

Oregon/Washington Water Year 2020 Climatological Summary and Perspective

Larry O'Neill

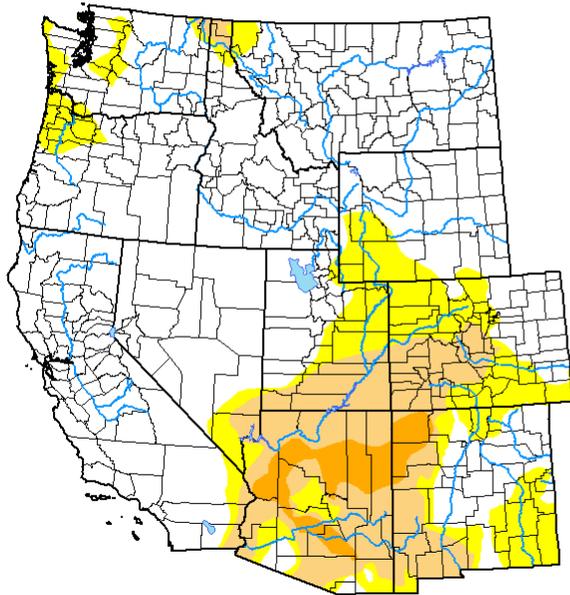
Oregon State University

Scott Oviatt (USDA-NRCS), Ken Stahr (Oregon Water Resources Dept),
Karin Bumbaco (UW), and Nick Bond (UW)

Wednesday, Oct. 28, 2020

Drought progression throughout the water year

U.S. Drought Monitor West



October 1, 2019
(Released Thursday, Oct. 3, 2019)
Valid 8 a.m. EDT

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	68.40	31.60	16.32	3.16	0.00	0.00
Last Week 09-24-2019	66.35	33.65	15.07	3.18	0.00	0.00
3 Months Ago 07-02-2019	86.89	13.11	5.53	1.24	0.00	0.00
Start of Calendar Year 01-01-2019	28.03	71.97	53.25	27.22	8.35	2.88
Start of Water Year 10-01-2019	68.40	31.60	16.32	3.16	0.00	0.00
One Year Ago 10-02-2018	14.15	85.85	59.29	38.88	17.58	4.36

Intensity:

None	D2 Severe Drought
D0 Abnormally Dry	D3 Extreme Drought
D1 Moderate Drought	D4 Exceptional Drought

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

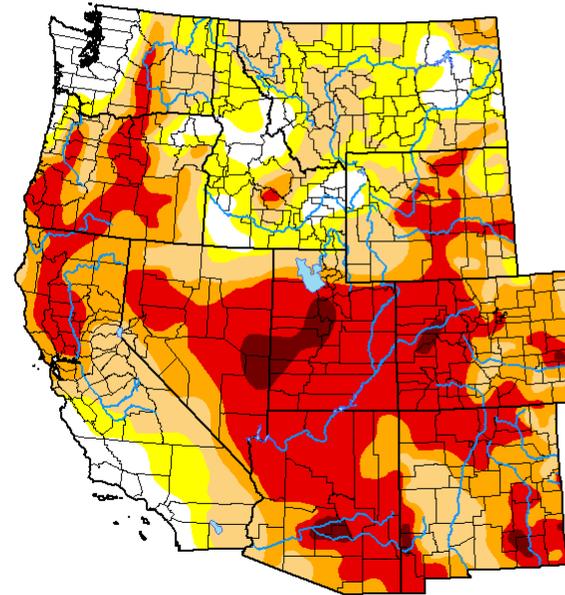
Author:

Brian Fuchs
National Drought Mitigation Center



droughtmonitor.unl.edu

U.S. Drought Monitor West



September 29, 2020
(Released Thursday, Oct. 1, 2020)
Valid 8 a.m. EDT

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	8.51	91.49	76.07	54.55	33.11	2.31
Last Week 09-22-2020	7.72	92.28	73.37	52.86	29.21	1.29
3 Months Ago 06-30-2020	35.15	64.85	45.24	22.93	5.00	0.12
Start of Calendar Year 12-31-2019	59.17	40.83	18.17	7.12	0.00	0.00
Start of Water Year 10-01-2019	68.40	31.60	16.32	3.16	0.00	0.00
One Year Ago 10-01-2019	68.40	31.60	16.32	3.16	0.00	0.00

Intensity:

None	D2 Severe Drought
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The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

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droughtmonitor.unl.edu

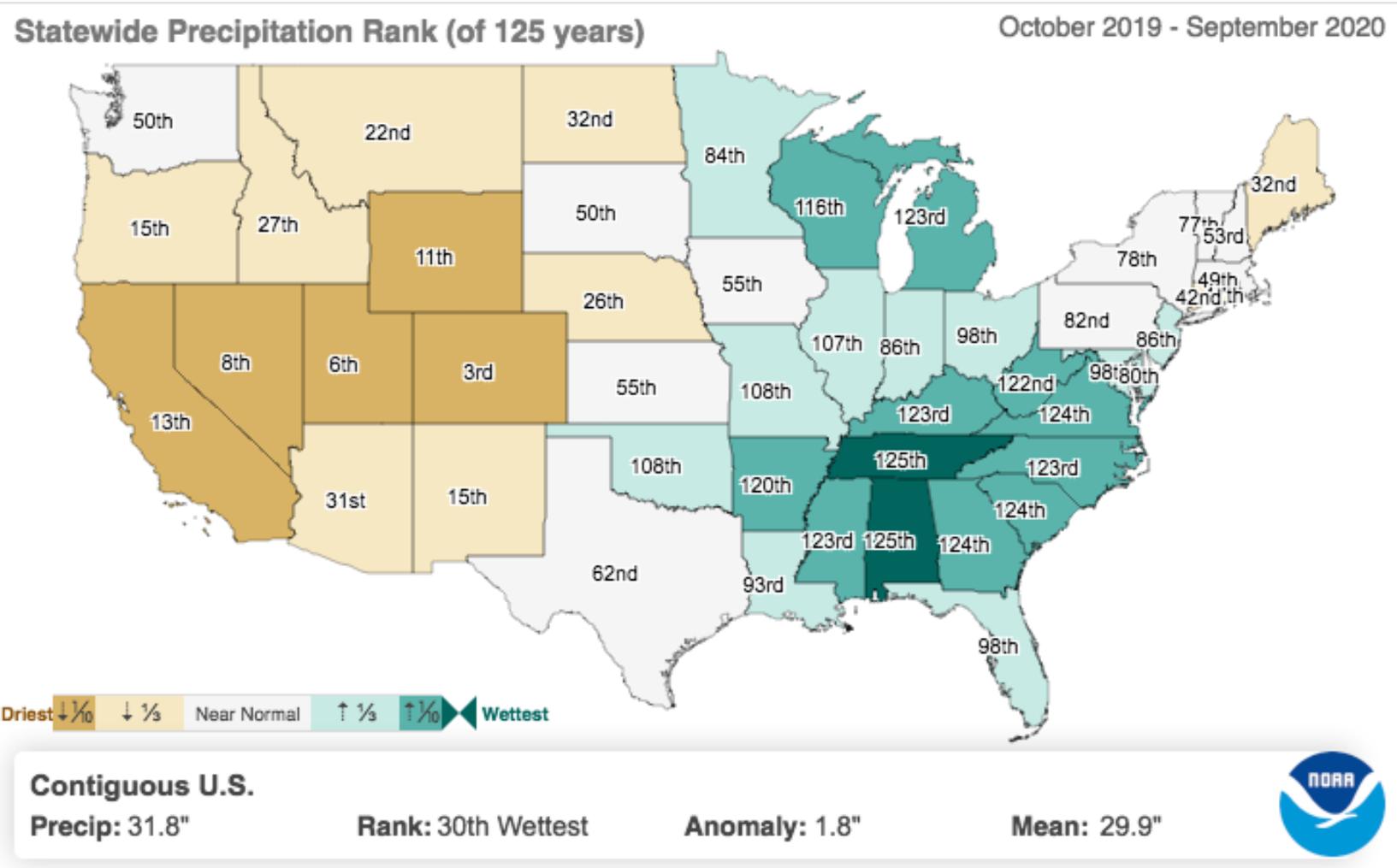
On October 1, 2019:

- Very little of PacNW in any category of drought
- OR: 11% in D0; 89% drought-free
- WA: 17% in D0; 1% in D1; 82% drought-free

On September 29, 2020:

- Oregon: 6% of area drought-free
 - 34% in D3; 32% in D2; 19% in D1; 9% in D0
- Washington: 37% of area drought-free
 - 6% in D3; 11% in D2; 27% in D1; 19% in D0

Water Year 2020 Precipitation Ranking



The US West suffered through an extremely dry water year overall

Oregon: 15th driest out of 125 years

Washington: 50th driest out of 125 years

Alaska: 32nd wettest (64th driest) out of 95 years

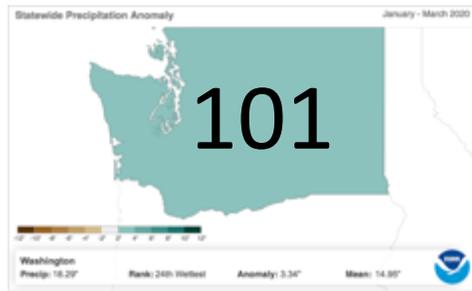


WY Seasonal Precipitation Rankings

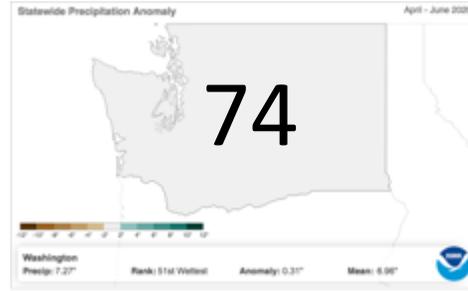
Oct-Nov-Dec 2019



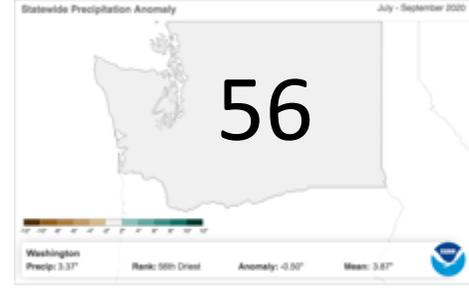
Jan-Feb-Mar 2020



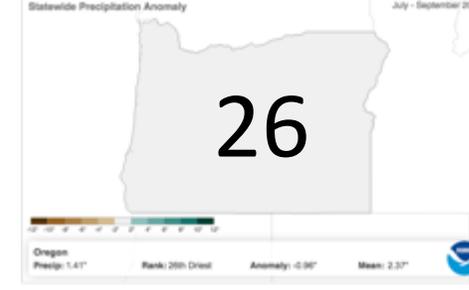
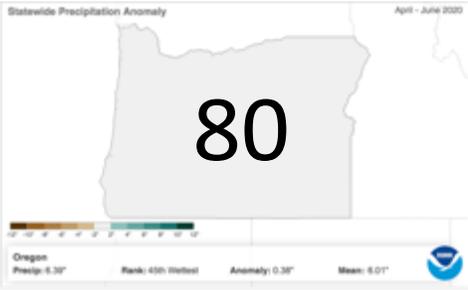
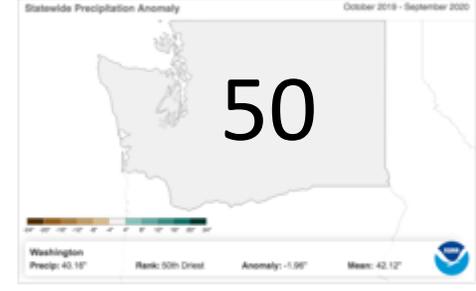
Apr-May-Jun 2020



