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February Southwest Climate Outlook

Monthly Precipitation and Temperature: January precipitation ranged from average to much below average in most of Arizona, while New Mexico was mostly average, but included areas that ranged from below average to above average (Fig. 1a). January temperatures were above average across nearly all of Arizona and New Mexico (Fig. 1b). The daily average temperature anomalies for Jan 1 – Feb 17 (Fig. 2) highlight the fluctuations at select stations around the region. Particularly notable was the cold snap in early February.

Water Year Precipitation and Temperature: Water year precipitation to date (since Oct 1) has been normal to above normal for much of Arizona and New Mexico (Fig. 3). The Four Corners region is a notable exception with below-normal precipitation, and with a swath of much above normal precipitation in eastern New Mexico. Temperatures over the same period were mostly normal to much above normal in Arizona, and below normal to much above normal in New Mexico (Fig. 4).

Snowpack & Water Supply: As of Feb 16, snow water equivalent (SWE) ranged between above and 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 Feb 11 U.S. Drought Monitor (USDM) maintains drought characterizations similar to last month in the Four Corners region while adding drought characterizations in central Nevada and California, as well as southeastern New Mexico (Fig. 6). A large pocket of "Moderate Drought" (D1) and "Severe Drought" (D2) remains centered on the Four Corners region, reflecting localized acute and accumulated precipitation deficits.

ENSO Tracker: The forecasts and outlooks continue to grapple with persistent warm waters in the western Pacific Ocean, but these forecasts also point to oceanic and atmospheric conditions that 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 March through May calls for slightly increased chances of below-normal precipitation in small pockets of California and eastern Arizona, and much of New Mexico, west Texas, and the U.S.-Mexico borderlands (Fig. 7, top). The three-month temperature outlook calls for increased chances of above-normal temperatures across most of the Southwest, with more increased chances in west Texas, southern New Mexico, and much of central Mexico (Fig. 7, bottom).

Tweet Feb 2020 SW Climate Outlook

CLICK TO TWEET

FEB2020 @CLIMAS_UA SW Climate Outlook, ENSO Tracker, AZ & NM Reservoir volumes, SWE, Environment and Society Graduate Fellows - https://bit.ly/39Kcq7o #SWclimate #AZWX #NMWX

February 2020 SW Climate Outlook

Online Resources

Figure 1
National Centers for Environmental Information
ncei.noaa.gov

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

Figures 3-4
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

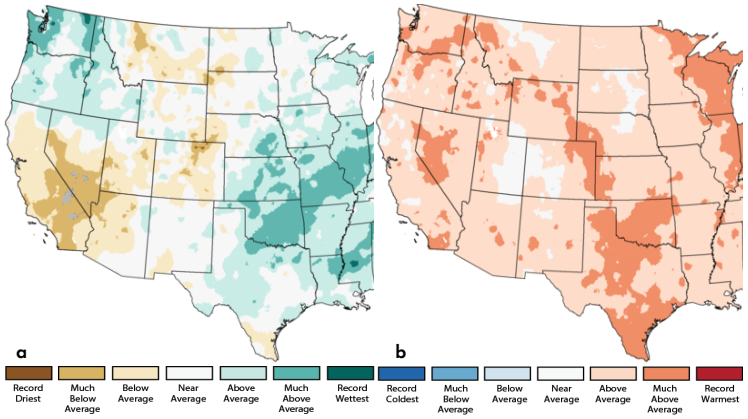


Figure 1: Jan 2020 Precipitation (a) & Temperature Ranks (b)

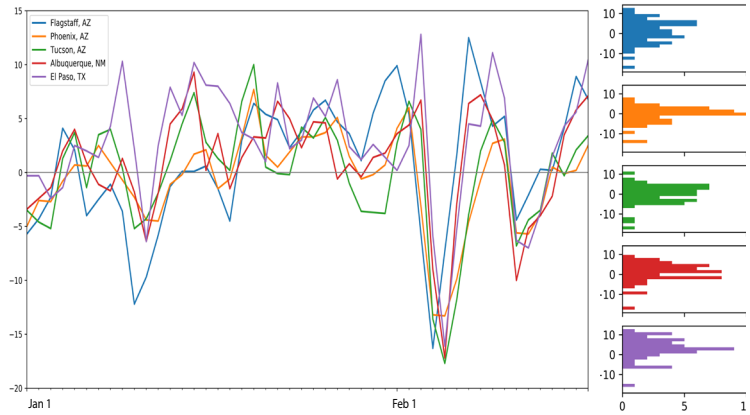


Figure 2: Daily Temperature Anomalies Jan 1 - Feb 17 (L) & Frequency of Anomalies (R)

