance of below normal precipitation, continuing the months-long trend in that region.

Precipitation Outlook is on the left, Temperature Outlook is on the right. Source: Climate Prediction Center.



July Station Data

All data is provisional and subject to change.

<u>Division/Station</u> <u>Name</u>	<u>TAVG</u>	<u>TAVG</u> <u>DEP</u>	<u>TMAX</u>	<u>TMAX</u> <u>DEP</u>	<u>MGX</u>	<u>TMIN</u>	<u>TMIN</u> <u>DEP</u>	<u>MGN</u>	<u>PREC</u>	<u>PDEP</u>	<u>PPCT</u>	<u>MGP</u>
North Coast	66.0	0.1	78.5	-0.5	0.2	53.4	0.8	0.2	0.08	-0.05	37.47	0.6
Arcata/Eureka AP	58.3	0.2	64.7	1.4	0	51.8	-1.0	0	0.11	-0.05	69	0
Crescent City												
3NNW	59.1	1.2	64.5	-0.9	0	53.6	3.2	0	0.11	-0.01	92	0
Fort Bragg 5N	58.1	0.0	66.6	0.0	0	49.5	0.0	0	0.02	0.00	100	0
Kentfield	66.7	-2.5	79.2	-5.8	0	54.1	0.7	0	0.00	-0.01	0	0
Napa	68.5	-0.1	80.2	-2.4	0	56.7	2.2	0	0.00	-0.05	0	0
Orleans	73.2	0.0	92.1	0.0	0	54.2	0.0	0	0.00	-0.18	0	0
Santa Rosa	66.9	-0.7	81.2	-1.0	1	52.6	-0.4	1	0.00	-0.06	0	3
Scotia	60.9	0.0	69.8	0.0	0	52.0	0.0	0	0.00	-0.11	0	0
Ukiah AP	74.0	0.1	92.5	-0.1	0	55.6	0.3	0	0.00	-0.05	0	0
Yreka	73.9	3.1	94.1	3.6	1	53.7	2.6	1	0.56	0.07	114	3
Sacramento	74.0	1.7	90.6	1.0	1.8	57.3	2.4	1.8	0.02	-0.20	5.37	1.8
Alturas	68.4	2.4	90.2	2.1	0	46.6	2.8	0	0.00	-0.30	0	1
Adin Ranger Stn	70.5	3.1	89.1	4.2	3	51.9	2.1	3	0.00	-0.37	0	3
Blue Canyon	69.7	2.1	76.6	-0.3	0	62.9	4.6	0	0.00	-0.37	0	0
Burney	69.9	4.3	90.5	1.9	3	49.3	6.7	3	0.00	-0.20	0	3
Dunsmuir Trt Plt	72.8	2.3	91.4	1.7	1	54.2	2.9	1	0.00	-0.34	0	1
Grass Valley	73.0	2.1	87.8	1.2	6	58.2	3.0	6	0.00	-0.18	0	6
Marysville	77.1	-1.7	94.5	-1.8	0	59.7	-1.7	0	0.00	-0.07	0	0
Mineral	63.0	1.8	82.1	2.1	8	43.8	1.4	8	0.27	-0.06	82	8
Mt. Shasta	69.0	2.9	86.6	3.4	0	51.3	2.4	0	0.00	-0.39	0	0
