WE WANT YOUR FEEDBACK - SEE PAGE 8

May Southwest Climate Outlook

Precipitation & Temperature: April precipitation was average to above average in New Mexico, while most of Arizona was below average, including much-below average and record-dry conditions in the southwestern corner of the state (Fig. 1a). April temperatures were above average in nearly all of Arizona and New Mexico, with much-above average temperatures in southern Arizona (Fig. 1b). May has been dry in southern Arizona and New Mexico, while parts of northern Arizona and northern and eastern New Mexico have picked up decent precipitation relative to the normally dry May climate (Fig. 2). May temperatures in Arizona and New Mexico have ranged from 4 degrees below to 4 degrees above normal, while temperatures in higher latitudes and upper elevations (e.g. Upper Colorado River Basin, California Sierras, etc.) have been generally warmer than average, ranging from 0 to 8 degrees above normal. Water year precipitation has been normal to above normal across most of Arizona and New Mexico aside from a small pocket of dry conditions along the Arizona-Mexico border (Fig. 3).

Snowpack & Water Supply: Snowpack and snow water equivalent (SWE) have declined in Arizona and New Mexico as well as in the Upper Colorado River Basin region of Utah and Colorado (Fig. 4). While areas of well-above-average snowpack and SWE remain, particularly in the Great Basin and the California Sierras, persistent warm temperatures are reducing once-impressive snowpack levels back to normal. This has resulted in some remarkable streamflow forecasts, as well as incremental improvements in reservoir storage volumes (see reservoir levels, p. 7).

Drought: Much of the West has seen improvements in drought conditions, and only 5.2 percent of the contiguous United States is now designated as experiencing moderate drought (D1) or worse. The wetter-than-normal conditions that helped reduce drought conditions across much of the West (see Fig. 3) provided limited relief (if any) in southern Arizona and New Mexico, which have experienced a return of both short- and long-term drought designations (Fig. 5). These changes are due to both near-record- to record-warm temperatures in recent months and very little precipitation falling since mid-January.

Wildfire, Environmental Health, & Safety: The transition from spring into summer brings rising temperatures, little precipitation, and frequent high winds that create highly favorable conditions for fire ignition and spread. As noted last month, fire managers are increasingly vigilant during this transitional season. This year, fire conditions have been enhanced by the senescence of grasses that thrived under the moisture of last fall and warm temperatures this winter into spring, and have now left behind a pervasive blanket of fine fuels that exacerbate wildfire risks, especially during hot, dry, windy days. The Sawmill fire of 2017 perfectly encapsulates this cluster of conditions (see pp. 3-5 for wildfire report). The warm and dry weather also produces dry and dusty conditions that prompt ongoing health and safety concerns such as dust exposure and traffic visibility.

El Niño Southern Oscillation: Current forecasts suggest ENSO-neutral conditions will continue through the spring and early summer, with approximately equal chances of an El Niño event or ENSO-neutral conditions during the second half of 2017.

Precipitation & Temperature Forecast: The May 18 NOAA Climate Prediction Center's outlook for June calls for equal chances of above- or below-average precipitation for most of the Southwest, and increased chances of above-average temperatures across the region. The three-month outlook for June through August calls for equal chances of above- or below-average precipitation in Arizona and much of New Mexico with only the northeast corner of New Mexico expecting increased chances of above-average precipitation (Fig. 6, top). Increased chances of above-average temperatures are forecast for the entire southwestern region (Fig. 6, bottom).

Tweet May SW Climate Outlook CLICK TO TWEET

MAY2017 @CLIMAS_UA SW Climate Outlook, Wildfire Report, ENSO Tracker, Reservoir Volumes http://bit.ly/2r12eFf #SWclimate #AZWX #NMWX #SWCO

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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.

Online Resources

Figure 1
National Center for Environmental Information
http://www.ncdc.noaa.gov

Figure 2
High Plains Regional Climate Center
http://www.hprcc.unl.edu/

Figures 3-4
Western Regional Climate Center
http://www.wrcc.dri.edu/

Figure 5
U.S. Drought Monitor
http://droughtmonitor.unl.edu/

Figure 6
NOAA - Climate Prediction Center
http://www.cpc.ncep.noaa.gov/

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www.climas.arizona.edu/media/podcasts

May 2017 Southwest Climate Outlook

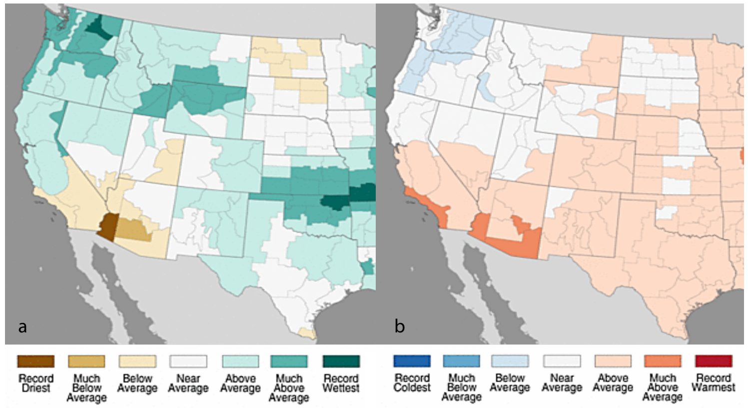


Figure 1: Apr 2017 Precipitation (a) & Temperature Ranks (b)

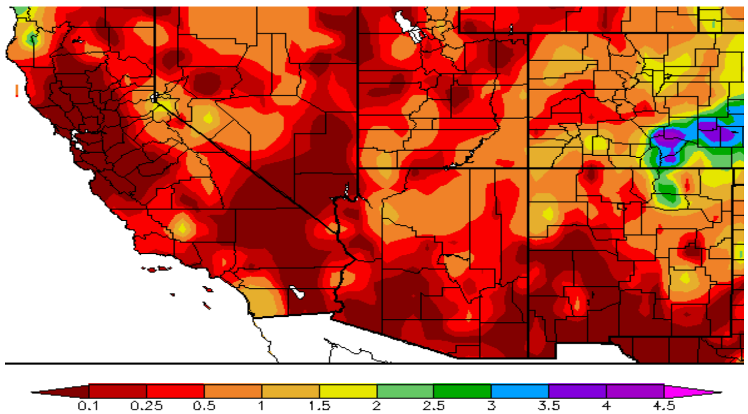


Figure 2: May 2017 - Precipitation (in.) 5/1 - 5/18/2017

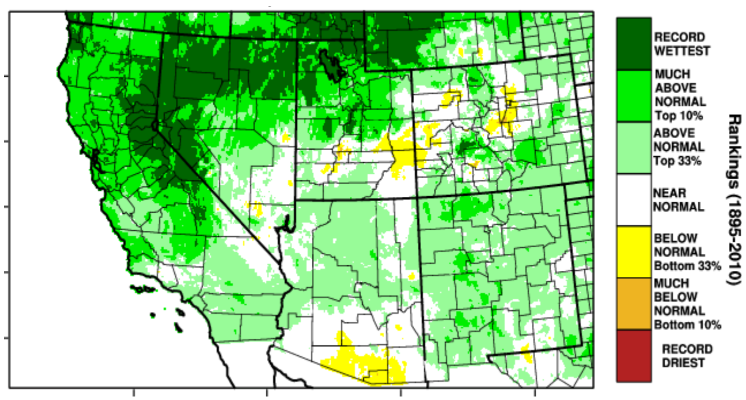


Figure 3: Water Year Precipitation Percentiles Oct 2016 - Apr 2017

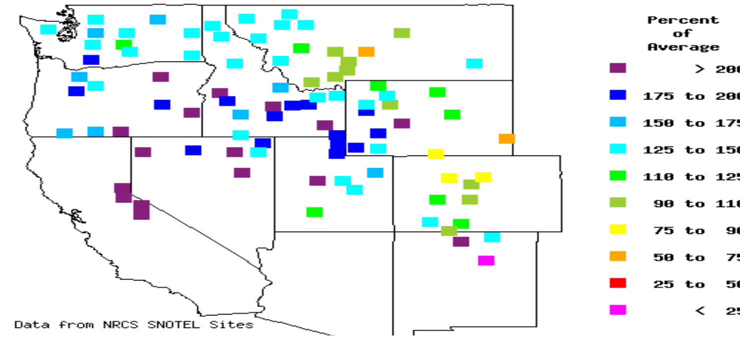


Figure 4: Basin Percent of Average Snow Water Equivalent (May 18, 2017)

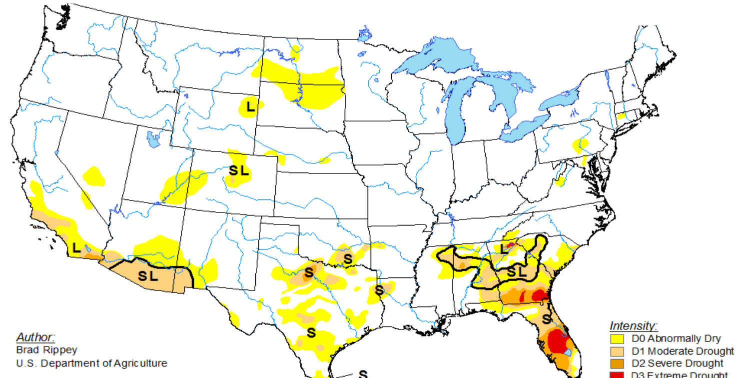


Figure 5: US Drought Monitor - May 16, 2017

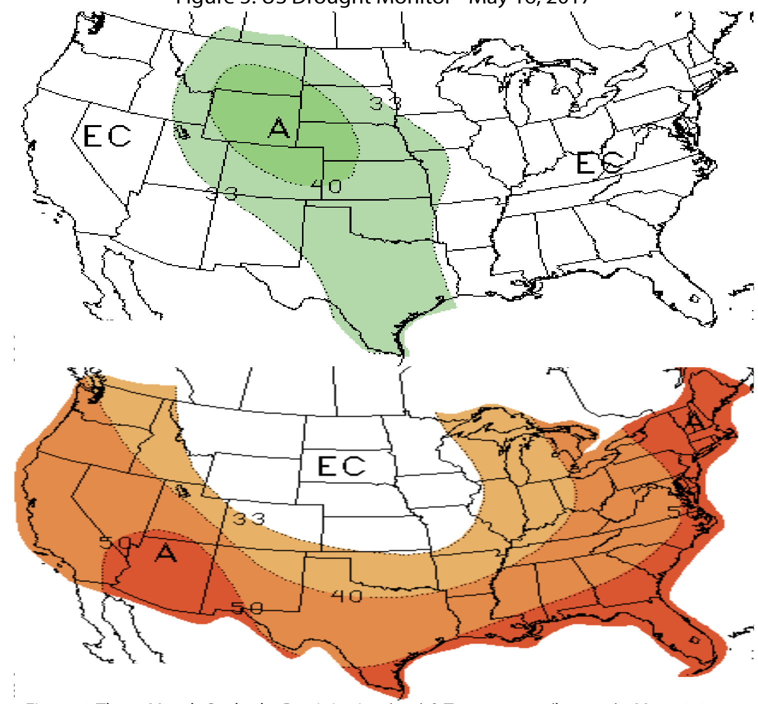


Figure 6: Three-Month Outlook - Precipitation (top) & Temperature (bottom) - May 18, 2017

Online Resources

Figure 1
Inciweb - Incident Info. System
http://inciweb.nwcg.gov/

Figure 2
Sawmill Fire 2017
http://twitter.com/SawmillFire2017

Figure 3
CLIMAS: Climate Assessment for the Southwest
http://climas.arizona.edu

Wildfire Resources

Southwest Coordination Center
https://gacc.nifc.gov/swcc/

National Interagency Fire Center
https://gacc.nifc.gov/swcc/

Wildfire Report - Sawmill Fire

The Sawmill fire (Fig. 1) started, reportedly by recreational shooting, on April 23, 2017 in a grass- and shrub-covered area of low-elevation Arizona state lands approximately 40 miles south of Tucson. The fire spread quickly due to dry and windy conditions that day: the temperature reached 98 degrees, relative humidity ranged between 4 and 18 percent, and sustained winds reached 20 mph with gusts up to 30 mph. High winds, high temperatures, and low relative humidity continued through much of the following week, driving rapid growth of the fire (Fig. 2).

The strong winds whipped the fire along, challenging ground-level fire-line containment efforts and repeatedly grounding aerial support. Numerous communities and rural households were evacuated, and wildfire management was eventually escalated to a type 1 incident management team. At peak effort, nearly 800 firefighters and multiple aerial tankers were deployed to fight the fire, slow the spread, and protect communities and structures. Initial estimates of the fire put the total acreage burned at 46,991 acres, making it the 14th largest wildfire in Arizona history (Fig. 3).

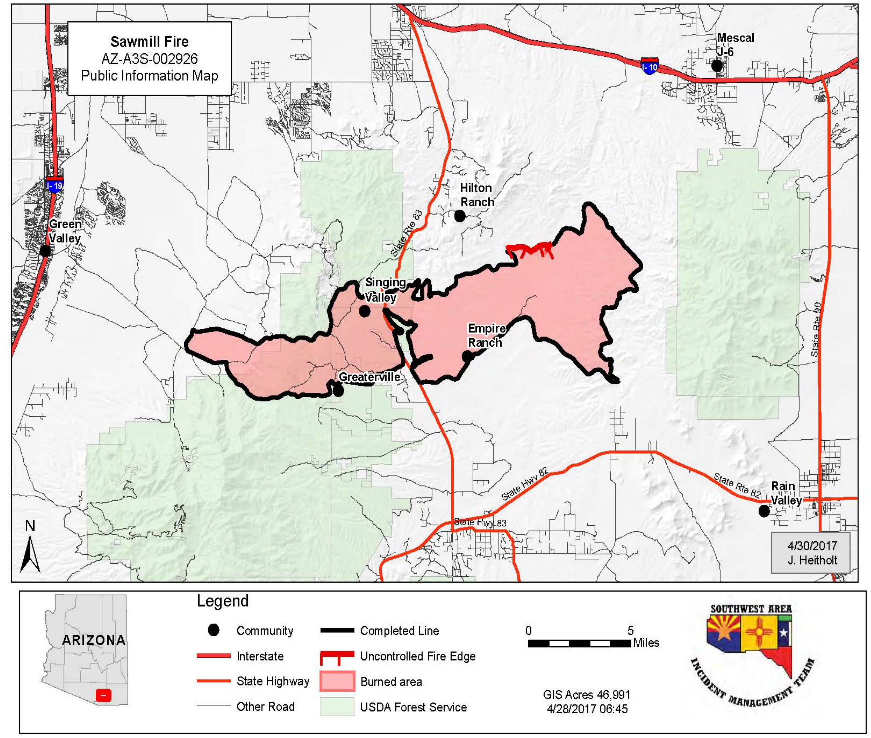


Figure 1: Inciweb - Public Information Map - Sawmill Fire Update 4/30/2017

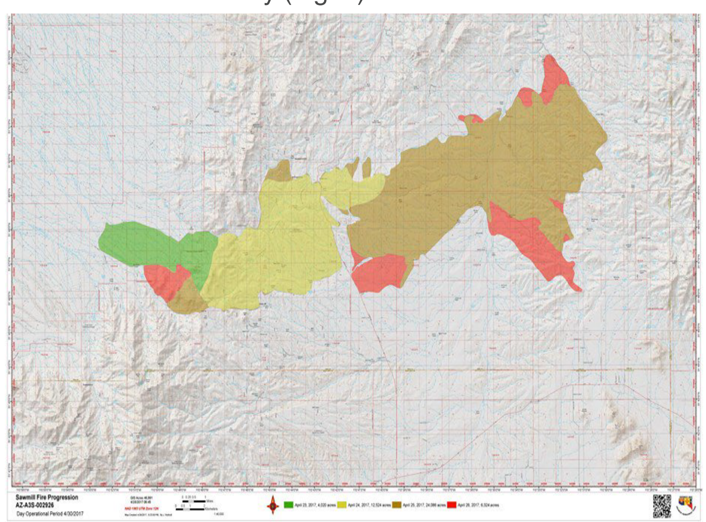


Figure 2: Sawmill Fire 2017 (Apr 23: Green, Apr 24: Mustard, Apr26: Brown, Apr 28: Red)

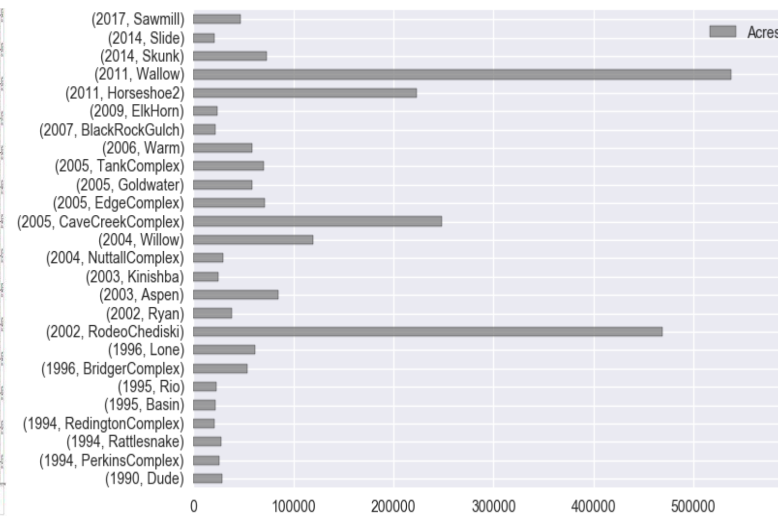


Figure 3: Largest Arizona Wildfires (1990-2017)

(continued on next page)

Online Resources

Figure 4
Southwest Coordination Center
https://gacc.nifc.gov/swcc/

Figure 5
National Interagency Fire Center
https://gacc.nifc.gov/swcc/

Figures 6,8
WestWide Drought Tracker
http://www.wrcc.dri.edu/wwdt/

Figure 7
UA Drought View - Climate Science Applications Program
https://droughtview.arizona.edu/
https://cals.arizona.edu/climate/

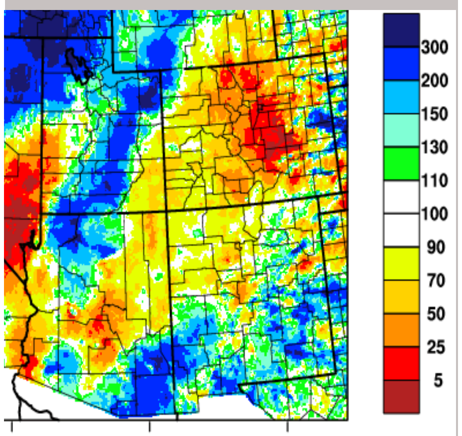


Figure 6: Sept 2016 Precipitation Percent of Normal

Wildfire Season in the Southwest / Sawmill Fire

In the Southwest, peak seasonal wildfire danger varies across the region, ranging from early-mid-May to early June in eastern New Mexico, to late June in western Arizona (Fig. 4). This roughly corresponds to the progression of the monsoon, which brings some relief to the hot and dry conditions that characterize late spring and early-to-mid summer, although dry lightning associated with early monsoon storms sometimes serves as an ignition source for wildfire. June and early July are characterized by the warmest and driest conditions, reaching the peak of the warm-up and dry-out period of late spring into summer.

While fire is possible during most of the year, most wildfire activity clusters in this warm/dry summer period (Fig. 5). The Sawmill fire demonstrates that large fires are possible outside of the peak of summer wildfire season, and was likely the culmination of a set of circumstances that brought about enhanced wildfire risk earlier than is typical in Arizona.

In September 2016, a surge in precipitation associated with hurricane Newton and lingering monsoon activity brought moisture into the Southwest, in particular to the southeastern corner of Arizona where the Sawmill fire broke out (Fig. 6). The rains boosted plant growth and green-up, and by mid-October, above-normal green-up was visible in satellite imagery of the grasslands in the region (Fig. 7).

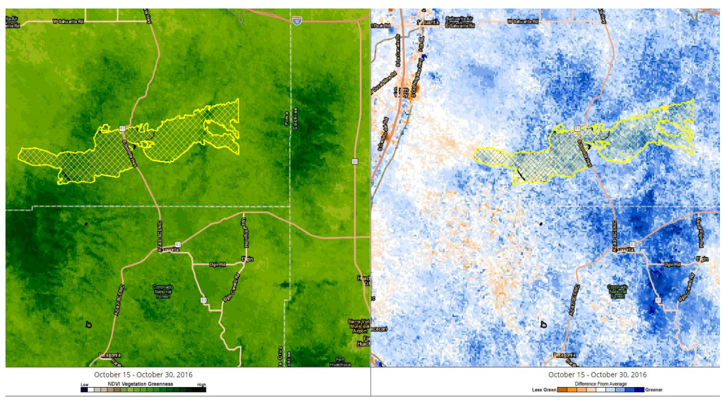


Figure 7: DroughtView Oct 15-Oct 30, 2016 NDVI Greenness (L) & Difference from Average (R)

Following this explosion of new vegetation, the region experienced an extended drier-than-average period, with water-year precipitation totals for the seven-month period of Oct 2016 to April 2017 well-below average in southern Arizona. (Fig. 8). *(continued on next page)*

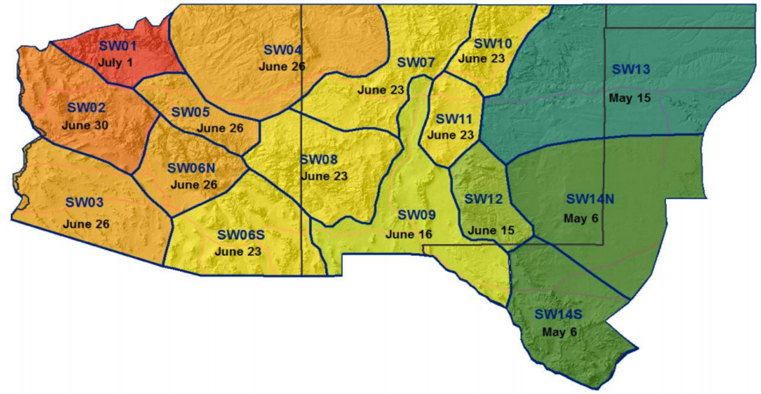


Figure 4: Median Dates - Peak Seasonal Fire Danger by SWCC Predictive Services Area)

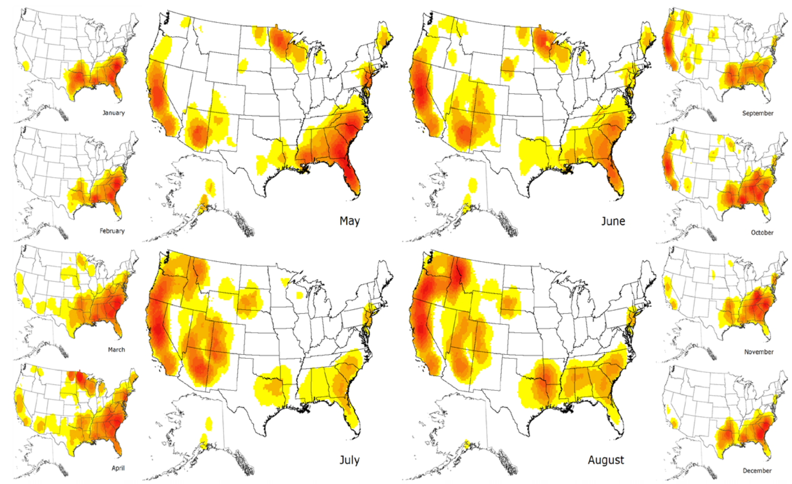


Figure 5: Average Fire Frequency by Month

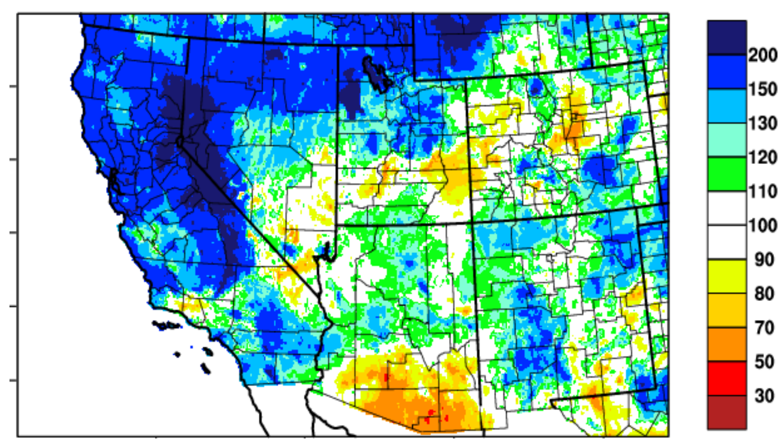


Figure 8: Water Year Precipitation Percent of Normal Oct 2016-Apr 2017

Online Resources

Figures 9-10
High Plains Regional Climate Center
http://www.hprcc.unl.edu/

Figures11-12
National Interagency Fire Center
https://gacc.nifc.gov/swcc/

NY Times, Mar 8,2017
https://www.nytimes.com/interactive/2017/03/08/climate/early-spring.html

Wildfire Season/Sawmill Fire (cont)

Temperatures during the same period were warmer than average across the Southwest, and in some locations approached or set records (Fig. 9). The relative wintertime warmth augmented by early January precipitation further enhanced plant growth. These moderate winter conditions extended the growing season and likely contributed to an early start for spring plant growth and development (for more details see the story in the sidebar about early arrival of spring conditions in 2017, links to a changing climate, and the National Phenology Network).

By late winter, however, heat and lack of precipitation (Fig. 10) had dried out the lower-elevation soils and the new vegetation began to dry out and die. By early-to-mid April, abundant fine fuels had accumulated. Add in strong winds and low relative humidity, and the stage was set for an earlier-than-normal significant wildfire event – all it needed was an ignition source. Although that source was a human, the fire itself, by virtue of its fast-moving nature, did not have severe adverse impacts to the soil and may ultimately be viewed as beneficial to the grasslands.

Wildfire Season Outlook (May 1, 2017)

The fire outlook for the next few months continues to reflect these conditions with above-normal wildfire risk for southern Arizona and New Mexico in May 2017 (Fig. 11), and across most of the southern half of Arizona in June 2017 (Fig. 12).

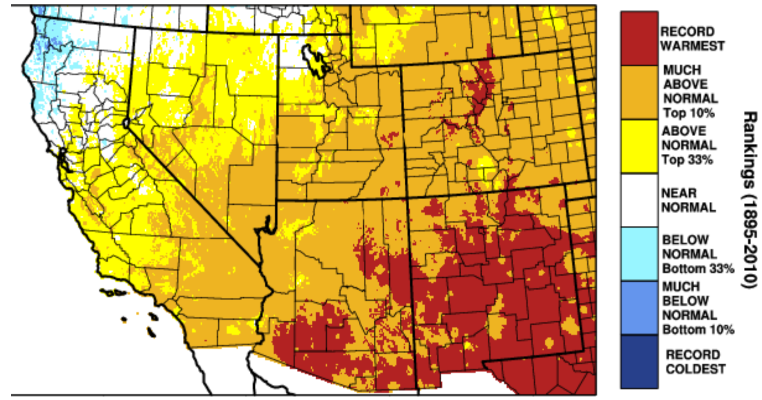


Figure 9: Water Year Temperature Percentiles Oct 2016-Apr 2017

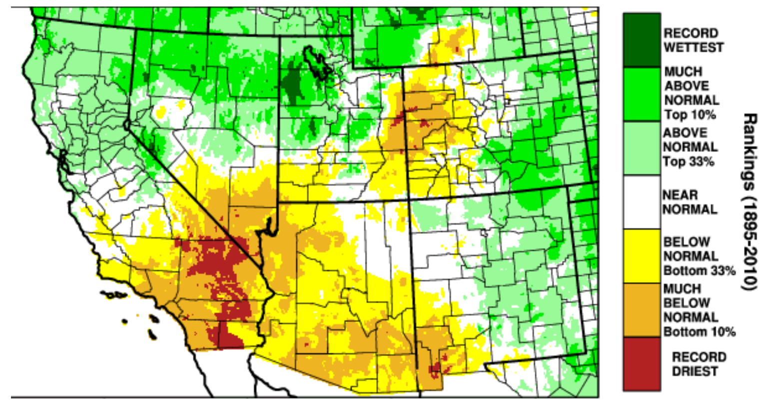


Figure 10: Mar-Apr 2017 Precipitation Percentiles

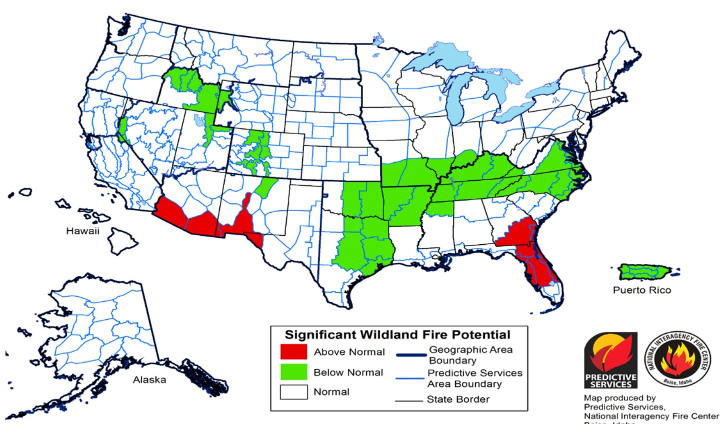


Figure 11: Significant Wildland Fire Potential Outlook - May 2017

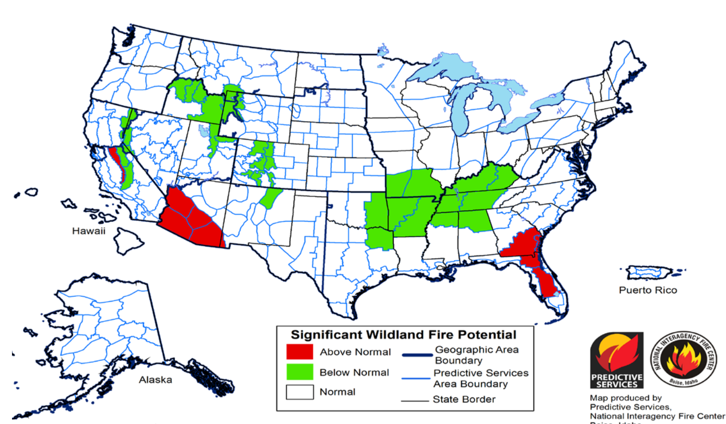


Figure 12: Significant Wildland Fire Potential Outlook - June 2017

Online Resources

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

Figure 2
NOAA - Climate Prediction Center
http://www.cpc.ncep.noaa.gov/

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

Figure 4
NOAA - Climate Prediction Center
http://www.cpc.ncep.noaa.gov/

NOAA - Climate.gov
The Spring Predictability Barrier
http://bit.ly/1Xipsx7

International Research Institute for Climate and Society
http://iri.columbia.edu - #IRIforecast

El Niño / La Niña

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

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

El Niño-Southern Oscillation (ENSO) - Tracker

Oceanic and atmospheric indicators are still within the range of neutral (Figs. 1-2), although sea-surface temperatures have more consistently hinted at El Niño compared to atmospheric indicators. Outlooks and forecasts generally agree that ENSO-neutral conditions are likely to remain through the summer, but by mid-to-late 2017, chances of an El Niño event emerging become approximately equal to the chances of continued ENSO-neutral conditions. On May 9, the Australian Bureau of Meteorology maintained its El Niño Watch with a 50-percent chance of an El Niño event, noting warming sea-surface temperatures but less movement towards El Niño in the atmosphere. On May 11, the NOAA Climate Prediction Center (CPC) observed that oceanic and atmospheric conditions were consistent with ENSO-neutral conditions, but expressed some doubt as to whether warming ocean temperatures would last long enough to reach official El Niño status, and whether coupling between ocean and atmosphere would be sufficient to drive an El Niño event. CPC identified nearly equal chances of El Niño (45%) and ENSO-neutral (50%) conditions during fall 2017, with uncertainty regarding El Niño potential attributed to "the lack of a clear shift toward El Niño in the observational data." On May 12, the Japanese Meteorological Agency (JMA) identified a continuation of ENSO-neutral conditions with a 50-percent chance of El Niño conditions by fall 2017, but like others noted a lack of development in atmospheric conditions that matched the warming sea-surface temperatures. On May 18, the International Research Institute for Climate and Society (IRI) and CPC identified a 60-percent chance of an El Niño in 2017 (Fig. 3) with "dynamical models showing weak El Niño, while statistical (models) predict (an) even weaker event". The North American Multi-Model Ensemble (NMME) is borderline weak El Niño as of May 2017, but the model spread indicates a wide range of possible outcomes for the rest of 2017 (Fig. 4), clustered mostly around ENSO-neutral and weak El Niño conditions, paralleling the uncertainty in the CPC and IRI/CPC outlooks.

Summary: The lack of clear atmospheric indicators of El Niño, the borderline status of sea-surface temperature anomalies, and the waning influence of remnant La Niña conditions together indicate there is not an imminent El Niño event, although it is too early to rule out an event later this year. Outlooks and forecasts this time of year come with the annual caveat regarding increased uncertainty during the "spring predictability barrier," and better predictions will become available over the summer. While this uncertainty makes forecasting difficult, one likelihood that does appear certain is a near-zero probability of a La Niña event in 2017. Other than that exclusionary forecast, it is essentially a coin-flip between El Niño and ENSO-neutral, and the Southwest remains in an El Niño holding pattern until more information is available, and/or conditions become less ambiguous.

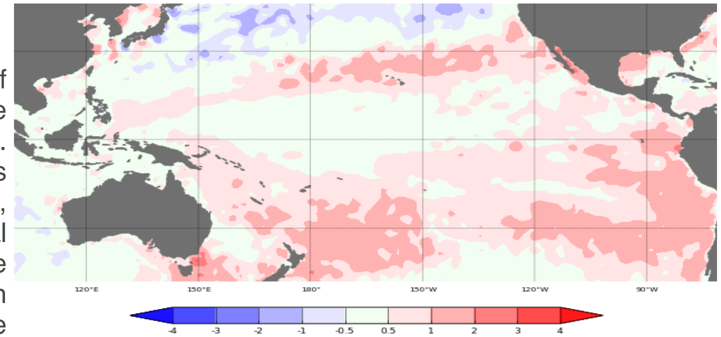


Figure 1: April 2017 Sea Surface Temperature (SST) Anomalies

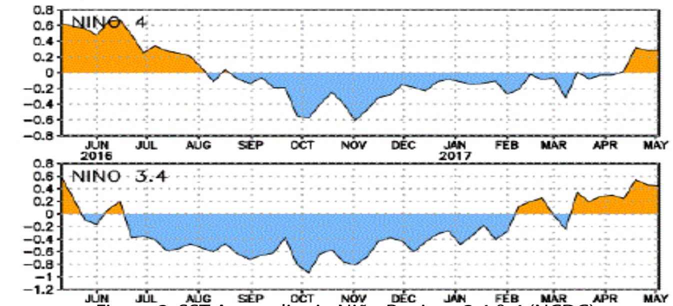


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

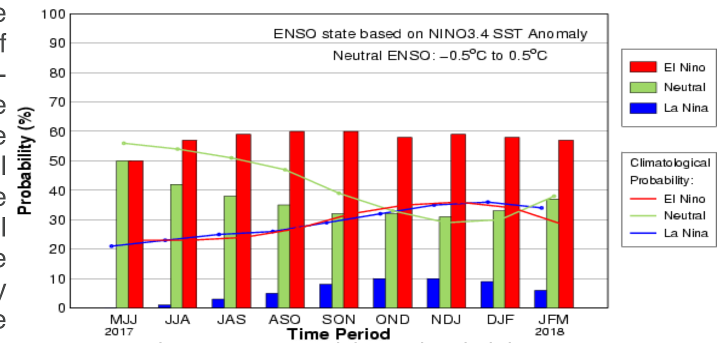


Figure 3: Mid-May IRI/CPC Model-Based Probabilistic ENSO Forecast

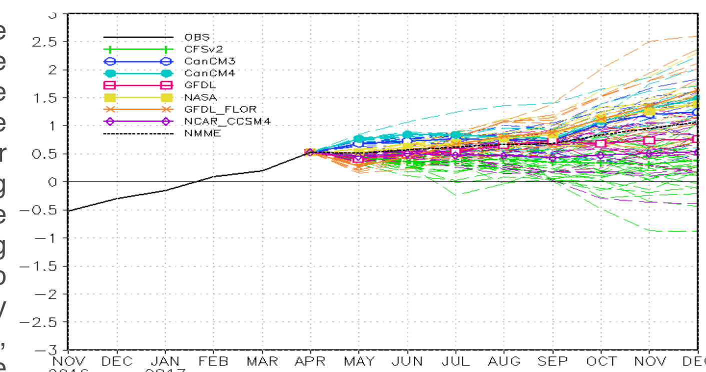


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

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

Arizona: http://1.usa.gov/19e2BdJ

New Mexico: http://www.wcc.nrcs.usda.gov/cgibin/resv_rpt.pl?state=new_mexico

Contact Ben McMahan with any questions or comments about these or any other suggested revisions.

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).

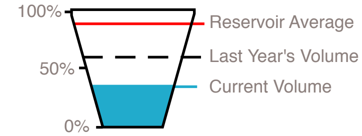
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). 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.

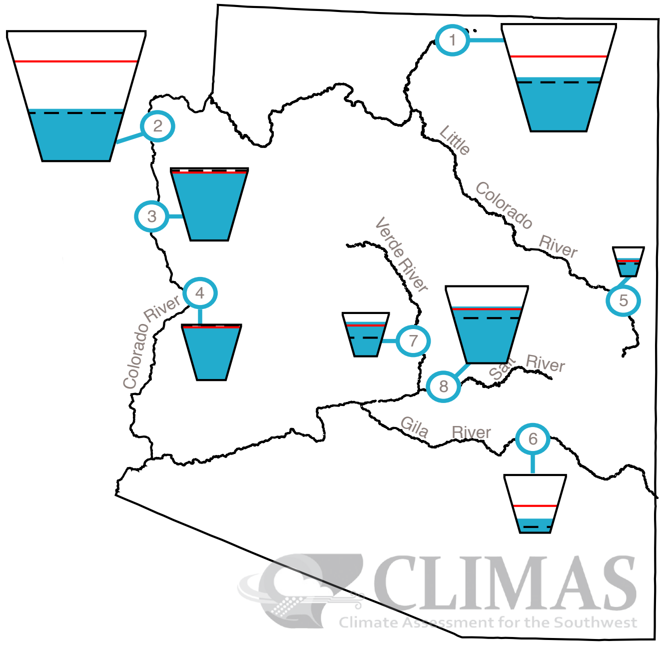
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

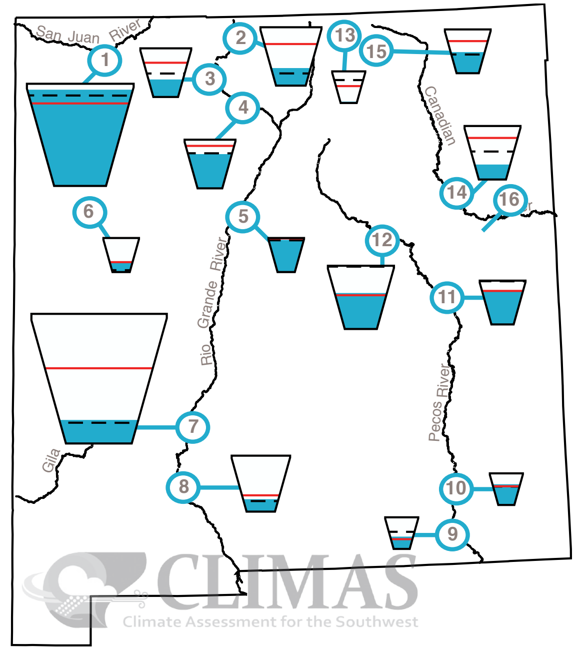
Reservoir Volumes

DATA THROUGH APR 30, 2017

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







Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Lake Powell	50%	12,149.5	24,322.0	937.1
2. Lake Mead	40%	10,404.0	26,159.0	-422.0
3. Lake Mohave	93%	1,683.0	1,810.0	-5.0
4. Lake Havasu	96%	596.2	619.0	8.4
5. Lyman	63%	18.9	30.0	8.4
6. San Carlos	25%	223.0	875.0	-4.9
7. Verde River System	79%	226.6	287.4	-53.5
8. Salt River System	74%	1,505.0	2,025.8	179.7

*KAF: thousands of acre-feet

* in KAF = thousands of acre-feet
**Reservoirs with updated "Max Storage"
***The last available reading for Costilla reservoir is Jan 5, 2017

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	94%	1,597.7	1,696.0	133.0
2. Heron	29%	114.7	400.0	28.0
3. El Vado	36%	69.4	190.3	10.8
4. Abiquiu	71%	132.3	186.8**	9.9
5. Cochiti	95%	47.3	50.0**	-0.4
6. Bluewater	30%	11.4	38.5	0.1
7. Elephant Butte	18%	395.6	2,195.0	82.9
8. Caballo	22%	72.0	332.0	-5.0
9. Lake Avalon	38%	1.7	4.5**	0.0
10. Brantley	66%	27.8	42.2**	-7.1
11. Sumner	76%	27.2	102.0**	-2.9
12. Santa Rosa	57%	60.6	105.9**	6.0
13. Costilla	5%	0.0	16.0	***
14. Conchas	27%	68.5	254.2	-3.8
15. Eagle Nest	48%	37.8	79.0	3.7
16. Ute Reservoir	86%	171	200	-1.0

Online Resources

Figure 1
Climate Program Office
http://cpo.noaa.gov/

RISA Program Homepage

http://cpo.noaa.gov/ClimateDivisions/ClimateandSocietalInteractions/RISAProgram.aspx

UA Institute of the Environment

http://www.environment.arizona.edu/

New Mexico Climate Center

http://weather.nmsu.edu/

CLIMAS Research & Activities

CLIMAS Research

www.climas.arizona.edu/research/

CLIMAS Outreach

www.climas.arizona.edu/outreach

Climate Services

www.climas.arizona.edu/climate-services

CLIMAS
Climate Assessment for the Southwest
A NOAA RISA TEAM

Dear colleagues,

We are reaching out to ask you share your CLIMAS story with us, and tell us about the kind of work you would like to see us do in the coming years.

In 1998, the Climate Assessment for the Southwest (or CLIMAS) was founded with a mission to improve the ability of people across the Southwest to respond sufficiently and appropriately to climate events, variability, and changes. Over those 19 years, we have worked directly with many of you to try to fulfill that mission. We are now looking ahead to the next 5 years and we would like to hear from you.

If you interact with CLIMAS–whether you read the Southwest Climate Outlook, listen to our podcast, or have partnered with us on projects–we would love to hear your story:

Please visit **www.climas.arizona.edu/climas-stories** to tell us what you think.

If your story or feedback is brief, you can also tweet it to us at @CLIMAS_UA

Thanks,

Dan

Daniel Ferguson, Ph.D.

Associate Research Scientist, Institute of the Environment

Director, Climate Assessment for the Southwest (CLIMAS)

Assistant Research Professor, School of Natural Resources and the Environment

Phone: 520-626-1779

Email: dferg@email.arizona.edu

Online Resources

Figure 1
Climate Program Office
http://cpo.noaa.gov/

RISA Program Homepage

http://cpo.noaa.gov/ClimateDivisions/ClimateandSocietalInteractions/RISAProgram.aspx

UA Institute of the Environment

http://www.environment.arizona.edu/

New Mexico Climate Center

http://weather.nmsu.edu/

CLIMAS Research & Activities

CLIMAS Research

www.climas.arizona.edu/research/

CLIMAS Outreach

www.climas.arizona.edu/outreach

Climate Services

www.climas.arizona.edu/climate-services

CLIMAS
Climate Assessment for the Southwest
A NOAA RISA TEAM

What is CLIMAS?

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 all work with partners across the Southwest to develop sustainable answers to regional climate challenges.

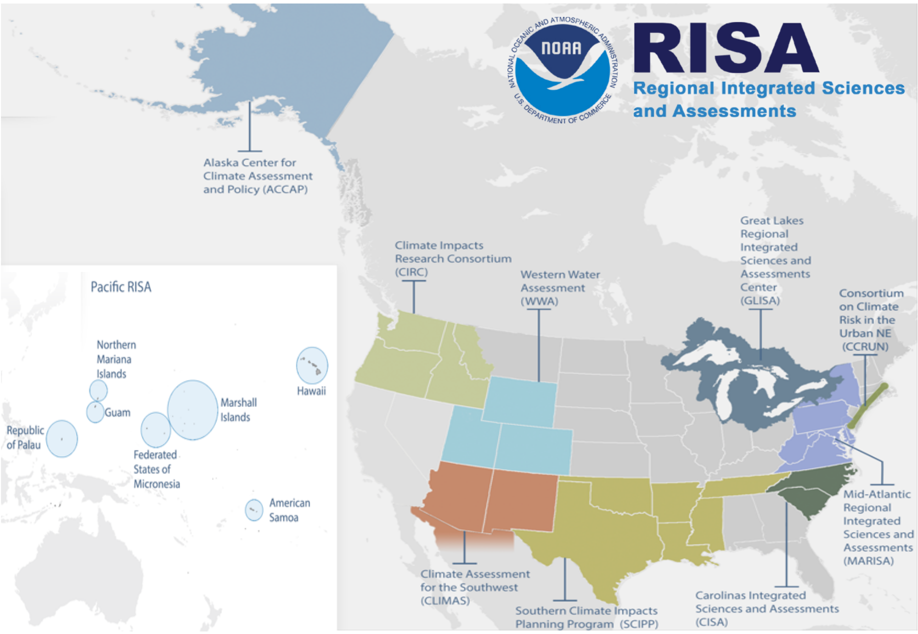


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions

What does CLIMAS do?

The CLIMAS team and our 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; 6) regional climate service options to support communities working to adapt to climate change.

Why is this work important?

Climate variability and the long-term warming trend affect social phenomena such as population growth, economic development, and vulnerable populations, as well as natural systems. This creates a complex environment for decision making in the semi-arid and arid southwestern United States. For example, natural resource managers focused on maintaining the health of ecosystems face serious climate-related challenges, including severe sustained drought, dramatic seasonal and interannual variations in precipitation, and steadily rising temperatures. Similarly, local, state, federal, and tribal governments strive to maintain vital economic growth and quality of life within the context of drought, population growth, vector-born disease, and variable water supplies. Uncertainties surrounding the interactions between climate and society are prompting decision-makers to seek out teams of natural and social scientists—like those that comprise CLIMAS—for collaborations to help reduce risk and enhance resilience in the face of climate variability and change.