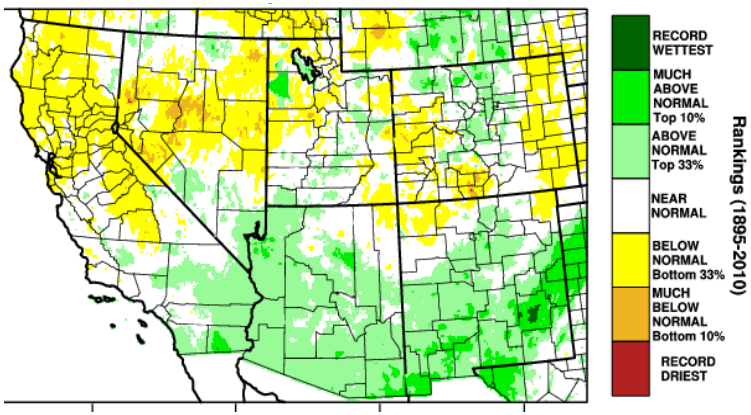


Figure 3: Oct 2019 - Jan 2020 - Water Year Precipitation Rankings

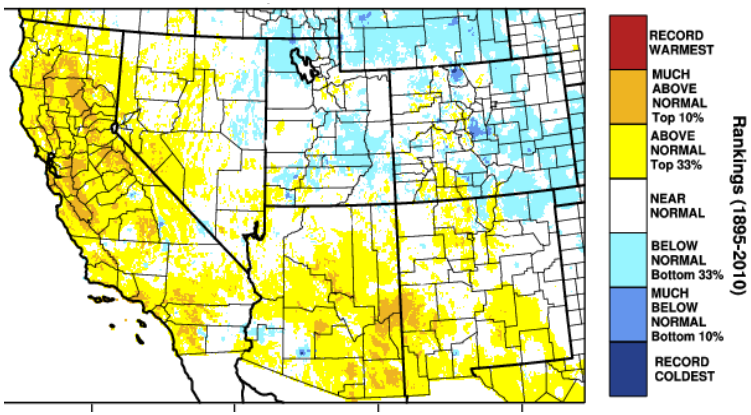


Figure 4: Oct 2019 - Jan 2020 - Water Year Temperature Rankings

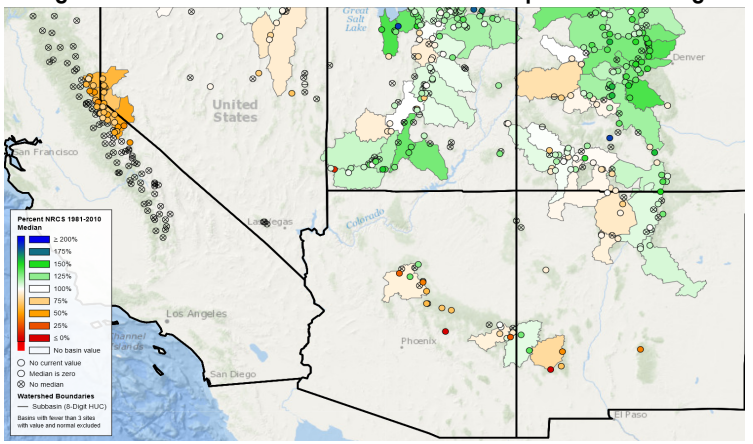


Figure 5: Feb 16 Snow Water Equivalent (Pct. 1981-2010 Median)