Paradise	78.8	1.0	91.4	-0.3	2	66.2	2.4	2	0.00	-0.12	0	2
Quincy	70.4	2.8	91.1	0.0	3	49.8	5.6	3	0.01	-0.23	4	3
Redding AP	83.3	2.0	99.4	0.9	0	67.2	3.1	0	0.00	-0.05	0	0
Red Bluff FSS	81.6	0.1	97.5	-0.1	0	65.8	0.3	0	0.00	-0.10	0	0
Sacramento AP	75.1	-0.2	90.8	-1.6	0	59.4	1.1	0	0.00	-0.05	0	0
Sacramento City	77.6	0.2	93.8	0.0	0	61.4	0.5	0	0.00	-0.05	0	0
Shasta Dam	83.1	1.9	96.6	2.1	2	69.6	1.7	2	0.00	-0.26	0	2
Northeast Interior	62.8	1.3	82.6	0.7	4.3	43.0	1.9	4.3	0.01	-0.45	1.33	3.7
Boca Reservoir	60.3	0.0	83.1	0.0	0	37.4	0.0	0	0.00	-0.57	0	0
Bodie	56.2	0.4	77.8	0.9	7	34.7	-0.1	7	0.00	-0.87	0	3
Bridgeport	60.9	0.0	81.4	0.0	0	40.3	0.0	0	0.03	-0.42	7	0
Markleeville	69.6	5.9	87.6	4.4	4	51.5	7.3	4	0.00	-0.54	0	3
Susanville 2 SW	68.3	-0.8	85.9	-2.5	15	50.8	1.0	15	0.00	-0.28	0	16
Tahoe Valley AP	61.4	2.2	79.8	1.2	0	43.0	3.2	0	0.00	0.00	N/A	0
Central Coast	66.4	-0.2	76.6	-2.0	0.3	56.1	1.6	0.3	0.01	-0.04	5	0.2
Gilroy	71.1	-0.9	84.8	-3.5	0	57.4	1.7	0	0.00	-0.06	0	0
Hollister	67.1	0.5	79.4	-1.5	0	54.7	2.5	0	0.00	-0.04	0	0
King City	70.0	1.0	85.3	0.2	0	54.7	1.8	0	0.00	-0.01	0	0
Oakland Museum	62.6	-2.2	69.6	-3.1	3	55.7	-1.3	3	0.00	-0.07	0	2
Paso Robles AP	72.6	-1.2	91.6	-2.3	0	53.6	-0.1	0	0.00	-0.01	0	0
Redwood City	68.3	0.3	78.2	-2.6	0	58.5	3.3	0	0.00	-0.03	0	1
Richmond	63.0	0.3	69.6	-0.9	1	56.5	1.6	1	0.00	-0.07	0	0
Salinas AP	63.5	0.4	70.5	-0.8	0	56.5	1.5	0	0.01	-0.03	25	0
San Fran MD	60.8	-0.5	66.1	-2.1	0	55.5	1.1	0	0.00	-0.04	0	0
San Francisco AP	64.8	2.0	72.1	1.0	0	57.5	3.0	0	0.00	-0.03	0	0
San Jose	69.3	-1.6	79.9	-4.4	0	58.7	1.2	0	0.00	-0.06	0	0
San Luis Obispo	66.4	-0.1	77.8	-2.5	0	55.0	2.3	0	0.00	-0.03	0	0
Santa Cruz	63.1	-0.6	70.9	-3.9	0	55.3	2.7	0	0.06	-0.08	43	0

