



# Office of the Washington State Climatologist

## August 2021 Report and Outlook

August 5, 2021

<http://www.climate.washington.edu/>

### July Event Summary

Average July temperatures were near-normal on the WA coast and some parts of the Puget Sound region, but warmer than normal elsewhere in the state. Temperatures were especially warm in eastern WA, where some stations broke average temperature records for the month (Table 1). July precipitation was below normal statewide. Figure 1 shows the July temperature and precipitation percentiles compared to the period 1895-2010, with both record warmth and record dryness shown for portions of the state.

Many locations recorded no precipitation for the month of July which adds to the extended dry period that began on June 16. At the time of this writing (8/4), the period without any measurable rain ( $<0.01$ "") at SeaTac Airport is 50 days, ranking as the 3rd longest on record (since 1945). Bellingham (50 days; 4th place) and Olympia (49 days; 3rd place) also have dry streaks that began on June 16 and are ongoing. Quillayute had 21 consecutive days without measurable precipitation (6/15-7/6), which tied 1987 and 1974 for 9th place, and ended with some very light precipitation on the 7th.

### In this Issue

July Event Summary.....	I
Streamflow and Drought Update.....	3
CoCoRaHS Corner.....	4
Wet Bulb Globe Temperature.....	5
Climate Summary.....	9
Climate Outlook.....	II

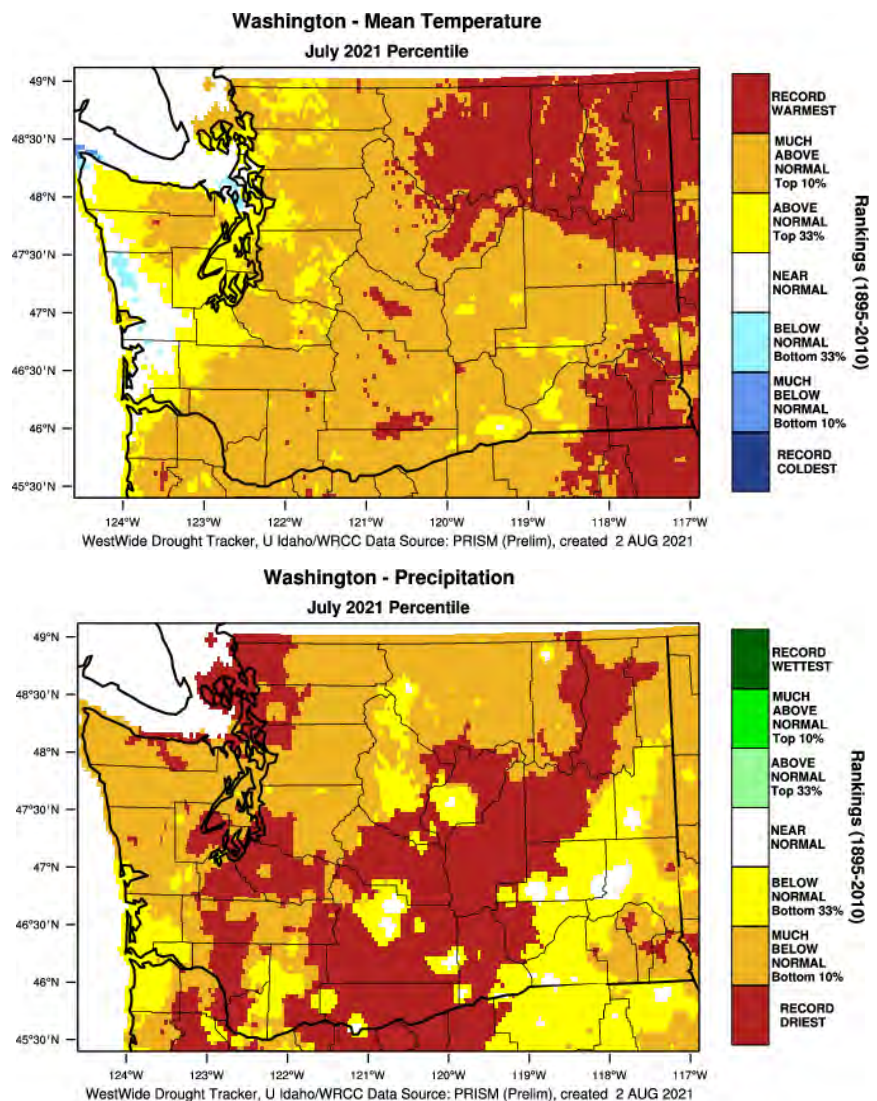
Station	Average July Temperature	Rank	Previous Record; Year	Records Began
Omak	81.2	1	78.2; 2014	1998
Yakima AP	79.4	1	77.8; 2014	1947
Wenatchee Pangborn	80.8	1	80.6; 2014	1960
Mazama	76.2	1	75.6; 2014	1965
Spokane AP	77.5	1	75.9; 1906	1881
Odessa	75.9	3	-	1903
Walla Walla AP	80.1	3	-	1949