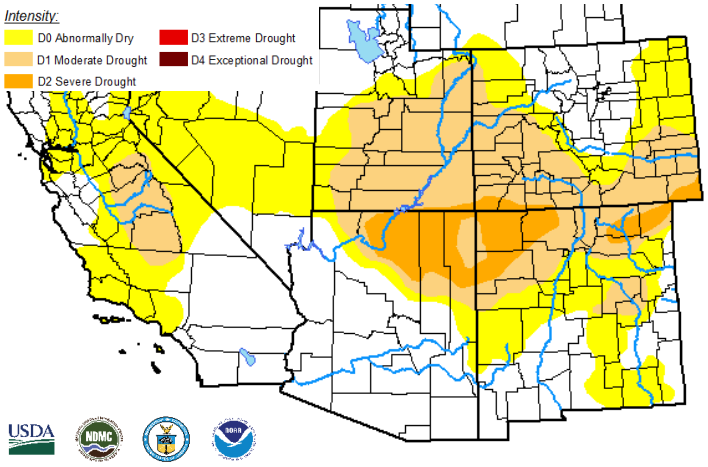


Figure 6: US Drought Monitor - Feb 11, 2020

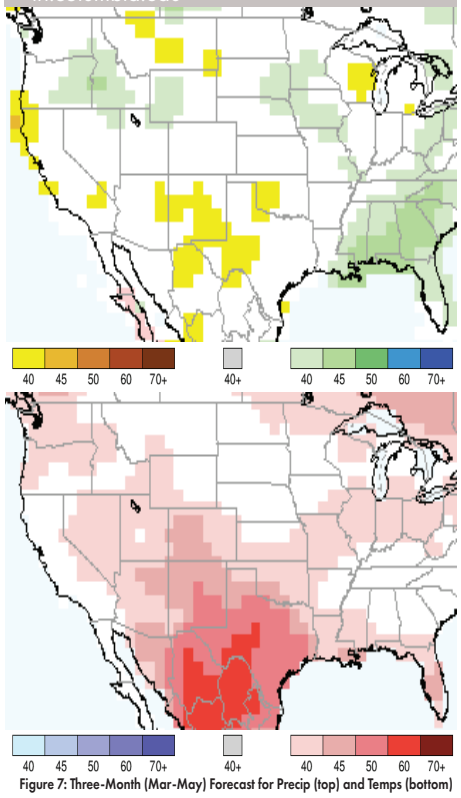


Figure 7: Three-Month (Mar-May) Forecast for Precip (top) and Temps (bottom)

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

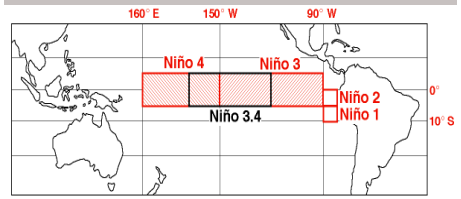
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

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 persisted in the equatorial Pacific, particularly in the western regions (Figs. 1-2). Despite these lingering warm waters, SSTs are expected to remain within the range of ENSO-neutral at longer timescales.

Forecast Roundup: On Feb 4, 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 Feb 10, the Japanese Meteorological Agency (JMA) maintained their call for a 60-percent chance of ENSO-neutral conditions to last until summer 2020. On Feb 13, the NOAA Climate Prediction Center (CPC) issued their ENSO diagnostic discussion with an inactive alert status. The CPC maintained their call for a 60-percent chance of ENSO-neutral through spring 2020 and a 50-percent chance of neutral lasting through summer. They highlighted that while SSTs were near the El Niño threshold in the short term, the longer-term outlook pointed towards oceanic and atmospheric conditions consistent with ENSO-neutral. On Feb 13, the International Research Institute (IRI) issued an ENSO Quick Look (Fig. 3), noting that "borderline weak El Niño" SSTs were present and forecast to last through winter 2020, but "returning to ENSO-neutral by spring and beyond." The Feb 2020 North American Multi-Model Ensemble (NMME) shows another month of positive SST anomalies on the border between neutral and El Niño, but is predicted to return and remain within the range of ENSO-neutral in Mar/Apr 2020 (Fig. 4).

Summary: Over the last month, we have seen another run of positive SST anomalies that are near the El Niño threshold, but none of the forecasts see much chance of an El Niño event...why? A quick reminder that while the warm oceanic conditions may be present and in the range of weak El Niño thresholds, to be considered an El Niño 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'). The more nuanced forecast discussions have focused on the fact that these positive SST anomalies are unlikely to last long enough to meet the El Niño criteria, as well as the lack of atmospheric conditions, and ENSO-neutral remains by far the most likely outcome. 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.