Jul-Aug-Sep 2020



Oct 2019-Sep 2020



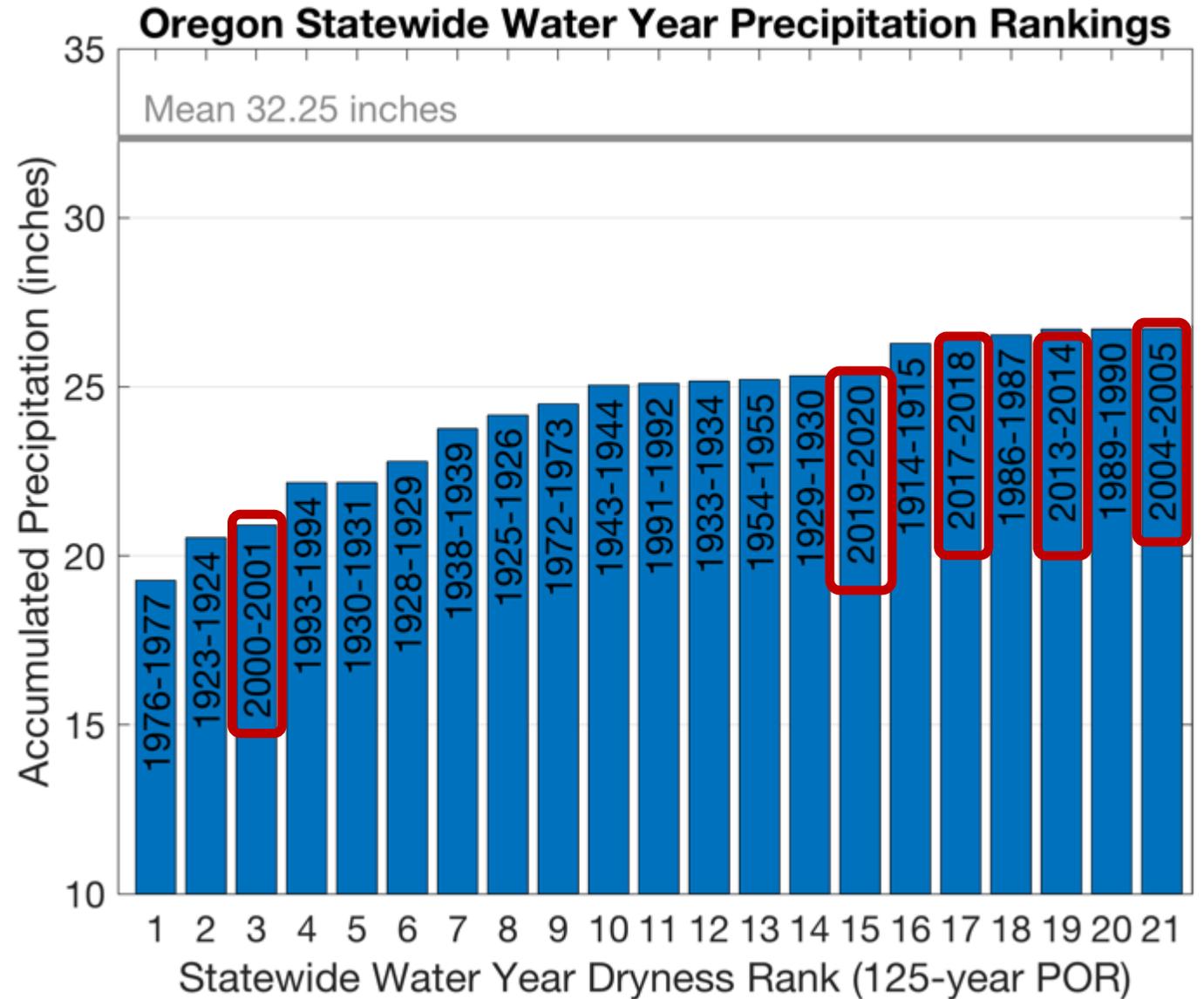
- Oregon started with an exceptionally dry fall, had a mildly dry winter, wet spring, and ended moderately dry
- Washington started extremely dry, was quite wet in the middle, and ended mildly dry

Oregon's historically significant drought

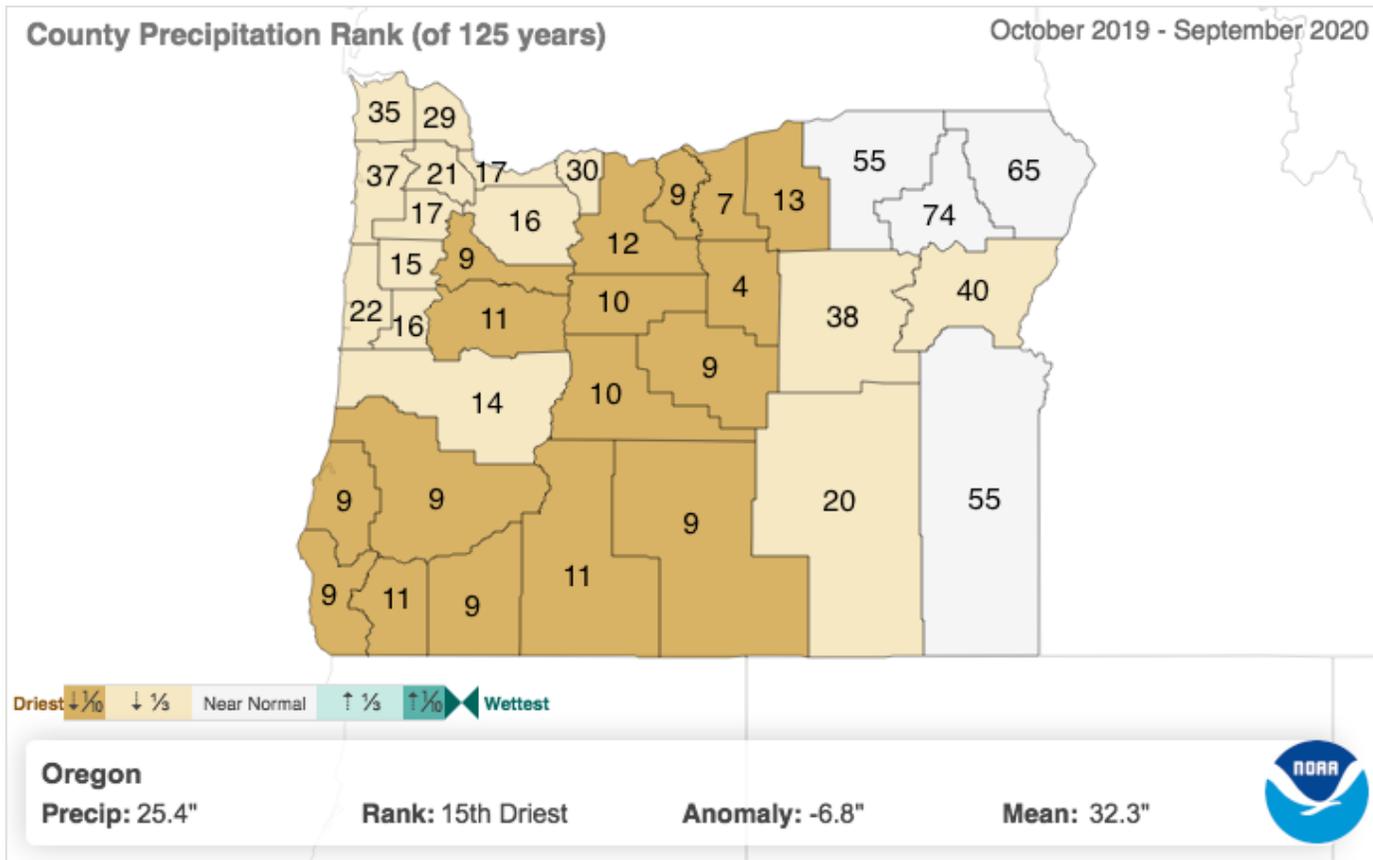
For Oregon, the Water Year ended with a statewide average of 25.45" of rain, which ranks as 15th driest for the last 125 years

WY2020 was the driest year since the WY2001, which had 20.91" and ranked 3rd driest on record

Compared to notable recent dry years, WY2020 (15th) finished with slightly less rainfall than WY2018 (17th), WY2014 (19th) and WY2005 (21st)



Water Year accumulated rainfall rankings by county -- Oregon



The numbers on the counties represent the rank of WY accumulated precipitation in the 125-year data record (1=driest; 125=wettest)

Shading represents the percentile rank (brown = within driest 10 percent; tan = within driest 33%)

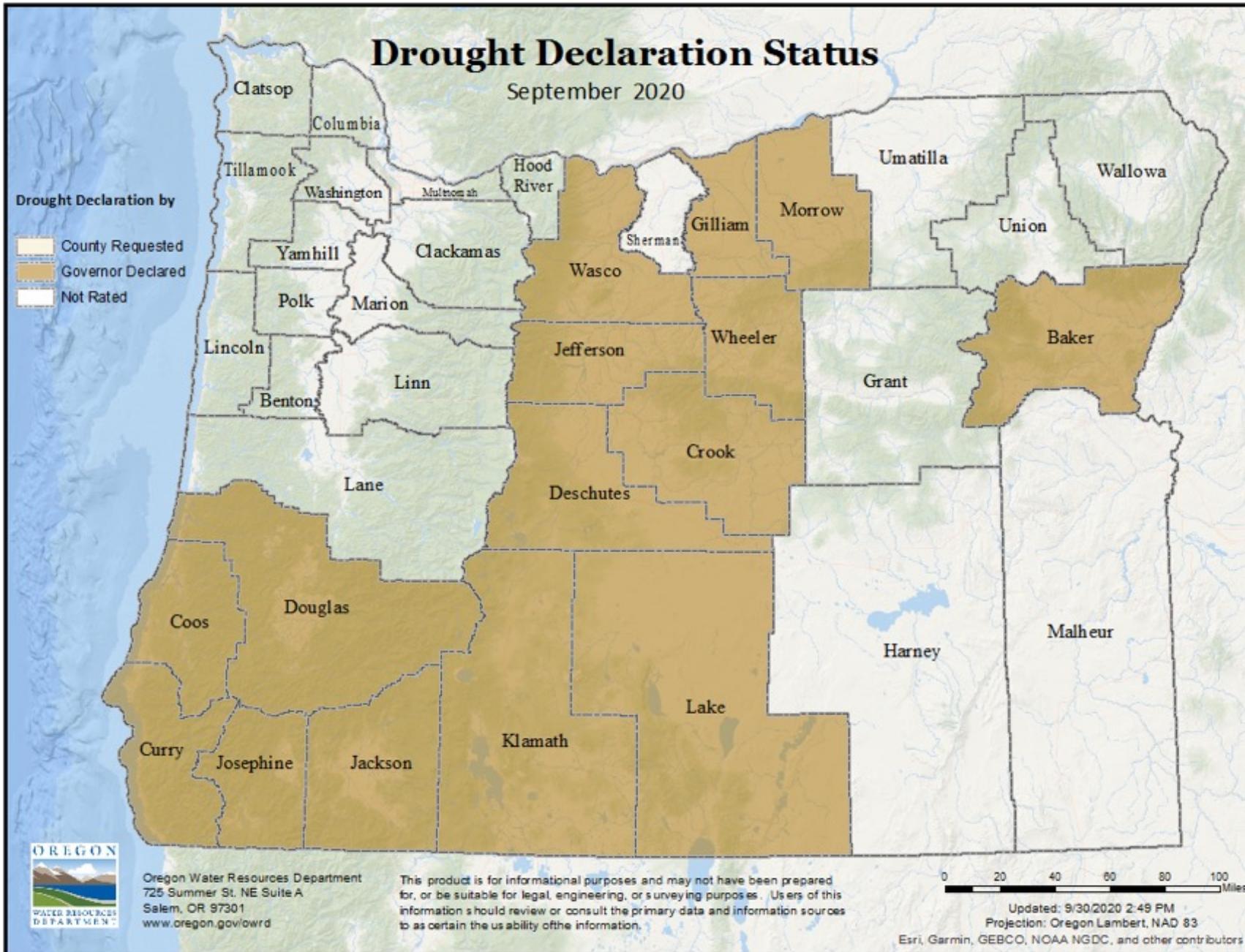
Counties in Southern and Central Oregon fared significantly worse than other parts of the state with WY precipitation totals in the driest 10 percent of record.