**Table 1: July 2021 average temperature historical rankings at selected stations in eastern WA.**

In general, the record dry streaks in eastern WA are much longer than those in western WA, and 2021 is not approaching record territory. It should also be noted that light precipitation (0.01-0.19") was recorded on July 20 for parts of the central Puget Sound region, but missed SeaTac Airport, causing the dry streak to live on.

There were some mountain thunderstorms on the 7th and 8th that sparked wildfires. The Cedar Creek fire (4 miles outside Mazama) and Lick Creek (2 miles outside Asotin) were ignited by lightning during that time period and are currently still burning. There are a number of other large fires currently burning, and the Summit Trail fire (17 miles west of Inchelium) that began on the 12th has also been determined to be lightning-caused. The others remain under investigation.

There were not many daily weather records that were broken during July, but a few record high daily temperatures fell at the end of the month. Record high daily temperatures were set at Walla Walla (109°F) on the 30th and at Omak (109°F), Ephrata (108°F), and Pullman Moscow AP (104°F) on the 31st.



**Figure 1: July 2021 average temperature (top) and total precipitation (bottom) percentiles compared to the 1895-2010 period. There was both record warmth and record dryness for portions of WA State ([WWDt](#)).**

# Streamflow and Drought Summary

As expected, WA streamflows have dropped into the “below normal” (10-24th percentile) or “much below normal” (less than 10th percentile) categories for the month of July (Figure 2). Several sites in southwestern WA have record low flows for July including the Skookumchuck River and Ohop Creek. Streamflows on the Hoko River and Calawah River in western Clallam county were in the 3rd-4th percentile. Streamflows in northeastern WA, such as the Okanogan and Kettle Rivers, are also much below normal.

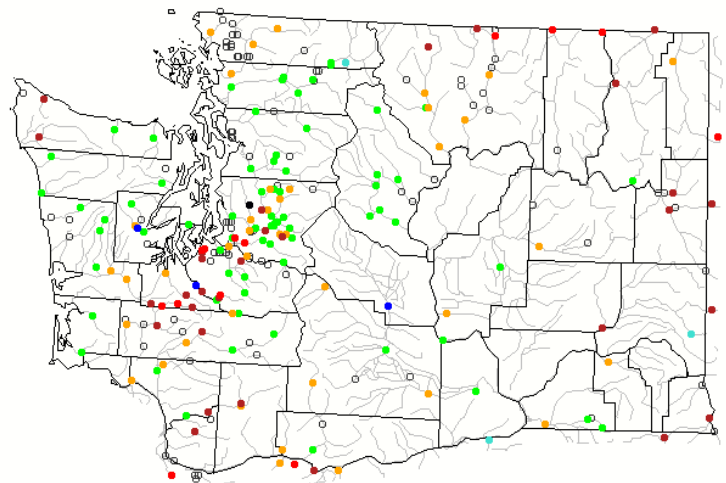
The U.S. Drought Monitor (Figure 3) is reflecting the worsening conditions. In the last month, “exceptional drought” (D4) - the worst drought category on the 5-category scale - was introduced into eastern WA to reflect the record dry conditions since March. This is the first time there were D4 conditions in WA since the Drought Monitor began in 2000. Drought also expanded in western WA, mostly corresponding to the below normal streamflows. Various impacts from the drought and heat at the end of June/early July have been reported around the state and include voluntary and mandatory outdoor watering restrictions, heat stress on crops, necessity of back up water supplies, increased wildfire danger, and extremely low yields on spring wheat. It is worth mentioning that many of the major water suppliers in western WA anticipate having adequate water supplies through the summer due to the storage from our above normal winter snowpack. Those regions were excluded from the “[Drought Emergency](#)” declared by Governor Inslee on July 14 for the remainder of the state.



## Report Your Drought Impacts

Are you experiencing a drought impact? Your on-the-ground observations are critical in helping us understand the broad picture of drought in the state. The National Drought Mitigation Center and partners have developed Condition Monitoring Observer Reports on Drought ([CMOR-drought](#)), a short survey that allows the public to enter their observations regarding crops, water supply, fire, etc.

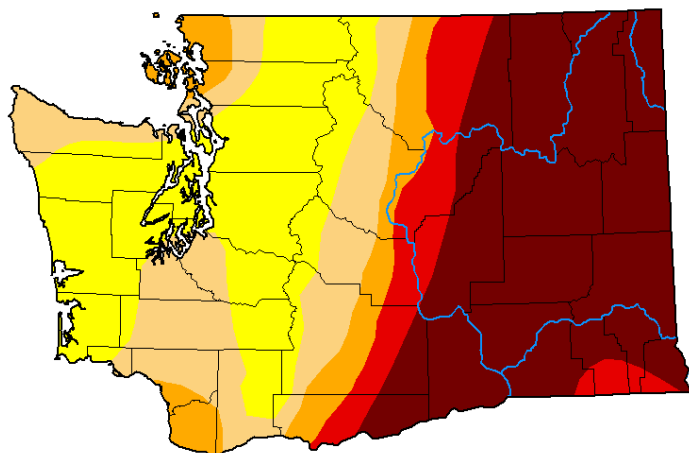
July 2021



Explanation - Percentile classes						
Low	<10 Much below normal	10-24 Below normal	25-75 Normal	76-90 Above normal	>90 Much above normal	High

**Figure 2: July average streamflow for WA (from [USGS](#)).**





**Intensity:**



**Figure 3: The August 5, 2021 edition of the [U.S. Drought Monitor](#).**



## Community, Collaborative Rain, Hail, and Snow (CoCoRaHS) Corner

After a brief hiatus, we're happy to bring back the CoCoRaHS Corner! Of course, the previous month wasn't the most interesting in the way of precipitation, but we want to highlight our stalwart citizen scientists nonetheless. In the month of July, Washington CoCoRaHS observers made a total of 9,779 observations. Of those

entries, less than 4% recorded any amount of precipitation greater than zero. Though a lack of precipitation may seem like nothing worth writing home (or CoCoRaHS) about, every single observation submitted to CoCoRaHS helps us gain a better understanding of statewide precipitation patterns.

Only one Significant Weather Report was submitted for the entire month of July. On July 5<sup>th</sup>, station WA-TH-54 located in Olympia reported: "Steady drizzle/shower. First moisture in awhile not on easily seen on radar." The next day, this station recorded a whopping 0.03" of precipitation. No station recorded higher than 0.19" on a single day. Two stations tied for this amount on the morning of July 21<sup>st</sup> -- Matthews Beach 0.4 NW and Chattaroy 0.2 ESE.

The nineteen Condition Monitoring Reports submitted for the month spoke of severely dry conditions, browning fields, and low river and creek flows. Observers in Stevens, Snohomish, Okanogan, San Juan, Yakima, and Ferry County all voiced concerns about fires or fire danger. Please continue to keep us updated as the month of August passes us by – when will your station's dry streak end?

# Wet Bulb Globe Temperatures during the 2021 Heatwave

Message from the State Climatologist

As must be well known by all the readers of this newsletter, the Pacific Northwest suffered through a severe heat wave at the end of June 2021. In association with extreme geopotential heights aloft and thermally-induced low pressure near the surface, many all-time temperature records were set. Much of the focus was on maximum temperatures, which is understandable in that temperatures in a variety of locations reached values that were much higher than in the past historical record. But minimum temperatures also were extreme, and this aspect of the heat wave presumably contributed substantially to the tragic number of fatalities that have been reported (e.g., [The Guardian](#), [KUOW](#)). The objective of the present piece is to describe what occurred in the lower Columbian basin of eastern WA during the afternoon of 29 June 2021 when some of the most brutal conditions occurred, using the wet-bulb globe temperature (WBGT) as a measure.