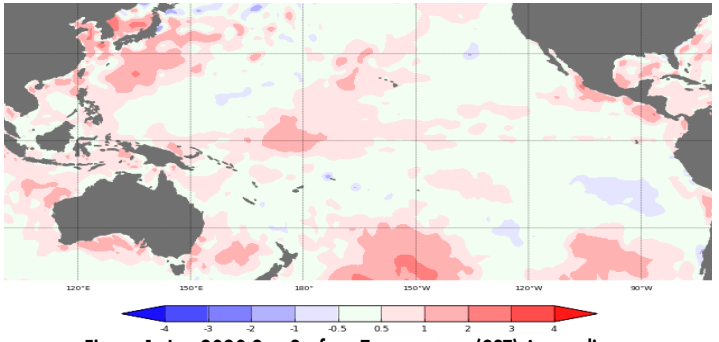


Figure 1: Jan 2020 Sea Surface Temperature (SST) Anomalies

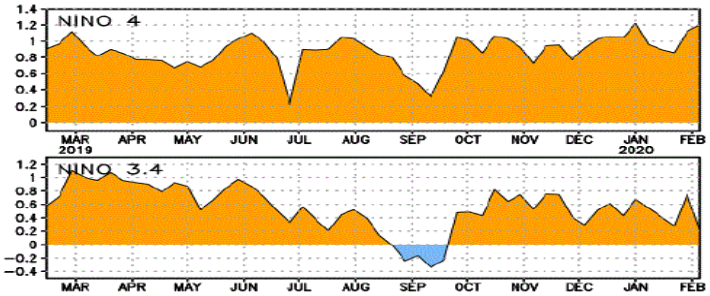


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

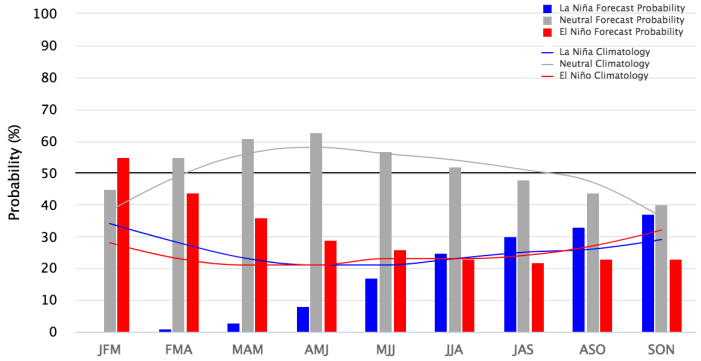


Figure 3: Early-Feb IRI/CPC Model-Based Probabilistic ENSO Forecast

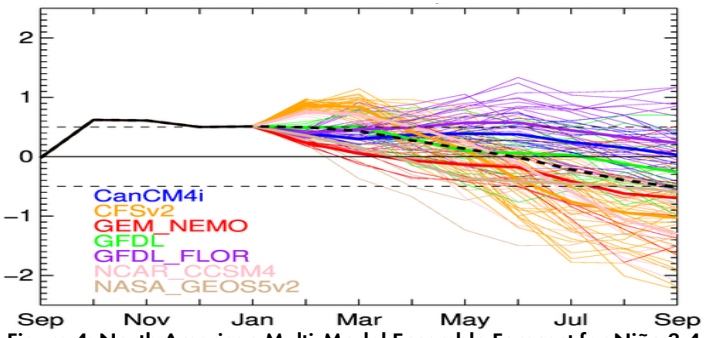


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

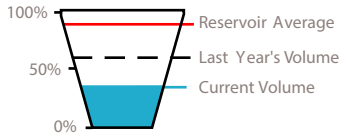
Portions of the information provided in this figure is available at the Natural Resources Conservation Service
www.wcc.nrcs.usda.gov/BOR/basin.html

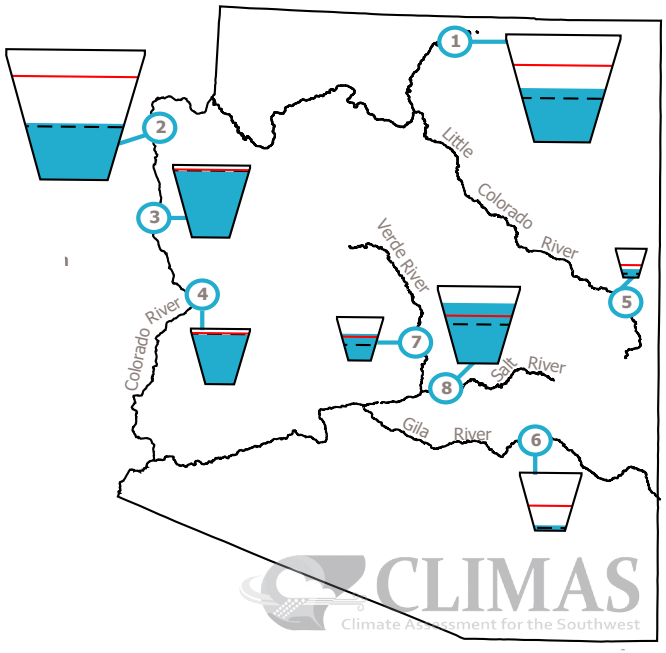
Contact Ben McMahan with questions/comments.