<u>Division/Station</u> <u>Name</u>	<u>TAVG</u>	<u>TAVG</u> <u>DEP</u>	<u>TMAX</u>	<u>TMAX</u> <u>DEP</u>	<u>MGX</u>	<u>TMIN</u>	<u>TMIN</u> <u>DEP</u>	<u>MGN</u>	<u>PREC</u>	<u>PDEP</u>	<u>PPCT</u>	<u>MGP</u>
San Joaquin	75.7	0.2	91.7	0.4	1.7	59.6	-0.1	1.7	0.04	-0.08	10	1.9
Bakersfield	83.9	0.9	97.8	0.9	0	70.0	0.8	0	0.00	0.00	N/A	0
Coalinga	84.0	1.4	99.8	0.8	1	68.1	2.0	1	0.00	-0.01	0	1
Fresno	83.3	2.0	98.9	2.3	0	67.7	1.6	0	0.00	-0.01	0	0
Glennville	70.2	1.1	88.7	-0.1	6	51.7	2.2	6	0.00	-0.05	0	8
Grant Grove	63.2	0.0	74.0	0.0	0	52.4	0.0	0	0.00	-0.23	0	0
Hanford 1 S	81.0	1.5	97.8	1.9	1	64.2	1.0	1	0.00	-0.01	0	1
Lodgepole	60.9	1.1	76.3	0.7	3	45.5	1.6	3	0.46	-0.01	98	3
Madera	78.5	-1.1	96.7	0.2	2	60.3	-2.4	2	0.00	-0.01	0	2
Porterville	79.6	-3.2	96.1	-2.0	2	63.1	-4.3	2	0.00	-0.01	0	2
Stockton WSO	75.9	-1.4	93.1	-0.7	0	58.7	-2.1	0	0.00	-0.05	0	0
Yosemite	72.1	-0.6	89.8	-0.1	4	54.4	-1.0	4	0.00	-0.51	0	4
South Coast	71.5	0.4	82.4	0.2	1.6	60.5	0.7	1.6	0.03	-0.09	14	1.6
Alpine	74.5	-0.1	88.0	-0.6	3	61.0	0.3	3	0.04	-0.12	25	3
Anaheim	75.4	2.2	86.4	2.4	1	64.4	2.0	1	0.00	-0.03	0	1
Big Bear Lake	65.7	1.8	84.0	3.3	6	47.3	0.2	6	0.00	-0.75	0	6
Burbank	75.2	-0.3	86.9	-2.0	0	63.4	1.3	0	0.00	-0.02	0	0
Campo	72.1	-0.1	91.7	-1.8	3	52.6	1.6	3	0.09	-0.20	31	3
Culver City	69.9	-0.8	77.6	-2.4	3	62.2	0.8	3	0.00	-0.02	0	3
El Cajon	76.0	1.3	88.6	1.6	6	63.4	1.0	6	0.00	-0.04	0	6
Escondido 2	74.9	-0.2	87.9	-0.7	4	61.8	0.3	4	0.00	-0.07	0	4
Idyllwild Fire D	70.8	3.9	87.6	4.6	7	53.9	3.2	7	0.41	-0.37	53	7
Lompoc	64.5	0.0	72.6	-2.8	1	56.4	2.9	1	0.00	-0.01	0	0
Long Beach AP	73.8	0.1	83.0	0.1	0	64.6	0.0	0	0.00	-0.02	0	0
Los Angeles/USC	73.0	-1.2	82.1	-1.7	0	63.9	-0.7	0	0.00	-0.01	0	0
Los Angeles AP	69.3	0.0	74.9	-0.4	0	63.7	0.4	0	0.00	-0.03	0	0
Mt Wilson No 2	73.8	1.2	83.8	1.7	0	63.8	0.6	0	0.00	-0.08	0	0
Riverside Citrus	77.3	-0.1	94.2	0.7	0	60.4	-0.8	0	0.00	-0.03	0	0
Newport Beach Ha	69.5	2.2	74.0	2.6	0	65.0	1.9	0	0.00	-0.02	0	0
San Diego AP	72.1	1.2	76.5	0.7	0	67.6	1.7	0	0.00	-0.03	0	0
Sandberg WSMO	74.8	1.0	86.2	1.5	0	63.3	0.5	0	0.00	-0.02	0	0
Santa Ana Fire S	73.8	0.9	85.1	2.4	0	62.5	-0.6	0	0.00	-0.02	0	0
Santa Barbara	64.3	-2.7	73.1	-3.6	0	55.5	-1.8	0	0.05	0.02	167	0
Santa Maria AP	63.8	0.3	73.4	-0.1	0	54.3	0.8	0	0.01	-0.02	33	0
UCLA	68.2	-1.3	75.6	-1.3	2	60.8	-1.3	2	0.00	-0.02	0	2
Southeast Desert	88.8	0.6	105.1	0.7	0.6	72.5	0.6	0.6	0.00	-0.26	1	0.8
Bishop	77.2	0.4	98.7	0.8	1	55.6	-0.1	1	0.02	-0.15	12	1
Blythe	94.7	1.0	108.3	1.1	0	81.2	1.0	0	0.00	-0.32	0	0
Daggett AP	90.0	2.1	105.6	1.1	0	74.4	3.1	0	0.00	-0.45	0	0
Imperial	91.7	1.5	107.3	2.0	0	76.2	1.0	0	0.00	-0.13	0	0
Inyokern	84.3	-0.2	102.4	-0.5	3	66.1	0.1	3	0.00	-0.12	0	4
Lancaster	82.3	1.6	98.5	3.0	0	66.2	0.2	0	0.00	-0.10	0	1
Needles AP	96.8	0.7	108.7	-0.4	0	84.8	1.8	0	0.00	-0.32	0	0
Palm Springs	92.8	0.7	107.3	-0.9	2	78.2	2.2	2	0.00	-0.19	0	2
Thermal AP	91.2	0.0	106.8	-0.7	0	75.6	0.7	0	0.00	-0.19	0	0
Twentynine Palms	86.9	-1.5	107.0	1.2	0	66.8	-4.2	0	0.00	-0.64	0	0
Statewide	72.4	0.6	86.3	0.0	1.4	58.5	1.1	1.4	0.03	-0.14	11.1	1.4

