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Coping With Historic Drought in California Rangelands: Developing a More Effective Institutional Response

By Joel Brown, Pelayo Alvarez, Kristin Byrd, Helena Deswood, Emile Elias, and Sheri Spiegal

On the Ground

- Drought response is widely varied depending on both the characteristics of the drought and the ability of individual ranchers to respond.
- Assistance from institutions during drought has not typically considered preemptive, during, and post-drought response as a strategic approach, which recognizes biophysical, sociological, and economic complexities of drought.
- A USDA Southwest Climate Hub-sponsored workshop brought together a range of representatives from public and private institutions with drought response responsibilities to examine how those institutions could better support drought decision-making.
- Institutions can greatly improve their support for individual land managers by doing more systematic collecting and organizing of drought-related information as a basis for programs, and by collaborating to enhance both institutional and individual learning.

Keywords: adaptive management, C sequestration, decision support, drought policy.

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This article describes the outcomes of a workshop organized by the USDA Southwest Climate Hub in late 2015. The workshop brought together academics, agency staff, user groups, and technical advisors to examine the institutional response to the historic drought in California. Workshop participants focused on three areas of analysis: improvement of programs and policies; improvement of monitoring; and mitigation opportunities and threats. The workshop consensus was that individual ranchers have a variety of mechanisms for coping with drought, but supporting public and private institutions lacked a coherent framework for learning and communicating from individual experiences.

The multiyear drought in California is of historic proportions, both in its intensity and its effect on agriculture. Although storms of the 2015–2016 and 2016–2017 winter rainfall season have provided modest drought relief, their effects on the multiyear drought are relatively small.[i] Both short- and mid-term forecasts for precipitation are highly uncertain, but they generally predict an increase in the frequency and intensity of drought in the southwestern United States.[1]

While irrigated agriculture operations have to make decisions about crops, irrigation schedules, and so on, rangeland-based livestock operations have to make similarly difficult, but fundamentally different, decisions. Erratic and reduced forage production is a problem across the southwestern United States in general and California in particular. Currently, the only two options for an individual operator are to buy replacement forage or reduce livestock numbers. Response to short-term drought usually involves purchased feed, but the intensity and length of this drought has resulted in most operators reducing livestock numbers. The financial impact has been softened somewhat by the high live-cattle prices of 2012 to 2014, but high prices also limit post-drought restocking options. Short-term precipitation events may lead to increased forage production, but the ability of individual grazing operations to respond quickly may be limited by economic constraints.[2] Forage production on rangelands requires marketable grazers for a business to be functional, especially in the short term.

The USDA Southwest Climate Hub[ii] and the USDA California Climate Hub[iii] collaborate to develop adaptation and mitigation strategies for coping with climate change

[i] See http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php for the US Seasonal Drought outlook.

[ii] Read more on the USDA Southwest Climate Hub at http://swclimatehub.info/.

[iii] Read more on the USDA California Climate Hub at http://caclimatehub.ucdavis.edu.

effects on agricultural productivity across the southwestern United States. One of their first activities was to develop a Rangeland Vulnerability Assessment (VA) for California. The VA will be completed in 2017 and is available online.[iv] In an effort to support the implementation of the VA, we brought industry leaders together with leaders of rangeland financial and technical assistance support programs, which we collectively refer to as *institutions*, with the objective of developing strategies for post-drought actions that can assist and support individual producers in returning to sustainable grazing operations. The attendees and their affiliations can be found at the VA webpage.[iv]

The workshop objectives were to 1) distribute and discuss the California Rangeland VA; 2) involve industry and program leaders in developing response strategies; and 3) identify priorities for implementation of the VA. Specifically, we asked, "What can the institutions (state and federal agencies, commodity groups and professional organizations) do to improve adaptation and mitigation?" and "Thinking at the state or regional level, what actions can institutions take to provide support for drought affected rangelands and grazing operations?"

One of our major working assumptions is that individual ranchers are constantly adapting to a variety of ongoing changes in the operating environment. Macon et al.[2] summarized the views of individual ranchers in terms of their approach to drought and access to information. These adaptations are expressed as a range of strategies and tactics, but their correlation to outcomes as a basis for designing and implementing more effective programs are poorly quantified. Our challenge is to systematically analyze these adaptations and integrate them into a systematic support framework that can help individuals and institutions learn.

Workshop Results

During the workshop, an expert panel shared the current state of knowledge of climate change impacts in the southwestern United States and California; workgroups developed response strategies on three topics: 1) enhancing adaptive capacity, 2) monitoring for decision-making, and 3) mitigation opportunities. The workgroup discussions and recommendations follow.

Overview of Climate Change Impacts on Rangelands in the Southwestern United States and California

The projected warming and uncertain precipitation will combine to decrease soil water availability and reduce both the amount and nutrient content of plant production, and alter plant community composition on rangelands in the southwestern United States.[3] This reduced water availability can be expected to reduce plant growth, shorten the growing season, and decrease the amount of forage that serves as a basis for the livestock industry. Similarly, changes in the amount and distribution of precipitation, coupled with higher temperature regimes, can be expected to alter plant phenology and reduce the reliability of forage production. In addition, the digestibility and nutritive value of plants are reduced in an elevated carbon dioxide environment due to increases in the carbon:nitrogen ratio. Lower quality forage and the ensuing reduced nutrient intake coupled with higher summer temperatures and more frequent heat stress are likely to further reduce livestock production compared to a late 20th century baseline.[4] Heat stress can also reduce forage intake and lower the reproductive efficiency of livestock, affecting herd management decisions.[3]

Increasing frequency and severity of droughts will likely change plant species composition and reduce plant cover through a combination of increased wildfire impacts and episodic plant death. The reduced availability of both soil moisture and water flowing in perennial and ephemeral streams will likely have negative impacts on the vegetation associated with riparian areas such as willows and cottonwoods, but increasing variable flows could favor invasive species such as salt cedar. As these changes in riparian vegetation become more widespread, the impacts on animal species reliant upon both the vegetation structure and water quality and quantity are likely to be more negative.[4]

Workgroup Response Strategies

Programs and Policies to Enhance Adaptive Capacity

The Adaptive Capacity Workgroup examined the problem from operational (this year), tactical (5 years), and strategic (10 years) decision-making standpoints. At the operational level, the most obvious action would be to improve accessibility and interpretation of 3- to 6-month forecasts. While improved spatial precision and forecast accuracy is always desirable, these attributes are seldom the limiting factor in drought decision-making. In particular, a better interpretation and communication of the likelihood of reaching predefined critical seasonal rainfall milestones would contribute to improved management decision-making. This timeframe allows ranchers to make decisions regarding livestock numbers and feed purchases. However, an operational decision-making tool has little use without the context of tactical and strategic support.

Enhancing tactical level drought support would include improving access to multiyear forecasts and the interpretations of impacts on forage supplies. As with operational outlooks, these forecasts are currently relatively accurate, but lack explicit connections to decision-making relative to stocking rates, destocking contingencies, and expectations of herd and individual-level animal performance.

Finally, at the strategic level, the most challenging decision for agencies revolved around being able to integrate the delivery of long-term information into a spatiotemporal framework that is relevant for producers. Much the same as management protocols in any field, a lack of explicit connections among monitoring information, model projections, and actions render most of the information useless for ranchers and land managers. What good is knowing that you are in a drought if you do not have a planned response? While

[iv] The California Vulnerability Assessment is available at http://swclimatehub.info/carange.

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