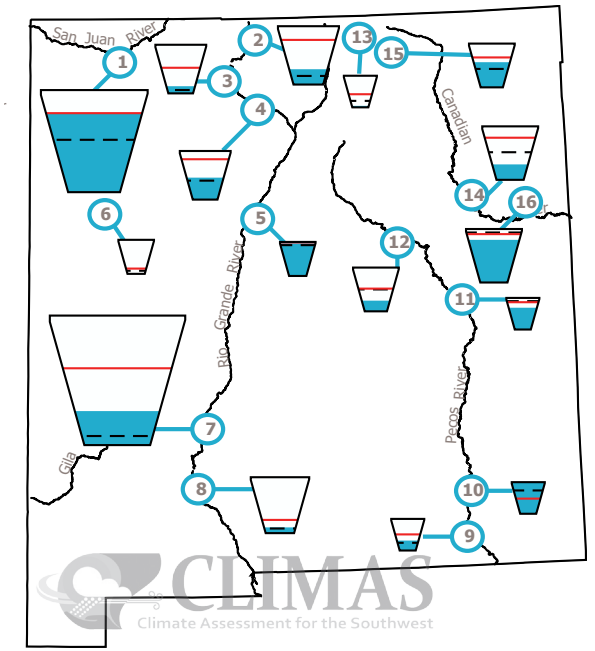
Reservoir Volumes

DATA THROUGH FEB 1, 2020

Data Source: National Water and Climate Center, Natural Resources Conservation Service







* in KAF = thousands of acre-feet

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).

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Lake Powell	50%	12,280.7	24,322.0	-323.2
2. Lake Mead	43%	11,274.0	26,159.0	362.0
3. Lake Mohave	91%	1,653.0	1,810.0	19.0
4. Lake Havasu	89%	553.0	619.0	-49.9
5. Lyman	29%	8.7	30.0	0.0
6. San Carlos	9%	77.0	875.0	34.3
7. Verde River System	62%	179.4	287.4	10.1
8. Salt River System	78%	1,570.7	2,025.8	54.0

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	77%	1307.8	1,696.0	-18.0
2. Heron	26%	105.7	400.0	-0.5
3. El Vado	15%	28.7	190.3	-1.9
4. Abiquiu	45%	84.3	186.8	2.4
5. Cochiti	96%	48.0	50.0	0.2
6. Bluewater	0%	0.0	38.5	-6.6
7. Elephant Butte	26%	577.4	2,195.0	20.1
8. Caballo	10%	34.3	332.0	0.5
9. Lake Avalon	31%	1.4	4.5	1.4
10. Brantley	100%	42.4	42.2	0.3
11. Sumner	69%	24.6	35.9	3.1
12. Santa Rosa	25%	26.1	105.9	0.1
13. Costilla	5%	0.9	16.0	0.9
14. Conchas	29%	73.9	254.2	-0.1
15. Eagle Nest	57%	45.3	79.0	0.5
16. Ute Reservoir	79%	157	200	0.0

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 recently developed a prototype data visualization tool for snow cover and snow water equivalent (Fig. 1). This helps demonstrate 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 Feb 16, 2020 highlights the extent to which snowpack is above median in some of the higher elevation locations, but below median in others, particularly in some of the lower elevation stations.