All data is provisional and subject to change.
Normal period is 1971-2000.

TAVG = average temperature in Fahrenheit

DEP = departure from average

TMAX = average maximum temperature in Fahrenheit

MGX = number of missing daily max temperature values

TMIN = average minimum temperature in Fahrenheit

MGN = number of missing daily min temperature values

MGP = number of missing daily precipitation values

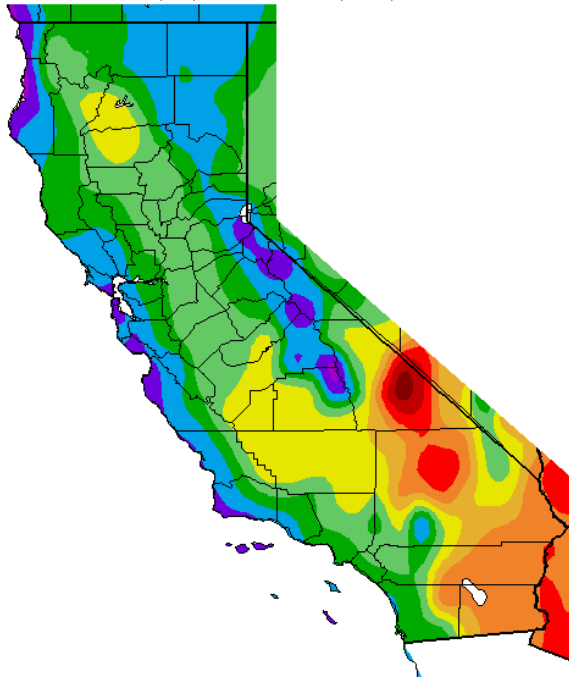
PREC = total monthly precipitation in inches

