



## Office of the Washington State Climatologist

August 5, 2009

### July: Hot and Dry

Two words can sum up July in Washington: hot and dry. Record-breaking high temperatures (both maximum and minimum) were observed in western WA at the end of the month. The month also started out warm, with the National Weather Service issuing heat advisories in the southern Cascade foothills. Those advisories became commonplace throughout the month. Red flag warnings were also common, as the fire danger kept getting worse and worse on the west-side as the month progressed. By July 31, fuel moisture (percent water content of vegetation) was below average and below last year's values near the coast and the interior of western WA, and near-average and above last year's value east of the Cascades. Washington did experience several fires this month (one near Chelan was sparked by lightning on July 28, among others) but currently the fires are not abnormal for this part of the fire season. The WA Department of Natural Resources (DNR) has currently classified the fire danger as "High" in 30 counties, and "Extreme" in Asotin, Columbia, Garfield, Okanogan, and Walla Walla. More fire information can be found at the DNR website ([http://www.dnr.wa.gov/RecreationEducation/Topics/FireInformation/Pages/rp\\_fire\\_fireinformation.aspx](http://www.dnr.wa.gov/RecreationEducation/Topics/FireInformation/Pages/rp_fire_fireinformation.aspx)).

#### In this Issue

<b>July: Hot and Dry.....</b>	<b>1</b>
<b>CoCoRaHS.....</b>	<b>4</b>
<b>Low Streamflow &amp; Drought.....</b>	<b>5</b>
<b>Climate Summary.....</b>	<b>6</b>
<b>Climate Outlook.....</b>	<b>7</b>

With the help of the heat wave (discussed below), the month of July in western WA has ranked as one of the warmest on record. The average temperature for SeaTac was 69.5°F, tying as the warmest average July temperature ever recorded (taking the SeaTac and Federal building records together so that records start in 1891). The other July with an average temperature of 69.5°F occurred in 1941 at the Federal building in downtown Seattle. When comparing July 2009's average temperature to all of the other months, the ranking is still impressive. Only one other month has been warmer than July 2009 and July 1941 - August 1967 with an average temperature of 71.1°F. The average high temperature for SeaTac in July 2009 (81.0°F) was also striking, ranking as the 2nd warmest July average high temperature on record. The warmer July average high temperature occurred in July 1958, and was 81.4°F. In Olympia, this year's average July temperature was 66.8°F, ranking as the 3rd warmest July on record. In Bellingham, this year's average July temperature was 65.4°F, ranking as the 4th warmest on record.

Despite this record warmth, there were a few periods throughout the month in which below normal temperatures were experienced in WA. Illustrated by Figure 1, a strong marine push caused by an upper level low on the evening of July 5 significantly reduced high temperatures by about 16°F from July 5 to July 6 at Seattle Sandpoint. Parts of northeastern WA received the bulk of the precipitation during that time. Precipitation also occurred on July 12 and July 13 for most of the state, and much of this was associated with thunderstorms. More isolated rain fell on July 23-25 in some

