Contributors

Ben McMahan
SWCO Editor; Assistant Research Scientist
(CLIMAS, Institute of the Environment)

Mike Crimmins
UA Extension Specialist

Dave Dubois
New Mexico State Climatologist

Gregg Garfin
Founding Editor and Deputy Director of Outreach, Institute of the Environment

Nancy J. Selover
Arizona State Climatologist

Published by the Climate Assessment for the Southwest (CLIMAS), with support from University of Arizona Cooperative Extension, the Arizona State Climate Office, and the New Mexico State Climate office.

February Southwest Climate Outlook

January Precipitation and Temperature: January was wetter-than-normal across much of northern Arizona and New Mexico, near-normal in southern Arizona, and below-normal across most of southern New Mexico (Fig. 1). January temperatures were normal to above-normal (Fig. 2). Winter storms brought wet and cool conditions to the region in February – including some heavy snow forecast later in the week of Feb 18. These storms feel like a departure, but may simply be closer to normal winter conditions in the Southwest, with expectations having shifted after persistent warm and dry winter conditions over the past few years or decades.

Seasonal & Annual Precipitation and Temperature: Nov-Jan precipitation was mostly normal to below-normal across Arizona and most of New Mexico (Fig. 3), while the temperature rankings were normal to above-normal in Arizona, and below-normal to above-normal in New Mexico. Water year precipitation includes a particularly wet October, and most of the Southwest recorded above-normal precipitation since Oct. 1, while 12-month totals highlight above-normal precipitation in southern Arizona and New Mexico, and persistent precipitation deficits in the four corners region (Fig. 4).

Drought: The Feb. 14 U.S. Drought Monitor (USDM) shows modest but widespread improvements in regional drought conditions, with much of Arizona and the four corners region seeing up to two levels of improvement in their drought designation (Fig. 5). Persistent drought conditions remain in the Four Corners region, although characterizations of drought extent and intensity are reduced on this map. Accumulated precipitation deficits built up over seasons and years, and weekly snapshots may struggle to capture the nuance of drought conditions that work across multiple timescales. This also applies to drought recovery, where above-normal precipitation in the short term is likely insufficient to make up for years of drought, but above-normal cool season precipitation should help in both short and long-term timescales.

Snowpack & Water Supply: Snow water equivalent (SWE) increased since last month. SWE values (as of Feb. 20) in northern Arizona and New Mexico are near normal, ranging from 90-110 percent of average, while southern stations are lower, ranging from less than 25-percent to 75-percent of average (Fig. 6). Heavy snowfall forecast for Feb 21-22 would increase these values considerably, but it remains to be seen how widespread this event will be in the Southwest. Reservoir storage remains a persistent concern, as water levels have been impacted by long-term drought and accumulated precipitation deficit. Most of the reservoirs are at or below their long-term averages, and a few of the Rio Grande reservoirs are especially low (see Arizona and New Mexico reservoir storage on p. 4).

El Niño Tracker: In the on-again, off-again saga, we are back "on" for a weak El Niño in 2018-2019, with a possible second year of El Niño in 2019-2020 (reminiscent of the sequence in 2014-2015 and 2015-2016). The atmospheric conditions are finally catching up with the ocean, and while the equatorial waters had cooled, they remain borderline weak El Niño, and a pulse of warm sub-surface water is poised to help. What this means for the Southwest, especially in the cool season that remains, is up in the air (see El Niño tracker on p. 3 for details). Given a choice, and considering the accumulated drought conditions over the past months and years, anything that hints at wetter and cooler than average conditions – or even to simply have a 'normal' southwestern winter – is welcome.

Precipitation and Temperature Forecast: The three-month outlook for March through May calls for increased chances of above-normal precipitation in most of Arizona, New Mexico, west Texas, and northern Sonora (Fig. 7, top). The three-month temperature outlook calls for slightly increased chances of above-normal temperatures in pockets of Arizona and Sonora, but otherwise would suggest equal chances of above, below, and near normal temperatures (Fig. 7, bottom).

Tweet Feb 2019 SW Climate Outlook

CLICK TO TWEET

FEB2019 @CLIMAS_UA SW Climate Outlook, El Niño Tracker, CLIMAS Environment & Society Graduate Fellows, AZ & NM Reservoir volumes bit.ly/2NiQDK8 #SWclimate #AZWX #NMWX

February 2019 SW Climate Outlook

Online Resources

Figures 1-4,6
Western Regional Climate Center
wrcc.dri.edu

Figure 5
U.S. Drought Monitor
droughtmonitor.unl.edu

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

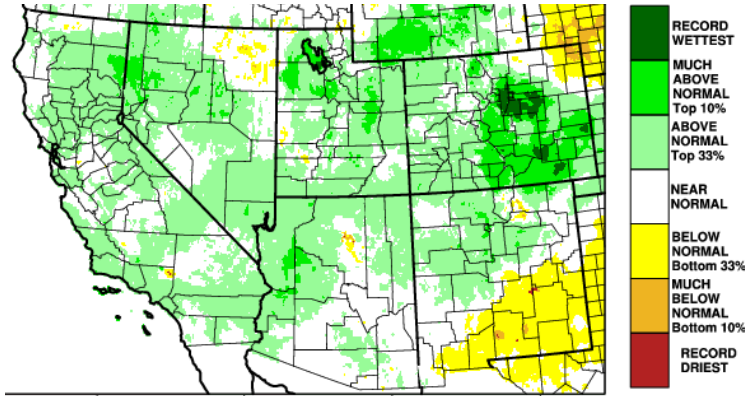


Figure 1: Jan 2019 - Precipitation Rankings

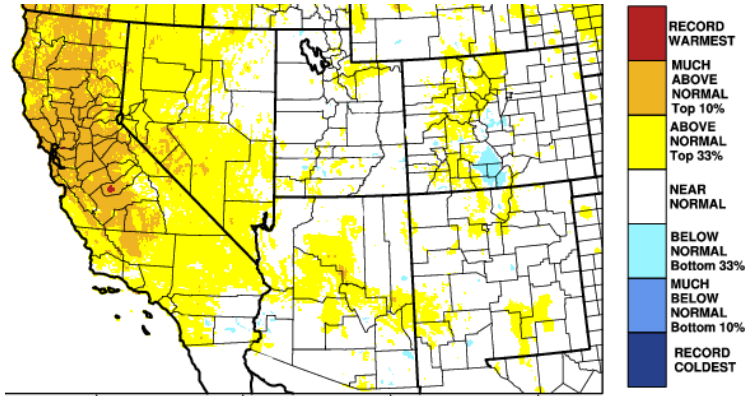


Figure 2: Jan 2019 - Temperature Rankings

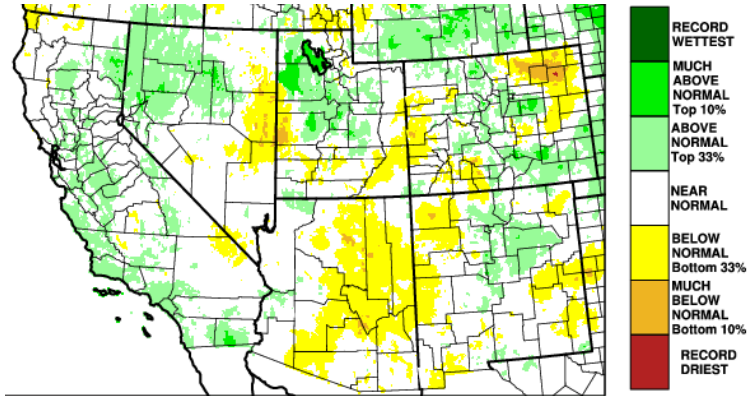


Figure 3: Nov 2018 - Jan 2019 - Precipitation Rankings

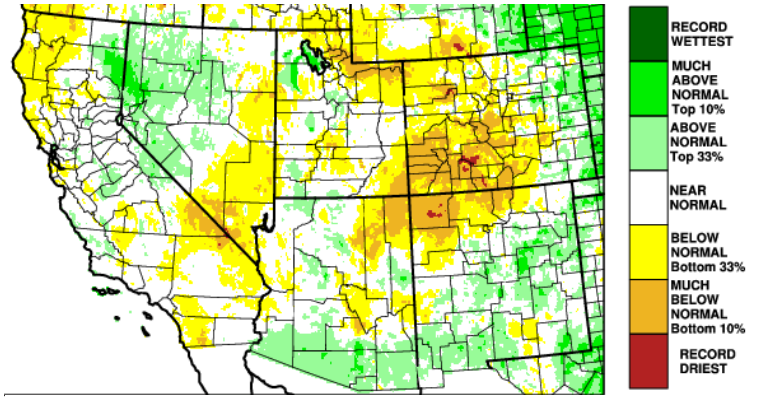


Figure 4: Feb 2018 - Jan 2019 - Precipitation Rankings

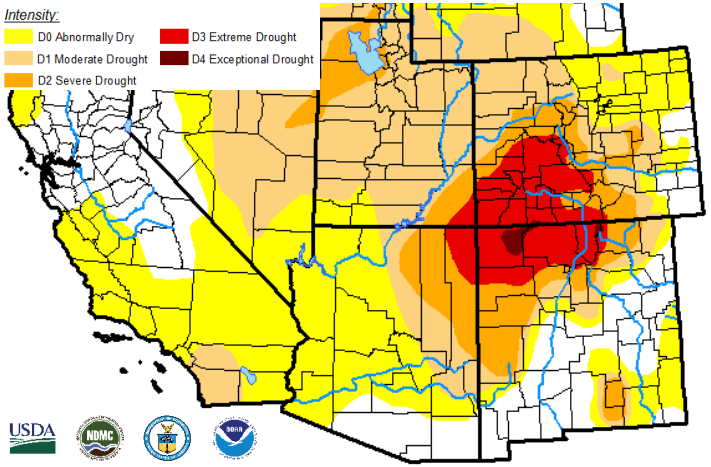
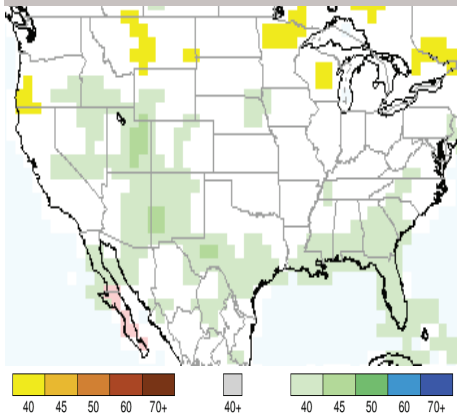


Figure 5: US Drought Monitor - Feb 12, 2019



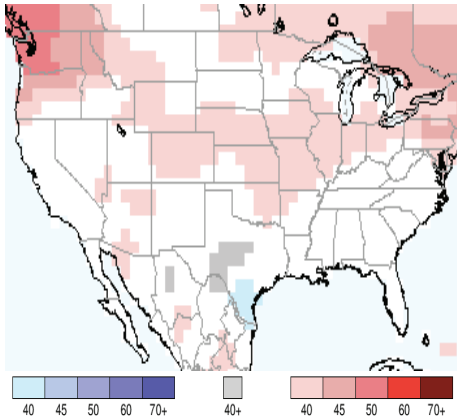


Figure 7: Three-Month (MAM) Forecast for Precipitation (top) and Temperature (bottom)

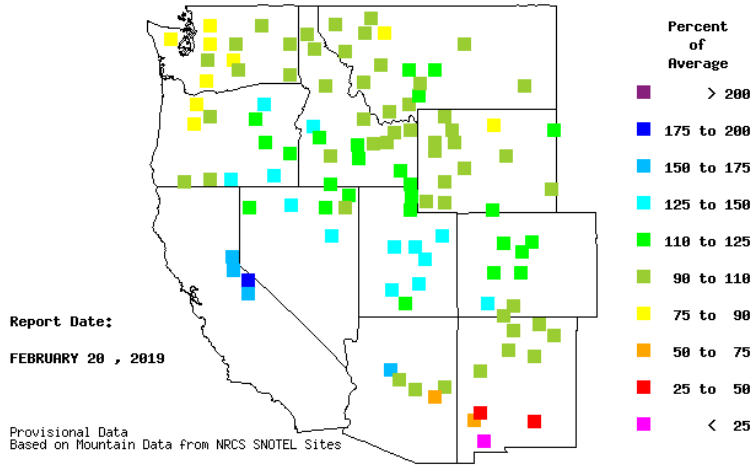


Figure 6: Snow Water Equivalent (SWE) - Feb 20, 2019

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

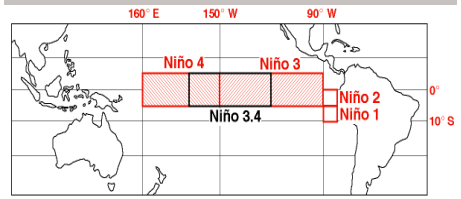
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

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/

El Niño Tracker

After months of El Nino on the horizon (but each month not appearing to get any closer), forecasters have identified the convergence of atmospheric and oceanic conditions that indicate the presence of a weak El Nino event. This is expected to last through spring, although there is not complete agreement across the international agencies. On Feb. 12, the Japanese Meteorological Agency (JMA) maintained their assertion of the presence of El Niño conditions in the equatorial Pacific and called for a 70-percent chance of these conditions lasting until summer 2019. On Feb. 14, the NOAA Climate Prediction Center (CPC) switched to an El Nino advisory, given the convergence of oceanic and atmospheric conditions, as well as warm subsurface waters on the way, but their outlook dropped to a 55-percent chance of an El Niño lasting through spring. On Feb.19, the Australian Bureau of Meteorology remained in an El Nino watch, reflecting the increased chance of an El Nino developing over spring and summer. On Feb. 19, the International Research Institute (IRI) issued an ENSO Quick Look, highlighting above-average sea surface temperatures (SSTs), warm subsurface waters, and the development of atmospheric conditions over the past few months. They maintained a 65-percent chance of an El Niño Feb-Apr, and a 50-percent chance Apr-Jun (Fig. 3). The North American Multi-Model Ensemble (NMME) points toward a weak El Niño at present lasting through spring 2018 (Fig. 4).

Summary: Sea surface temperatures (SSTs) are still above-average across the equatorial Pacific (Figs. 1-2), and atmospheric conditions finally caught up – the question is: will it be too late for the Southwest, or have we already been observing borderline weak El Nino impacts? The delayed convergence of oceanic and atmospheric conditions was the main factor holding back a more confident outlook, but 2018-2019 looks like it will be classified as a weak El Nino event. In the Southwest, El Nino is associated with increased chances for above-normal winter precipitation, but weak events demonstrate limited correlation with increased precipitation, and some of the wettest winters in the Southwest have been under ENSO-neutral conditions. Winter thus far in parts of Arizona and New Mexico line up with the narrative of winters under El Nino, but direct attribution is challenging given small sample size, aforementioned weak correlations, and the challenges in tracking precipitation anomalies in a region that already sees relatively infrequent rain events in a "wet" year. Additionally, it remains to be seen whether this will turn out to simply be a normal southwestern winter, which only feels wetter and cooler after multiple warm and dry winters altered expectations.

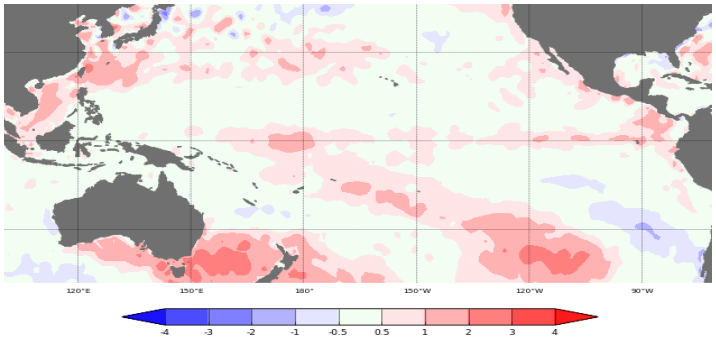


Figure 1: January 2018 Sea Surface Temperature (SST) Anomalies

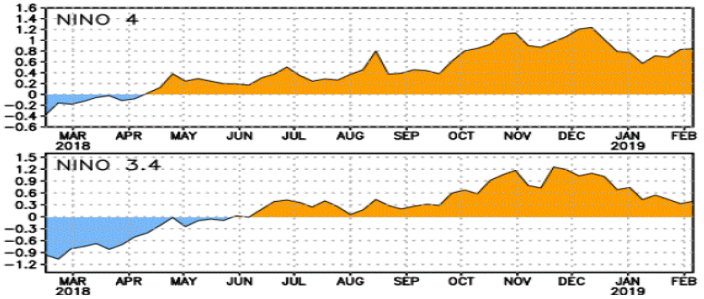


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

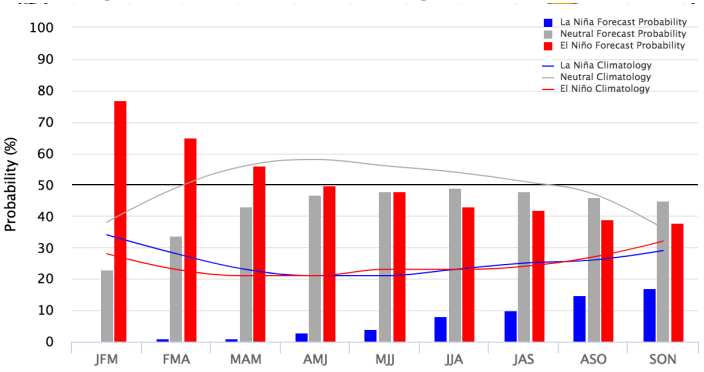


Figure 3: Early-Feb IRI/CPC Model-Based Probabilistic ENSO Forecast

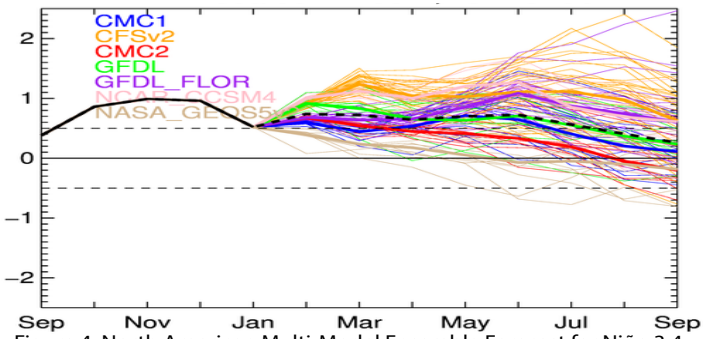


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

Portions of the information provided in this figure can be accessed at the Natural Resources Conservation Service

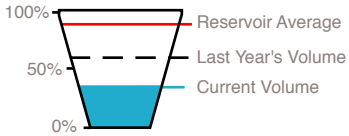
www.wcc.nrcs.usda.gov/BOR/basin.html

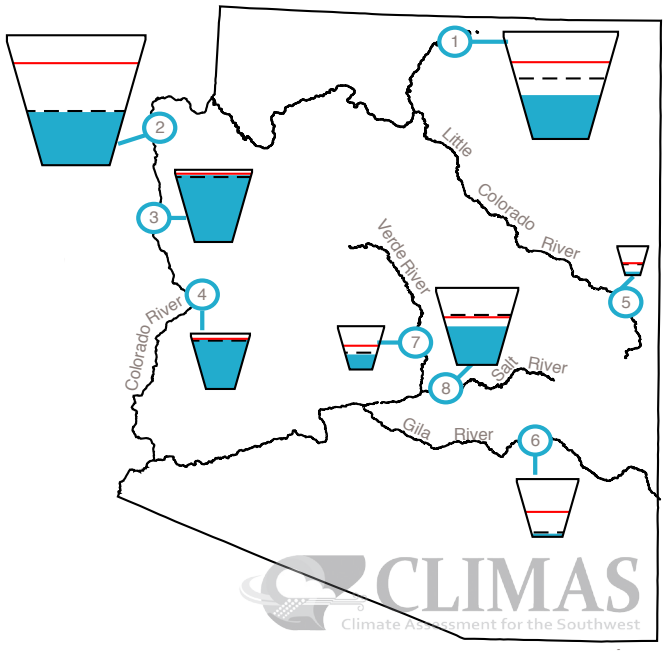
Contact Ben McMahan with any questions or comments.

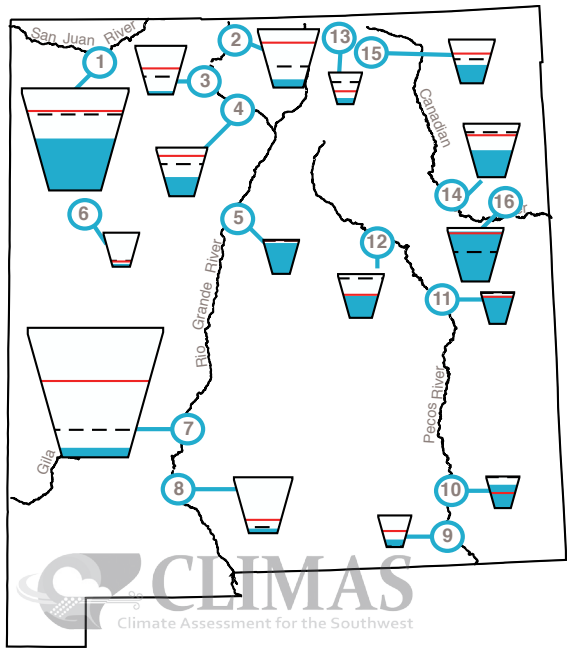
Reservoir Volumes

DATA THROUGH FEB 1, 2019

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	40%	9,629.2	24,322.0	-469.6
2. Lake Mead	40%	10,495.0	26,159.0	363.0
3. Lake Mohave	92%	1,666.0	1,810.0	32.0
4. Lake Havasu	90%	555.8	619.0	3.4
5. Lyman	12%	3.7	30.0	0.0
6. San Carlos	4%	31.8	875.0	12.3
7. Verde River System	35%	101.0	287.4	14.8
8. Salt River System	50%	1015.7	2,025.8	21.7

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	51%	869.1	1,696.0	-9.6
2. Heron	14%	56.1	400.0	-0.2
3. El Vado	7%	14.0	190.3	1.5
4. Abiquiu	39%	72.2	186.8	-5.9
5. Cochiti	90%	45.1	50.0	1.5
6. Bluewater	8%	3.1	38.5	0.0
7. Elephant Butte	7%	143.4	2,195.0	28.6
8. Caballo	8%	27.4	332.0	0.7
9. Lake Avalon	24%	1.1	4.5	1.1
10. Brantley	73%	30.6	42.2	0.9
11. Sumner	89%	31.8	35.9	3.2
12. Santa Rosa	50%	53.3	105.9	-0.1
13. Costilla	19%	3.0	16.0	3.0
14. Conchas	51%	129.5	254.2	-0.1
15. Eagle Nest	42%	33.4	79.0	0.1
16. Ute Reservoir	93%	186	200	0.0

Notes

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).

CLIMAS

Environment & Society Graduate Fellows Program

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.

For more information about the program: climas.arizona.edu/education/fellowship-program

2018 CLIMAS Environment and Society Fellows

Beyond the Ranchers-Versus-City Narrative of the Owens Valley Water Conflict

Sophia Borgias

The conflict over the City of Los Angeles' extraction and export of water from California's Owens Valley has long captivated the public and policymakers alike. However, narratives about the Owens Valley water conflict have often fixated on the demise of the agricultural economy at the hands of the Los Angeles Department of Water and Power (LADWP) in the early 20th century. Though often described as an act of theft and lawlessness, Los Angeles' acquisition of 95% of the valley's land and water was in fact authorized under the law and facilitated by the federal government in the name of "the greatest good of the greatest number in the long run." But, over the 105 years since the Los Angeles Aqueduct was completed, notions of what constitutes the greatest good – and the long run, for that matter – have shifted. Read more: https://bit.ly/2Mhk8LZ

Hunting for Black Gold

Stephanie Doerries

With the aid of my headlamp, I check the contents of my backpack in the pre-dawn darkness. Food, water, vials, coin envelopes...check. I strap a shovel to the outside of my pack and swing it across my shoulders with a huff, shrugging to adjust the weight. Two and a half gallons of water is not light, but I'll drink most of it over the course of the next 12 hours. A warm breeze blowing across the Pinta Sands, a remote area on the Cabeza Prieta National Wildlife Refuge, hints at the heat to come. I sling the strap of my binoculars over my shoulder and start walking at a brisk pace so I can cover the three plus miles to the first wildlife water before sunrise. If I'm lucky, I'll see a pronghorn at the edge of the playa—a dried lakebed—like I did last year.

Read more: https://bit.ly/2QTSGVe

Groundwater in Southern Arizona: People, Perceptions, and Policies

Tamee Albrecht

The fan made it difficult to hear, but the room was hot. Attendees were seated in tightly spaced rows, shoulder-to-shoulder. It was the Southeast Arizona Citizen's Forum—a public meeting of the International Boundary and Water Commission that brings together stakeholders interested in water resources in the U.S.-Mexico border region. As each person stood up to introduce themselves the diversity of stakeholders became even more apparent—representatives from U.S. Senator's offices, state agency scientists, water utility professionals, local farmers, citizen activists, NGO employees, and concerned residents. They gathered to discuss water—each bringing a unique perspective.

Read more: https://bit.ly/2QUvXs3

Understanding Farmers' Choices, Trade-Offs, and Barriers for Selecting Land Management Practices in Northern Ghana

Marie Blanche Roudaut

In June and July of 2018, I conducted field work in the Bawku East and Nabdam Districts located in the Upper East region of northern Ghana. This is a semi-arid region that has been historically one of the least developed areas in the country. This regional inequality is in part related to the country's colonial past, a growing population, low soil fertility, increasing environmental degradation, period droughts, and erratic rainfall. My research focuses on understanding the socio-economic and ecological drivers of land degradation in this region of Ghana as well as understanding the barriers that prevent farmers from adopting sustainable land management practices (SLM) to combat land degradation.

Read more: https://bit.ly/2QTSGVe

CLIMAS

Environment & Society Graduate Fellows Program

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.

For more information about the program: climas.arizona.edu/education/fellowship-program

CLIMAS
Climate Assessment for the Southwest
A NOAA RISA TEAM

2019 Fellows

Introducing the 2019 cohort of the CLIMAS Environment and Society Graduate Fellows

Alma Anides Morales

Alma's project is in collaboration with Cochise Health and Social Services to sample and analyze the chronic untreated effluent flowing north into Naco, Arizona, a town of about 1,000 residents in the US-Mexico border. The sewage flows are a community concern as sewage flow is in close proximity to a school, private property, and eventually discharges into tributaries of the San Pedro River. The study will center on the determining potential environmental impacts and health risks for residents. Information produced will be used to help inform residents and assist CHSS in their preparedness and response to such events.

Norma Villagomez-Márquez

Norma Villagómez-Márquez has a background in Environmental Engineering investigating the role of advanced membrane technologies such as reverse osmosis (RO), nanofiltration (NF) and electrodialysis reversal (EDR) in water treatment, primarily desalination. As a member of the organic analysis team within Project Harvest: Be Informed-Grow Smarter, she is engaging community members through citizen science about the health of their harvested rainwater, soil, and plants. Norma's doctoral research examines the presence of emerging contaminants in roof-harvested rainwater using analytical techniques, particularly liquid chromatography-high-resolution mass spectrometry (LC-HRMS). As a 2019 Environment & Society Fellow Norma will create an illustrative children's book that will spark interest in water conservation alternatives by addressing the global water crisis and the vital role rainwater harvesting will have when it comes to maximizing our existing water supply.

Nupur Joshi

Nupur is an urban geographer interested in studying urbanization and development in African and Indian cities. Her doctoral dissertation is based in low-income settlements of Nairobi, Kenya. Through a mixed-methods approach, she is conducting a spatial analysis of informal water infrastructures (locally called 'water cartels') and their health implications on women. She conducts research with women community members, Nairobi County government officials, non-profit groups and cartels themselves, to understand water quality, affordability and accessibility issues.

Sean Schrag-Toso

Increasing variance in groundwater recharge conditions due to climate change and increasing demand for groundwater have residents and stakeholders with the Sonoita Creek Watershed in Southeastern Arizona concerned about future groundwater and surface water flow conditions. To address these concerns, a two-stage project is proposed. The first phase is an analysis of isotope ratios and the geochemistry of local springs to create a conceptual model of groundwater flow. These insights, coupled with available data and knowledge on the hydrology of the area will guide the second phase. The second phase is the creation of a monitoring plan that is within a local citizen science group's resources, capabilities, and level of enthusiasm. The plan will expand the current efforts of the Citizen Science group to include monitoring of spring flow around Harshaw Creek; a tributary of Sonoita Creek, with its headwaters in the Patagonia Mountains, and other vulnerable tributaries. The data collected by the group will contribute to future hydrologic studies within the basin and aid in making management decisions around water use by the Town Council. In addition, the project will empower stakeholders and well owners to be vigilant about monitoring their water supply through documenting and monitoring the effects of varying precipitation and groundwater use on spring flow and the groundwater table.

Online Resources

Figure 1
Climate Program Office
cpo.noaa.gov

RISA Program Homepage

http://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 (UA) Institute of the Environment—is a collaboration between UA 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

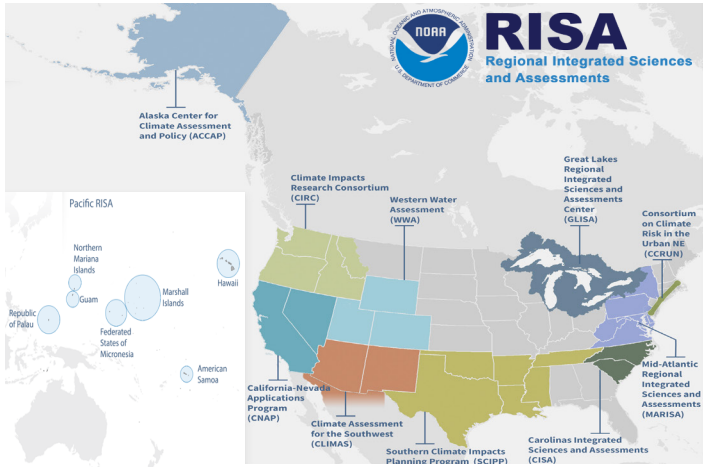


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions

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.

Workshop - Monitoring and Reporting Drought in Arizona

Wed, March 6, 2019 - 9:00 AM – 4:00 PM MST - Scottsdale, AZ

https://bit.ly/2XgL7w7

Join experts from the National Drought Mitigation Center, the Arizona Drought Monitoring Technical Committee, and the USDA for a one-day workshop to learn about and discuss:

The U.S. Drought Monitor · Drought Tools and Resources · Increasing the coverage of ground-measured precipitation data in AZ · Opportunities and technologies for drought impact reporting ·

Primary objectives include:

To share how the Arizona Drought Monitoring Technical Committee (DMTC) gathers data about Arizona drought, climate and weather, what type of information goes into Arizona drought reports, who is contributing this information – and most importantly – where the DMTC needs more information about drought impacts.

To demonstrate how U.S. Drought Monitor (USDM) maps are made, and how important DMTC information is to map accuracy.

To discuss opportunities for improving the coverage of precipitation monitoring and drought impacts reporting in AZ.

The draft agenda can be found here: https://bit.ly/2T3t5eh

Questions?

Contact Caiti Steele: tel. 575-646-4144, email. caiti@nmsu.edu

Podcasts in the Southwest

In addition to the CLIMAS Southwest Climate Podcast, available here:

climas.arizona.edu/media/podcasts

There is a new podcast running out of New Mexico, focused on climate change in New Mexico, check it out!

hotdry.org