PDEP = monthly precipitation departure from normal in inches

PPCT = monthly precipitation percent of normal

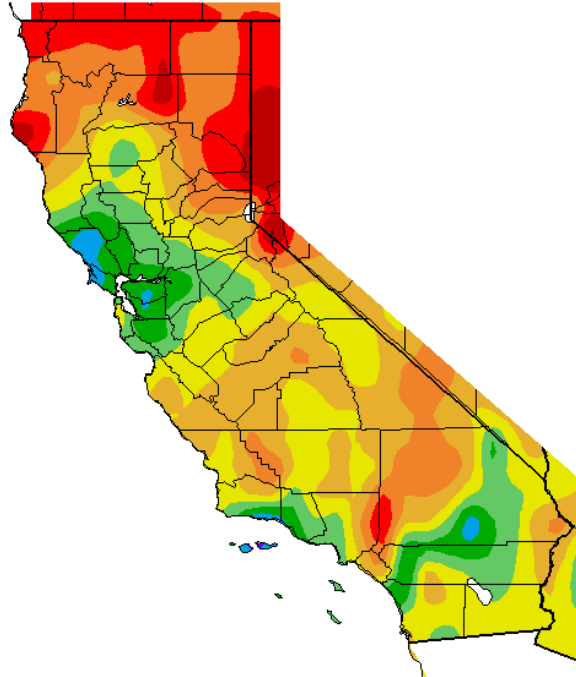
Climate Maps for July

Ave. Temperature (deg. F)
7/1/2004 – 7/31/2004



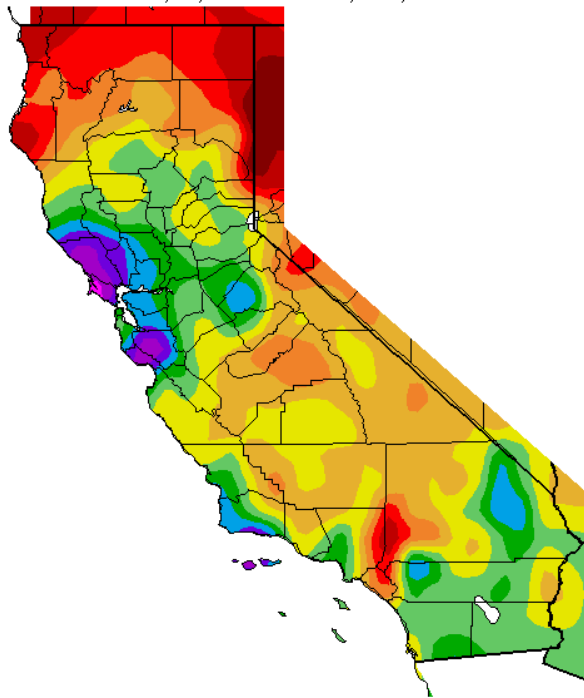
Generated 8/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Ave. Temperature dep from Ave (deg F)
7/1/2004 – 7/31/2004



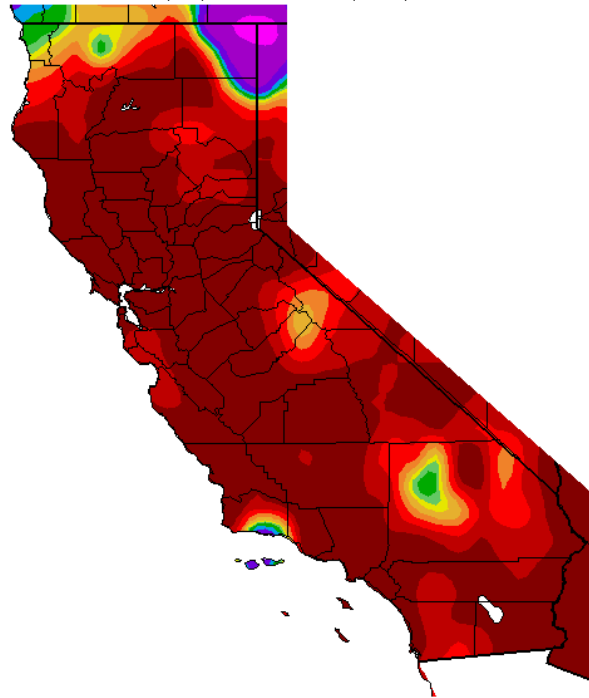
Generated 8/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Av. Max. Temperature dep from Ave (deg F)
7/1/2004 – 7/31/2004



Generated 8/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Percent of Average Precipitation (%)
7/1/2004 – 7/31/2004



Generated 8/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers