



MODIS data products point to hotspots of change in the U.S. West during the current megadrought

Combining MODIS ESDRs to understand the progression of drought in the western U.S.

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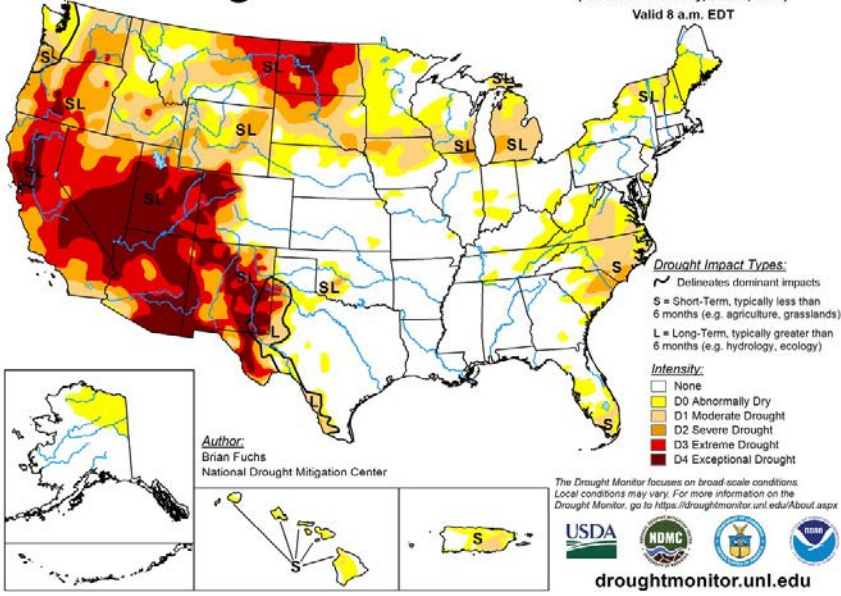
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Terra, Aqua, and Aura Drifting Orbits Workshop (virtual)

November 1, 2022

U.S. Drought Monitor

June 1, 2021
(Released Thursday, Jun. 3, 2021)
Valid 8 a.m. EDT



Note the large areas of *Exceptional Drought* in the Southwest US.

Megadrought in the U.S. West

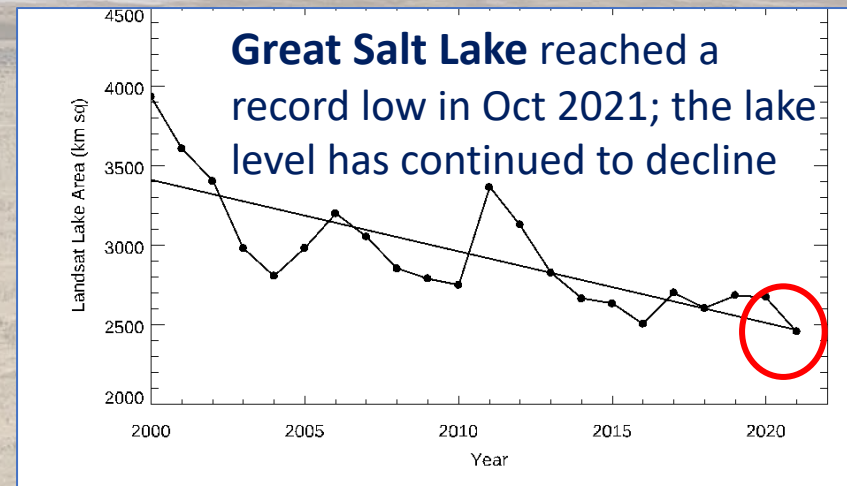
A decades-long drought in the southwestern U.S. began the year of the Terra launch (1999)

One effect has been desiccation of saline lakes

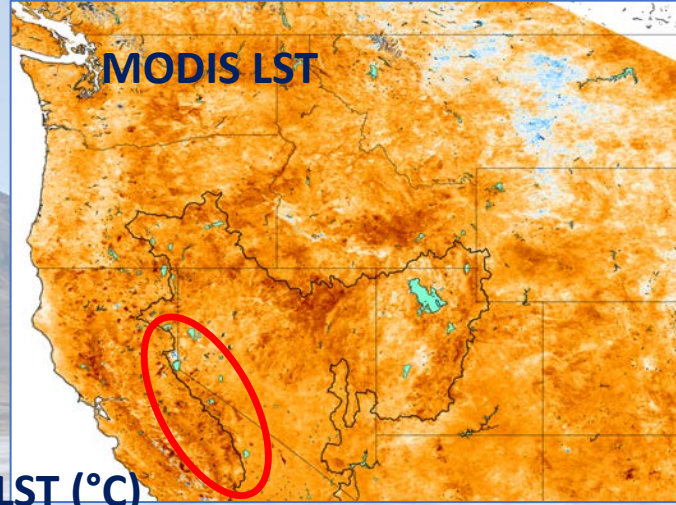
We have used ESDRs from diverse, coincident and validated MODIS data products to understand environmental conditions associated with the drought



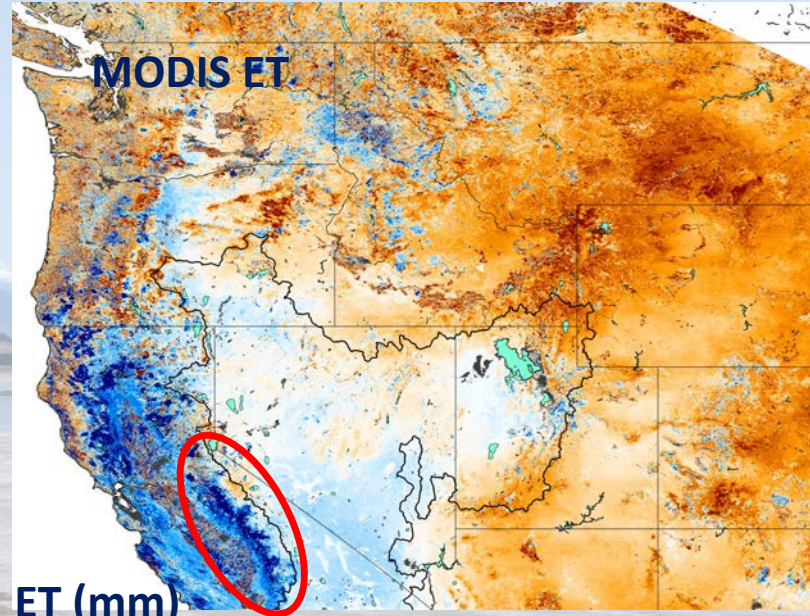
Saline lakes turn red from *Halobacteria* when water levels get low and salinity gets too high. Photo: Lake Abert, OR, 30 July 2014, R. Larson.



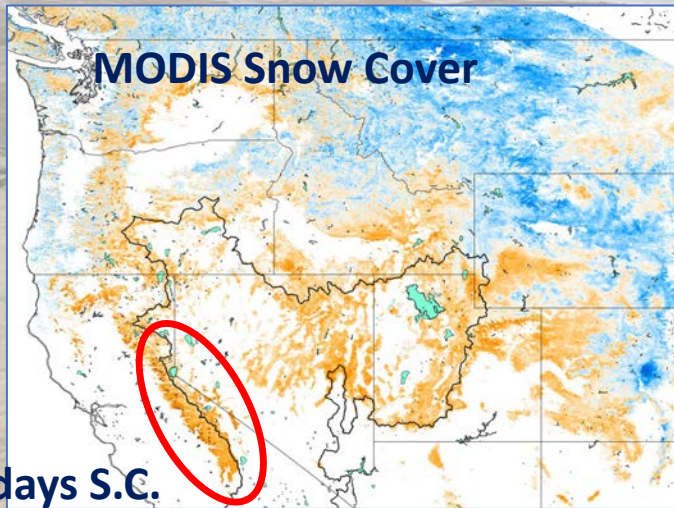
MODIS ESDR trend maps show a dramatic increase in LST, while snow cover and ET trends are mixed in the western U.S., 2001 - 2021



LST (°C)



ET (mm)



#days S.C.



MODIS ESDRs enable identification of “hot spots” of extreme drought-related changes, e.g. Sierra Nevada Mts. (incl. Mono Lake basin):

- +2.3°C mean **LST** increase
- -23.7 (fewer) days persistent **snow cover**
- -26.5 mm **ET** decrease

ET increases in areas where water supplies are adequate to sustain greater evaporation, but *decreases* in the severe drought areas of California and the Great Basin where vegetation is becoming increasingly sparse and soils are drying.

From: Hall, D.K., J.S. Kimball, R. Larson, N.E. DiGirolo, K.A. Casey & G. Hulley (submitted): Intensified warming and aridity accelerate terminal lake desiccation in the Great Basin of the western United States.

Conclusions

- The combination of increasing LST (warming) and declining ET and snow cover is intensifying climate aridity and **drought severity** in California and the southwestern U.S.
- Only through analysis of trends in coincident data products (snow cover, ET and LST), can we identify “hotspots” of drought-related activity, to inform models and thus formulate the **societal response** needed to mitigate effects of the megadrought in local areas.
- Continuing the Terra and Aqua missions will enable their ESDRs to approach critical 30-year thresholds allowing for more precise delineation of subtle climate trends and analysis of hotspots of change.