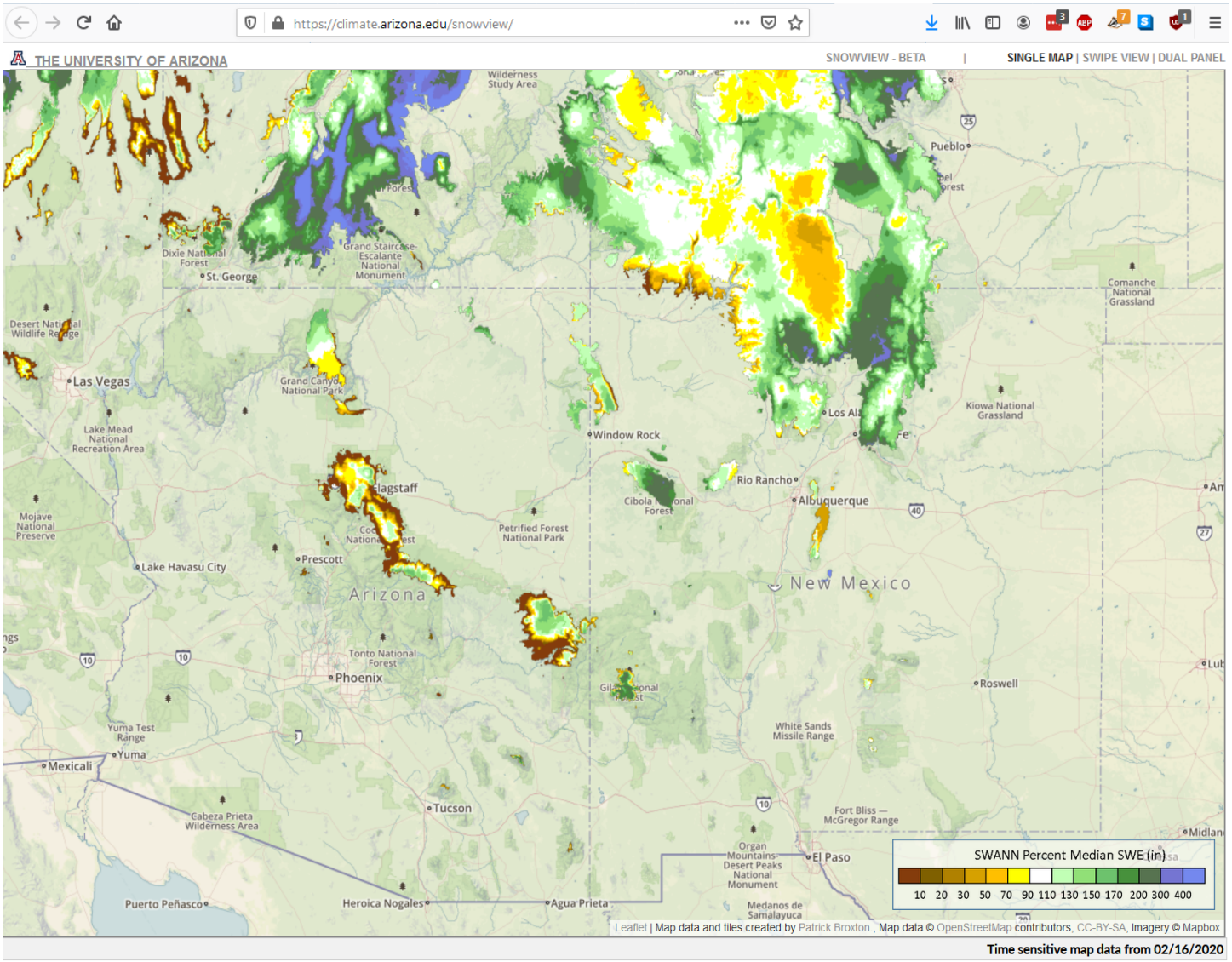


Figure 1: Snow Water Equivalent (SWE) Percent of Median - Source: UArizona SnowView Data Viewer (climate.arizona.edu/snowview)

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.

Projects must be use-inspired and address research and information needs voiced by the students' project partners.

The Fellowship is funded and supported by the University of Arizona Office of Research, Innovation, & Impact, and CLIMAS.

climas.arizona.edu/education/fellowship-program

CLIMAS
Climate Assessment for the Southwest
A NOAA RISA TEAM

2019 Environment and Society Fellows Final Presentations & Final Reports

Building a Risk Assessment - A combined effort between Naco Elementary School, Cochise County Health and Social Services, and the University of Arizona

Alma Anides Morales, a masters student in Soil, Water, and Environmental Science, discusses her past year of relationship building, skill training, and sample collection in an effort to produce a risk assessment specific to Naco Elementary students from the potential microbial hazards due to sewage overflows in the area.