The WBGT is based on the air temperature, humidity, wind speed, and solar radiation. It has been designed to reflect the thermal stress on humans in uncovered areas; Occupational Safety and Health Administration (OSHA), the military, and other organizations have activity guidelines using the WBGT to minimize the hazards of heat exposure. An advantage of using the WBGT over heat index is that it is a measure of heat stress in sunlight as opposed to shade for the latter. Here we estimate WBGT at selected locations during our past heat wave using a web application hosted by the Tulsa, OK office of the National Weather Service (NWS) with the following URL: <https://www.weather.gov/tsa/wbgt>. That website includes the table (Table 2) on the implications of elevated values of the WBGT.

Temperature and dew point observations at 00 UTC 30 June (5 PM local time) from the lower

Suggested Actions and Impact Prevention		
WBGT(F)	Effects	Precautionary Actions
< 80		
80-85	Working or exercising in direct sunlight will stress your body after 45 minutes.	Take at least 15 minutes of breaks each hour if working or exercising in direct sunlight
85-88	Working or exercising in direct sunlight will stress your body after 30 minutes.	Take at least 30 minutes of breaks each hour if working or exercising in direct sunlight
88-90	Working or exercising in direct sunlight will stress your body after 20 minutes.	Take at least 40 minutes of breaks each hour if working or exercising in direct sunlight
>90	Working or exercising in direct sunlight will stress your body after 15 minutes.	Take at least 45 minutes of breaks each hour if working or exercising in direct sunlight

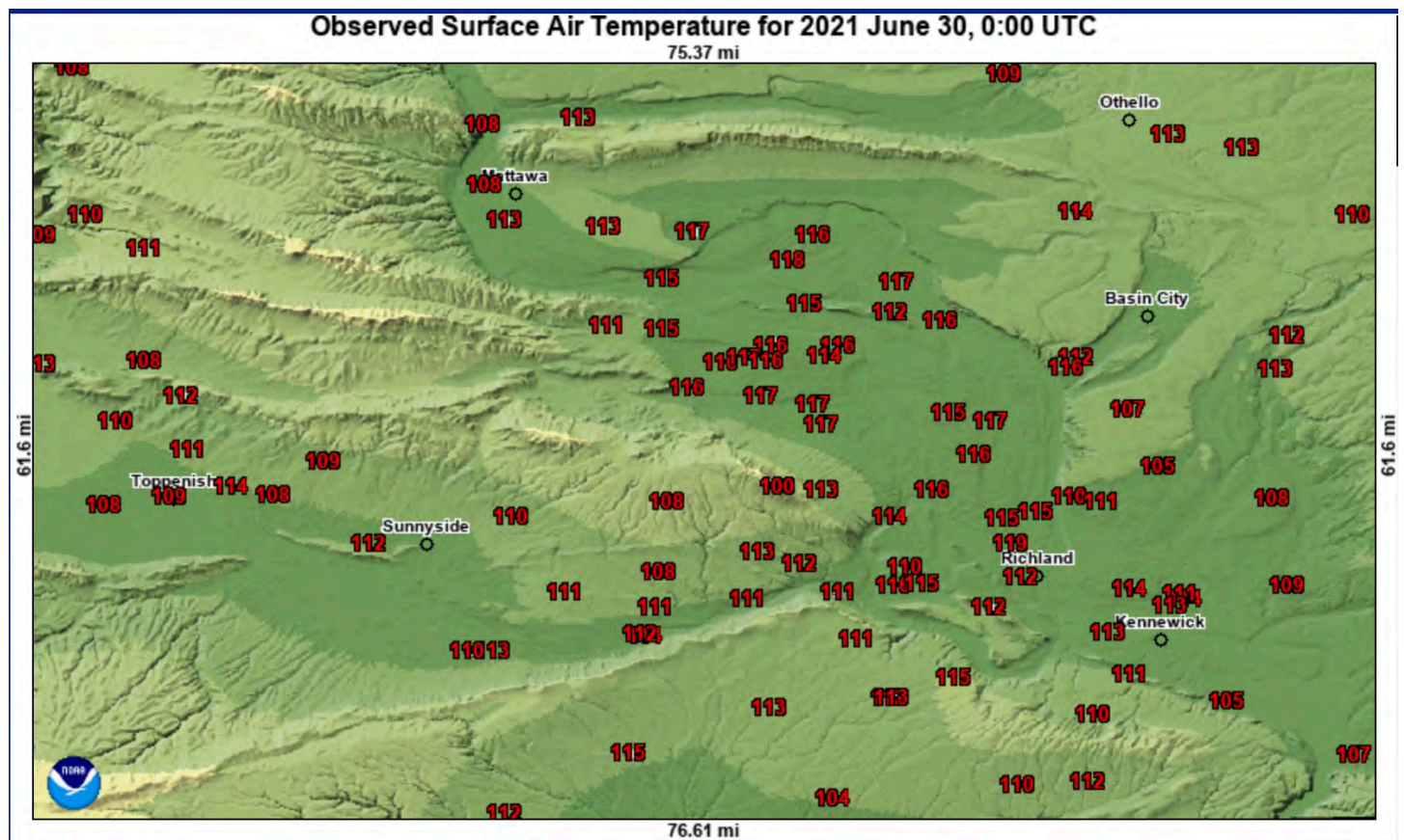
**Table 2: WBGT thresholds, impacts, and suggested actions from [NWS Tulsa](#).**



Columbia basin are shown here in Figures 4 and 5. These maps were produced using the widget provided by NOAA's National Operational Hydrologic Remote Sensing Center (NOHRSC) at <https://www.nohrsc.noaa.gov/interactive/html/map.html>. The preliminary observations are from stations that are part of different networks and there are likely reports that are not represented here. The consistency associated with the temperature observations suggests they are reliable. There are considerably greater local variations in the reported dewpoints. Hotter locations were also mostly drier (i.e., lower dewpoints), both in comparing stations close to one another and in considering regional differences. Regarding the latter, the reports out of the Yakima Valley and lower Columbia basin close to irrigated fields were generally a bit cooler and more humid with the reports from south of

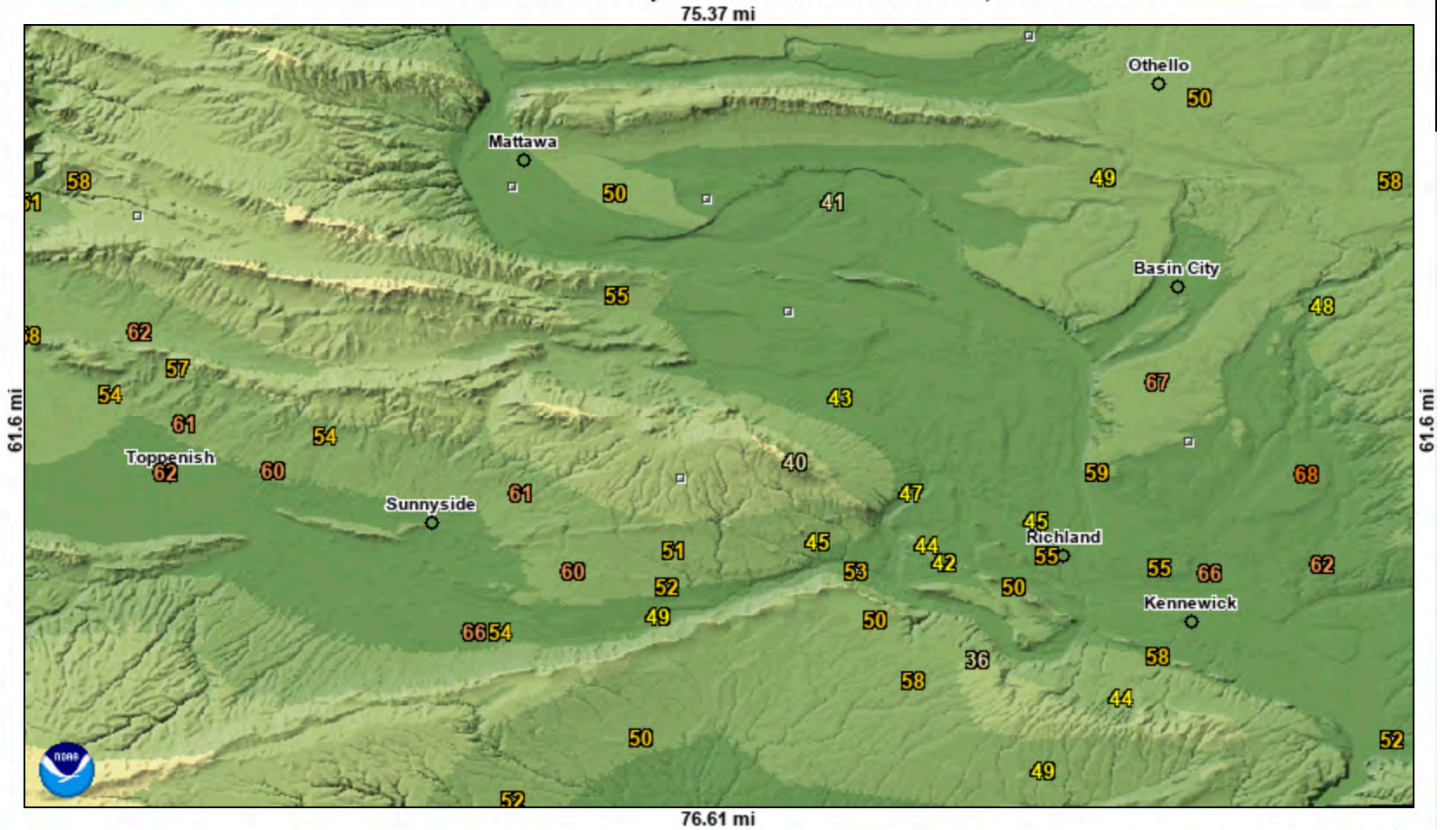
the Wahluke Slope (stretching from near Mattawa to southwest of Odessa) indicating higher temperatures and lower dewpoints. It is not obvious which places had conditions leading to a greater heat stress on humans, which is why the WBGT can be useful. For selected locations, we chose representative values for the air temperature, dew point and wind speed, and found the resulting magnitudes of the WBGT and heat index (which does not account for the wind or insolation) using the NWS application mentioned above. The results are itemized in Table 3.

Before discussing conditions from the WBGT perspective, we would like to point out the high number of stations in the lower Columbia basin reporting temperatures above 115°F at 00 UTC 30 June 2021 (Fig. 4). The multiple reports in the



**Figure 4: Temperature observations at 00 UTC 30 June 2021 (5 pm local time) in the Lower Columbia Basin from [NOHRSC](https://www.nohrsc.noaa.gov/interactive/html/map.html).**

### Observed Dew Point Temperature for 2021 June 30, 0:00 UTC



**Figure 5: As in Figure 4, except for dewpoint temperature.**

range of 116-118°F give credence to the validity of temperature measurements of 119 to as high as 120°F at the Hanford Site north of the Tri-Cities which are currently under review by the State Climate Extremes Committee; reports from these stations are not included in Figure 4. Forecasters that monitor the weather for that site routinely see summer temperatures on hot days in the lower elevations of the Hanford site that are about 18°F warmer than those on Rattlesnake Mountain at an elevation of 1004 meters. As shown in Table 3, Rattlesnake Mountain reported a temperature of 100°F at 00 UTC, and its maximum temperature on 29 June was 102°F.

As indicated in Table 3, especially torrid conditions occurred in the Yakima Valley, as exemplified by the WBGT of 92 for the location of Toppenish. In general, more humid locations

were worse from a human heat stress perspective even though they were a bit cooler. We note that it was also the case in comparing Seattle with Portland. The latter's temperature of 115°F seems a lot worse than Seattle's 107 (the high temperatures that day were 1°F greater at both locations), but Seattle had a considerably higher dewpoint temperature and somewhat weaker winds, resulting in a greater WBGT. A WBGT value of 90°F is generally considered a critical level, and at and above these values, the athletic organizations such as the New Jersey State Interscholastic Athletic Organization and others prohibit outdoor activities. This threshold was exceeded in portions of eastern WA on 29 June, and at least approached at Sea-Tac and other locations in western WA on 28 June. Given the record-breaking heat has been seared into our consciousness, we expect that most folks would

not have any quarrel with policies protecting outdoor workers and athletes from unnecessary heat stress in these extreme conditions.

Location	Air Temperature (°F)	Dewpoint (°F)	Wind Speed (mph)	Heat Index (°F)	WBGT (°F)
<b>Toppenish</b>	110	61	3	113	92
<b>Upper Basin</b>	117	45	5	111	90
<b>Rattlesnake</b>	100	40	9	95	79
<b>Tri-Cities</b>	114	54	4	112	91
<b>SeaTacAP</b>	107	64	9	111	89
<b>Portland</b>	115	52	12	113	88

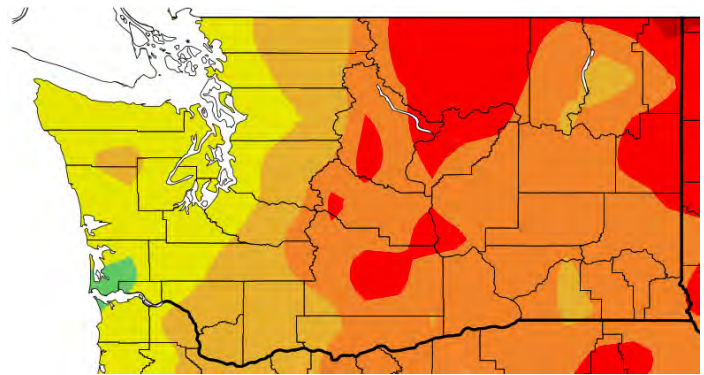
**Table 3: Average air temperature, dewpoint, and wind speed for the locations listed from [NOAA NOHRSC](#) at 5 pm 30 June and the calculated heat index and wet bulb globe temperature. The values are representative of the locations selected rather than actual observations from individual stations. Reports from SeaTac and Portland Airport are also included; values here are from late in the afternoon on 28 June.**



## Climate Summary

Washington continued to see above average temperatures throughout most of the state during the month of July, according to the map from the High Plains Regional Climate Center. Western WA saw average monthly temperatures range between 0 and 4°F above normal for the most part; some coastal and Puget Sound locations had near-normal July temperatures. For example, Quillayute and SeaTac AP were only 0.7 and 0.9°F above normal, respectively (Table 4). In Eastern WA, temperatures were markedly more anomalous, with temperatures between 4 and 8°F above normal. Another heat wave passed through at the end of the month, albeit one that was much smaller in scope compared to June. Even so, temperatures soared over 100°F in parts of Eastern WA during the last few days of July – many stations across the state recorded temperatures between 10 and 20 degrees higher than average.

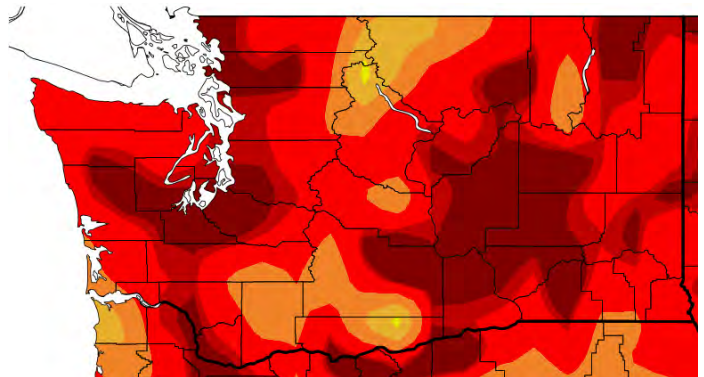
July was abnormally dry statewide. Almost all of the state saw less than 25% of normal precipitation. The northern tip of Chelan County and a small spot in northeastern Klickitat County are the only two areas that received near-normal amounts of precipitation (80-90% of normal). Many stations, as seen in Table 4, recorded trace or no precipitation for the entire month.



Temperature (°F)



**July temperature (°F) departure from normal relative to the 1991-2020 normal (HPRCC).**



Precipitation (%)



**July total precipitation percent of 1991-2020 normal (HPRCC).**

Station	Mean Temperature (°F)			Precipitation (inches)		
	Average	Normal	Departure from Normal	Total	Normal	Percent of Normal
Western Washington						
Olympia	65.6	64.2	1.4	T	0.53	0
Seattle WFO	68.9	66.5	2.4	0.06	0.78	8
SeaTac AP	68.0	67.1	0.9	T	0.60	0
Quillayute	60.0	59.3	0.7	0.08	1.58	5
Hoquiam	62.4	60.3	2.1	0.11	0.85	13
Bellingham AP	65.9	63.9	2.0	T	0.88	0
Vancouver AP	71.8	69.0	2.8	0.00	0.42	0
Eastern Washington						
Spokane AP	77.5	71.0	6.5	0.12	0.42	29
Wenatchee	80.8	74.4	6.1	0.01	0.24	4
Omak	81.2	73.7	7.5	T	0.52	0
Pullman AP	71.4	67.0	4.4	0.22	0.39	56
Ephrata	80.2	75.3	4.9	T	0.30	0
Pasco AP	80.0	74.7	5.3	T	0.15	0
Hanford	83.2	78.2	5.0	T	0.20	0

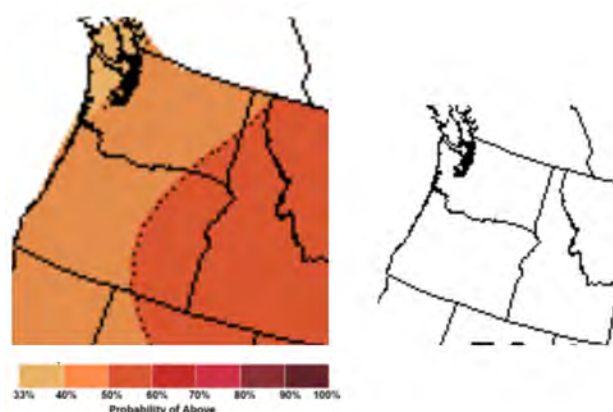
**Table 4: July 2021 climate summaries for locations around Washington with a climate normal baseline of 1991-2020.**

## Climate Outlook

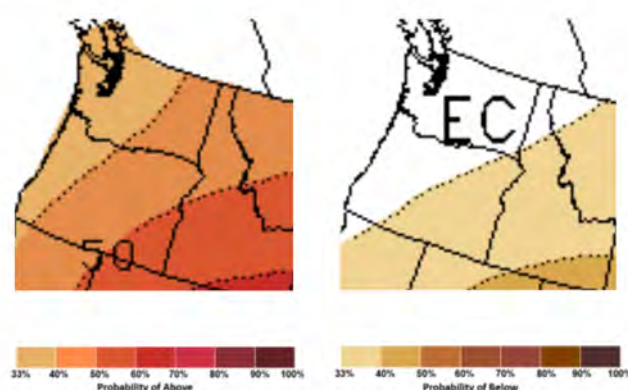
According to the Climate Prediction Center (CPC), neutral ENSO conditions are present in the equatorial Pacific Ocean. Over the last 4 weeks, sea surface temperatures (SSTs) in the equatorial Pacific Ocean have been near or below average. The neutral ENSO conditions are expected to persist through the summer (51% chance for the August-October season). La Niña conditions could potentially emerge during the September-November time frame and persist throughout the winter (55% chance during November-January). The “La Niña Watch” issued last month is still in effect. There is a smaller chance of neutral conditions (42%) and a very small chance of El Niño (3%) developing later this year.

The CPC outlook for August (Figure 6) has increased chances of above normal temperatures for all of WA State. The probability of above normal temperatures is between 40 and 50% for most of the state. There are equal chances statewide of above normal, below normal, and normal precipitation.

The three-month outlook for August-September-October (ASO) shown in Figure 7 shows increased chances of above normal temperatures and equal chances of above normal, below normal, and normal precipitation for the entire state.



**Figure 6: August outlook for temperature (left) and precipitation (right).**



**Figure 7: August-September-October outlook for temperature (left) and precipitation (right) ([Climate Prediction Center](#)).**