Drought Declaration Status

September 2020

Drought Declaration by

- County Requested
- Governor Declared
- Not Rated



15 Oregon counties were granted state-level drought declaration status for WY2020

No counties in Washington

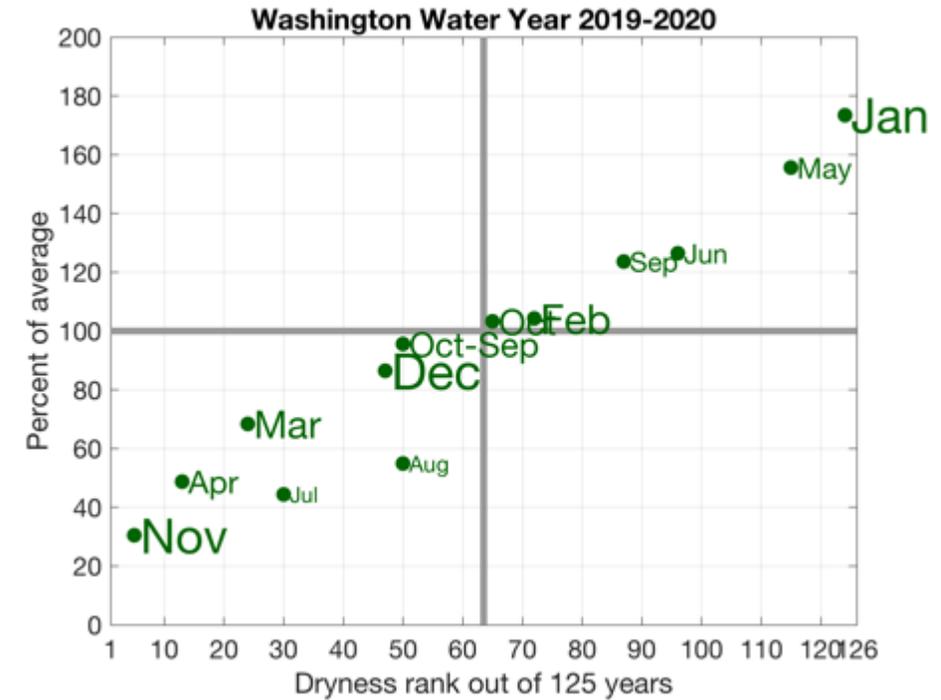
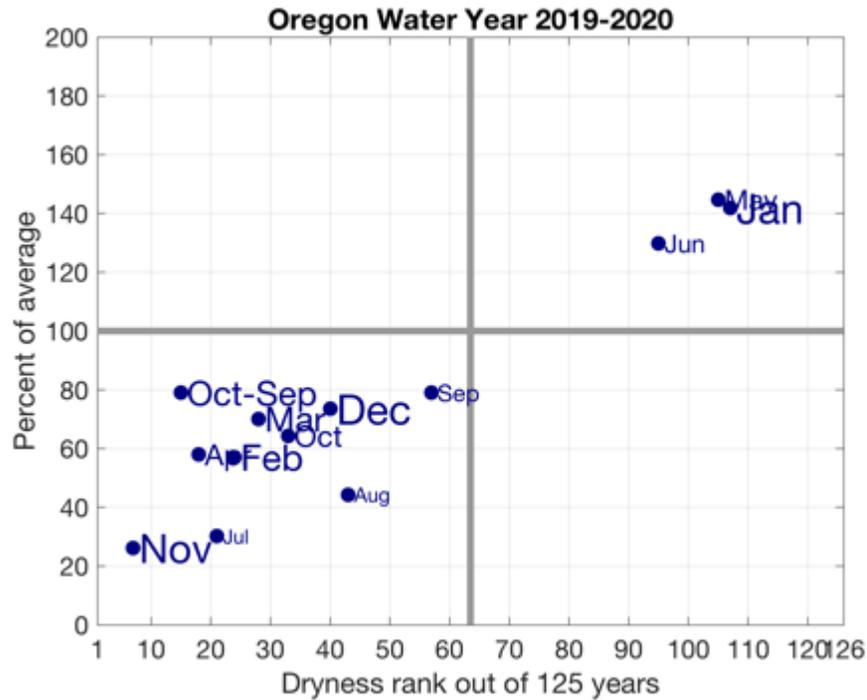


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0 20 40 60 80 100 Miles
Updated: 9/30/2020 2:49 PM
Projection: Oregon Lambert, NAD 83
Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Summary of monthly statewide rainfall



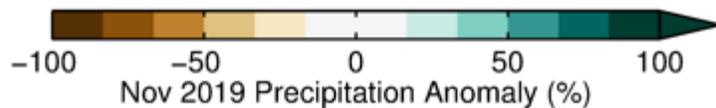
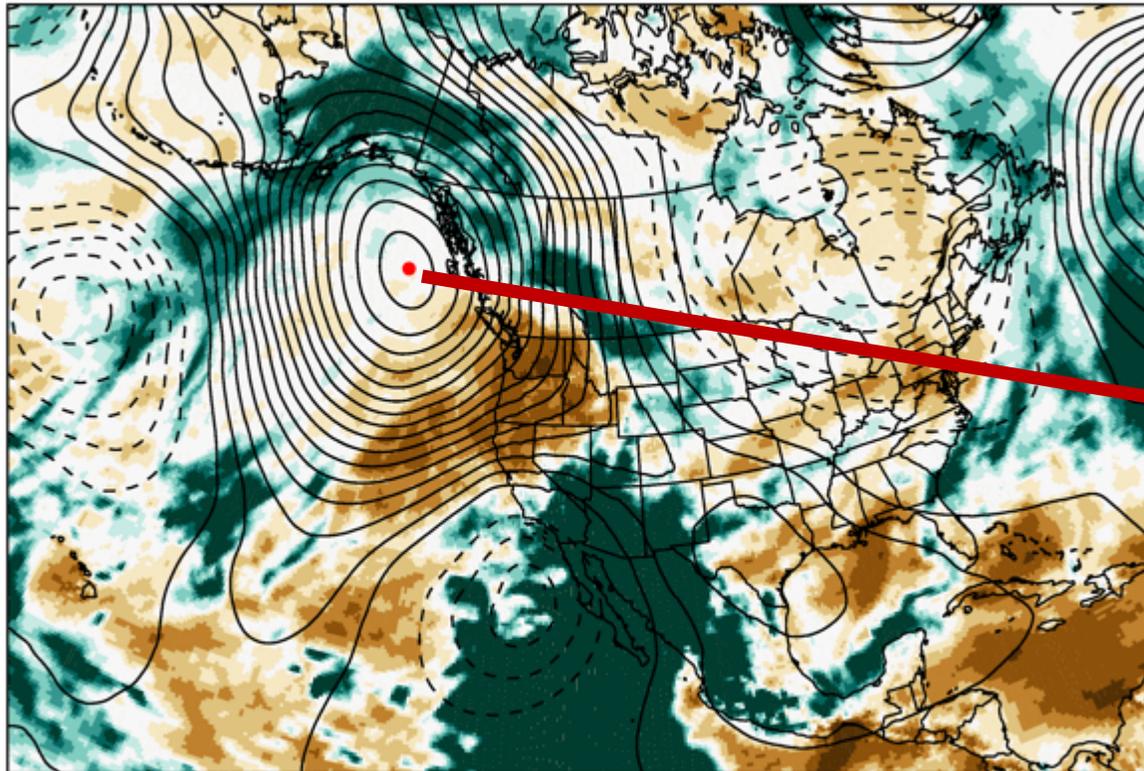
- Oregon: 9 out of 12 months below normal
- Jan – 18th wettest January on record
- Nov – 7th driest November on record
- Oregon more consistently dry throughout the WY compared to Washington

- Washington: 6 months above normal, 6 below normal
- Jan – 2nd wettest January on record
- Nov – 5th driest November on record

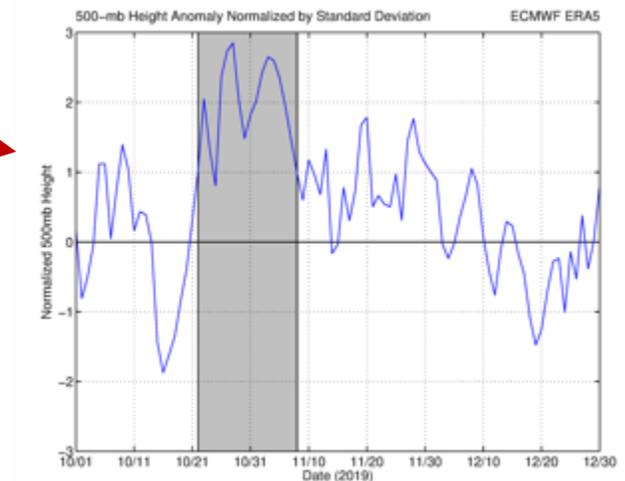
Fall 2019 Ridiculously Resilient Ridge

Accumulated Precipitation Anomaly (shading)
500mb Height Anomaly (contours)
November 2019 (1979–2010 Baseline)

ECMWF ERA5

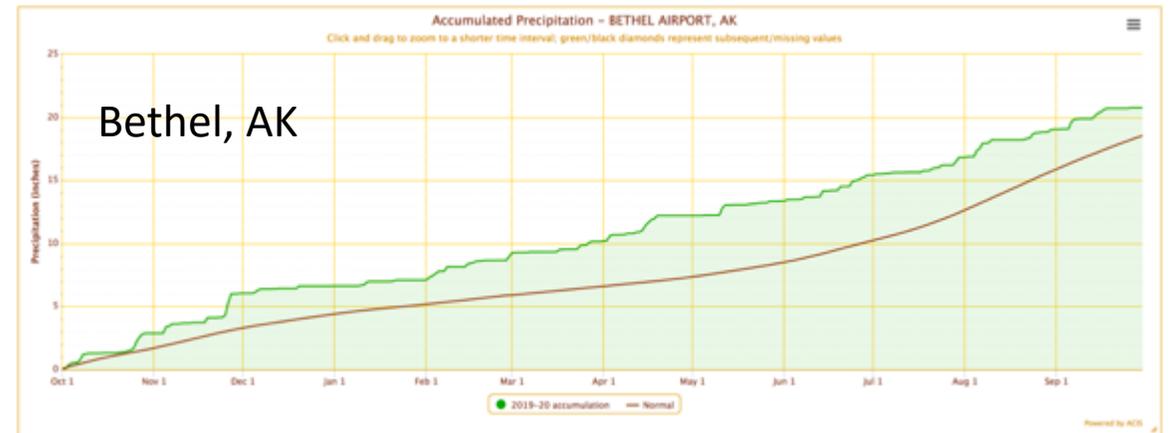
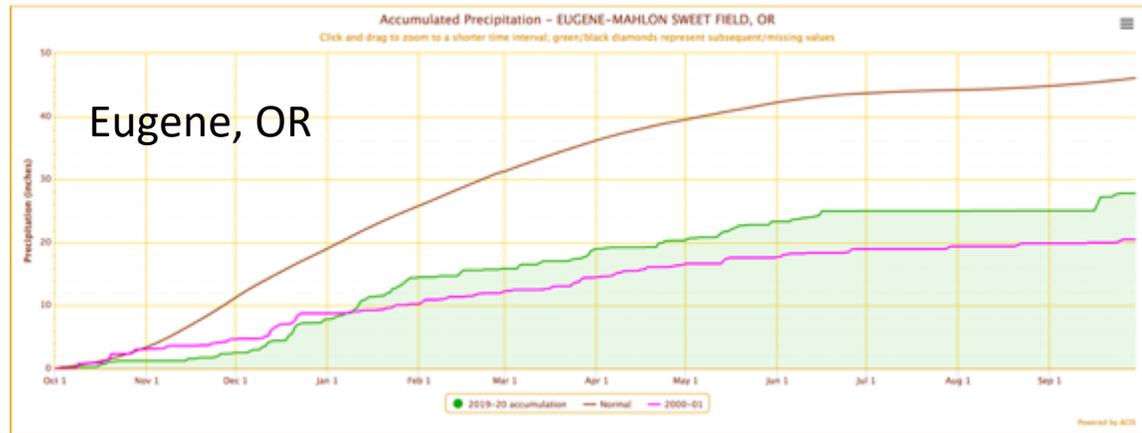
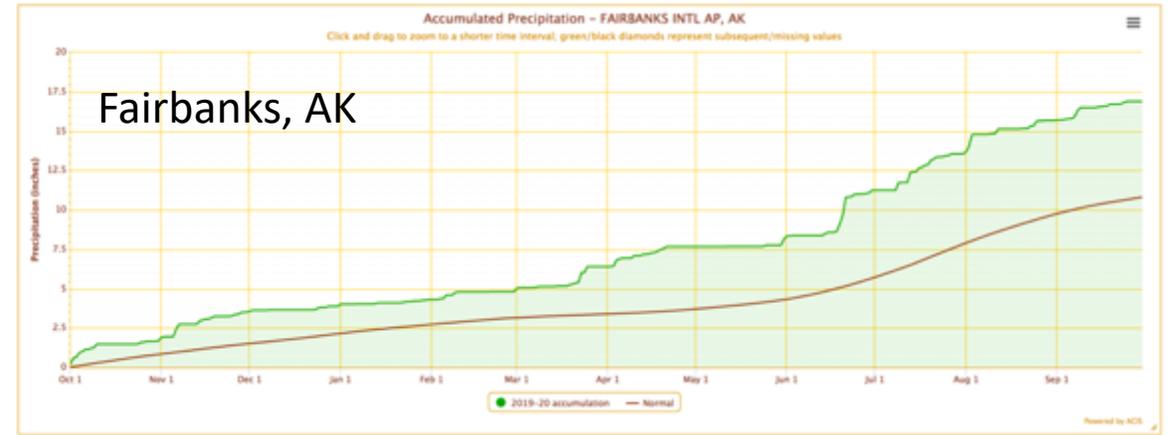
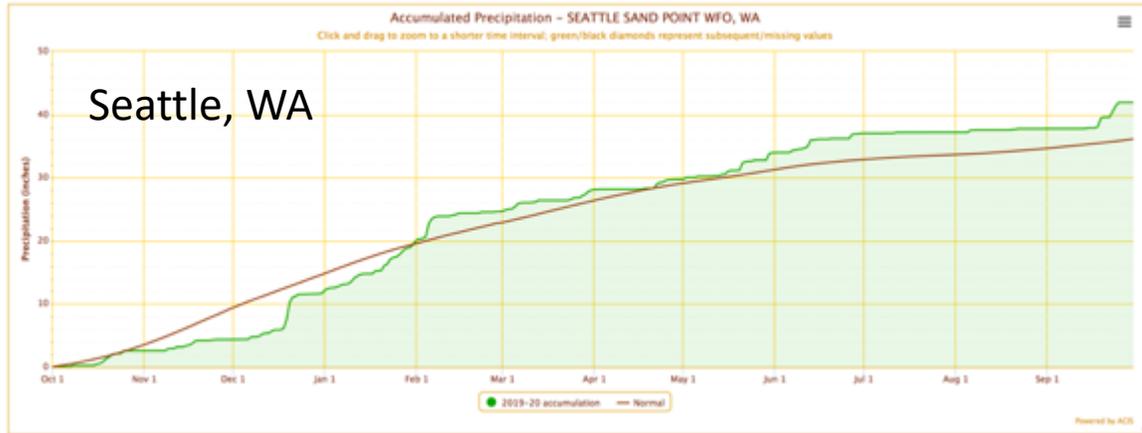


