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March Southwest Climate Outlook

Monthly Precipitation and Temperature: February precipitation ranged from below average to much below average in Arizona and New Mexico (Fig. 1a), while February temperatures were average to above-average across nearly all of Arizona and New Mexico (Fig. 1b). The daily average temperature anomalies for Feb 1 – Mar 18 (Fig. 2) highlight the fluctuations at select stations around the region.

Seasonal Precipitation and Temperature: Winter precipitation (Dec 2019 - Feb 2020) ranged between below average and above average across Arizona and New Mexico, with large areas of below-average conditions in other parts of the Southwest (Fig. 3a). Winter temperatures were average to much above average across most of the region (Fig. 3b).

Water Year Precipitation: Water year precipitation to date (since Oct 1, 2019) has been normal to much above normal for much of Arizona and New Mexico (Fig. 4). The Four Corners region remains a notable exception, with mostly below-normal precipitation since Oct 1.

Snowpack & Water Supply: As of Mar 15, snow water equivalent (SWE) was mostly below median in Arizona, New Mexico, and southern Colorado, while southern Utah was more consistently above median (Fig 5). Many of the reservoirs in the region are at or above the values recorded at this time last year, but most are below their long-term average (see reservoir storage on p. 5).

Drought: The Mar 10 U.S. Drought Monitor (USDM) maintains drought characterizations similar to last month in the Four Corners region while expanding drought characterizations in central Nevada and California, and scaling back drought characterizations in southeastern New Mexico (Fig. 6). "Moderate Drought" (D1) and "Severe Drought" (D2) characterizations are centered on the Four Corners region, reflecting localized acute and accumulated precipitation deficits.

ENSO Tracker: Oceanic and atmospheric conditions are generally consistent with an ENSO-neutral outlook for 2020 (see ENSO-tracker on p. 3 for details).

Precipitation and Temperature Forecast: The three-month outlook for April through June calls for slightly increased chances of below-average precipitation in small pockets of California, southern Nevada, and northwest Arizona, which much of the rest of the southwestern U.S. and northern Mexico calling for equal chances of above or below average precipitation (Fig. 7, top). The three-month temperature outlook calls for increased chances of above-normal temperatures across most of the southwestern U.S. and northern Mexico (Fig. 7, bottom).

Tweet Mar 2020 SW Climate Outlook

CLICK TO TWEET

MAR2020 @CLIMAS_UA SW Climate Outlook, ENSO Tracker, AZ & NM Reservoir volumes, SWE, Environment and Society Graduate Fellows - https://bit.ly/2QvfAEW #SWclimate #AZWX #NMWX

March 2020 SW Climate Outlook

Online Resources

Figures 1,3
National Centers for Environmental Information
ncei.noaa.gov

Figure 2
Climate Assessment for the Southwest
climas.arizona.edu

Figure 4
West Wide Drought Tracker
wrcc.dri.edu/wwdt/

Figure 5
Natural Resources Conservation Service
nrcs.usda.gov

Figure 6
U.S. Drought Monitor
droughtmonitor.unl.edu

Figure 7
Intl. Research Institute for Climate and Society
iri.columbia.edu

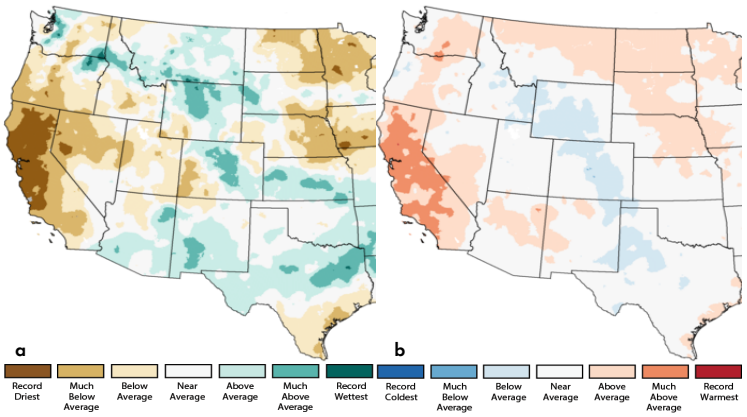


Figure 1: Feb 2020 Precipitation (a) & Temperature Ranks (b)

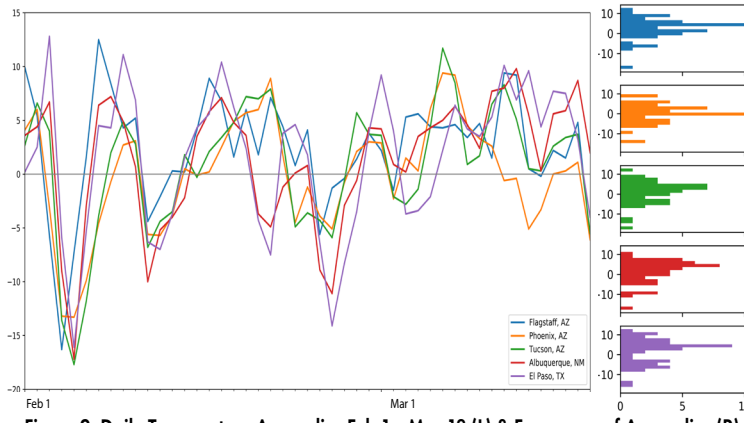


Figure 2: Daily Temperature Anomalies Feb 1 - Mar 18 (L) & Frequency of Anomalies (R)

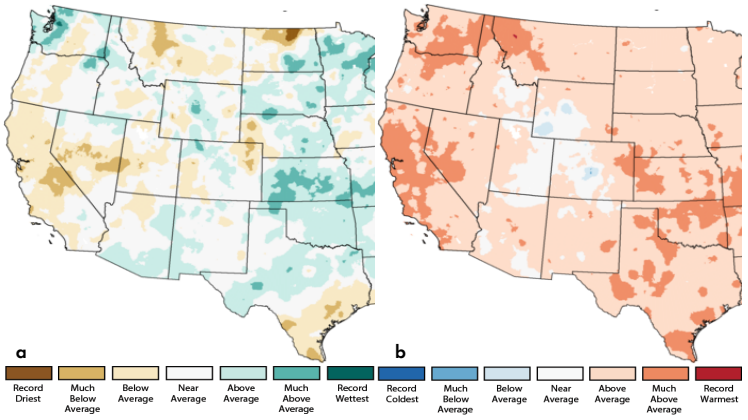


Figure 3: Dec 2019 - Feb 2020 Precipitation (a) & Temperature Ranks (b)

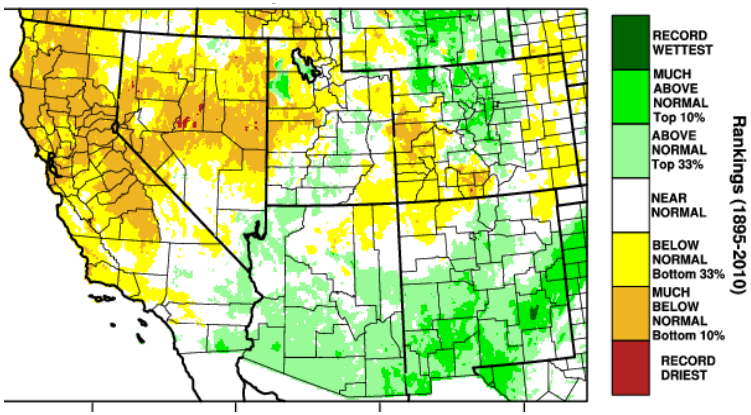


Figure 4: Oct 2019 - Feb 2020 - Water Year Precipitation Rankings

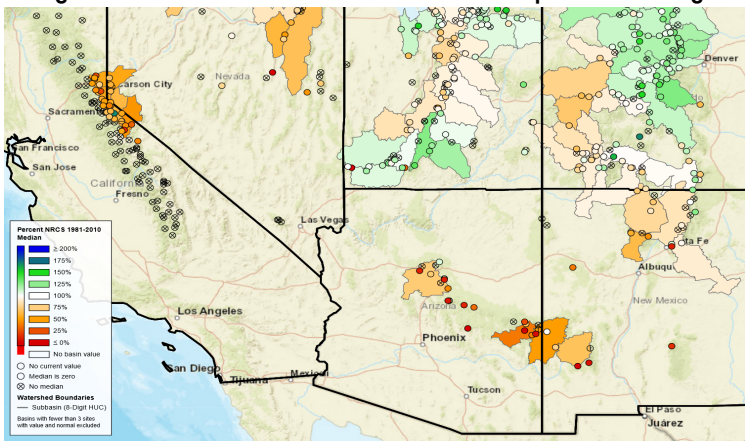


Figure 5: Mar 15 Snow Water Equivalent (Pct. 1981-2010 Median)

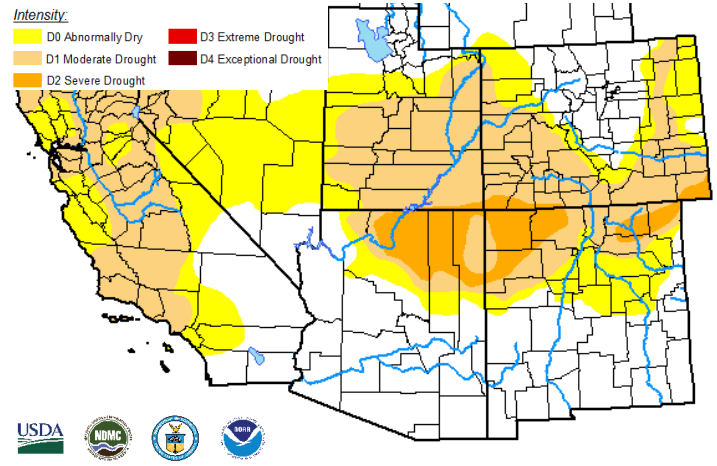


Figure 6: US Drought Monitor - Mar 10, 2020

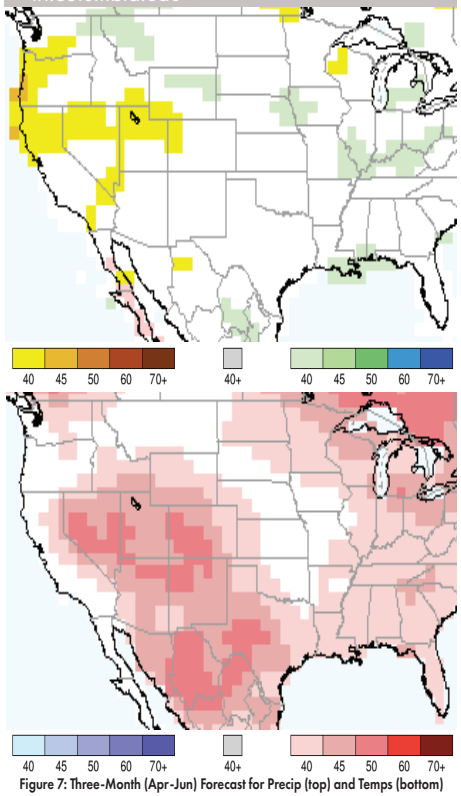


Figure 7: Three-Month (Apr-Jun) Forecast for Precip (top) and Temps (bottom)

Online Resources

Figure 1
Australian Bureau of Meteorology
bom.gov.au/climate/enso

Figure 2
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

Figure 3
International Research Institute for Climate and Society
iri.columbia.edu

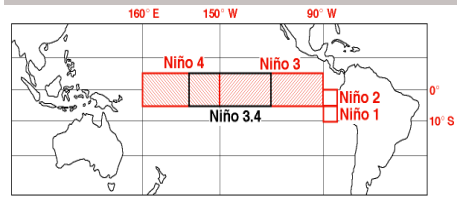
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

El Niño / La Niña

Information on this page is also found on the CLIMAS website:

climas.arizona.edu/sw-climate/el-niño-southern-oscillation

Equatorial Niño Regions



For more information: ncdc.noaa.gov/teleconnections/enso/indicators/sst/

Image source: aoml.noaa.gov/

ENSO Tracker

Positive sea surface temperature (SST) anomalies remain in the equatorial Pacific, particularly in the western regions (Figs. 1-2). Despite lingering warm waters, forecasts expect overall conditions will stay in the range of ENSO-neutral through at least summer 2020.

Forecast Roundup: On Mar 3, the Australian Bureau of Meteorology maintained their ENSO outlook at an inactive status, seeing "little or no sign of El Niño or La Niña developing in the coming months." On Mar 12, the NOAA Climate Prediction Center (CPC) issued its ENSO diagnostic discussion with an inactive alert status. The CPC called for a 65-percent chance of ENSO-neutral through spring 2020 and a 55-percent chance of ENSO-neutral lasting through summer. They highlighted that while SSTs were near the El Nino threshold in the short term, forecaster consensus was for a gradual decline of these positive anomalies, and with oceanic and atmospheric conditions to remain consistent overall with ENSO-neutral through at least mid-2020. On Mar 12, the International Research Institute (IRI) issued an ENSO Quick Look (Fig. 3), noting a "split between neutral and weak El Nino conditions" in the short-term, but that they expect conditions to remain ENSO-neutral overall. On Mar 10, the Japanese Meteorological Agency (JMA) maintained its call for a 60-percent chance of ENSO-neutral conditions to last until summer 2020. The Feb 2020 North American Multi-Model Ensemble (NMME) continues steady movement into ENSO-neutral territory and is forecast to remain there at least through early summer (Fig. 4).

Summary: Much like last month, positive SST anomalies persist, and some of the forecasts even reference El Nino conditions. Also similar to the previous month, none of the forecasts see much chance of an El Nino event...why? The positive SSTs reflect warmer than average oceanic conditions and are occasionally in the range of weak El Nino thresholds. To be considered an El Nino event, the three-month average would need to stay above this threshold for five consecutive months. The atmosphere would also need to cooperate (often called 'oceanic-atmospheric coupling'). Current forecasts do not expect these positive SST anomalies to last long enough to meet the El Nino criteria, much less see sufficient evidence in atmospheric conditions. ENSO-neutral remains by far the most likely outcome. As we noted last month, in the Southwest, ENSO-neutral winters have produced some of the wettest and driest winters (and everything in between). We continue to monitor sub-seasonal and short term forecasts for insight into upcoming events.

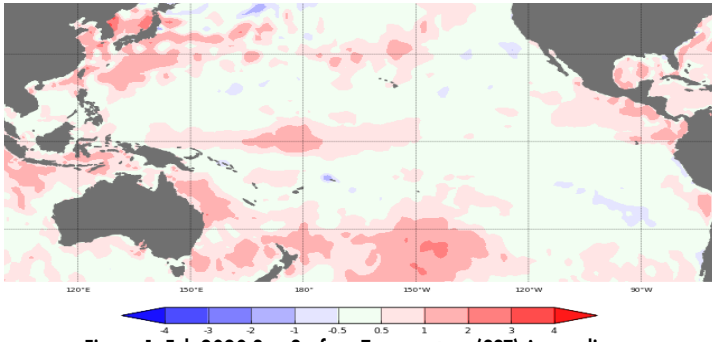


Figure 1: Feb 2020 Sea Surface Temperature (SST) Anomalies

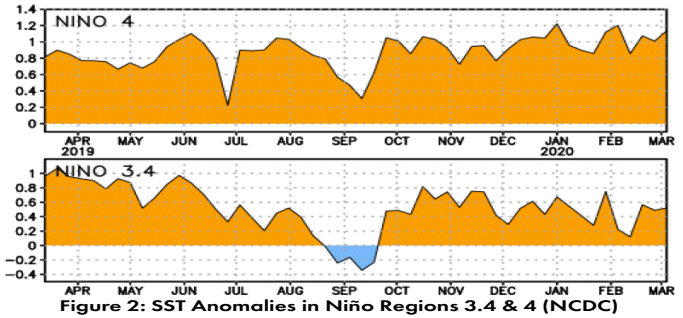


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

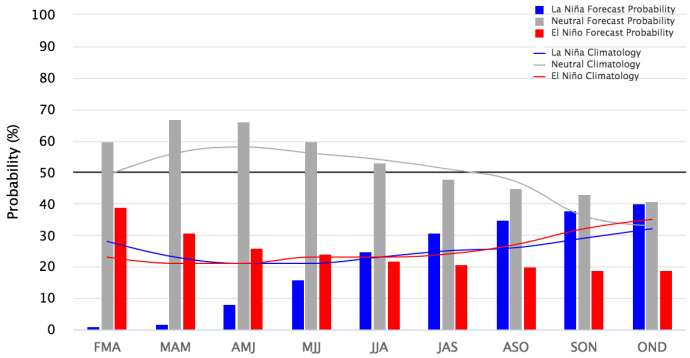


Figure 3: Early-Mar IRI/CPC Model-Based Probabilistic ENSO Forecast

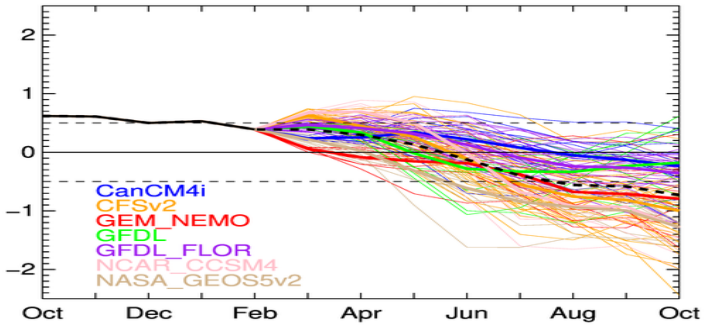


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

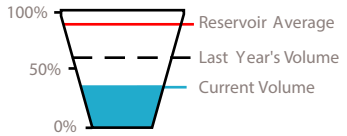
Online Resources

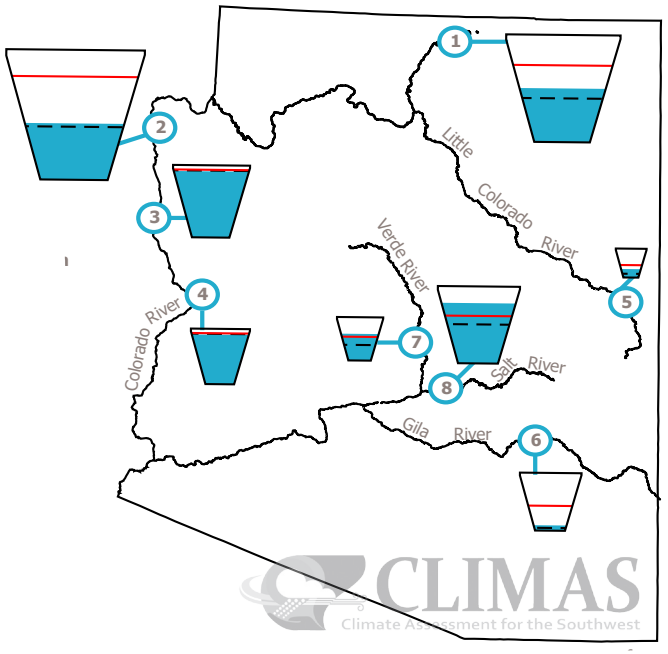
Portions of the information provided in this figure is available at the Natural Resources Conservation Service
www.wcc.nrcs.usda.gov/BOR/basin.html

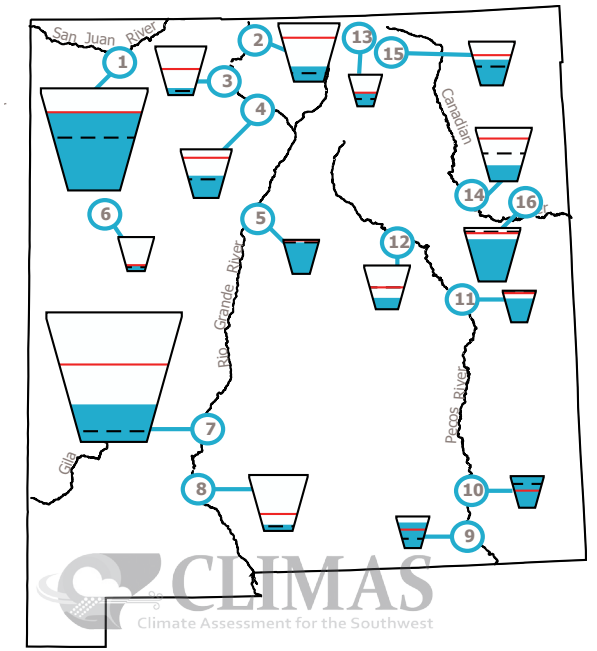
Contact Ben McMahan with questions/comments.

Reservoir Volumes

DATA THROUGH MAR 1, 2020
Data Source: National Water and Climate Center, Natural Resources Conservation Service







* in KAF = thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Lake Powell	49%	11,997.0	24,322.0	-283.8
2. Lake Mead	44%	11,414.0	26,159.0	140.0
3. Lake Mohave	93%	1,675.0	1,810.0	22.0
4. Lake Havasu	94%	584.6	619.0	31.6
5. Lyman	29%	8.8	30.0	0.2
6. San Carlos	14%	118.9	875.0	41.9
7. Verde River System	64%	184.9	287.4	5.6
8. Salt River System	83%	1,683.5	2,025.8	112.8

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	76%	1294.8	1,696.0	-13.0
2. Heron	26%	104.7	400.0	-1.0
3. El Vado	15%	27.9	190.3	-0.8
4. Abiquiu	46%	86.5	186.8	2.2
5. Cochiti	92%	46.2	50.0	-1.8
6. Bluewater	17%	6.6	38.5	6.6
7. Elephant Butte	28%	609.5	2,195.0	32.1
8. Caballo	11%	36.4	332.0	2.1
9. Lake Avalon	80%	3.6	4.5	2.2
10. Brantley	100%	42.0	42.2	-0.4
11. Sumner	74%	26.6	35.9	2.0
12. Santa Rosa	25%	26.1	105.9	0.0
13. Costilla	42%	6.7	16.0	5.8
14. Conchas	29%	73.6	254.2	-0.3
15. Eagle Nest	58%	45.9	79.0	0.6
16. Ute Reservoir	78%	156	200	-1.0

The map gives a representation of current storage for reservoirs in Arizona and New Mexico. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage (blue fill) as a percent of total capacity. Note that while the size of each cup varies with the size of the reservoir, these are representational and not to scale. Each cup also represents last year's storage (dotted line) and the 1981–2010 reservoir average (red line).

The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). On average, 1 acre-foot of water is enough to meet the demands of four people for a year. The last column of the table lists an increase or decrease in storage since last month. A line indicates no change.

These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

Online Resources

Figure 1
University of Arizona - SnowView
climate.arizona.edu/snowview/

Snow Water Equivalent - Details Across the Southwest

Researchers at the University of Arizona developed a data visualization tool for snow cover and snow water equivalent (Fig. 1). This demonstrates the variability of snowpack and deviations from median across the Southwest, at finer scales compared to basin and sub-basin estimates, and with greater spatial coverage than single SNOTEL station measurements. The image below from Mar 16, 2020 highlights just how much snowpack has declined in much of the Southwest, and in particular in some of the lower elevation locations (not to mention higher elevation locations in California, Colorado, and parts of northern New Mexico).

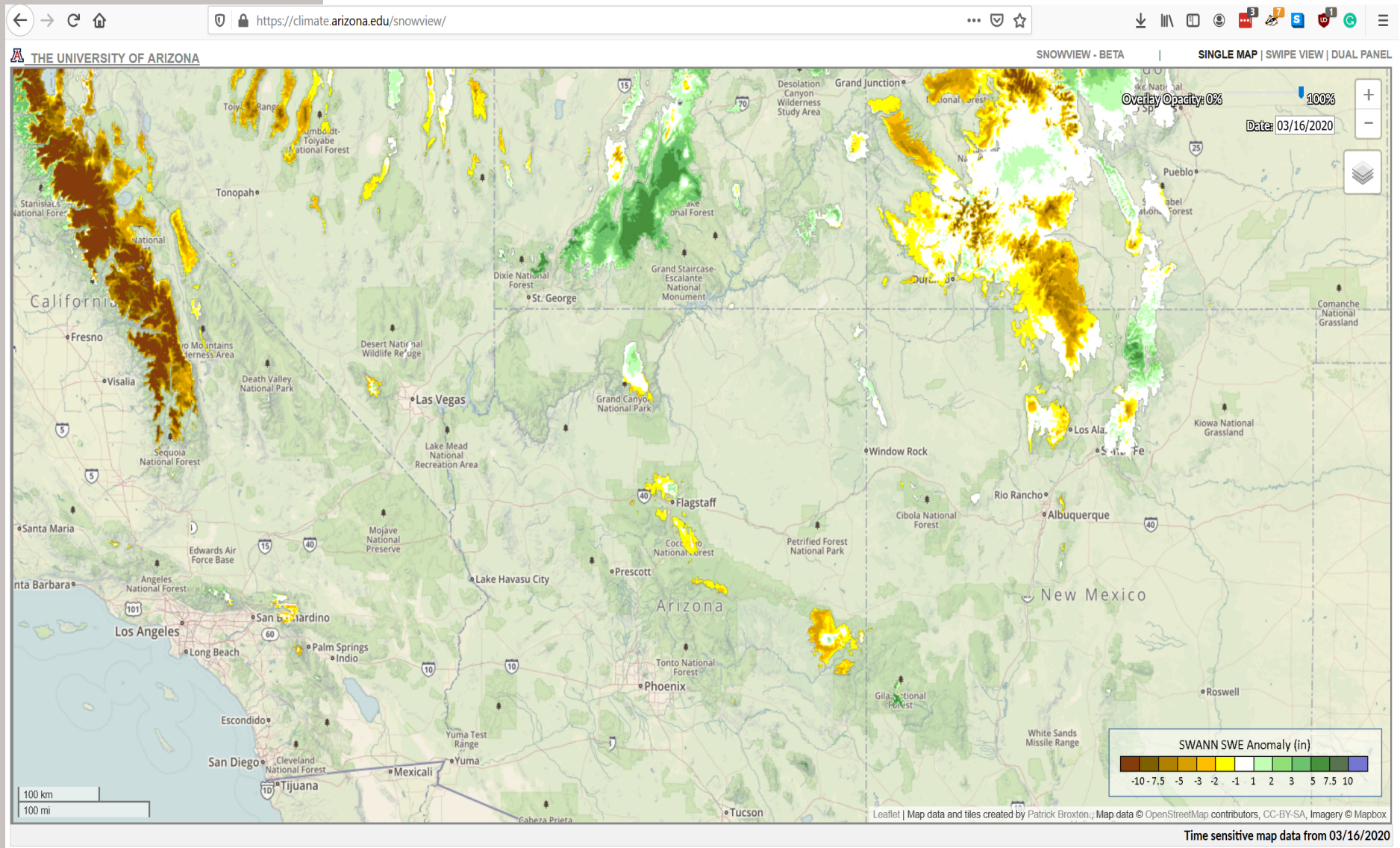


Figure 1: Snow Water Equivalent (SWE) Percent of Median - Source: UArizona SnowView Data Viewer (climate.arizona.edu/snowview)

Environment & Society Graduate Fellows

The Environment & Society Fellowship was created in 2013 as a funding opportunity for graduate students to practice use-inspired research and science communication.

The Fellowship supports projects that connect social or physical sciences, the environment, and decision-making.

climas.arizona.edu/education/fellowship-program

The 2020 CLIMAS E&S fellows have written an introductory blog post that tells part of their story - how and why they landed where they did.

These excerpts are the introductions to their longer posts, which will be posted on the CLIMAS blog:

climas.arizona.edu/blog

Emily Cooksey - The World is My Oyster

Over the past eight years, I have lived in five different states as I have been pursuing my dream of becoming an environmental microbiology and water quality research scientist.

As a native Floridian, I ventured to Michigan during my undergraduate degree and became interested in molecular genetics research. I focused on confocal microscopy analysis of tau protein in fruit flies to better understand potential drivers of Alzheimer's disease and was a collegiate soccer player. After I graduated, I moved to rural Colorado to serve a term with AmeriCorps and work in a county public health office as a tobacco specialist. I provided math and literacy intervention to students in grades K-12 and ran an after-school program. While working in the county public health office, I was influential in changing the tobacco policy in the school district. I realized the importance of public health and headed to Louisiana for my MSPH. It was during my time at Tulane University that I was introduced to microbial water quality and food safety.

JoRee LaFrance - Responsibility of an Apsáalookbia (Crow Woman) to the protection of Apsáalooke bilé (Crow Water)

I was raised by an Apsáalooke/Crow matriarch who also came from strong, independent Apsáalookbia/Crow women. Apsáalooke people are a matrilineal and, traditionally, an egalitarian society. It is innately known that we have three mothers: the earth, our homes, and our birth mothers. We are taught that we must respect all three mothers and do what we must so that they stay protected. Our mothers are our first teachers and have taught us much of what we know as Apsáalooke people. We were taught the stories of Hisshiishduwiia/Red Woman, the Chíilapsahpua/Seven Sacred Big Horn Rams, rock medicine, and old man coyote stories. In particular, it was the stories of Hisshiishduwiia/Red Woman and the seven sacred rams that struck a distinct chord with me. Both of these stories remind me of the inherent responsibility I have to protect all that has provided. I know that I only play a small role in protecting but I hope that role has a much larger impact than I can imagine.

Kunal Palawat - What feeds you? An exploration of resilience, sense of place, and food

This question has followed me around my entire life. Who and what contributes to my healing, development, growth? Literally, physically, romantically, academically, environmentally; what gives me strength? Growing up Jain, I was taught critical appreciation and curiosity about the natural world through the lenses of food and non-human connection. I also grew up in an affluent New Jersey suburb where I had easy access to hiking trails, farmer's markets, and my Nani's cooking in Queens. My family, queerness, privileges, religion, experiences with whiteness, and more all contribute to my sense of place.

I ask this question to other Queer, Trans, Two-Spirit, Black, Indigenous, and People of Color (QT2SBIPOC) because we are not often given the space we need to deeply consider our relationships to environment and healing. For me, there is a lot that keeps me going in the wake of environmental catastrophe, personal hardship, and activist burnout. But, it boils down to sharing meaningful food with meaningful people.

Rachel Rosenbaum - Recycle Lebanon

In the summer of 2017, a young woman living in Beirut remarked to me, "People are used to going around the government to achieve what needs to get done. People are resilient, resourceful, and fed up." This sentiment is common among those I work with in Lebanon as daily life is structured by intersecting issues of environmental and infrastructural degradation, perceptions of instability, and government ineptitude. Since the civil war ended in the 1990s, the government has struggled to provide basic infrastructures like 24-hour electricity, waste management, or public transportation and, like most places around the world, continually mismanages environmental resources from their forests to their coasts. As an anthropologist, however, I work to understand how these issues of infrastructure and the environment intersect with people's resilience and resourcefulness, leading them to create alternatives to increase wellbeing for themselves, their communities, and the planet.

Online Resources

Figure 1
Climate Program Office
cpo.noaa.gov

RISA Program Homepage

cpo.noaa.gov/Meet-the-Divisions/Climate-and-Societal-Interactions/RISA

UA Institute of the Environment

environment.arizona.edu

New Mexico Climate Center

weather.nmsu.edu

CLIMAS Research & Activities

CLIMAS Research

climas.arizona.edu/research

CLIMAS Outreach

climas.arizona.edu/outreach

Climate Services

climas.arizona.edu/climate-services

CLIMAS

Climate Assessment for the Southwest
A NOAA RISA TEAM

The Climate Assessment for the Southwest (CLIMAS) program was established in 1998 as part of the National Oceanic and Atmospheric Administration's Regional Integrated Sciences and Assessments program. CLIMAS—housed at the University of Arizona's Institute of the Environment—is a collaboration between the University of Arizona and New Mexico State University.

The CLIMAS team is made up of experts from a variety of social, physical, and natural sciences who work with partners across the Southwest to develop sustainable answers to regional climate challenges

What does CLIMAS do?

The CLIMAS team and its partners work to improve the ability of the region's social and ecological systems to respond to and thrive in a variable and changing climate. The program promotes collaborative research involving scientists, decision makers, resource managers and users, educators, and others who need more and better information about climate and its impacts. Current CLIMAS work falls into six closely related areas: 1) decision-relevant questions about the physical climate of the region; 2) planning for regional water sustainability in the face of persistent drought and warming; 3) the effects of climate on human health; 4) economic trade-offs and opportunities that arise from the impacts of climate on water security in a warming and drying Southwest; 5) building adaptive capacity in socially vulnerable populations; and 6) regional climate service options to support communities working to adapt to climate change.

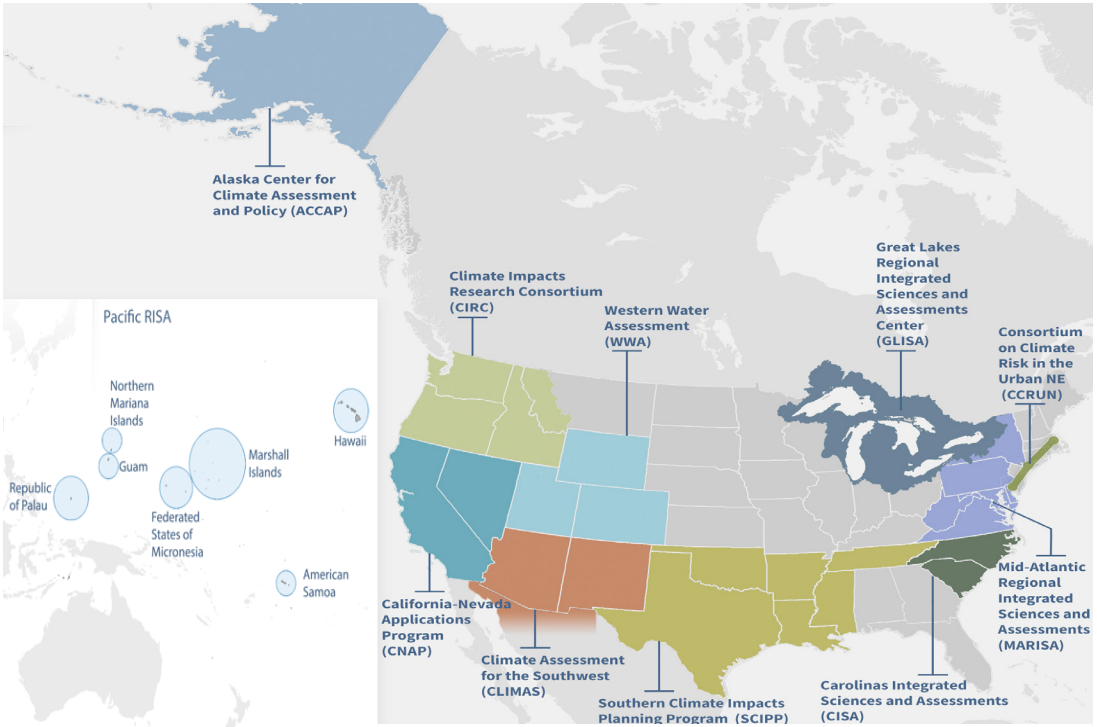


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions