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Issue 6 of the Southwest Climate Hub Newsletter

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What's Happening at The Hub:

- Drought in the Southwest
- Climate Change Vulnerability Assessment of Southwestern Agricultural and Forest Systems
- Adapting to More Variable Rainfall on Rangelands
- Recent Research
- Recent News

Drought in the Southwest

In this newsletter we focus on drought impacts in the Southwestern United States. Recent research summarized below portends future dry conditions in the region. Measured snowpack across much of the region is below normal. Groups of researchers and resource managers are working together to tackle this impending challenge. One example was the recent, well-attended [Great Basin Consortium](#) where scientists and managers met about regional resource issues. Two USDA Climate Hub representatives participated with representatives of Climate Science Centers and Landscape Conservations Cooperatives to discuss regional climate change challenges and opportunities. Amongst other topics discussed at the meeting were new technologies to support adaptation, such as the Soil Moisture Active Passive satellite, may help improve forecast accuracy and support irrigation planning. With luck, our regional snowpack will recover soon. Regardless, the USDA Southwest Climate Hub will continue to work with new partners and technologies to support adaptation and community resilience.



Preparing for Wildfires: Moving from Crisis to Opportunity

Mar. 10 - 12, 2015

Tucson, AZ

→ [Find out more](#)

Drought Forum Webinar Series - 3 Dates, 3 Topics

Mar. 11, 2015 - Tip of the Spear: The Horizon for Drought Data, Modeling, and Mapping Technology

March 25: Managing Forest Health for Water Resources

April 8: One Size Does Not Fit All - Why Variation in Hydrology and Legal Structure Means That Drought Looks Different Across the West

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Climate Hubs across the nation authored our first vulnerability assessments of regional agriculture and forests to climate change. In the Southwest Region the Southwest Hub and the California Sub Hub collaborated to assess the vulnerability of selected specialty and field crops, rangeland and animal agriculture and forest systems to climate change. This effort generated 'building blocks' for future work. We now have a database of more than 700 articles pertaining to vulnerability of Southwestern agriculture and forest systems. Those articles are being added to a searchable, geospatial, online database called [Journal Map](#). Many crop specialists and extension agents reviewed and added to sections of the vulnerability assessment which led to a new list of experts to help farmers and ranchers in adapting to climate change. It was truly a community effort. Here we provide the first excerpt of our assessment introduction as well as several major findings related to the regions crops.

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Adapting to More Variable Rainfall on Rangelands

By Joel Brown, Allen Torrell and Teresa Sedlacek

A grant to the USDA Southwest Regional Climate Hub from the USDA Climate Change Program Office provides support for Natural Resource Conservation Service (NRCS) and New Mexico State University (NMSU) scientists to investigate how the effects of increasing variability in precipitation will affect rangeland grazing management in the Southwest. Increased variability in rainfall and forage production is particularly problematic for the cow/calf producers of the Southwest.

In our initial analysis, we have identified some very interesting and important historical trends that may hold some insight as to how a changing climate will affect the interactions between animals and rangeland ecosystems and how management might respond to be more sustainable.

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Recent Research

US Faces Worst Drought in 1,000 Years, Predicts Scientists

The coming drought age – caused by higher temperatures under climate change – will make it nearly impossible to carry on with current life-as-normal conditions across the Southwest and Great Plains. Read more about this in the study, *Unprecedented 21st-Century Drought Risk in the American Southwest and Central Plains*, which was published in a new online journal, *Science*

Agriculture Summit

Mar. 24 - 25, 2015

Davis, CA

→ [Find out more](#)

Climate Prediction Applications Science Workshop

Mar. 24 - 26, 2015

Las Cruces, NM

→ [Find out more](#)

National Association of Environmental Professionals Annual Conference

Apr. 13 - 17, 2015

Honolulu, HI

→ [Find out more](#)

Western Snow Conference

Apr. 20 - 23, 2015

Grass Valley, CA

→ [Find out more](#)

Drought Classes in Nevada

University of Nevada Cooperative Extension will be hosting drought classes in April 2015.

Topics will include:

a water rights surveyor explains some provisions for temporary transfers of ground water rights which farmers can use to increase their flexibility during droughts, a group discussion of long-term drought planning, and

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Slim Cascade and Sierra Snowpack Declines in February

While much of the East Coast has been buried under snow this winter (looking at you, Boston), there are large snowpack deficits in the Cascades and Olympics of Washington, most of Oregon, the Sierra Nevada in California, as well as much of Nevada, Arizona, southwest New Mexico, two basins in Idaho, and one basin in southwest Utah.

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Statistical Downscaling of Rainfall Changes in Hawai'i Based on the CMIP5 Global Model Projections

The Hawaiian islands are expected to experience a greater contrast between the wet and dry regions in the future, predicts a study by Timm, Giambelluca, and Diaz. Using a statistical downscaling on the latest Coupled Model Intercomparison Project phase 5 (CMIP5) global model results for two representative concentration pathways (RCP4.5 and RCP8.5) to provide seasonal mean rainfall projections for Hawai'i in a future climate. The results were used to derive a spatially interpolated map with estimated future rainfall change for the main islands. Rainfall anomalies for the wet (November - April) and dry (May - October) seasons for the middle and late 21st century suggest that a negative trend dominates the area-averaged changes in the statistical downscaling over the Hawaiian islands. *Available on Wiley.com.*

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Analysis of Low-Frequency Precipitation Variability in CMIP5 Historical Simulations for Southwestern North America

Drier future conditions are projected for the arid southwest of North America, increasing the chances of the region experiencing severe and prolonged drought. To examine the mechanisms of decadal variability, 47 global climate model historical simulations performed for phase 5 of the Coupled Model Intercomparison Project (CMIP5) were assessed by Langford, Stevenson, and Noone. Their study, published in April 2014, found that "on average, the CMIP5 models have higher climatological precipitation over the past century in southwestern North America than current instrumental reanalysis products."

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The Magnitude and Spatial Patterns of Historical and Future Hydrologic Change in California's Watersheds

What is the magnitude of historical and projected future change in the hydrology of California's watershed? This question and others were the subject of a study published by Thorne et al., in February 2015. They used the Base Characterization Model (BCM) to assess

kind of information they would like to have to make informed decisions and to be resilient in uncertain weather conditions.

The dates and locations:

April 13 - Gardnerville
April 15 - Lovelock
April 22 - Yerington
April 29 - Fallon



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Yield Determination and Water-Use Efficiency of Wheat Under Water-Limited Conditions in the US Southern High Plains

What's new with WUE? A study by Xue et al., published in November 2013, sought to investigate the physiological basis of yield determination and water-use efficiency (WUE) of wheat in the Southern High Plains. Through a 2 year field experiment of 10 genotypes under both dryland and irrigated conditions, the researchers uncovered that the newer cultivars or more drought-tolerant genotypes had higher biomass, yield, WUE, and water-use efficiency for biomass under drought conditions. *Subscribers of Crop Science may access the study or select the "pay per view" option.*

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Integrated Climate and Land Use Change Scenarios for California Rangeland Ecosystem Services: Wildlife Habitat, Soil Carbon, and Water Supply

What is the potential impact of climate and land use change on rangeland ecosystem services in California? Quite a lot, according to a study by Byrd et al., published on February 5, 2015. The study unveils 6 spatially explicit climate/land use change scenarios for case-study watersheds in California's Central Valley and the surrounding foothills to address this question. The results showed that habitat loss across the region is expected to occur predominantly in grasslands with up to 37% decline by 2100 – most of that due to future development. However, "habitat loss in priority conservation errors will likely be due to cropland and hay/pasture expansion (up to 40% by 2100). Up to 39% of the approximately 100 teragrams SOC in the top 20 cm of soil is subject to conversion by 2100. Future development also lowers the precipitation value at which recharge processes dominate runoff, which when combined with periods of drought, reduce the opportunity for recharge.

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Unprecedented 21st Century Drought Risk in the American Southwest and Central Plains

In coming decades the Southwest and Central Plains of Western North America is expected to see increased drought severity as a result of climate change. These regions experienced droughts that were more persistent than any historical event, providing crucial targets in the paleoclimate record for benchmarking the severity of future drought risks. The study by Benjamin I. Cook, Toby R. Ault, and Jason E. Smerdon used an empirical drought reconstruction and three soil moisture metrics from 17 state-of-the-art general circulation models to show that these models project significantly drier conditions in the later half of the 21st century compared to the 20th century and earlier paleoclimatic intervals. This desiccation is consistent across most of the models and moisture balance variables, indicating a coherent and robust drying response to



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the Medieval Climate Anomaly (1100–1300 CE) in both moderate (RCP 4.5) and high (RCP 8.5) future emissions scenarios, leading to unprecedented drought conditions during the last millennium.

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Southwest Climate Science Center Paper: "Are Conservation Organizations Configured for Effective Adaptation to Global Change?"

The Department of the Interior's Southwest Climate Science Center recently co-authored a paper that investigates whether conservation organizations are equipped to adapt to climate change. This paper discusses the capacity of conservation organizations to adapt to changing environmental conditions, focusing primarily on public agencies and nonprofits active in land protection and management in the U.S. The paper reviews how organizations anticipate and detect impacts and discusses whether they are sufficiently flexible to prepare and respond by reallocating resources. The paper hypothesizes how configuration of different organizations enables them to protect particular conservation targets and discusses resources that may help conservation organizations assess their capacity to adapt.

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Western Water Assessment and Partners Release Colorado Climate Change Vulnerability Study

Western Water Assessment, in collaboration with Colorado State University, University of Colorado, Boulder, and the Cooperative Institute for Research in Environmental Sciences (CIRES) conducted a broad study of climate vulnerability for the state of Colorado. Drawing from existing data and peer-reviewed research, the study summarizes key challenges facing seven sectors: ecosystems, water, agriculture, energy, transportation, outdoor recreation and tourism, and public health.

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Proceedings of the National Academy of Sciences Journal Article: "Anthropogenic Warming Has Increased Drought Risk in California"

A study published in the Proceedings of the National Academy of Sciences Journal finds that climate change is exacerbating the intensity of the California drought. The record-setting drought has led to acute water shortages, groundwater overdraft, critically low streamflow, and enhanced wildfire risk. Analysis shows that California has historically been more likely to experience drought if precipitation deficits co-occur with warm conditions and that such confluences have increased in recent decades, leading to increases in the fraction of low-precipitation years that yield drought. In addition, the study suggests that anthropogenic warming is increasing the probability of the co-occurring warm-dry conditions that have created the current California drought.

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COOPERATIVES

**Education****Communications**

The following are external tools & resources, not affiliated with the SW Hub.

- [SMAP Mission Site](#)
- [The California Drought](#)
- [Climate Science Library](#)
- [U.S. Climate Resilience Toolkit](#)
- [Global Climate Change by NASA](#)
- [California Climate Data Archive](#)
- [Rangelands West](#)

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Vulnerability Assessment and Adaptation Planning for National Forest Lands in Southern California

[Ongoing project by the CALCC](#)

Developing Effective Tools for Communicating Drought Information

[Ongoing project by the California LCC](#)

Modeling Systems to Inform Water Management

[Ongoing project by the South Central CSC](#)

Assessing Climate Change Vulnerability and Adaptation in the Great Basin: A Policy Perspective on Resource Managers and the Use of Science in Decision Making

[Ongoing project by the Southwest CSC](#)

Adaptation to Climate Variability and Change: Markets, Policy, Technology, and Information

[Ongoing project by CLIMAS](#)



RECENT NEWS

NOAA declares an El Niño Advisory

Over the past few months, [NOAA has recorded positive temperature anomalies in the tropical Pacific](#); sea surface temperatures have been warmer than average in the Niño 3.4 region (+0.6C) and in the Niño 4 region (+1.2C). For NOAA to declare an El Niño advisory, they must also observe that the atmosphere is responding to the positive temperature anomalies. Sure enough, Walker circulation seems to be weakening over the tropical Pacific, as indicated by negative Equatorial Southern Oscillation Index values for two consecutive months. Low-level westerly wind anomalies have also increased over the equatorial Pacific and upper level easterly wind anomalies are persisting over the east-central pacific.

NOAA emphasize that this is a weak El Niño and the CPC/IRI consensus forecast give a 50-60% chance of El Niño conditions prevailing through Spring. Even if [El Niño does persist until the summer months](#), it is unlikely to bring to bring much relief to drought-stricken California. Emily Becker, author of [NOAA's El Niño blog](#), writes that although El Niño is linked with wetter conditions over California, above-average rainfall occurred in only 3 of the last 10 El Niño years during the March-April-May period.

Record Low Snowpack in Cascades, Sierra Nevada

Water availability may be increasingly scarce in Western states after this winter's showing. Nearly a third of the USDA's SNOTEL

[Climate Data Initiative](#)

- [California Climate & Agriculture Network](#)
- [Climate Adaptation Knowledge Exchange \(CAKEx\)](#)
- [NCA Videos](#)
- [NCA Impacts - SW](#)
- [NCA Impacts - Hawaii](#)
- [NCA Impacts - Ag](#)
- [Data.gov Food Resilience Theme Datasets](#)
- [Climate.gov NCA Teaching Resources](#)
- [COMET Climate Variability and Change Course Material](#)
- [Climate Change Resource Center](#)

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for the first time, areas in California, Oregon, Washington, Nevada and Utah, as well as in parts of Arizona, New Mexico, and Colorado can expect reduced summer streamflow.

March 2015 Southwest Climate Podcast

In the March Southwest Climate Podcast, Zack Guido is back from his world travels (for work!) and is joined by Mike Crimmins to discuss SW climate, including winter precipitation, snowpack, and temperature reports so far. They also dive into the "warm in the west, cold in the east" pattern, and talk jetstream, polar vortex, and digging troughs as it pertains to SW weather patterns. Next is the (finally arriving!) El Niño, which is a bit late, and a bit weak, but there are interesting aspects of this year to consider looking into the next year, especially the persistent ridge that has helped drive the patterns of the past few months. Finally, they wrap up by looking into next year regarding what's left of winter, and what 2015 may have in store.

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Speaking of Climate...New CLIMAS Podcast Series

This Episode: Susanne Moser & Dan Ferguson

And now for something new. The [Southwest Climate Podcast](#) will continue to live on, but the team is expanding their focus in a new CLIMAS Podcast Series to take advantage of the numerous people who are living and breathing climate science, communication, outreach, education, and engagement on a daily basis.

The [first episode](#) is an interview with Dan Ferguson (CLIMAS program director) and Dr. Susanne Moser, during the time she was visiting Tucson as a CCASS Distinguished Visiting Fellow in early 2015. They discuss the state of climate research, alternative or creative ways to engage people or even to think about climate and society, the power of social change, the challenges/rewards of working in this field, and perspectives on future directions for research, education, and engagement.

Western Governors Kicks Off Drought Forum Webinar Series

Don't miss the Western Governors' Drought Forum Webinar Series, [Tip of the Spear: The Horizon for Drought Data and Technology](#) on Wednesday, March 11 at 11am MT. This event kicks off a 5-part series that will focus on drought in the West and feature regional experts on water and drought management. Each hour-long webinar will include a 40-minute panel discussion followed by questions. View the Events sidebar for additional dates or [register here on WebEx](#).

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SMAP Satellite to Measure Soil Moisture From Space

Every 2–3 days for the next three years, NASA will measure soil from space using a recently launched Soil Moisture Active Passive (SMAP) satellite. Though moisture in soil makes up a small fraction

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enhance crop yield forecasts, and support irrigation planning to aid global food production – which are just some of the benefits of this measurement technique. Check out this [SMAP infographic](#) and visit the [SMAP mission site](#).

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