Final Presentation Video: https://youtu.be/ThkjBr5d1Q0

Final Report: climas.arizona.edu/publication/report/building-risk-assessment-naco-elementary-school-combined-effort-between-naco

Blog: climas.arizona.edu/blog/working-projects-students-naco-elementary

Hybrid Waters: Informal Water Provision, Municipal Governance and Household Water Security in Nairobi's Informal Settlements

Nupur Joshi, a doctoral student in Geography, discusses how small scale private water sellers operate and the roles that Nairobi's municipal water governance play in these private operations. Her presentation is a story of water's urbanization in low-income settlements of Nairobi, and the everyday struggles of the urban poor to secure water.

Final Presentation Video: https://youtu.be/Ta6TfRPd6SY

Final Report: climas.arizona.edu/publication/report/hybrid-waters-informal-water-provision-municipal-governance-and-household-water

Blog: climas.arizona.edu/blog/story-h2o-informal-water-provision-nairobi's-low-income-settlements

Isotopes, geochemistry, citizen science, and local partnerships as tools to build upon a fractured understanding of the hydrology of the Patagonia Mountains

Sean Schrag-Toso, a masters student in Hydrology and Atmospheric Sciences, presents on how drought and increased demand for groundwater resources have led to concern about future groundwater availability and dwindling spring flow in the Patagonia Mountains of southern Arizona. This research aims to better understand groundwater movement in the Mountains, and through collaborating with local partners, will inform monitoring and management of groundwater resources in the area.

Final Presentation Video: https://youtu.be/Zw2BnFRCRCg

Final Report: climas.arizona.edu/publication/report/isotopes-geochemistry-citizen-science-and-local-partnerships-tools-build-upon

Blog: climas.arizona.edu/blog/Mining-and-groundwater-southern-arizona

Let it Rain: Discovering the Chemistry of a Raindrop

Norma Villagómez-Márquez, a doctoral student in Soil, Water, and Environmental Science, presents personal illustrations of rainwater collection systems, rainwater contamination, and quality through the eyes of urban children.

Final Presentation Video: https://youtu.be/bdiHRVQEeAg

Final Report: climas.arizona.edu/publication/report/discovering-quality-harvested-rainwater

Blog: climas.arizona.edu/blog/save-it-rainy-day-roof-harvesting-rainwater-sonoran-desert

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.

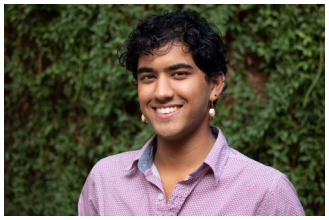
Please welcome our 2020 cohort!

climas.arizona.edu/education/fellowship-program

2020 Environment and Society Fellows

Emily Cooksey (she/her) is PhD student in Environmental Health Science in the Mel and Enid Zuckerman School of Public Health. Her doctoral dissertation is focused on presence, persistence, and human health risk associated with pathogenic Vibrio from oysters harvested in Southern California through a collaboration with Southern California Coastal Water Research Project (SCCWRP). The primary focus of her research is to expand scientific knowledge of the interactions between shellfish, microbial water quality, environmental factors, and public health. As an Environment and Society Fellow, Emily will identify implications for human health by coupling oyster research in Southern Californian estuaries and in simulated marine environments with QMRA. Her laboratory findings will influence her QMRA model and assess regulatory standards. The collaboration between the University of Arizona and SCCWRP provides a platform for groundbreaking Vibrio research on the West Coast and the ability to influence current oyster harvesting policy in Southern California. Emily will use her research to evaluate existing policy to reduce human health risk from exposure to pathogenic Vibrio.

JoRee LaFrance (she/her) is a PhD student in the Department of Environmental Science. She comes from the Crow Reservation located in southeastern Montana and is Apsáalooke (Crow). Her Apsáalooke name is Iichiinmaaáatchilash – Fortunate with Horses and she comes from the Greasy Mouth clan and is a child of Ties in the Bundle clan. She uses the intersection of her background in earth sciences and Native American studies to focus on water quality issues on her reservation. JoRee's PhD research aims to understand the contaminant behavior in the Indigenous Food, Energy, Water Security and Sovereignty (Indige-FEWSS) nexus in the Little Bighorn River watershed. More specifically, she will address the contaminant concentration-discharge relationship in the river to further determine any implications and to characterize exposure routes unique to Apsáalooke people. As a CLIMAS fellow, she plans to produce a short documentary about surface water sampling and will collaborate with artists to create the hydrologic cycle from an Apsáalooke perspective.