Split storm track evident in the rainfall anomalies for November, with the PacNW and NorCal far below normal, while SoCal, Alaska, and NorBC were well above normal



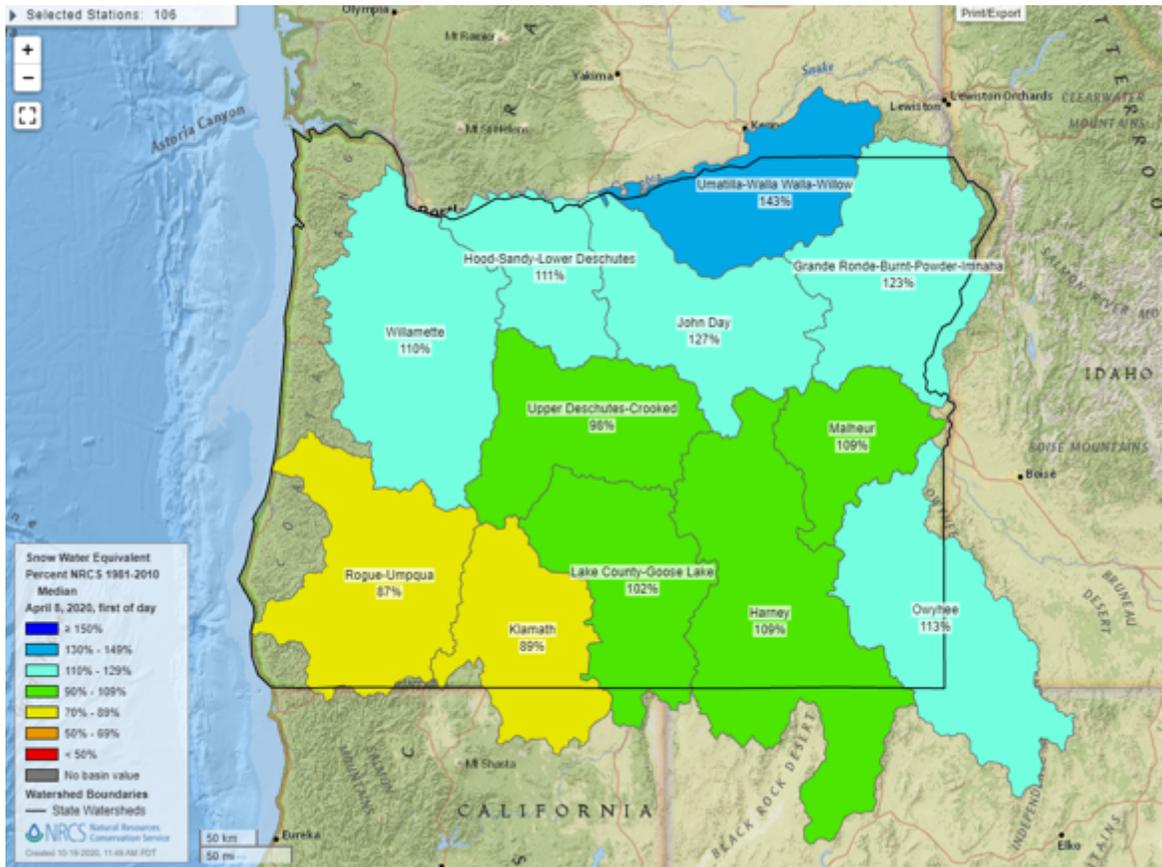
From late Oct-early Dec, the ridiculously resilient ridge was present in the Gulf of Alaska

Select Rainfall WY Accumulation Curves

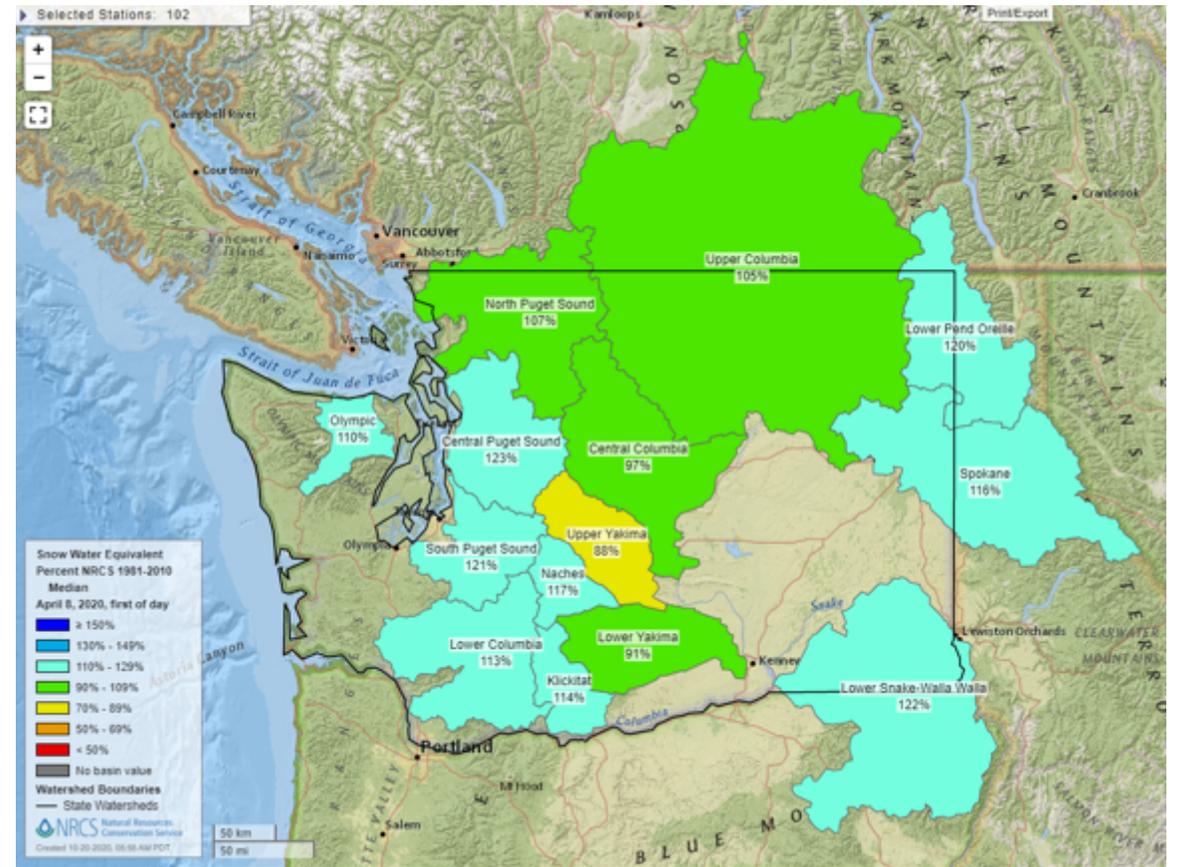


Northward shift in the storm track evident in well above average rainfall in Alaska

SNOTEL date of peak SWE



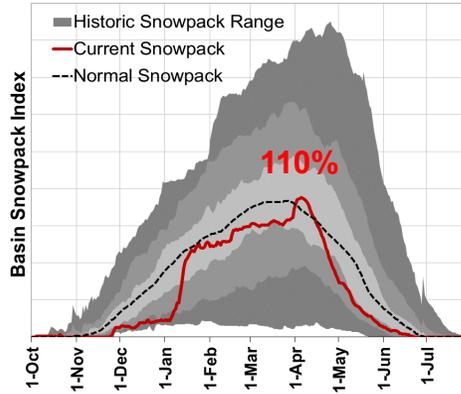
SWE peaked on April 8, 2020 in Oregon at 109% of median



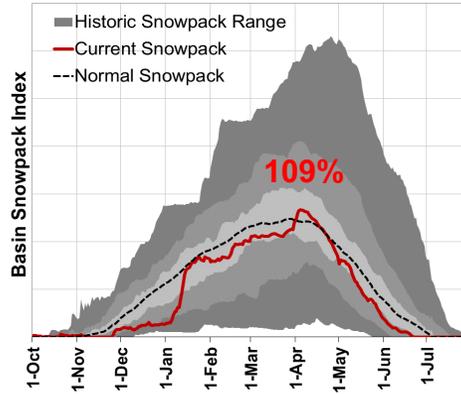
SWE peaked on April 6, 2020 in Washington at 111% of median

SWE time series for Oregon SNOTEL sites during Water Year 2020

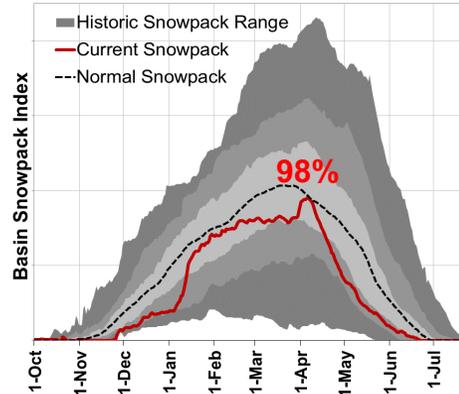
Willamette



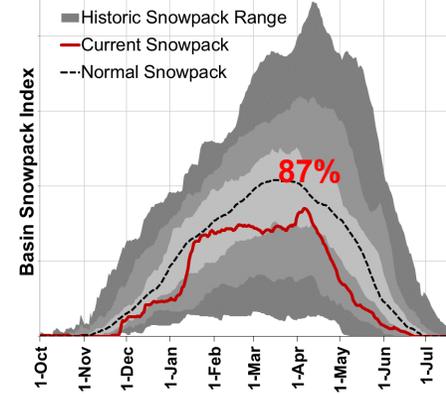
Hood/Sandy/L. Deschutes



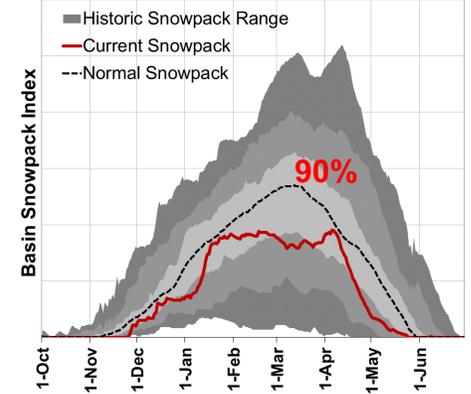
Deschutes



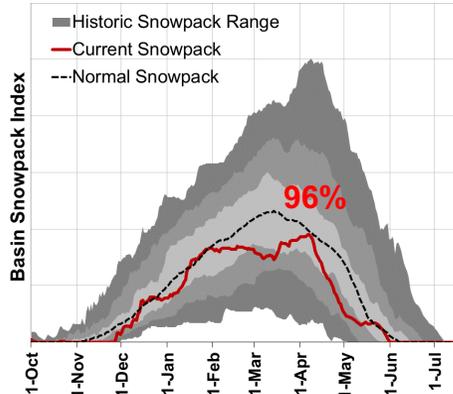
Rogue/Umpqua



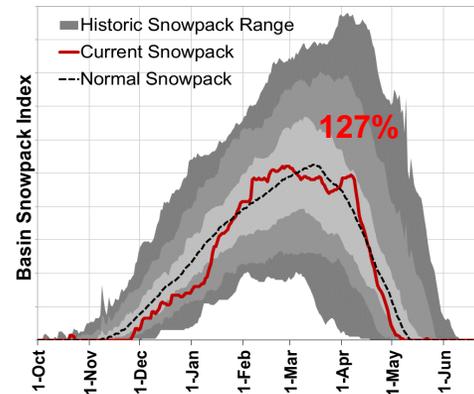
Klamath



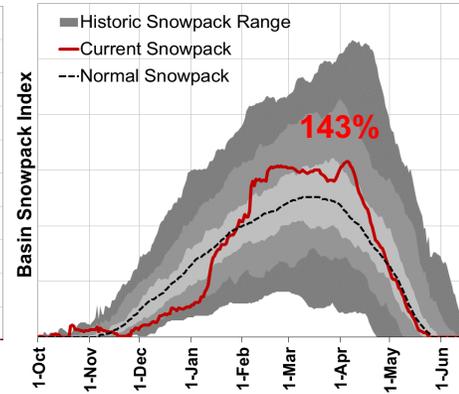
Lake County/Goose Lake



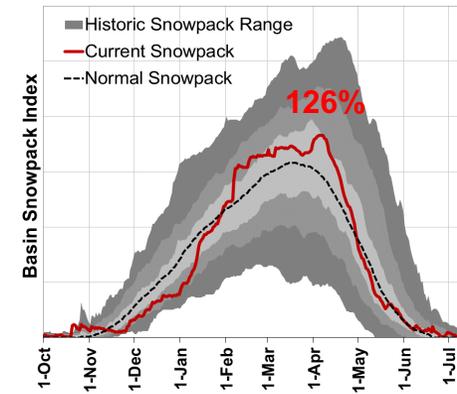
John Day



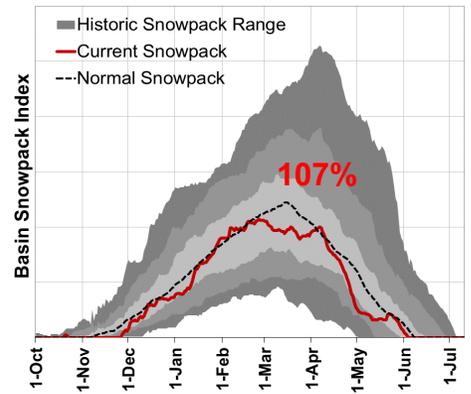
Umatilla



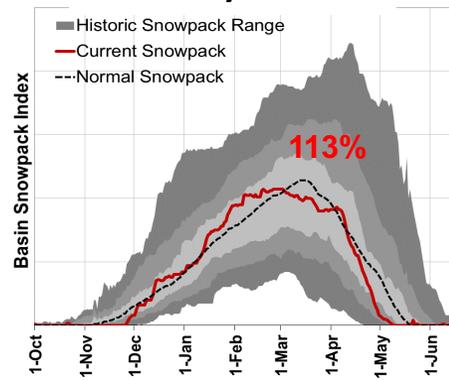
Grand Ronde/Powder/Burnt



Harney



Owyhee



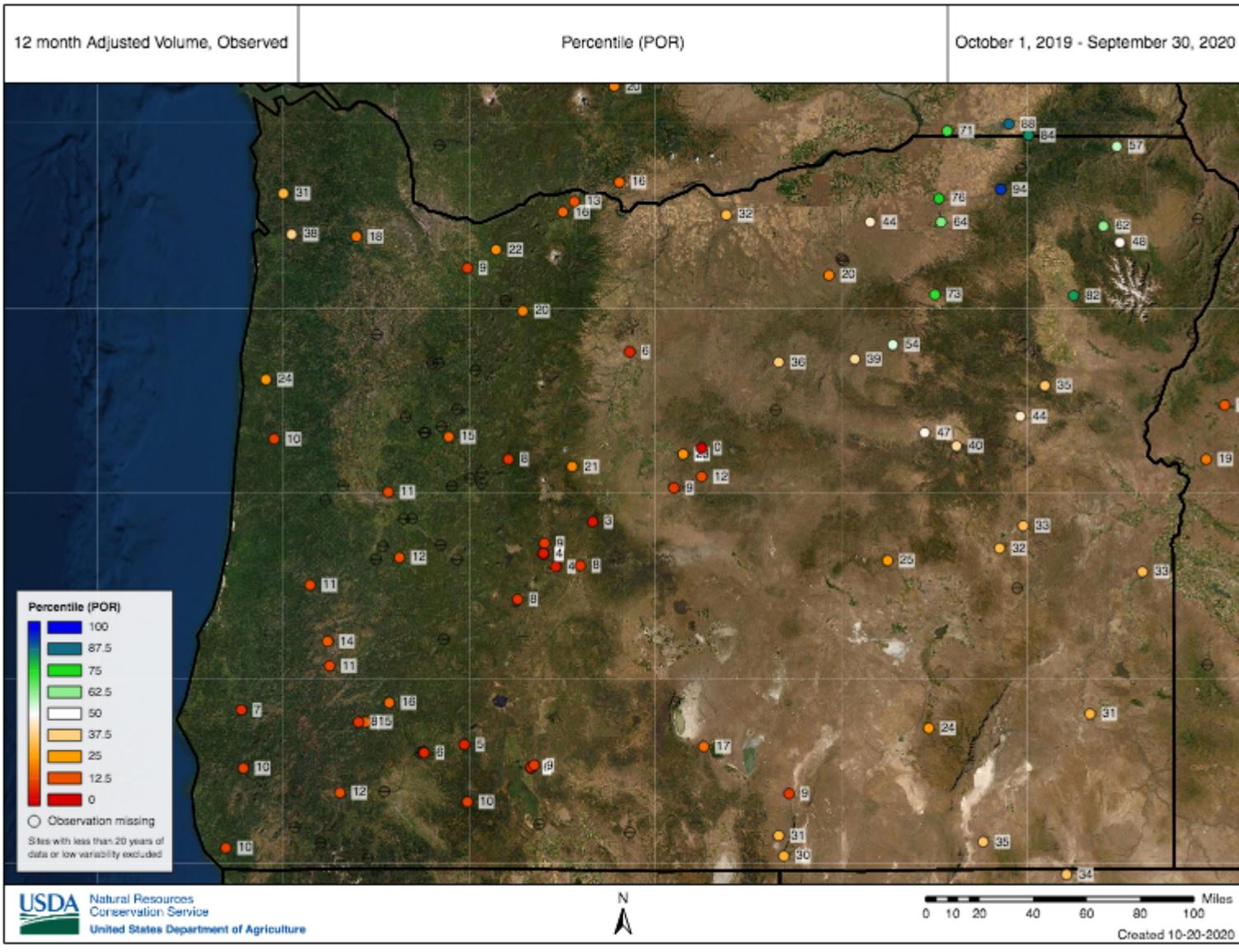
Oregon snow season: late start, early end

Very large jump in SWE in January

While all basins had near-normal SWE in early April, many melted out 1–3 weeks early due to a warm spell in late April/early May

Exceptions – northeast Oregon basins (Umatilla, Grande Ronde, possibly John Day)

Water Year 2020 runoff percentiles – Oregon



WY runoff largely follows pattern of WY precipitation in Oregon:

Below 20th percentile in western Oregon, High Cascades, and most of central Oregon

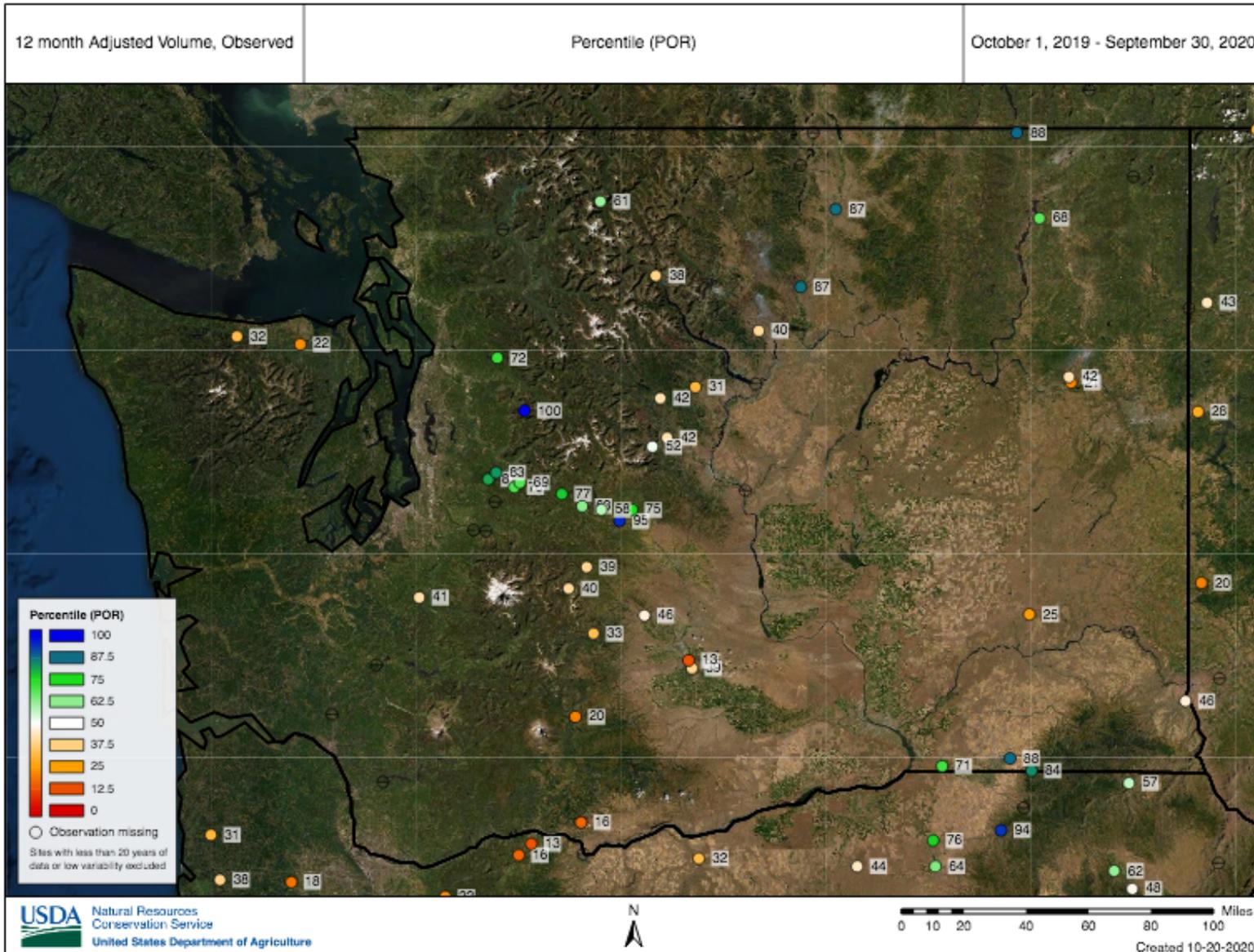
A number of locations below the 10th percentile

Northeast Oregon generally above normal runoff, while SE Oregon mostly between the 25th and 35th percentiles

Notable extremes:

- All-time low at Ochoco Creek blw Prineville
- Umatilla River abv Meacham (94th percentile)
- South Fork Rogue nr Prospect (5th percentile)
- Deschutes River at Benham Falls (3rd percentile)
- Upper Williamson River (6th percentile)
- S Fork Coquille River (7th percentile)
- Warm Springs River (6th percentile)
- Wickiup Res inflow (4th percentile)

Water Year 2020 runoff percentiles – Washington



Washington WY runoff pattern also generally follows the pattern of precipitation and snowpack

Washington Cascades above median

Olympic peninsula somewhat below median

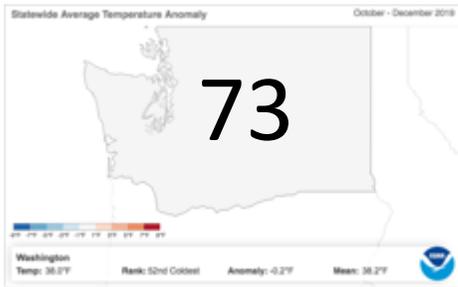
South-central and SE Washington with a few well below normal runoff stations

Notable extremes:

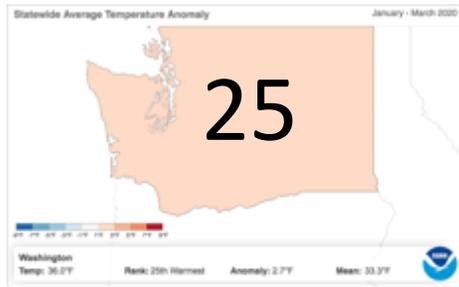
- S Fork Tolt River (12147600) sets record high runoff (out of 55 year POR)
- Yakima River at Cle Elum (95th percentile)

WY Seasonal Surface Air Temperature Rankings

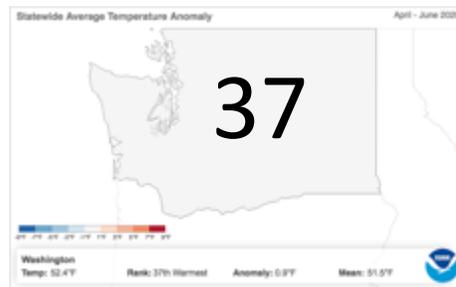
Oct-Nov-Dec 2019



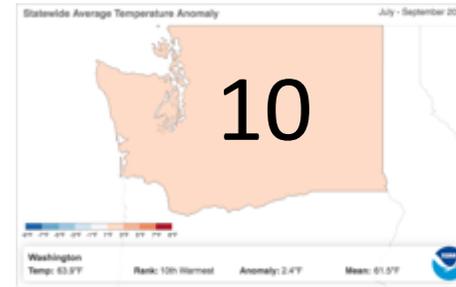
Jan-Feb-Mar 2020



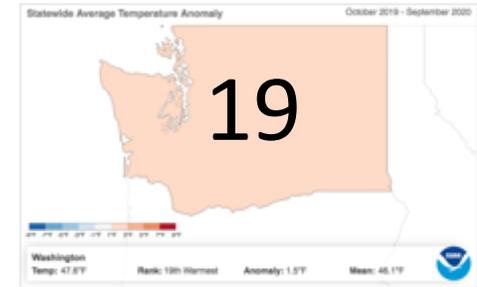
Apr-May-Jun 2020



Jul-Aug-Sep 2020



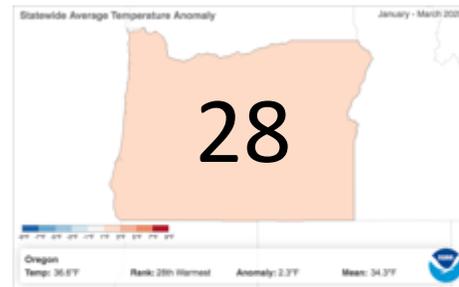
Oct 2019-Sep 2020



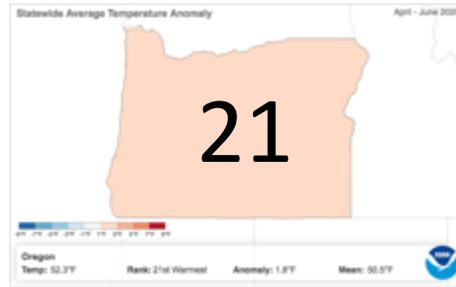
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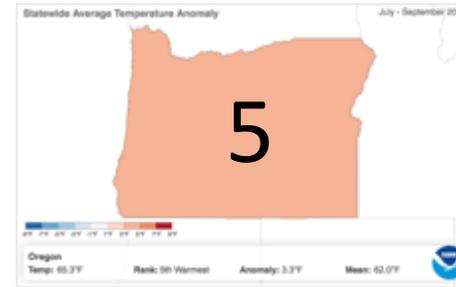
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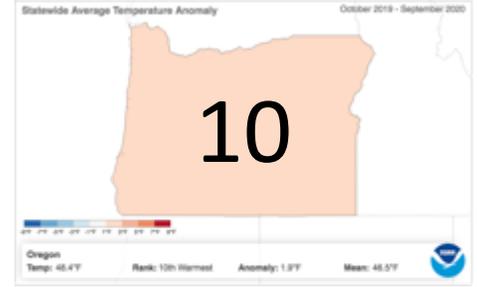
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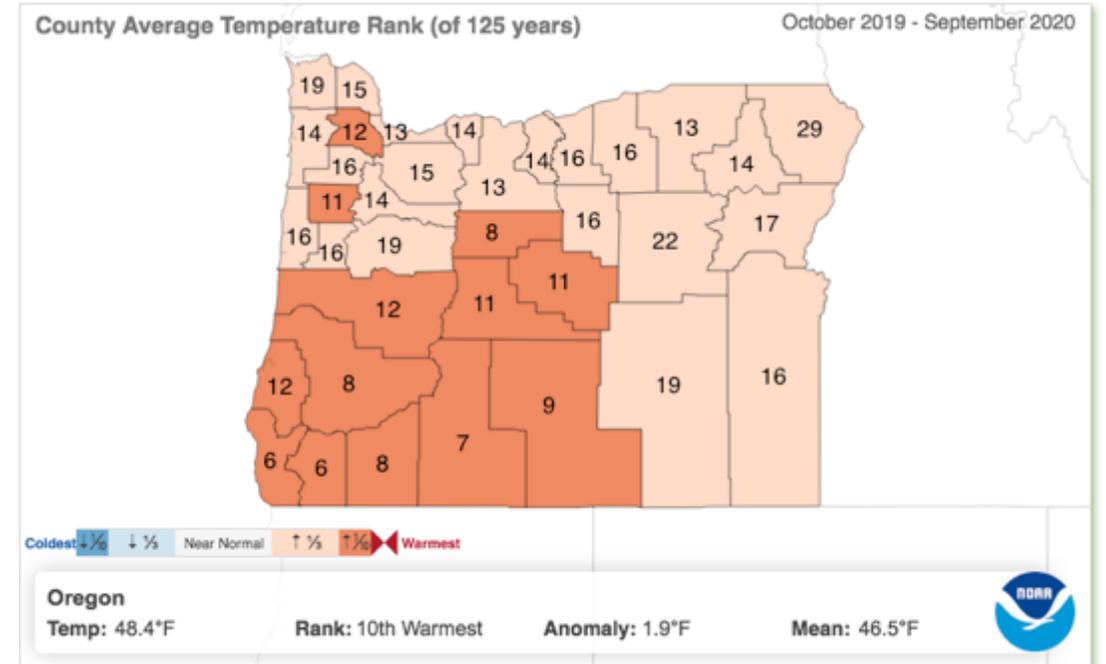
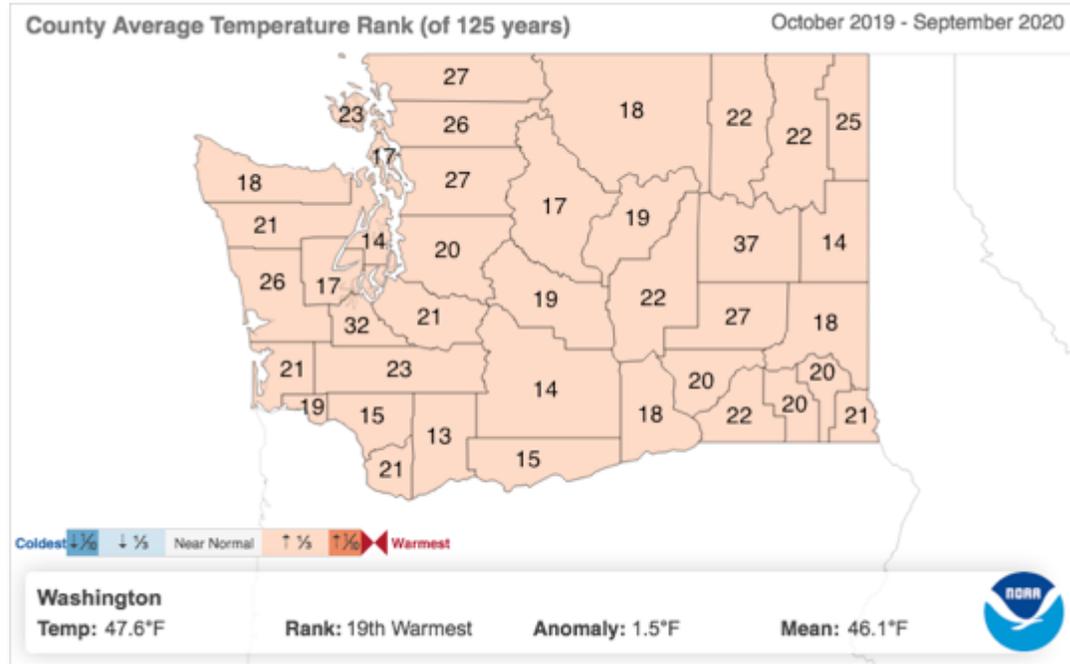


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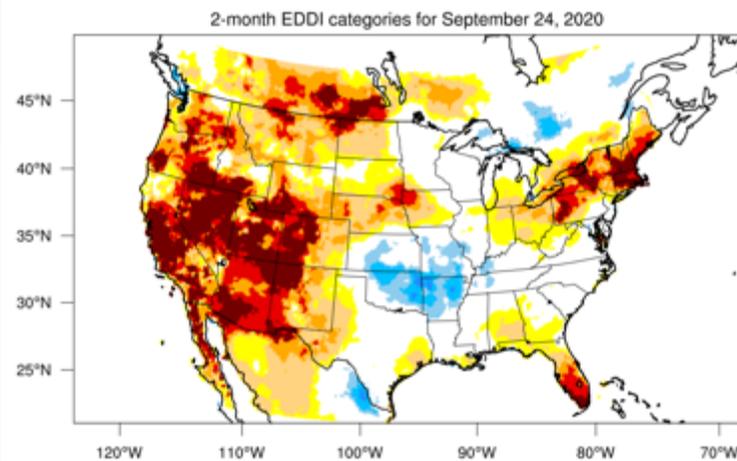
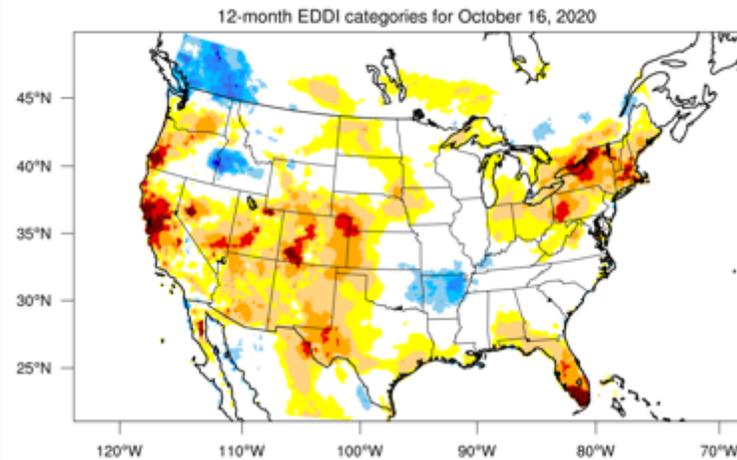
- Fall 2019 started with mild temperatures in both Oregon and Washington
- Abnormally warm weather followed during the remainder of the year, particularly summer 2020
- Oregon WY2020 ranked as 10th warmest on record (POR 125 years)
- Washington WY2020 ranked as 19th warmest on record

Average surface air temperature rankings by county



Much warmer than normal in both WA and OR, with 19th and 10th warmest WYs on record, respectively
SW and Central Oregon the most anomalous

Evaporative Demand Drought Index (EDDI)



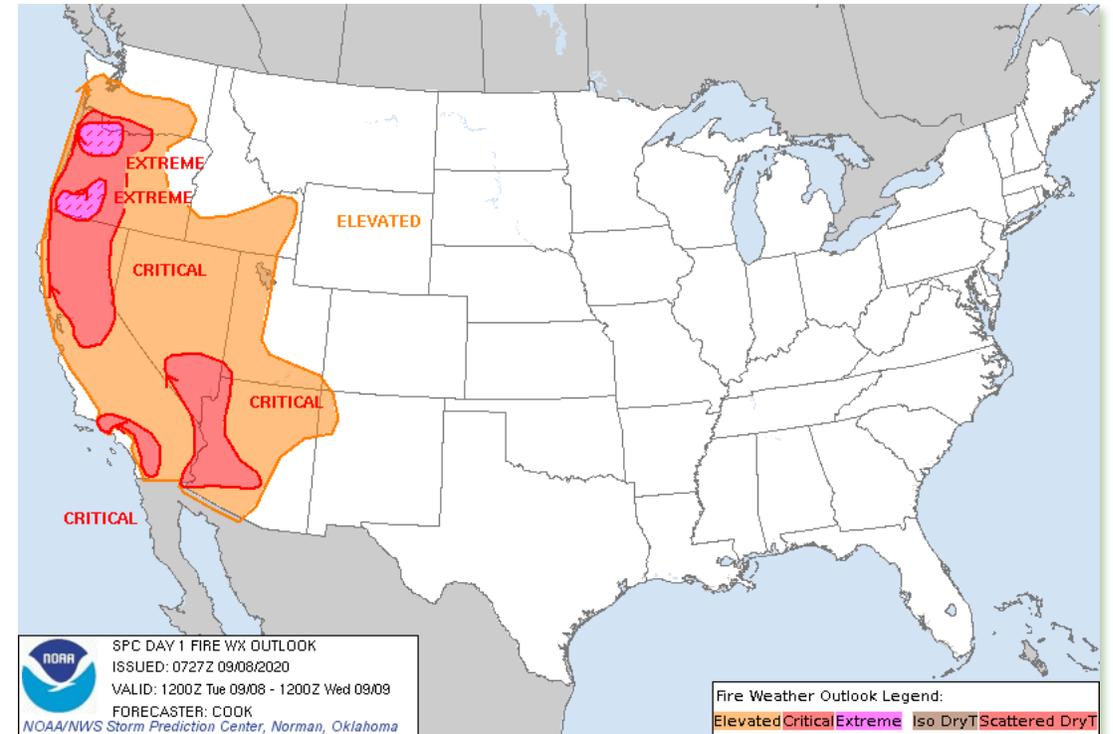
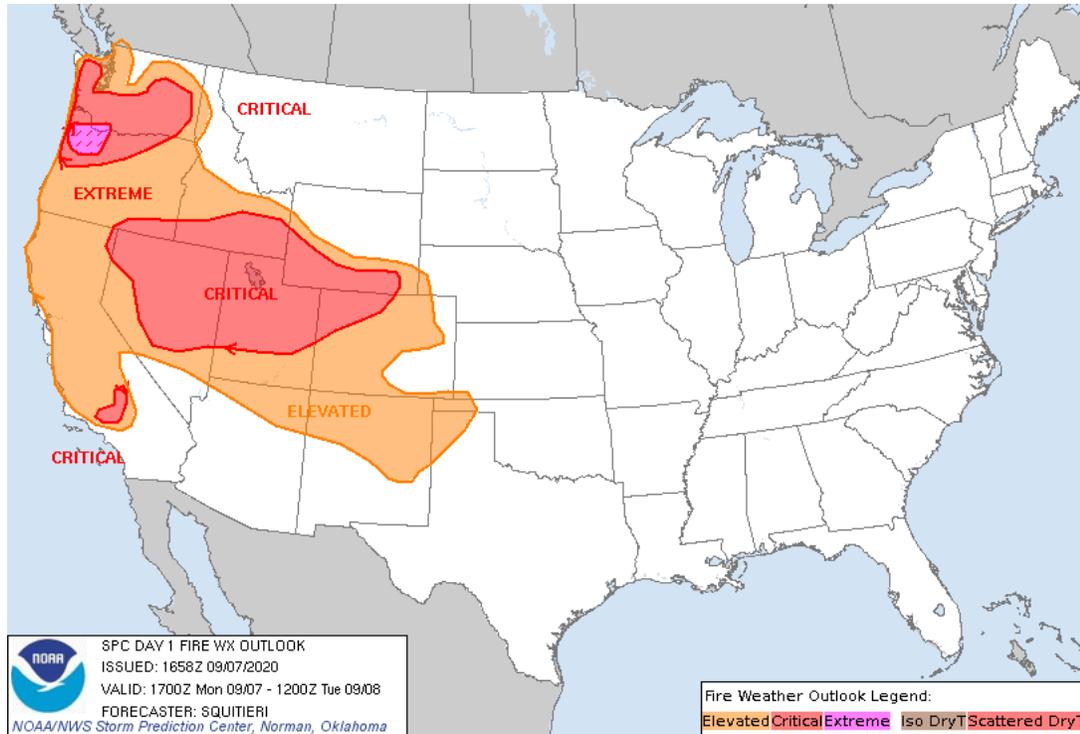
Warmer than normal temperatures contributed to abnormally high evaporative demand over much of Oregon and Washington

Severe-to-exceptional evaporative demand in most of western Oregon and the south-central Washington on 12-month timescales

Excess evaporative demand was a contributing factor for the severity of this year's drought, particularly in SW and central Oregon

2-month EDDI for Aug-Sept was exceptionally high across Oregon and southeastern Washington

Extremely critical fire weather warning



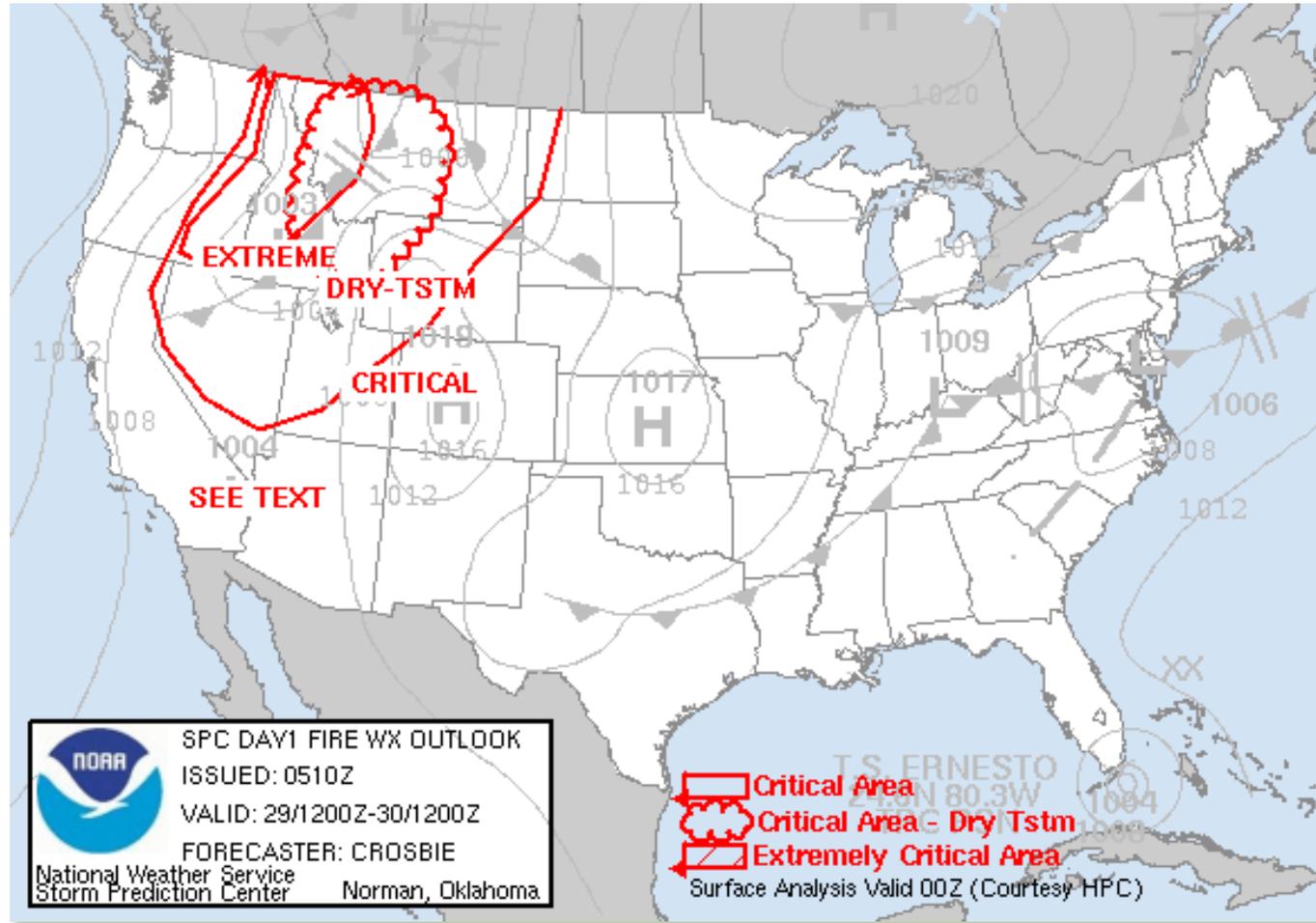
The NOAA Storm Prediction Center (SPC) issued an *extremely critical fire weather warning* on Sept 7 for NW Oregon and Clark & Skamania counties in extreme southern Washington. It was only the second time ever (since 2002 when these warning maps were archived) that one was issued anywhere within the states of Oregon and Washington. The other time was August 29, 2006.

The next day, another warning region was issued for SW Oregon, including Jackson, Josephine, and Douglas counties

Extremely critical fire weather warning

August 29, 2006

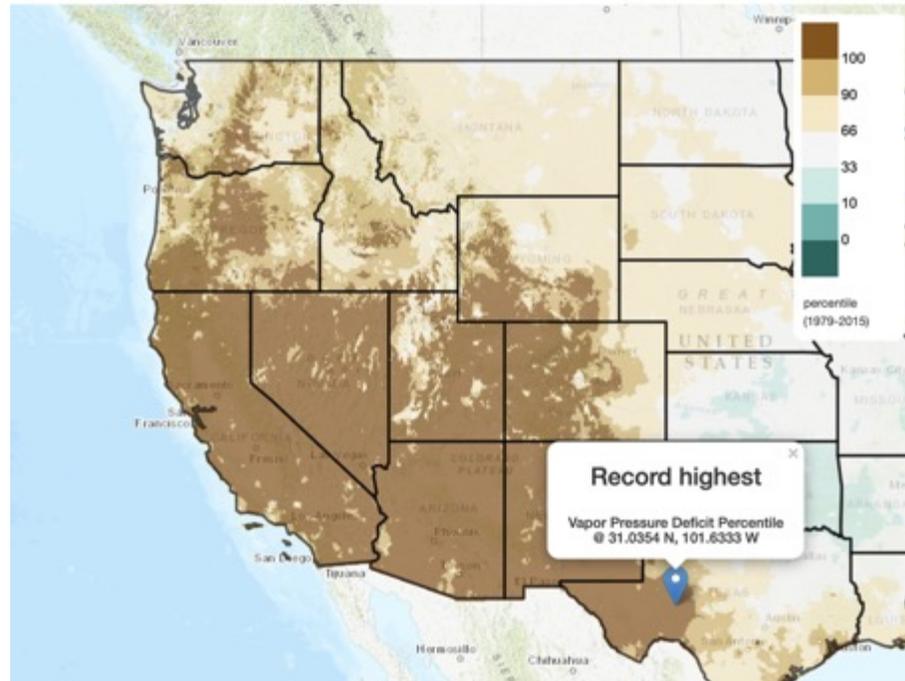
This was the only other SPC extremely critical fire weather warning issued for anywhere in Oregon or Washington since such warnings were issued operationally by the SPC (since 2002)



Early September fire weather conditions

Many regions in the west experienced their highest vapor pressure deficit in the month leading up to the fires

Mean Daily Vapor Pressure Deficit Percentile, Last 30 Days
2020/08/09 - 2020/09/07



Source: Northwest Climate Toolbox; Gridmet

Much of Oregon was experiencing near record soil moisture dryness due to evaporative demand and seasonal precipitation deficits

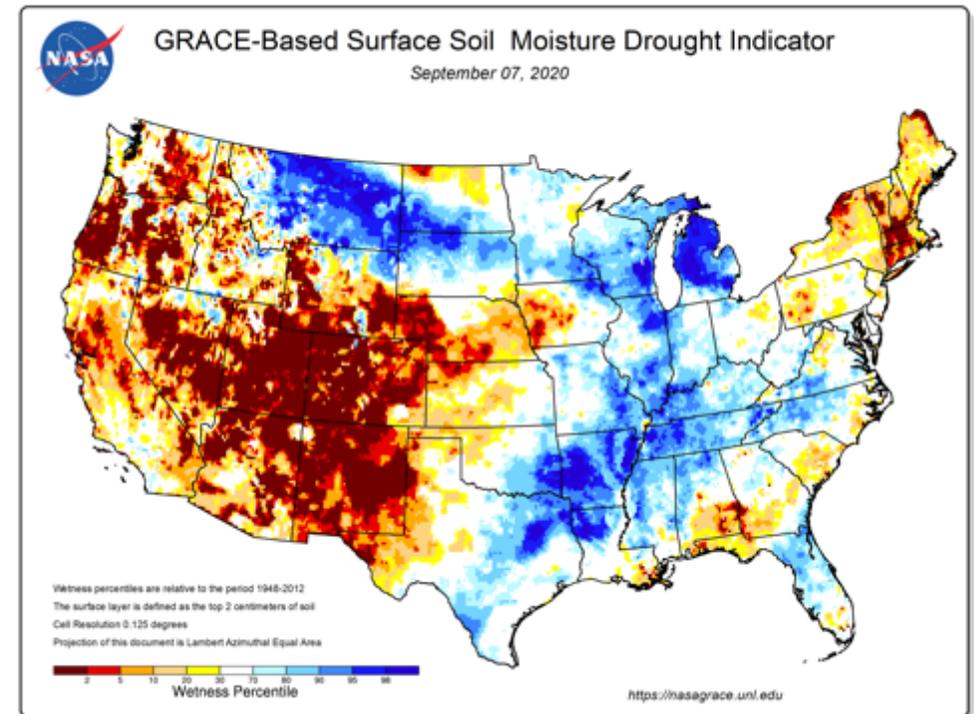
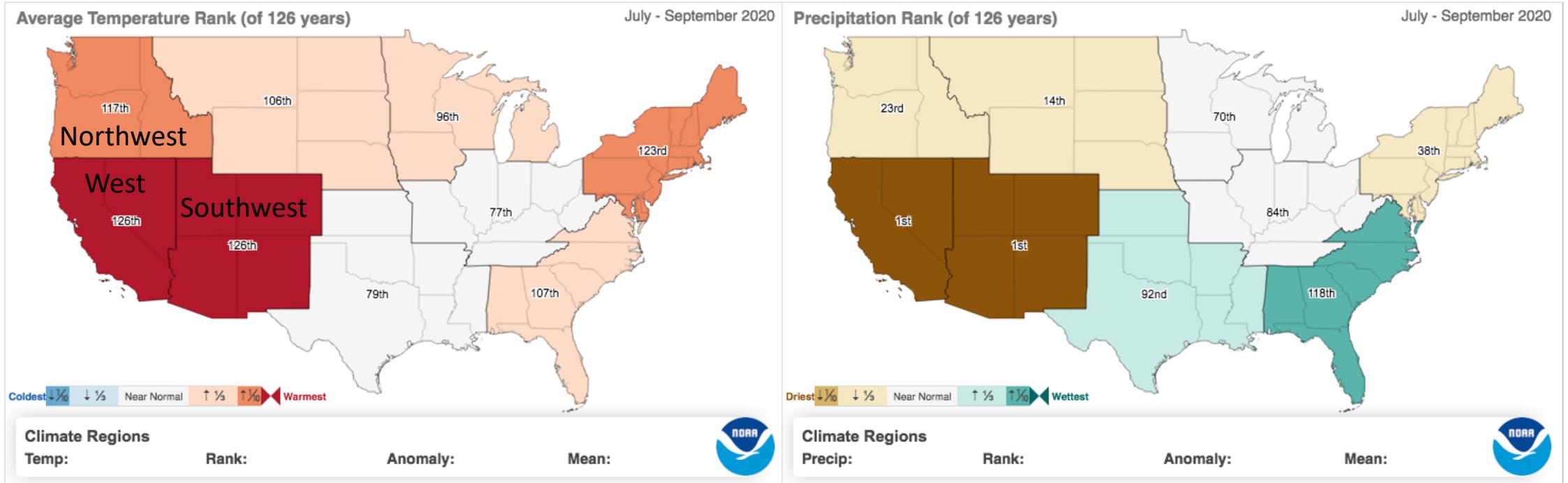


Image Source: <https://nasagrace.unl.edu>

North American Monsoon Summary



- Southwest and West climate regions experienced their warmest and driest monsoon season (July-August-September) on record
- Our Northwest climate region recorded its 23rd driest and 10th warmest JAS on record

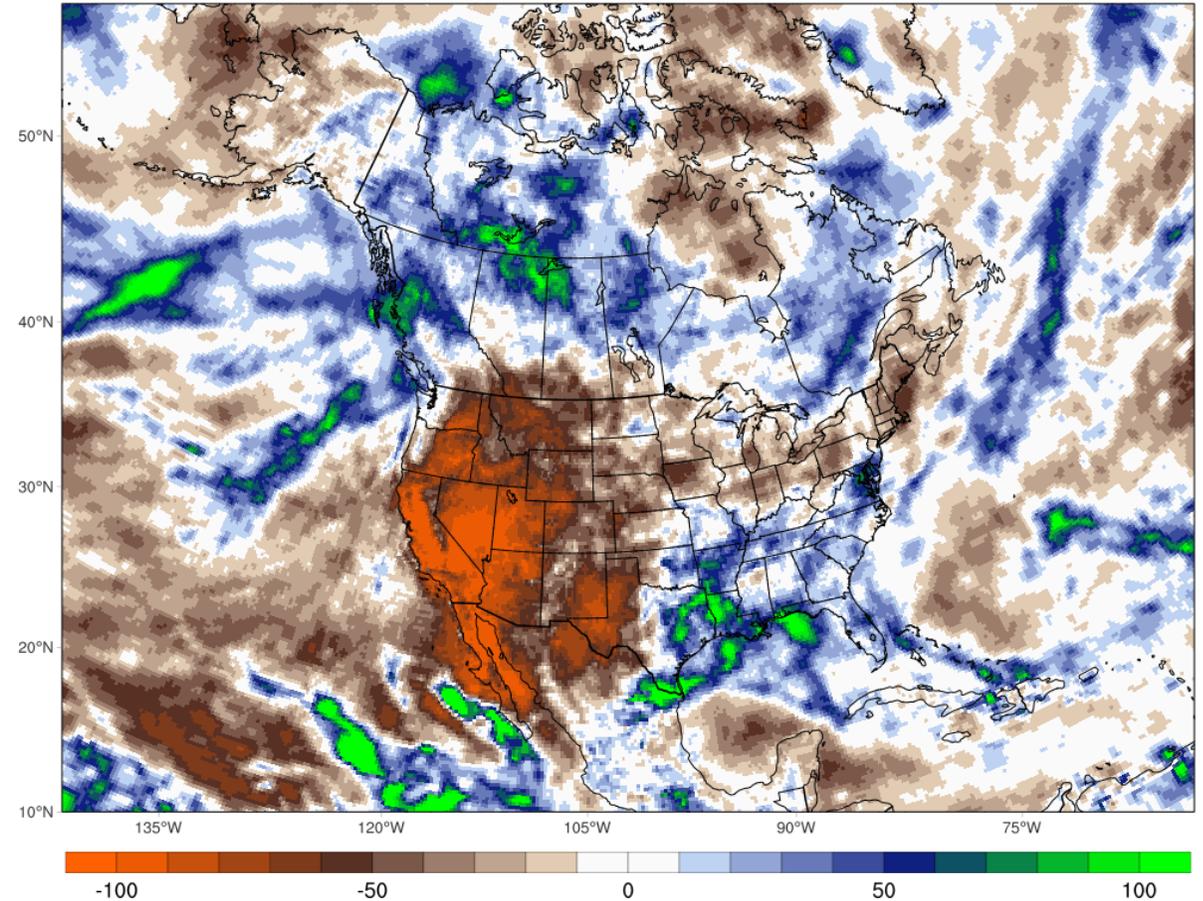
“Non-soon” season

The typical North American Monsoon (NAM) during July-Sept 2020 did not materialize, leaving the southwest US exceptionally dry and contributing to a substantial degradation of drought conditions

Persistent circulation anomalies during July–September 2020 resulted in an abnormally inactive monsoon season. The Southwest climate region experienced its warmest and driest July–September period on record. Anomalously warm and dry summer weather further exacerbated existing drought conditions over the western US.

Acc. Precipitation Anomaly (%)
JAS 2020 - 1979-2000

ECMWF ERA5



“Non-soon” season

The typical North American Monsoon (NAM) during July-Sept 2020 did not materialize, leaving the southwest US exceptionally dry and contributing to a substantial degradation of drought conditions

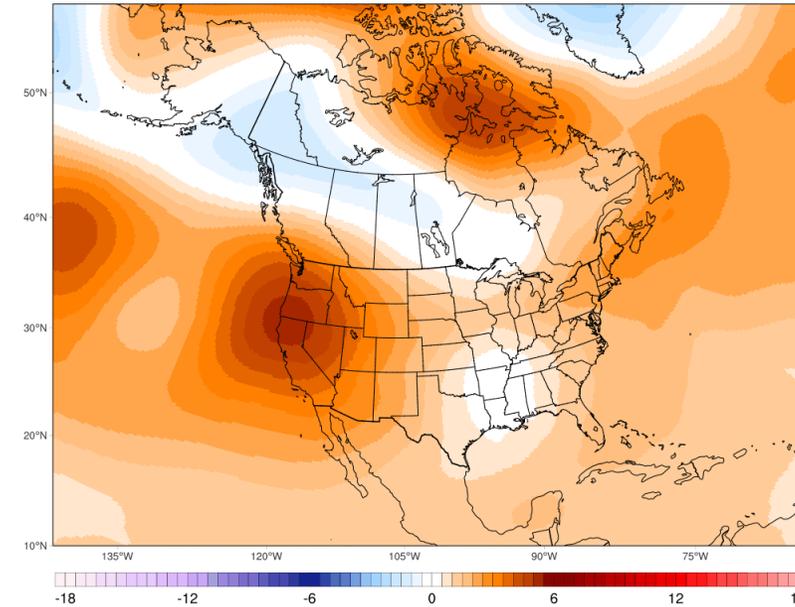
Persistent circulation anomalies during July–September 2020 resulted in an abnormally inactive monsoon season

These maps show circulation anomalies through the 500hPa height anomalies (top) and the total fields (bottom)

The typical desert southwest ridge was shifted roughly 1000 miles west, which weakened or reversed typically moist southerly winds by shifting the normal ridge pattern westward

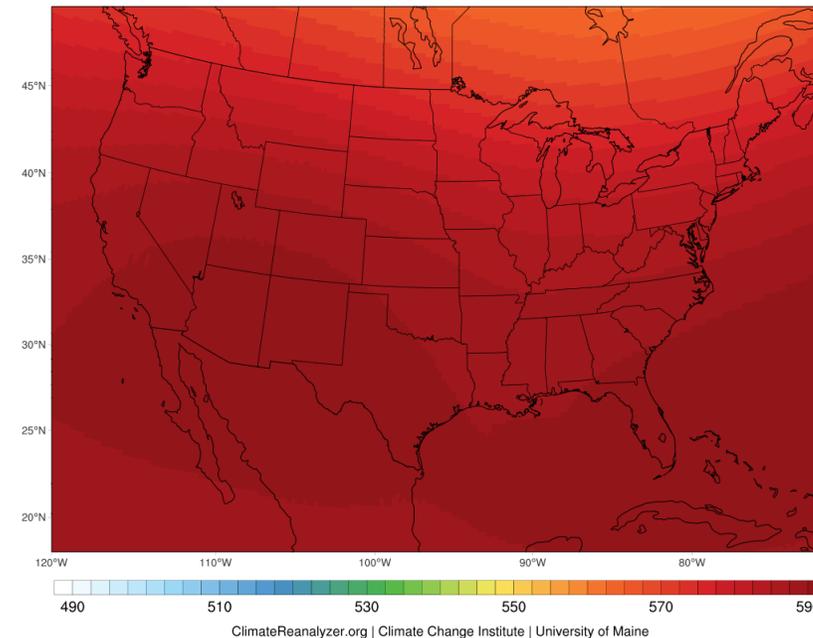
Geopot Hgt 500hPa Anomaly (dam)
JAS 2020 - 1979-2000

ECMWF ERA5



Geopot Hgt 500hPa (dam)
JAS 2020

ECMWF ERA5



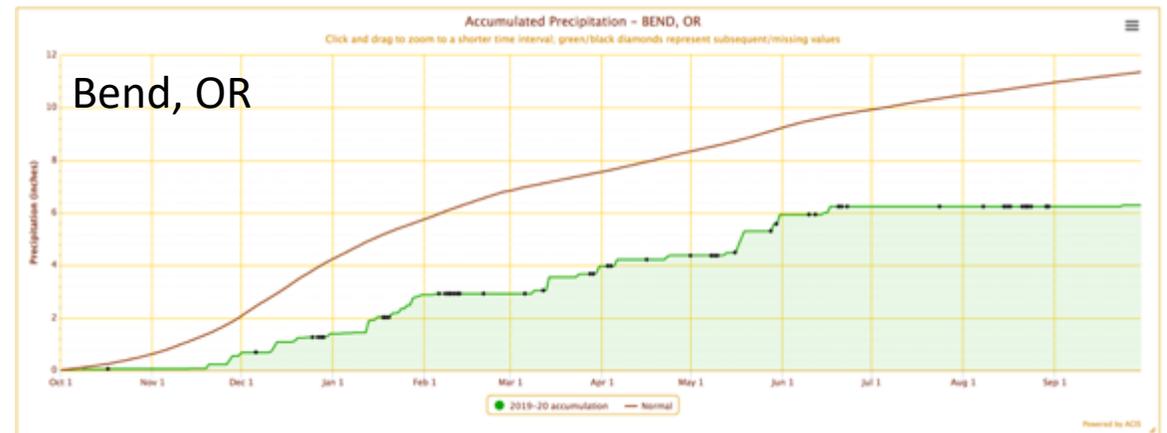
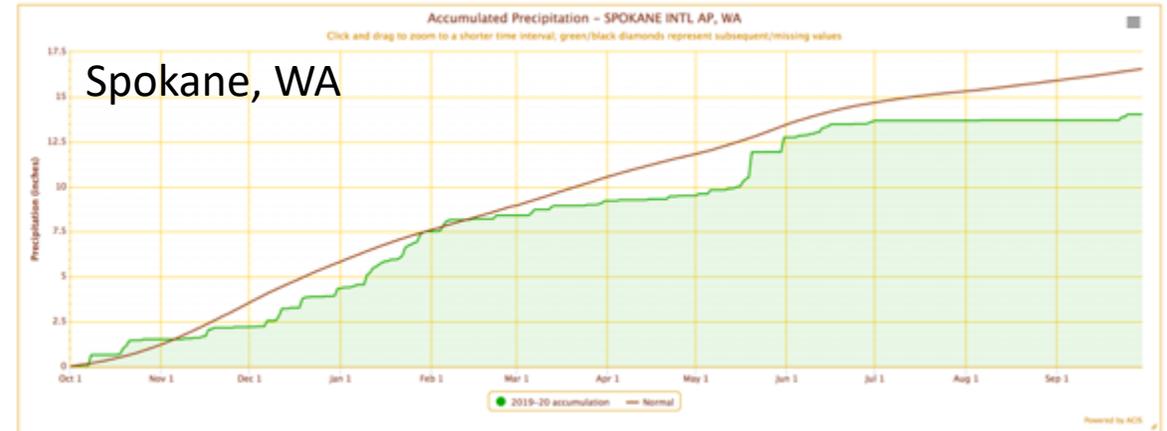
Select rainfall WY2020 accumulation curves

Yes, it can rain during the summer in eastern Oregon and Washington!

For instance, Bend and Spokane get about 1.7-2 inches of rain during JAS on average, mainly during monsoon-generated thunderstorms

Did it rain this year?

Both Spokane, WA and Bend, OR received almost no rain after July 1st





Flash drought in Oregon

- Extremely warm and dry conditions associated with the lack of monsoon generated severe-to-extreme flash drought conditions in southern and southeast Oregon
- It was a challenge to communicate these conditions to the US drought monitor partially due to a deficiency of station data in this area suitable to quantify rapid onset of flash drought (e.g., VPD and soil moisture)

Summary

- Late start to rain and snow season due in part to the ridiculously resilient ridge in the Northeast Pacific
- January/February brought much needed rain and snow, particularly in much of western Washington
- Oregon snow season started late and finished early
- Southwest Oregon, including the Klamath Basin, had an early start to drought this year due to lack of rainfall and adequate snowpack
- Extreme drought conditions in central Oregon spread to central Washington mid-summer
- North American Monsoon was a no-show this year, further contributing to drought conditions east of the WA/OR Cascades

Oregon east wind event

The combination of high wind speed and extremely low relative humidity observed in Salem, OR on Sept 9, 2020 00Z was unprecedented

This occurred the evening when the Beachie Creek fire exploded down the Santiam Canyon

Salem Radiosonde Temperature, Humidity, and Wind Speed at 1000-mb
1956–2016 (N=25209)