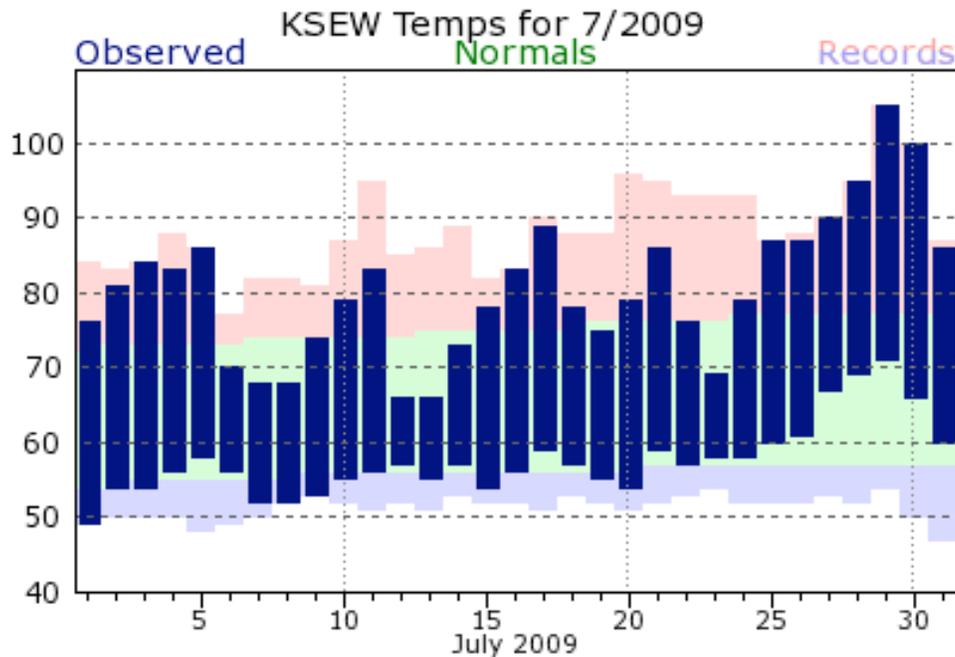


Figure 1: July 2009 high and low temperatures for Seattle Sandpoint (from NWS).

isolated rain fell on July 23-25 in some locations (San Juan's, Whatcom county, Spokane county, northeastern WA) again mainly due to thunderstorms. Despite these scattered rain events, the precipitation was vastly below normal for the month of July in a majority of the state. However, a few regions (the north central region of the state and southeastern WA) did receive above normal precipitation for the month.

The most interesting climatological story from July 2009, however, is undoubtedly the heat wave experienced in western WA during the last week of July. Conditions were set up just right for an extended heat wave, and daily records as well as all-time records were broken. High temperatures in the 90's and 100's, as well as high dewpoint temperatures and high minimum temperatures, were experienced in parts of western WA from July 27 through July 31. Table 1 shows the daily high and low temperatures for selected WA locations during the main part of the heat wave. The daily records are also listed in that table, and eastern WA locations are included to contrast against the western WA observations. On July 29, locations west of the Cascades were warmer than places east of the Cascades that are more accustomed to the heat. The Yakima Region had high temperatures that were higher than normal during the entire heat wave, but daily records were not broken.

The atmosphere was set up well for a heat wave in western WA: there was a high pressure to our east, warm air aloft, a strong, stationary upper level ridge, high dewpoint temperatures, and easterly flow at the surface. Winds from the east meant that there was downslope warming over the Cascades, making and keeping our temperatures warm. It also inhibited relief

from westerly ocean air. In addition, the relatively high dewpoint temperatures (especially for our region) made it feel more humid than usual and kept it warm at night. Relief came from marine air that moved in on the evening of July 30, bringing cooler overnight temperatures. The air from the ocean brought thick, stratus clouds throughout western WA on the morning of July 31, but clearing occurred and the high temperatures in the interior of western WA were still about 5-10 degrees F above normal (in the mid to upper 80's). The next few days

		27-Jul	28-Jul	29-Jul	30-Jul			27-Jul	28-Jul	29-Jul	30-Jul
<b>SeaTac</b>	High Temp	94	97	103	96	<b>Quillayute</b>	High Temp	88	87	83	67
	Low Temp	65	69	71	62		Low Temp	52	59	55	55
	Break Record?	Yes	Tied	Yes	Yes		Break Record?	Yes	No	No	No
	Daily Record	90	97	95	94		Daily Record	86	88	89	88
	Year of Record	1996	1998	1971	1965		Year of Record	1998	1974	1974	1968
<b>Seattle Sandpoint</b>	High Temp	90	95	105	100	<b>Hoquiam</b>	High Temp	88	93	77	65
	Low Temp	67	69	71	66		Low Temp	63	68	57	57
	Break Record?	Tied	Yes	Yes	Yes		Break Record?	No	Yes	No	No
	Daily Record	90	88	95	92		Daily Record	92	81	80	88
	Year of Record	1996	1996	1998	2003		Year of Record	1958	1965	1990	1968
<b>Olympia</b>	High Temp	97	101	104	95	<b>Walla Walla</b>	High Temp	100	101	100	100
	Low Temp	61	63	64	58		Low Temp	65	70	69	66
	Break Record?	No	Yes	Yes	No		Break Record?	No	No	No	No
	Daily Record	99	100	96	97		Daily Record	106	107	106	108
	Year of Record	1998	1998	2003	1965		Year of Record	1982	1974	1960	1971
<b>Bellingham</b>	High Temp	88	90	96	85	<b>Pasco</b>	High Temp	98	102	97	100
	Low Temp	60	63	63	72		Low Temp	61	63	68	60
	Break Record?	No	Yes	Yes	No		Break Record?	No	No	No	No
	Daily Record	90	88	92	93		Daily Record	103	106	105	107
	Year of Record	1958	1958	1960	1965		Year of Record	2006	2003	2003	2003
<b>Vancouver</b>	High Temp	103	106	108	96	<b>Yakima</b>	High Temp	97	100	95	97
	Low Temp	69	69	71	66		Low Temp	62	66	67	59
	Break Record?	Yes	Yes	Yes	No		Break Record?	No	No	No	No
	Daily Record	93	98	100	98		Daily Record	106	105	102	104
	Year of Record	2005	2003	2003	2003		Year of Record	1998	1998	2003	2003

Table 1: High and low temperatures (°F) for selected WA locations during the heat wave. Daily records are also listed, and there is a column confirming whether or not the 2009 temperature broke the record for that day.

were warm as well with high temperatures above normal and even a few daily records broken (i.e. Seattle Sandpoint reached 91 on Aug 2), but it offered some sense of relief from the all-time record high temperatures.

The all-time record for highest minimum temperature was broken at SeaTac on July 29. The minimum temperature was only 71°F, breaking the previous record of 69°F that occurred the night before (July 28) and on September 2, 1974. Seattle Sandpoint also broke its record for highest minimum temperature on July 29 (71°F) that was previously set as 68°F on July 22, 2006.

All-time high temperatures were broken as well during this heat wave. On July 29, the high temperature at SeaTac reached 103°F, breaking the record of 100°F set on July 20, 1994. Bellingham and Seattle Sandpoint also broke their all-time record high temperatures on July 29, reaching 96°F and 105°F, respectively. Bellingham's previous all-time record was 94°F set on July 11, 2007, and Seattle Sandpoint's previous all-time record of 96°F set on July 20, 1994 was shattered by 9°F. Olympia's all-time high temperature of 104°F was tied on July 29. Parts of interior WA (i.e. Lewis County) recorded temperatures as high as 111°F.

A common parameter used in human health studies is consecutive days above 90°F. During this heat wave, SeaTac had 4 consecutive days with high temperatures above 90°F (July 27-31). This is the fifth occurrence of 4 consecutive days above 90°F at SeaTac. The record is 5 consecutive days that occurred on August 7-11, 1981 and July 14-18, 1941. More information like this can be found on the Climate Events section of our webpage: <http://www.climate.washington.edu/events/>.

## Community Collaborative Rain, Hail, and Snow Network



Thank you, observers, for continuing to make precipitation observations during this dry period. Your observations are just as important now, as they can give information on precipitation that is falling outside standard weather stations and airports. If you have any questions about CoCoRaHS, then please contact [wash.cocorahs@gmail.com](mailto:wash.cocorahs@gmail.com) or your regional coordinator. If you are interested in observing or know someone who is, please register at [www.cocorahs.org](http://www.cocorahs.org).

## Low Streamflow & Drought

The warm and dry conditions have impacted streamflow across the state. The 28-day average streamflow map from USGS shows streams throughout western WA (i.e. Olympic Peninsula, Puget Sound, southwestern WA) that rank as “much below normal”, or below the 10th percentile for this time of year (Figure 2). The flow is compared to a 30-year average flow for this time of year. As discussed in last month’s newsletter, even areas that were not affected by low snowpack this winter could (and are) seeing low streamflows because of the dry conditions. In 2003, there were record or near-record low streamflows in western WA as a result off a hydrologic summer drought despite snowpack being near-normal that year. With how this summer is playing out, there is concern for fish runs later in the summer.

The NWS Northwest River Forecast Center’s most recent forecast for snowmelt-dominated streamflow through September has stayed relatively consistent with what was expected last month. The forecast for the Dungeness River near Sequim, however, has degraded because the dry conditions have compounded with the low snowpack this winter. The forecast is now for 73% of normal flow through September.

There is also increased concern for Okanogan, Chelan, and Douglas counties in north central WA. Agricultural impacts have been reported in those areas, ranging from not enough water for livestock to an outbreak of grasshoppers, causing the United States Drought Monitor (<http://www.drought.unl.edu/dm/monitor.html>) to up its drought designation to “Severe” in those counties . WA State committees have been called to discuss whether localized drought designations will be declared, but there is unfortunately not much money to help relieve impacts in those areas even if a drought is declared.

Monday, August 03, 2009

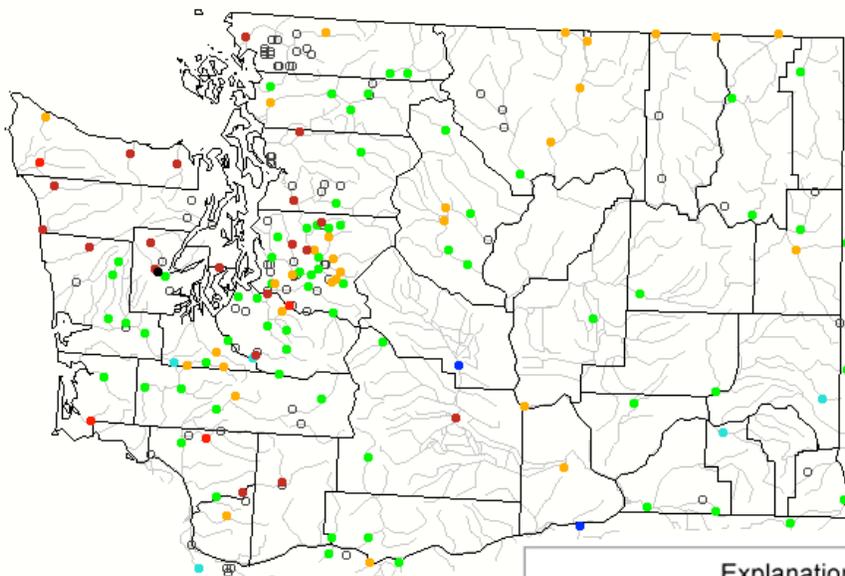


Figure 2: 28-day average streamflow through August 3 from USGS.

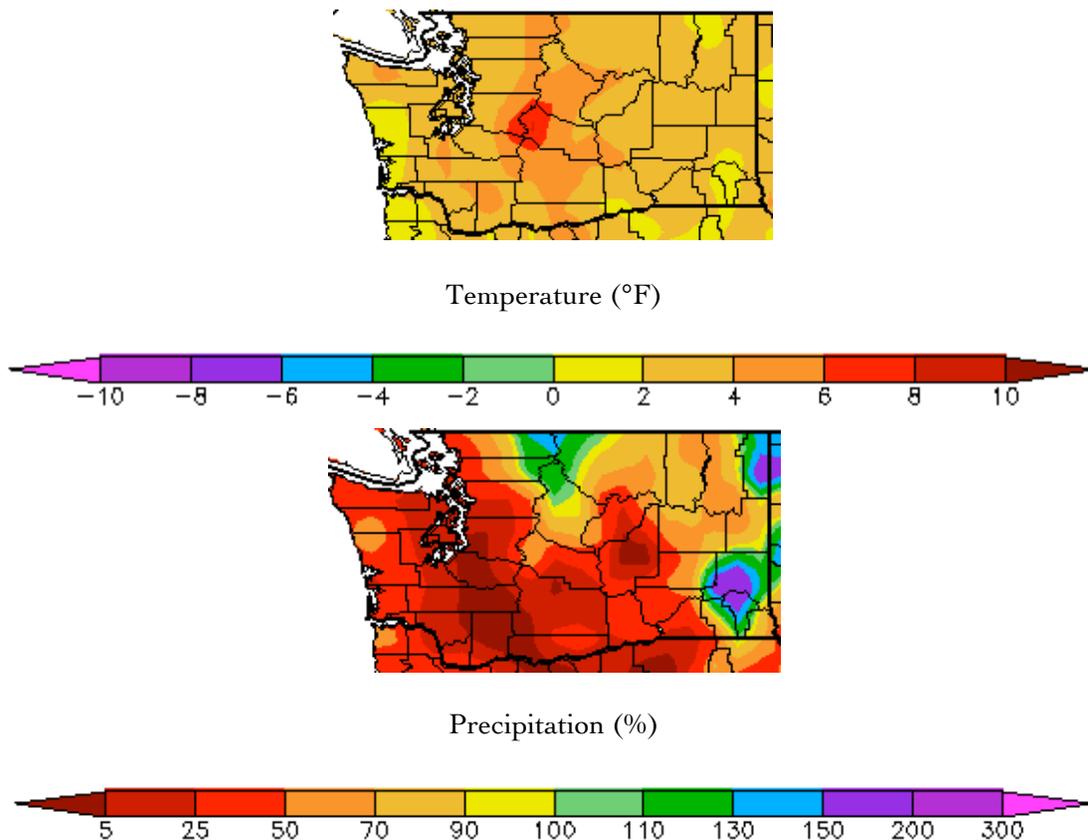
Explanation - Percentile classes							
Low	<10 Much below normal	10-24 Below normal	25-75 Normal	76-90 Above normal	>90 Much above normal	High	Not-ranked



## Climate Summary

Similar to June, the entire state of Washington experienced above normal temperatures for July. The plot of temperature departures from normal from the High Plains Regional Climate Center shows a majority of state 2-4°F above normal. Sea-Tac and Yakima were greater than 4°F above normal (Table 2). There is one station on the border of Kittitas and King counties (likely Snoqualmie Pass) that measured 6-8°F above normal, and is causing the bull's eye on the plot.

The July precipitation was also similar to June: most of western WA received less than 50% of the normal precipitation for the month. There were even parts around the Puget Sound that received between 5 and 25% of normal precipitation (i.e. SeaTac, Seattle, and Olympia - Table 2). Eastern WA also had below normal precipitation for the month, but it ranged from 50 to 90% of normal, likely because of the thunderstorm activity. There were some wetter spots as well, such as the north central basin where precipitation was in the 100-110% of normal bracket. The Blue Mountains (southeastern WA) also saw above normal precipitation (between 150 and 200% of normal), and Pullman (shown in Table 2) had 123% of normal precipitation. Again, this was because of the thunderstorms that produced heavy rain. There were exceptions to this generalization in eastern WA as well, as Ephrata only got a trace of precipitation, and Yakima only 0.03 inches for the month.



*(July temperature (°F) departure from normal (top) and July precipitation % of normal (bottom).  
Source: High Plains Regional Climate Center (<http://www.hprcc.unl.edu>).*

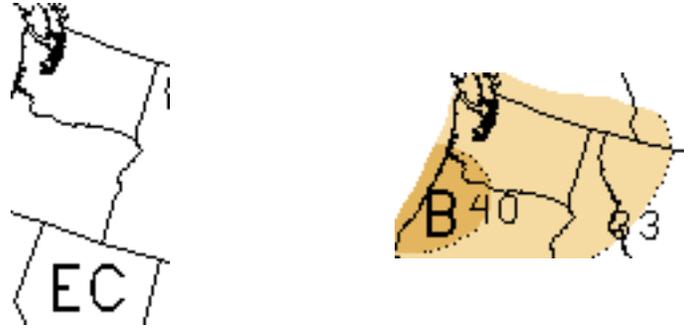
	Temperature (°F)			Precipitation (inches)		
	Avg	Normal	Departure from Normal	Total	Normal	% of Normal
Olympia	66.8	62.8	4.0	0.15	0.82	18
Quillayute	60.2	58.6	1.6	1.07	2.34	46
Seattle	69.1	65.2	3.9	0.16	0.97	16
Sea-Tac	69.5	65.3	4.2	0.06	0.79	8
Spokane	72.1	68.6	3.5	0.48	0.76	63
Omak	74.5	71.0	3.5	0.54	0.80	68
Pullman	68.0	65.9	2.1	0.97	0.79	123
Ephrata	77.4	74.7	2.7	Trace	0.44	0
Pasco	76.0	74.9	1.1	0.08	0.25	32
Yakima	73.7	69.0	4.7	0.03	0.22	14

Table 2 - July Climate Summaries from locations in western Washington and eastern Washington (highlighted in orange) from NWS (climate normal baseline is 1971-2000).

## Outlook

The seasonal climate forecast by the NOAA Climate Prediction Center for August-September-October (ASO) calls for equal chances of below, equal to, or above normal temperatures for the entire state. There is at least a 33% chance of below normal precipitation for most of the state for ASO, and at least a 40% chance of below normal precipitation for the very southwestern portion of the state.

The outlook for September-October-November (SON) calls for an equal chance of below, equal to, or above normal temperatures for the entire state. SON Precipitation, on the other hand, is predicted to be at least 33% below normal for most of the state, and at least 40% below normal for southeastern Washington.



*(August-September-October outlook for temperature (left) and precipitation (right) from the CPC).*



*(September-October-November outlook for temperature (left) and precipitation (right) from the CPC).*

According to the Climate Prediction Center, El Niño conditions are present in the Pacific Ocean. The El Niño is expected to intensify through the summer and persist into the winter (<http://www.cpc.noaa.gov/products/precip/CWlink/MJO/enso.shtml>). The below normal precipitation that is forecasted for WA in the outlook is a result of the expected continuation of the warm ENSO conditions.