Kunal Palawat (they/them) is pursuing a masters in soil and water science at the University of Arizona Department of Environmental Science. They have a background in soil/water science and community organizing from their time living in Vermont and are excited to blend their passions together in Arizona. Kunal's research focuses on public participation in science, environmental pollution, and ecological modeling through the community rainwater harvesting study called Project Harvest. They are also passionate challenging the oppressive norms of western science through the democratization of science, supporting queer, trans, and two-spirit BIPOC (Black, Indigenous, and People of Color) students, mentorship, and climate activism. Their project with CLIMAS involves creating a climate change and contamination informed community cookbook. The Arizonan communities participating in the process are the members of Project Harvest in four towns (Dewey, Globe, Hayden, Tucson) and the Mission Garden in Tucson. The cookbook will have recipes developed by community members and Kunal in addition to photographs and historical narratives of each dish.

Rachel Rosenbaum (she/her) is a sociocultural anthropologist studying the politics of urban infrastructure in Beirut, Lebanon. Her doctoral dissertation research examines how Lebanese grapple with decades of infrastructural and environmental degeneration, histories of violence, and issues of ineffective governance. Her research centers local environmental and infrastructural change-makers who are working collectively to tackle these issues and institute alternatives. Her project with CLIMAS will use this ongoing research to facilitate the design and implementation of a data visualization platform with her local partners, Recycle Lebanon. The platform, "Regenerate Lebanon," is an open-source online platform visualizing interconnected environmental and infrastructural issues around the country and connecting people to solutions.

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.

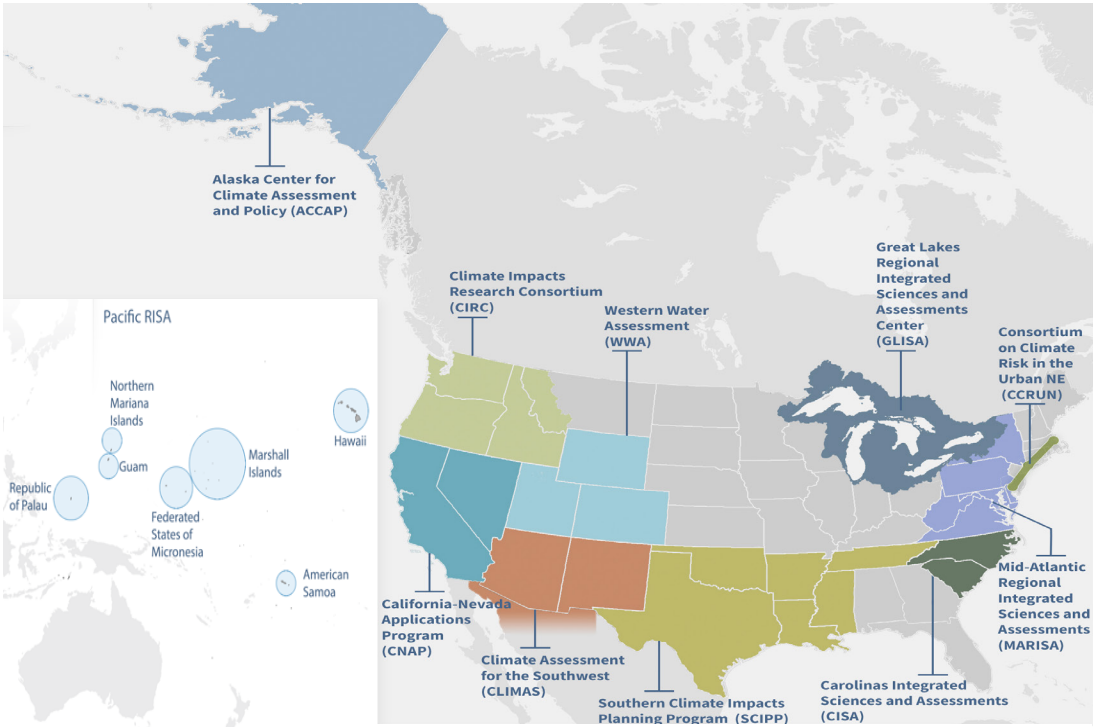


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions