A changing climate in the Klamath basin

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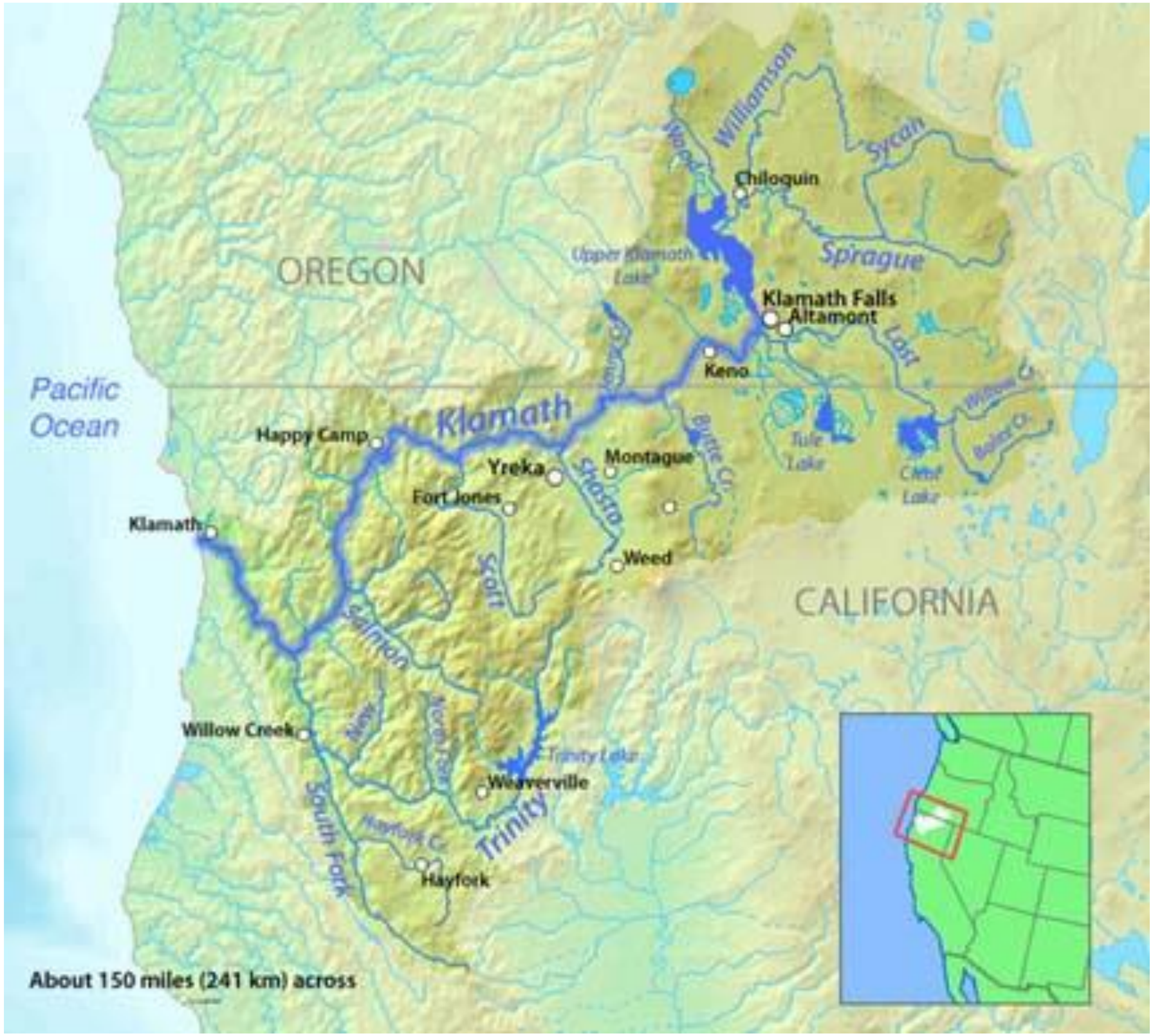
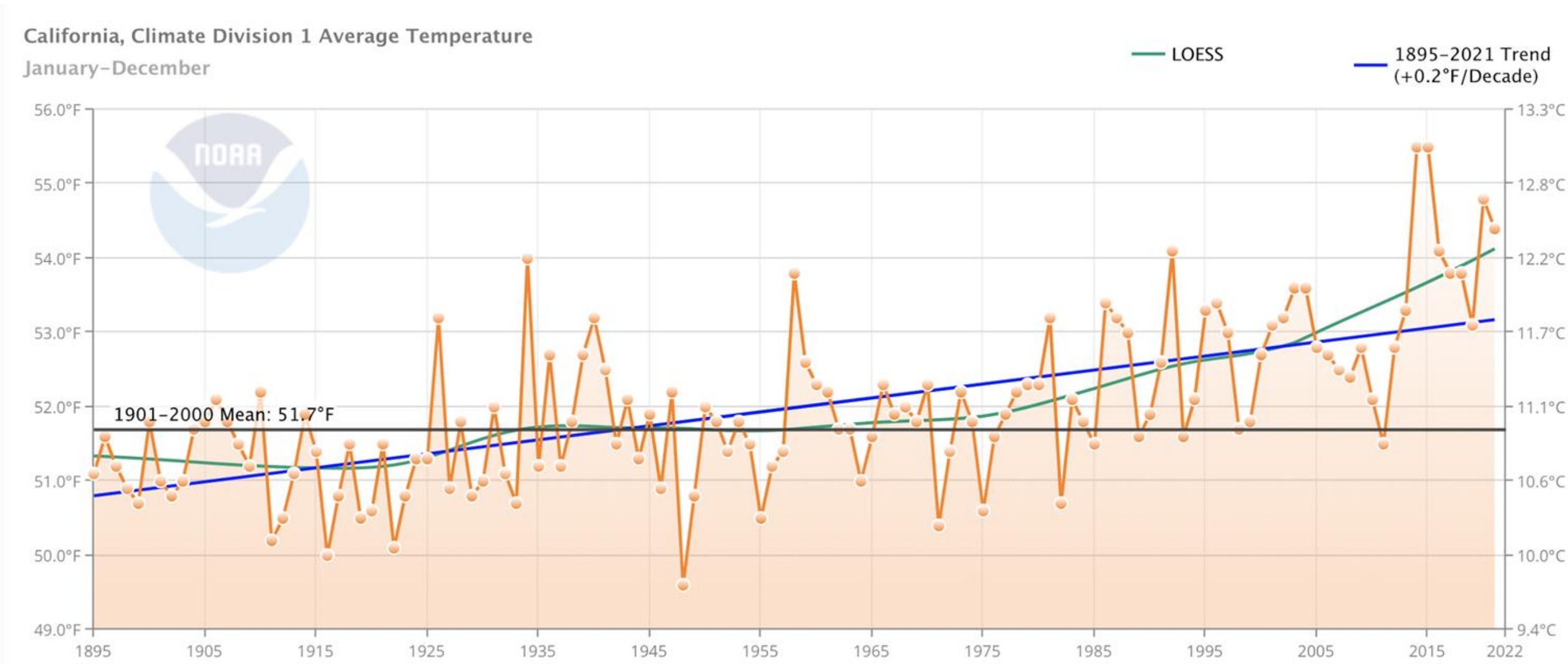
Upper Klamath Lake. source: https://www.opb.org/news/article/oregon-upper-klamath-lake-algae-bloom-health-advisory/

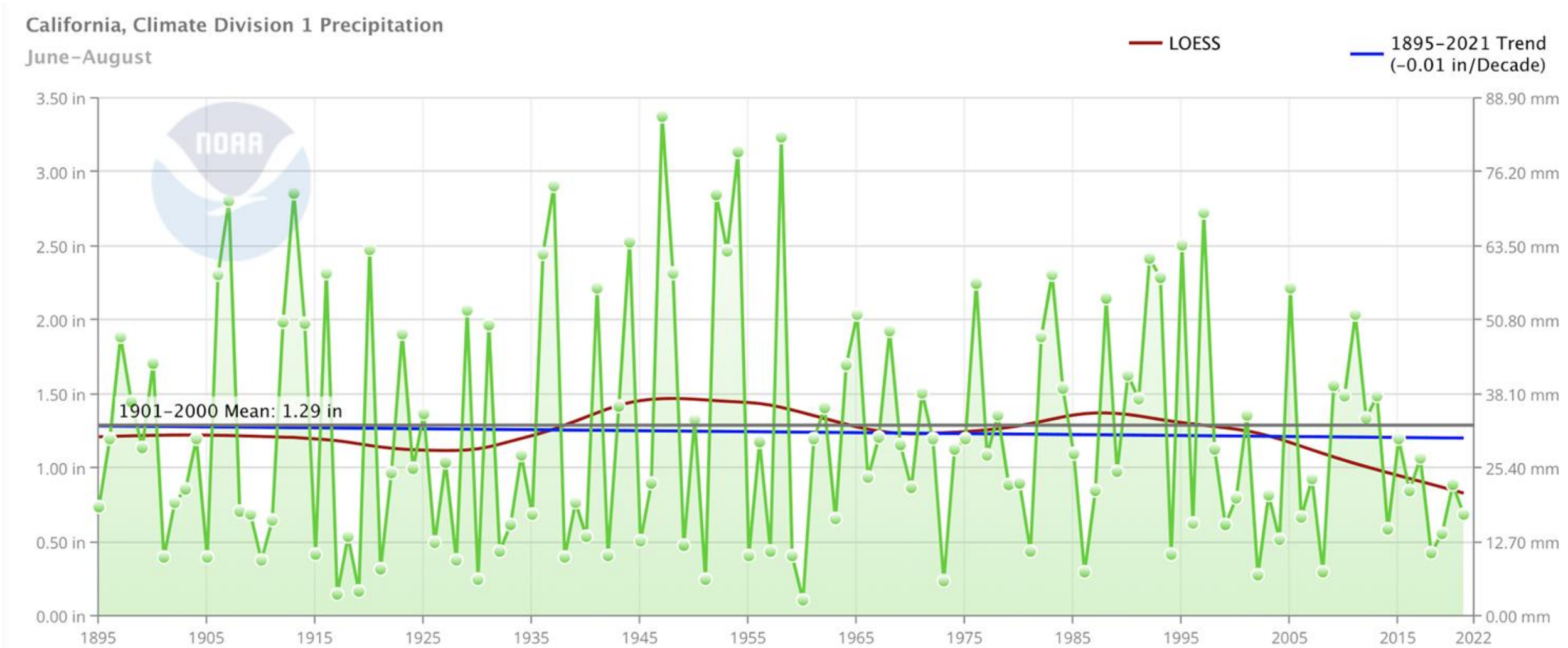

OREGON
CALIFORNIA
Pacific Ocean
Williamson
Sycan
Sprague
Chiloquin
Upper Klamath Lake
Klamath Falls
Altamont
Lost
Keno
Klamath
Happy Camp
Yreka
Montague
Fort Jones
Shasta
Butte Cr.
Tule Lake
Clear Lake
Willow
Klamath
Weed
Scott
Salmon
Willow Creek
Trinity Lake
Weaverville
Trinity
South Fork
Hayfork
About 150 miles (241 km) across

Klamath Basin warming



http://www.ncdc.noaa.gov/cag
/

Klamath summer (June-Aug) precipitation



http://www.ncdc.noaa.gov/cag
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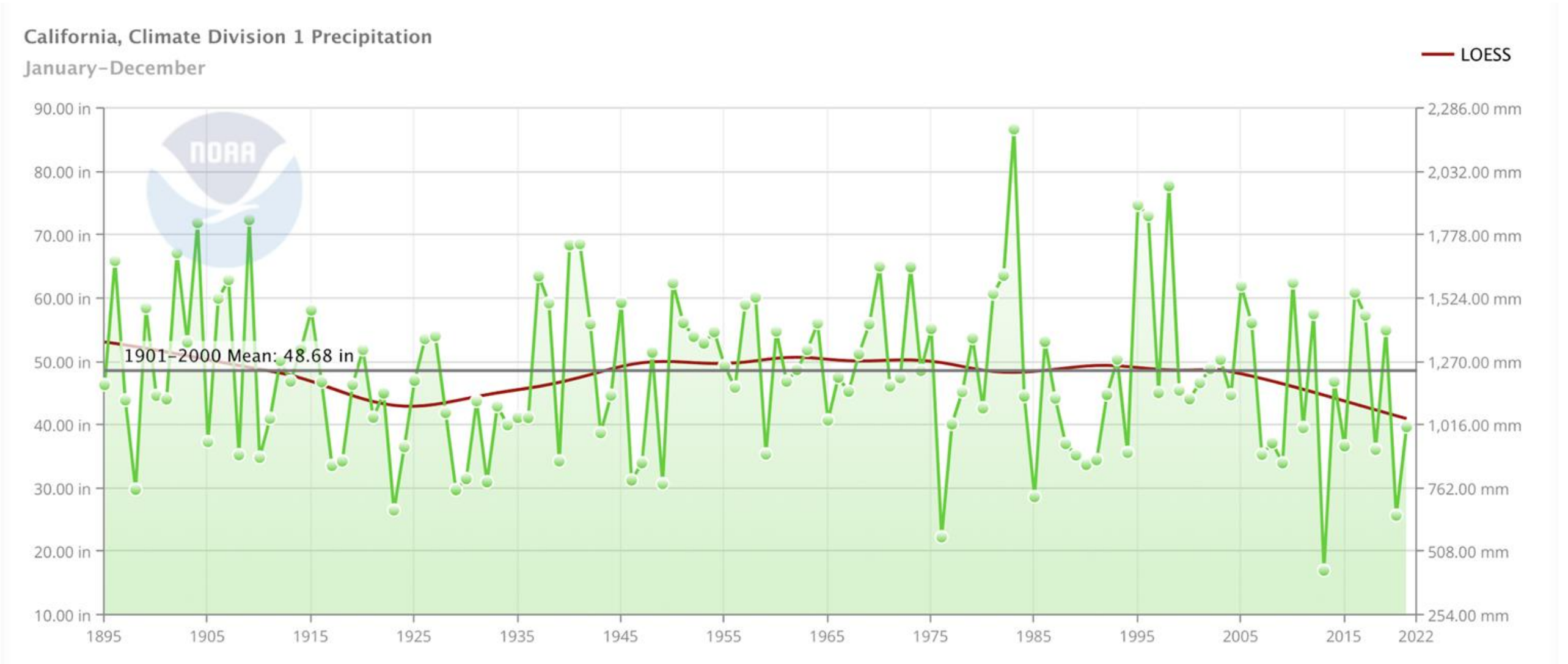
Klamath annual mean precipitation



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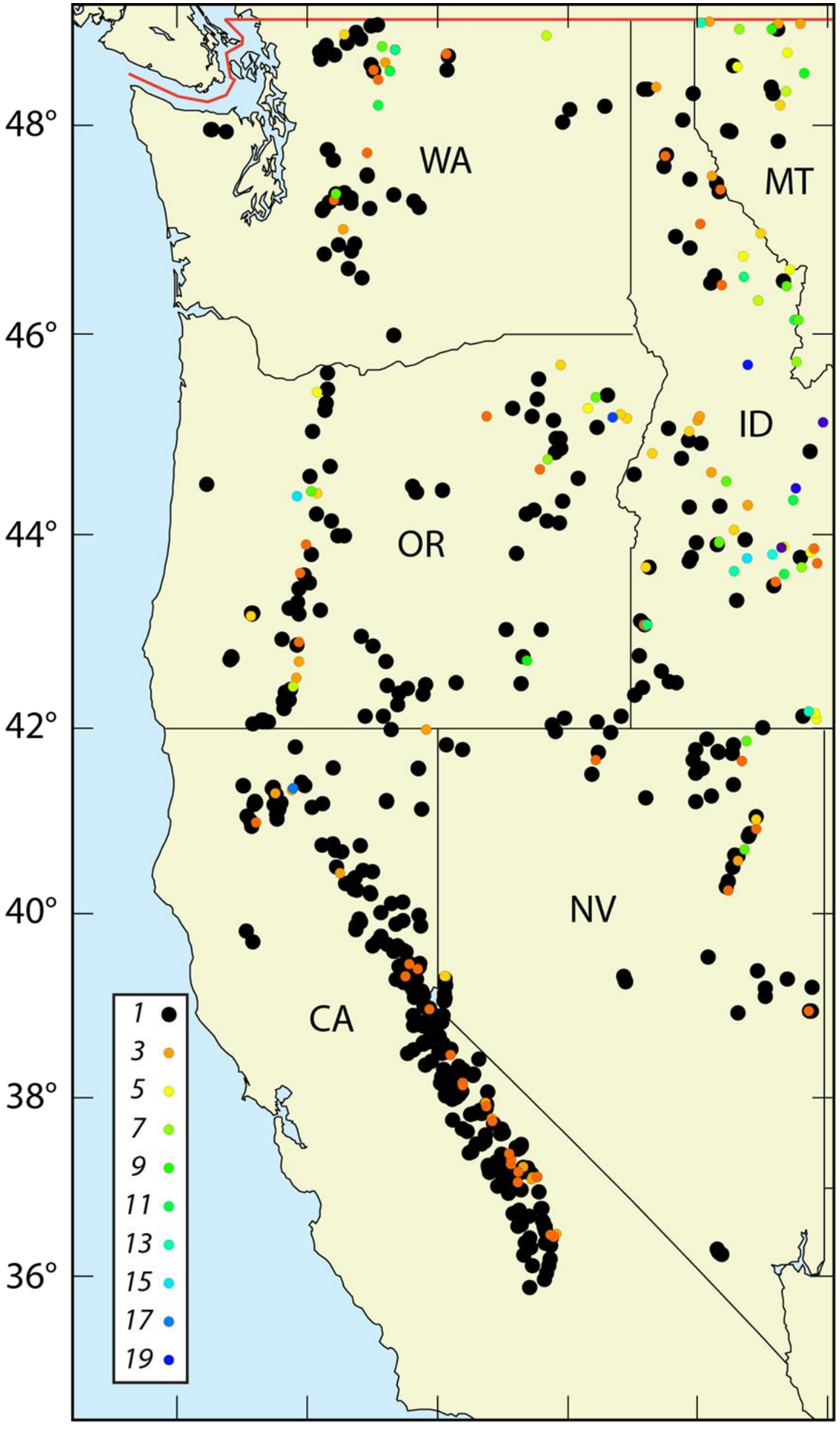


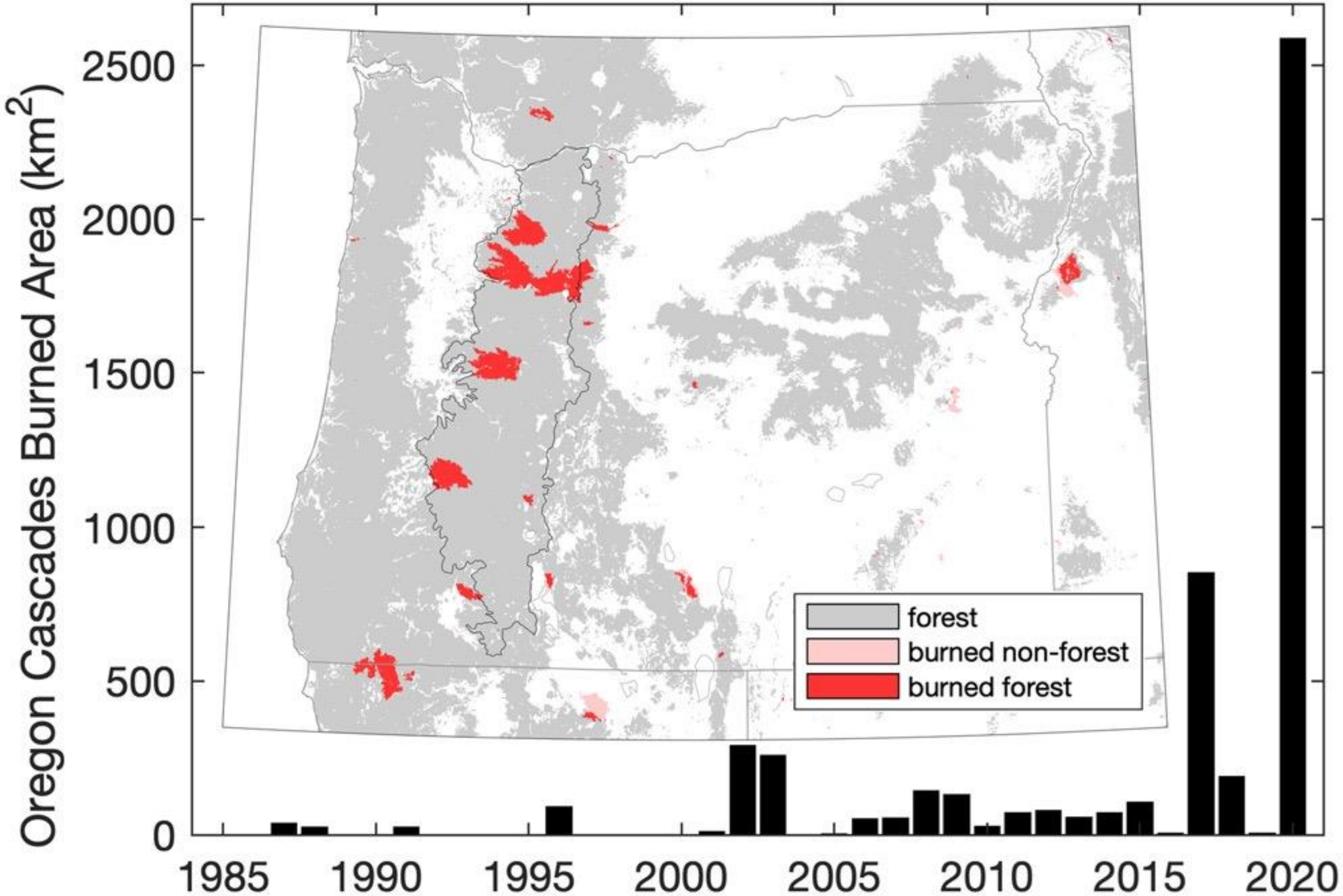
from Hoodoo web cam
February 23, 2015

2015 Snow drought:
Normal precipitation, ~3°C warmer than normal

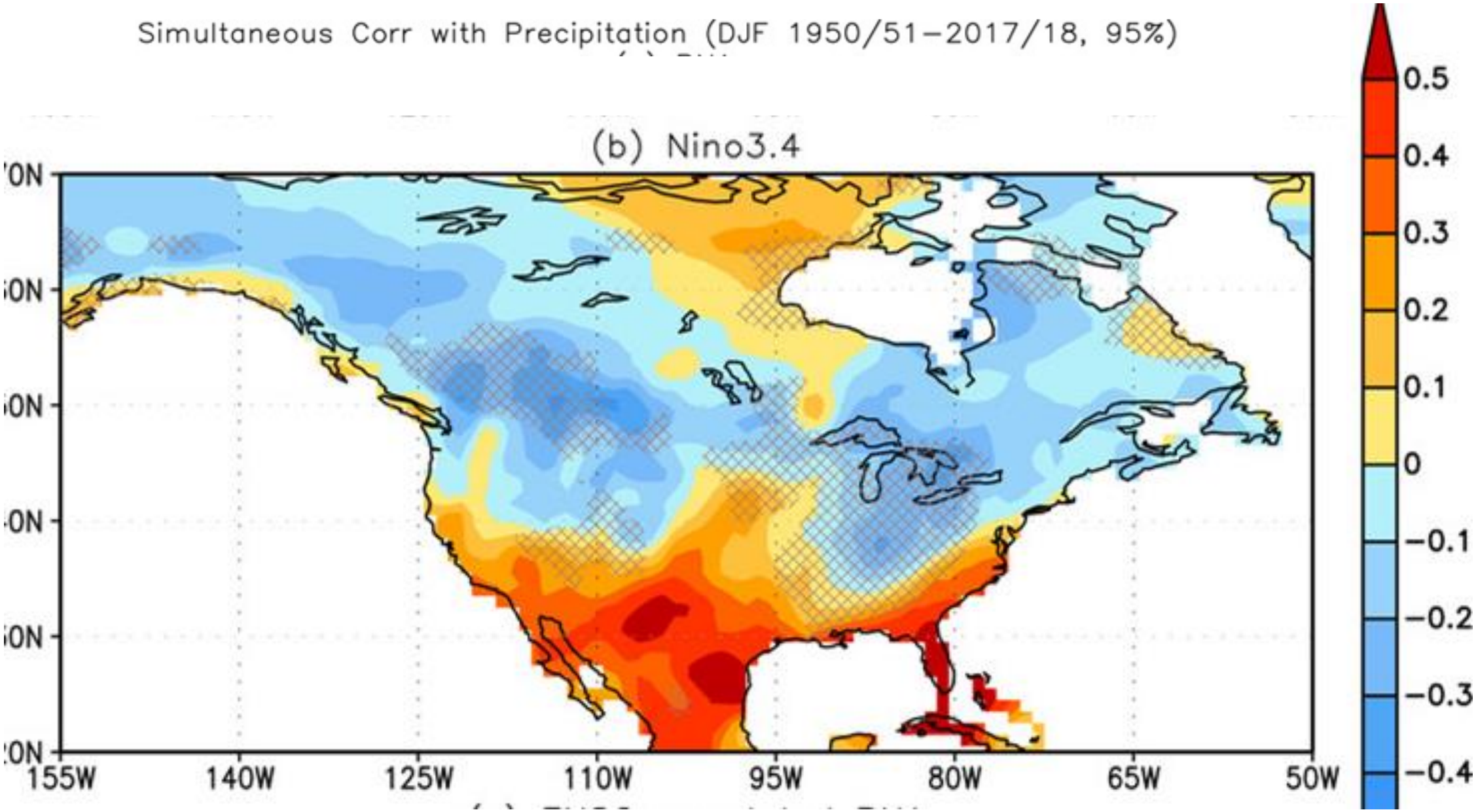
Record low April 1 snow at ~80% of sites

Mote et al. GRL 2016

September 2020 fires

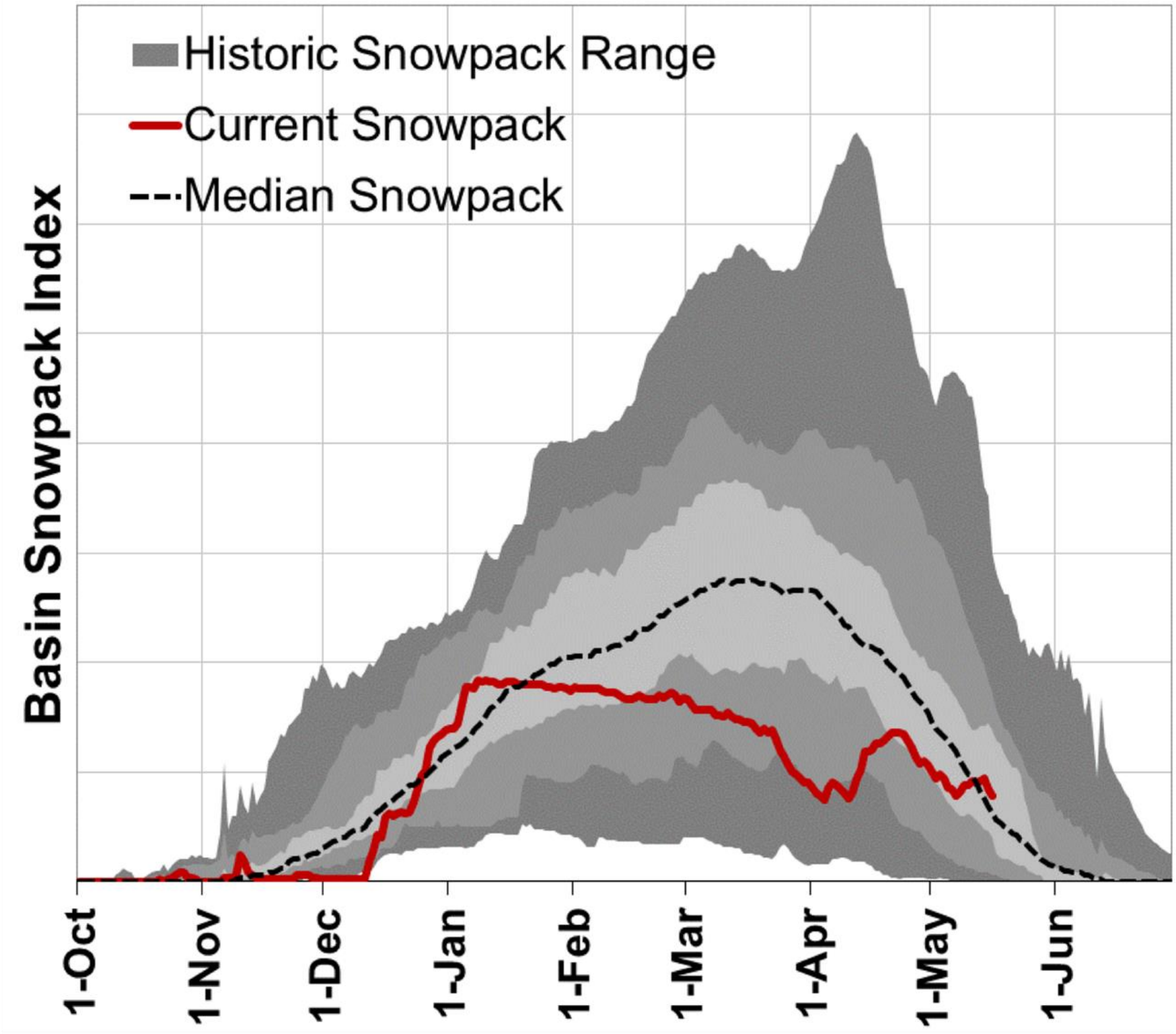


Abatzoglou et al 2021



Li et al, Journal of Climate 32, 19; 10.1175/JCLI-D-19-0033.1

Klamath



Source: OWRD water report May 2022

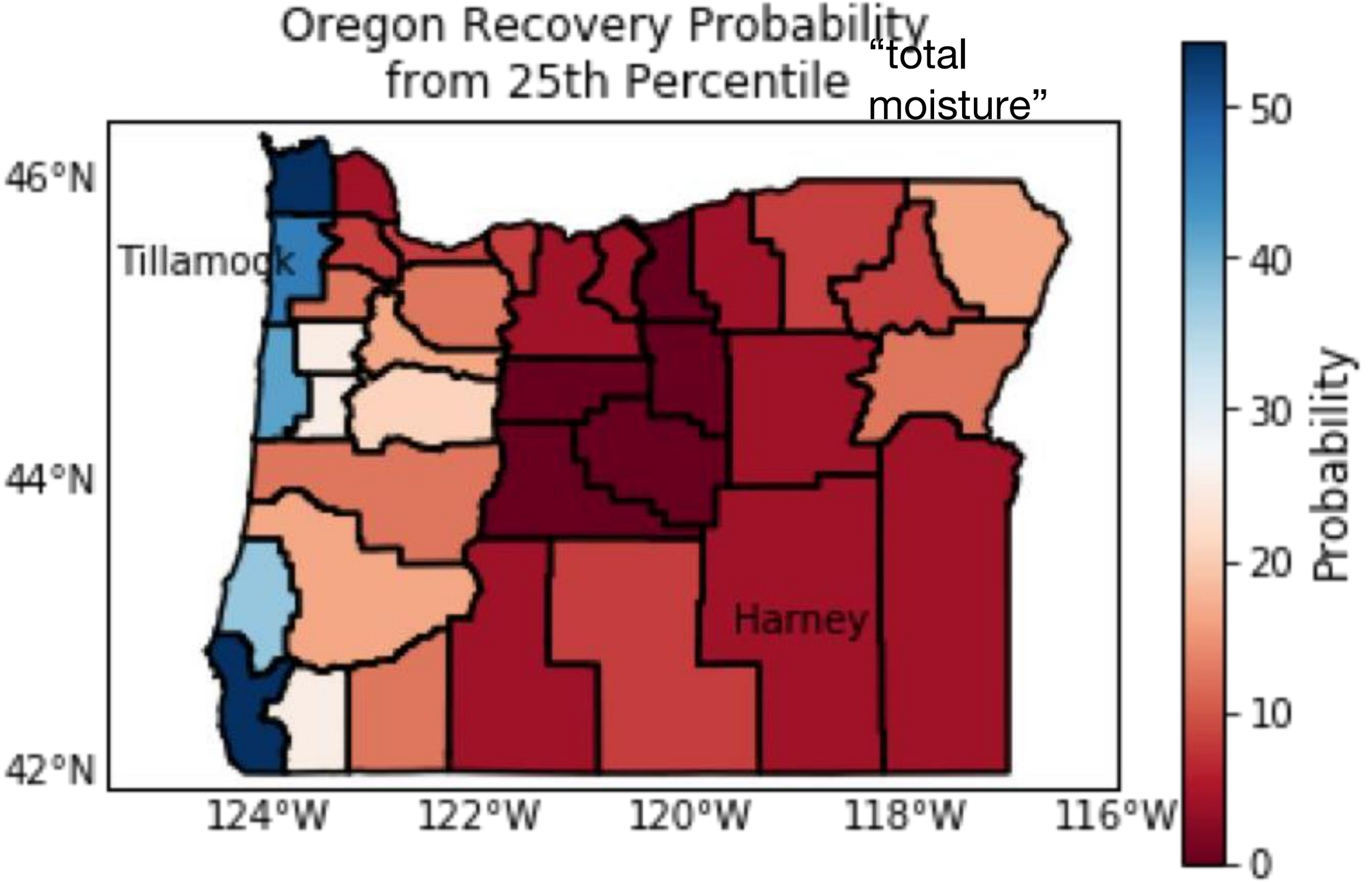


Figure 8: The probability of each county recovering from being at or below the 25th percentile in February and recovering to the median percentile in July for Oregon.

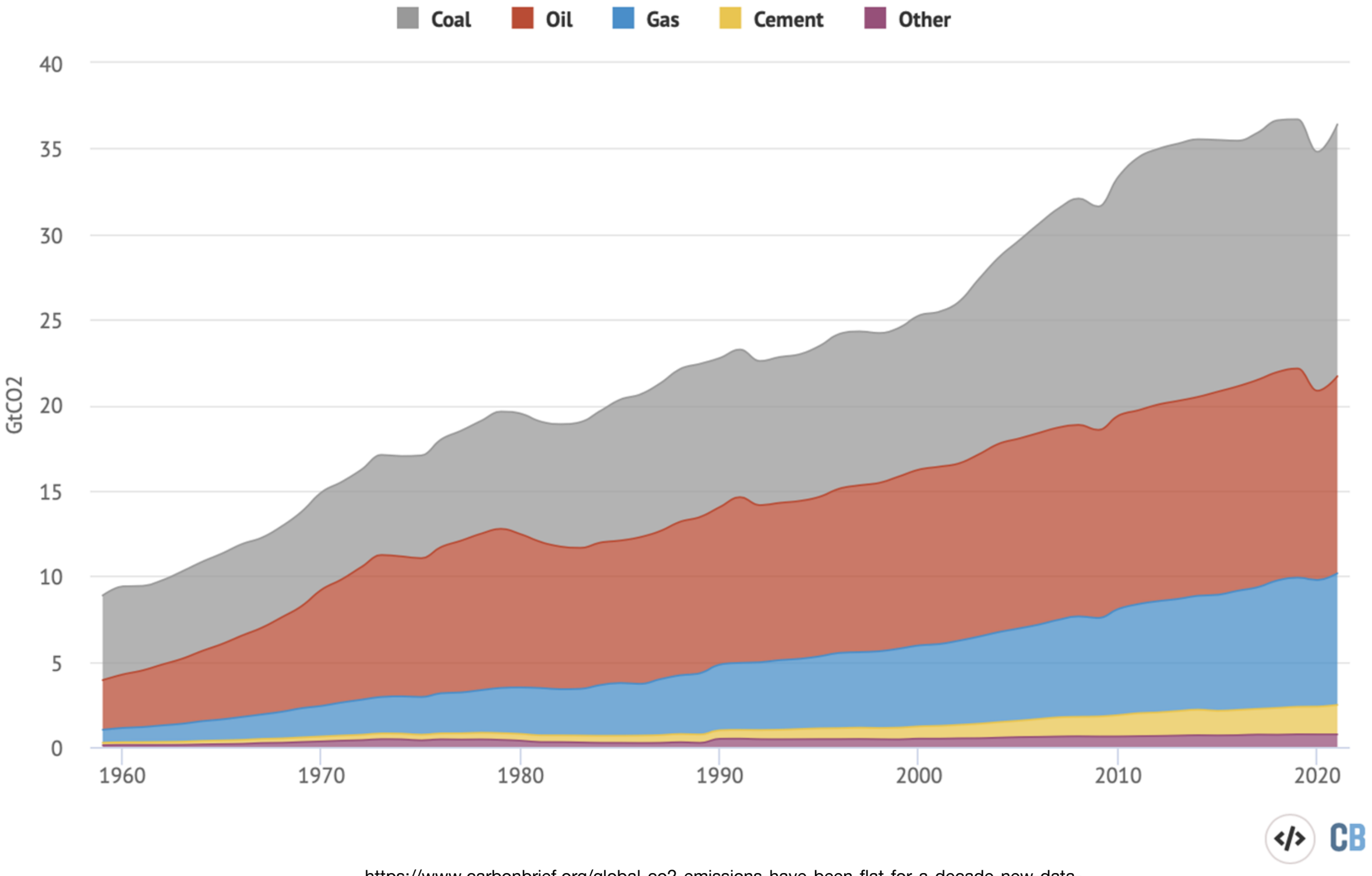
Moruzzi 2019

June 2021

https://www.opb.org/article/2021/06/03/5-things-to-know-about-the-klamath-water-crisis/

What about the future?

Annual CO2 emissions by fuel, 1959-2021



https://www.carbonbrief.org/global-co2-emissions-have-been-flat-for-a-decade-new-data-reveals/

Data: SSP database (IIASA)/ 2018

Scenario group

Forcing target and temperature

Baseline (3.0–5.1°C)

6.0 W/m² (3.2–3.3°C)

4.5 W/m² (2.5–2.7°C)

3.4 W/m² (2.1–2.3°C)

2.6 W/m² (1.7–1.8°C)

1.9 W/m² (1.3–1.4°C)

>5°C

4–5°C

3–4°C

2–3°C

net-negative global emissions

Net CO_2 emissions ($GtCO_2$)

140

100

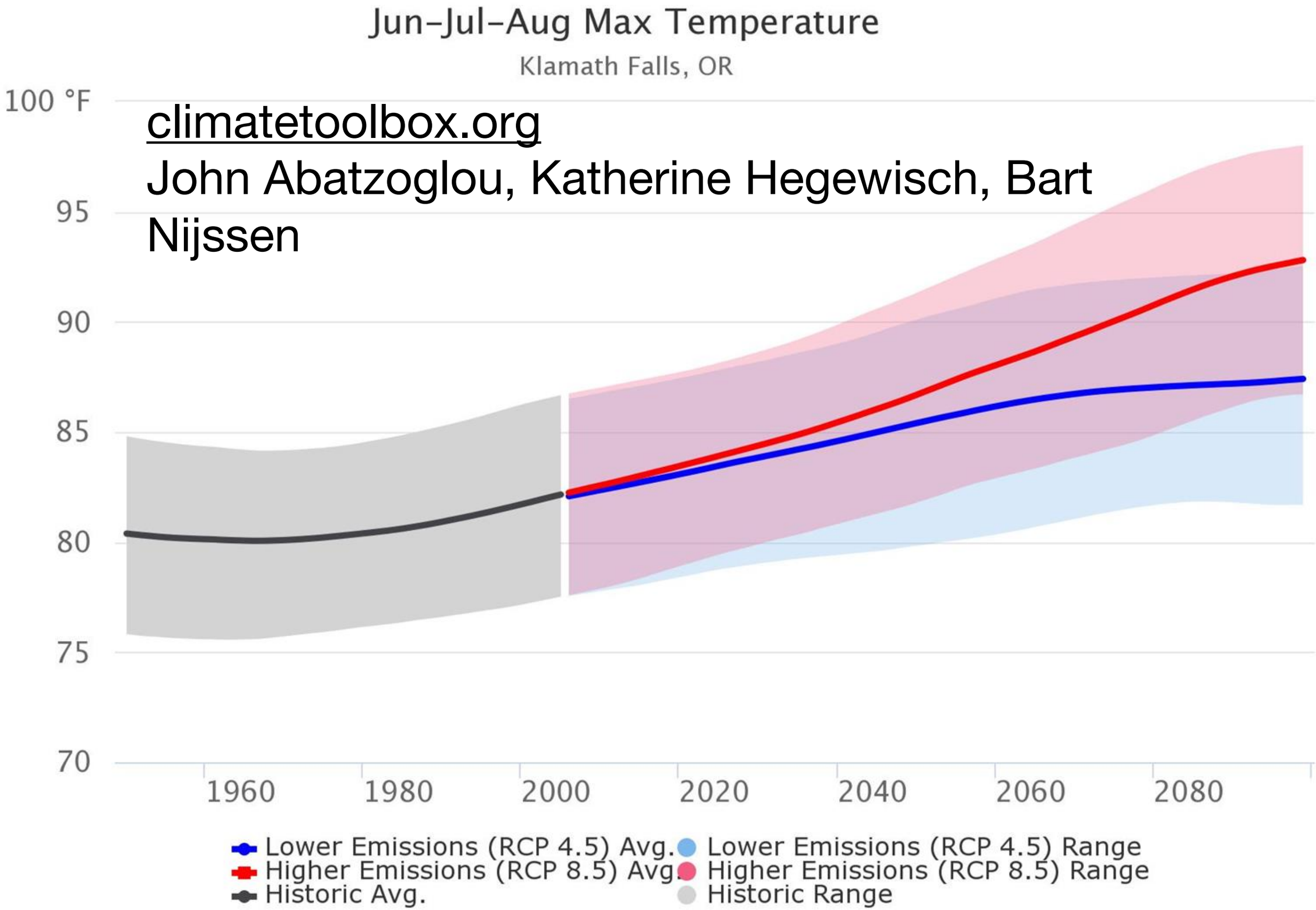
50

0

-40

1980 2000 2020 2040 2060 2080 2100

Global Carbon Project



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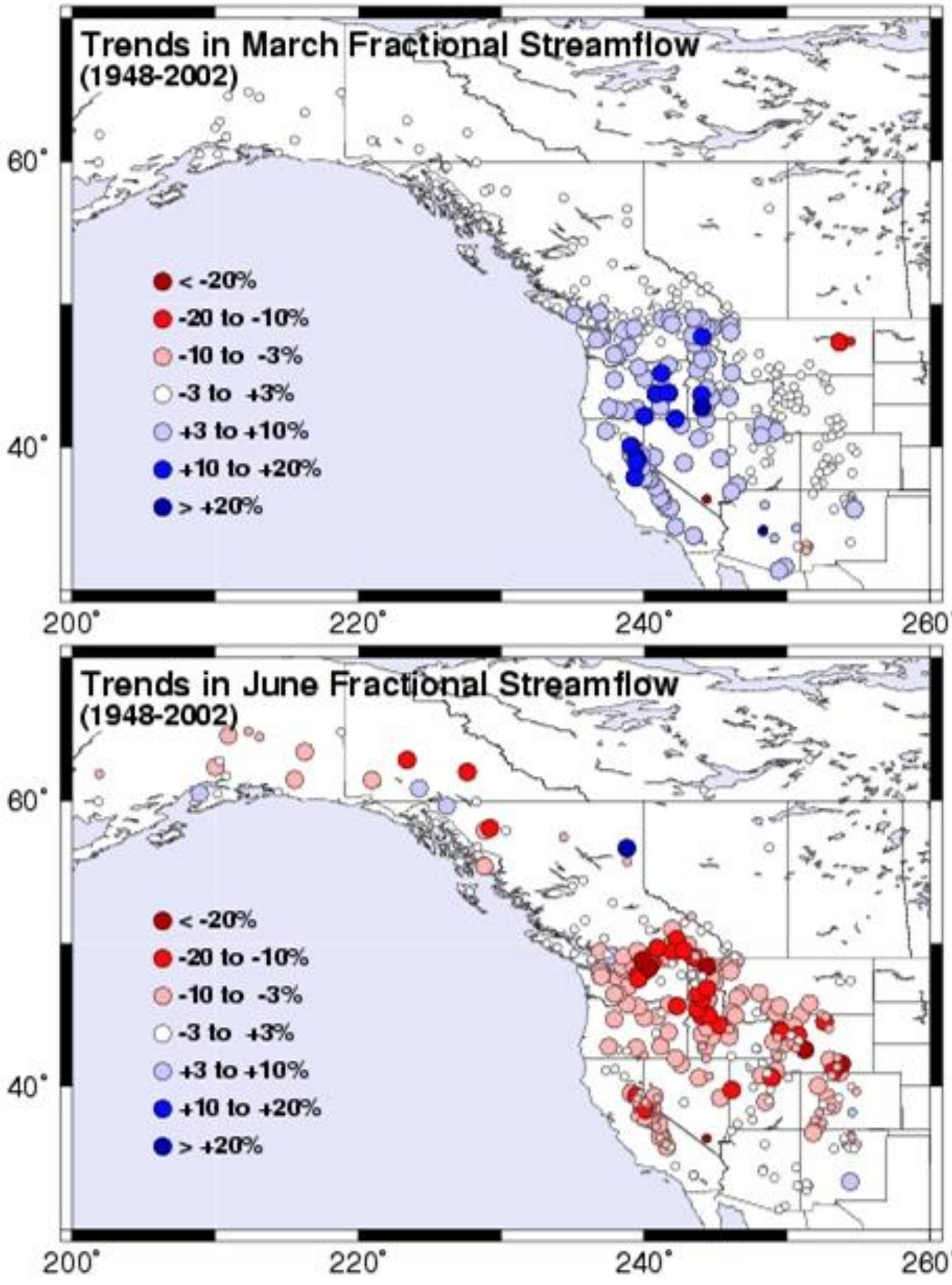
John Abatzoglou, Katherine Hegewisch, Bart Nijssen



As the West warms, winter flows rise and summer flows drop

Stewart et al. J Climate 2005

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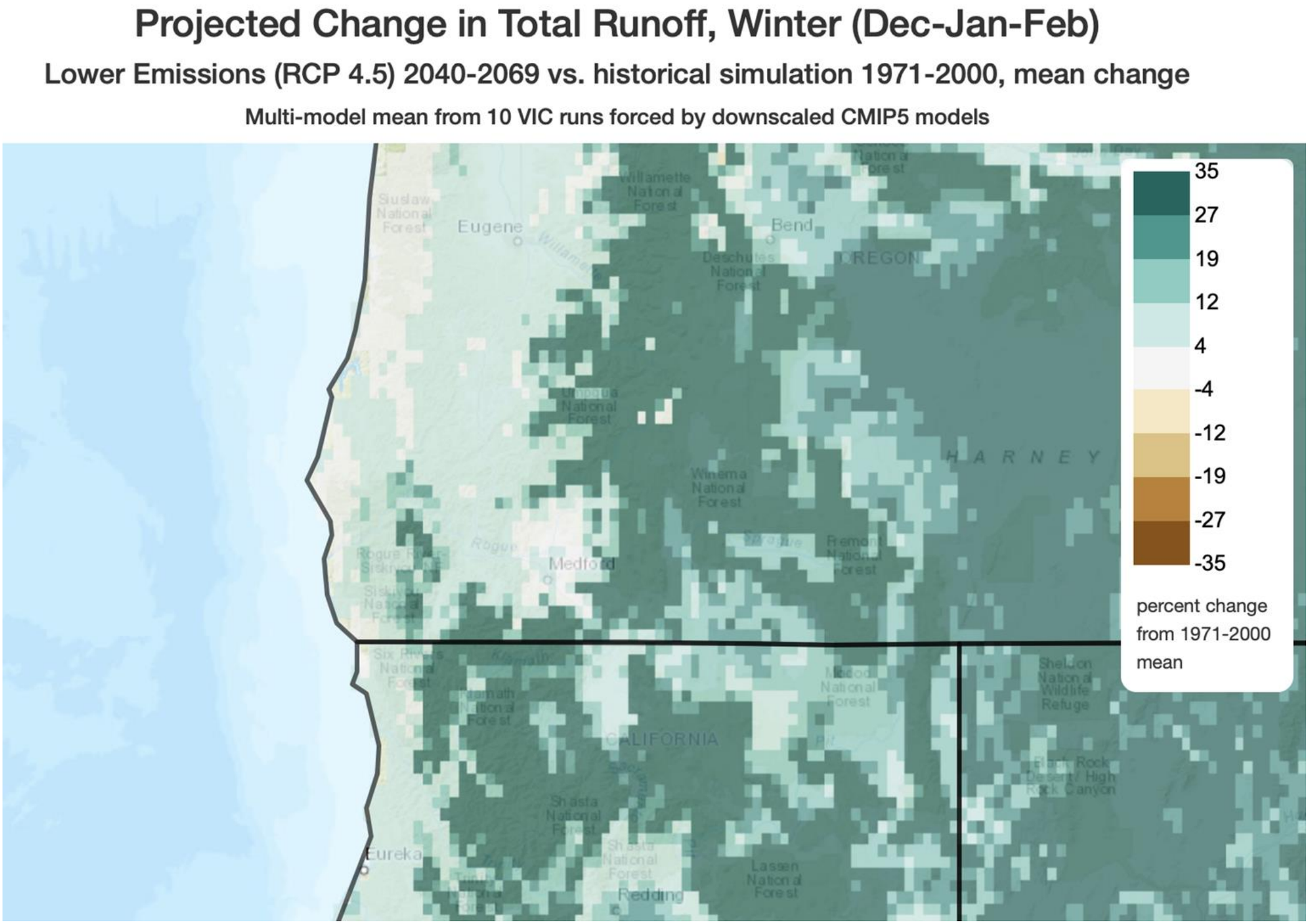
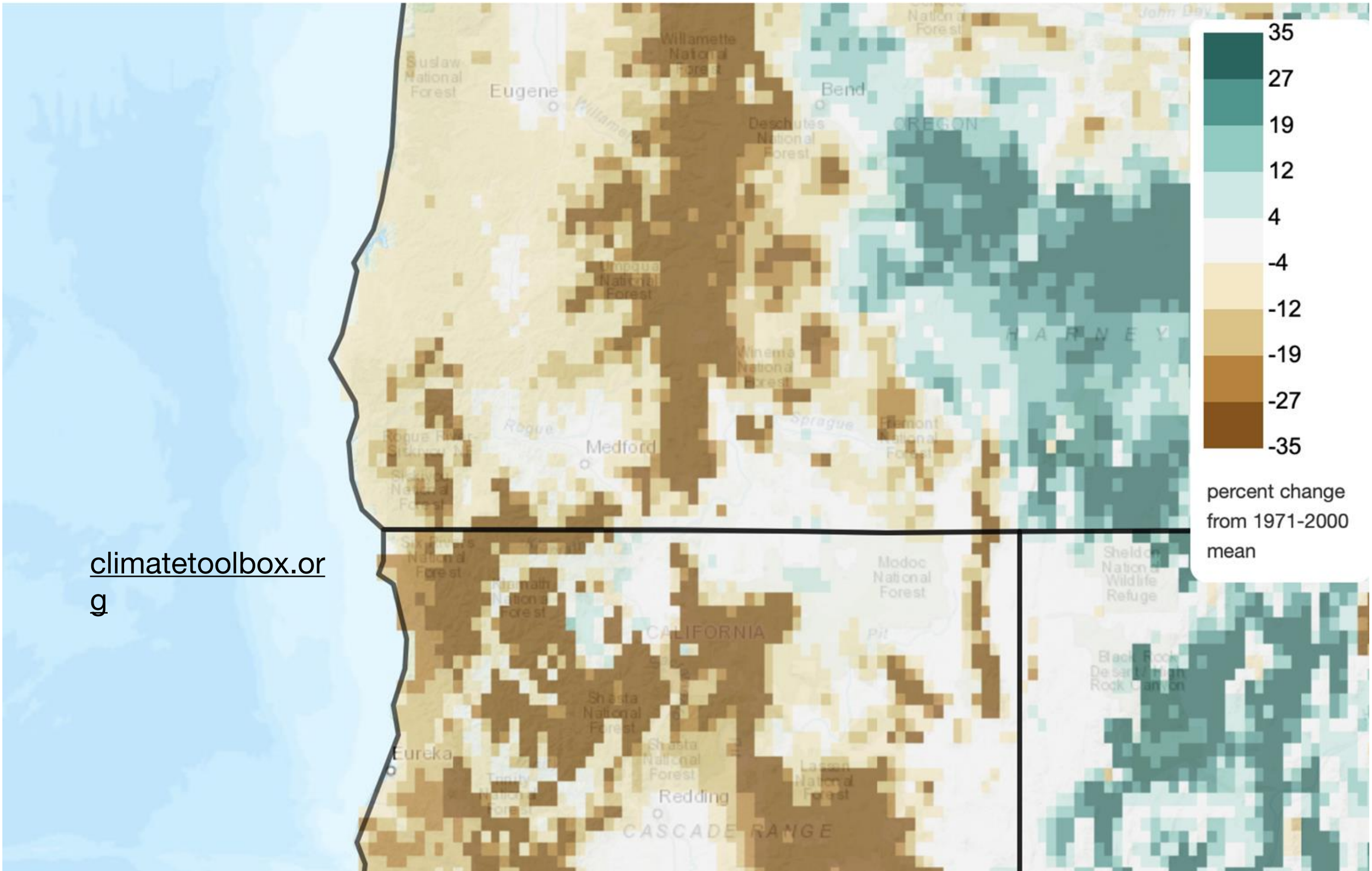


Projected Change in Total Runoff, Summer (Jun-July-Aug)

Lower Emissions (RCP 4.5) 2040-2069 vs. historical simulation 1971-2000, mean change

Multi-model mean from 10 VIC runs forced by downscaled CMIP5 models



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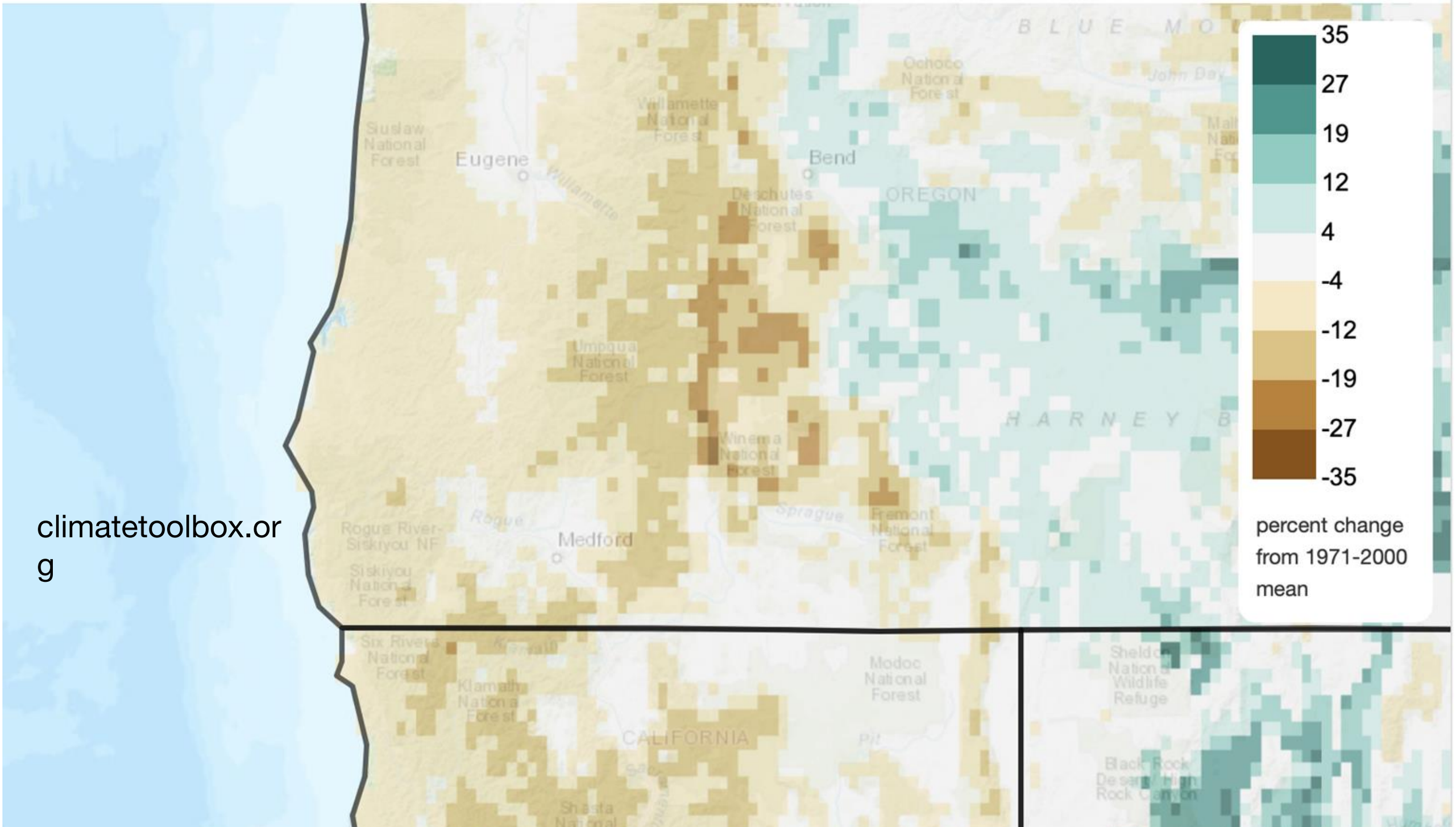
Projected Change in Total Soil Moisture, Summer (Jun-July-Aug)

Lower Emissions (RCP 4.5) 2040-2069 vs. historical simulation 1971-2000, mean change

Multi-model mean from 10 VIC runs forced by downscaled CMIP5 models



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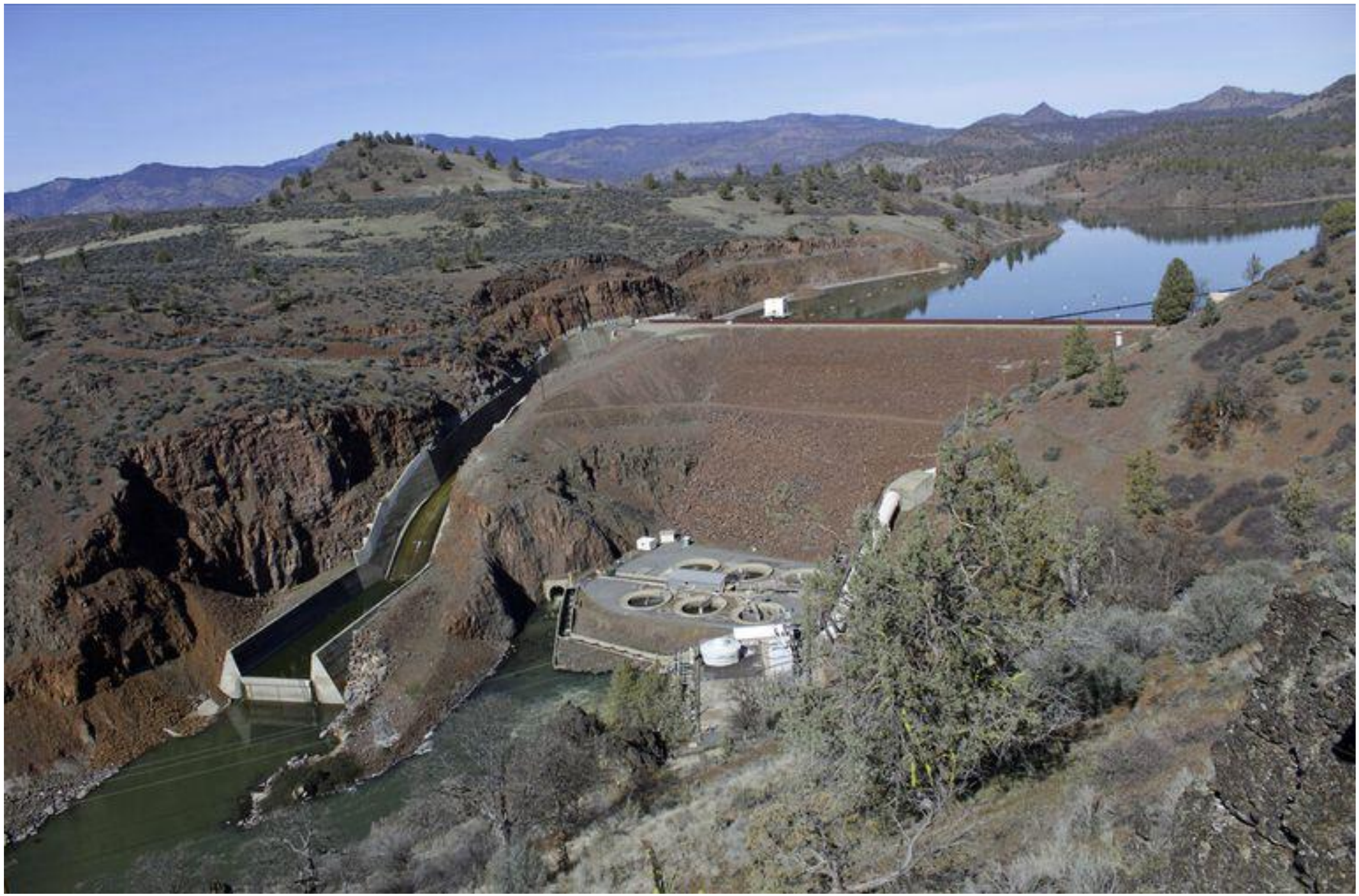
More changes…



https://www.opb.org/article/2022/02/26/major-hurdle-cleared-in-plan-to-demolish-4-klamath-river-dams/

Conclusions

- Climate-driven shifts in summer flow will make drought even more common
- Intersections with other factors exacerbate the effects