Workshop Report

Ranching with Drought in the Southwest: Conditions, Challenges, and a Process to Meet the Challenges

27-28 February 2013
Santa Rita Experimental Range, AZ

Organizers
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Executive Summary

This report summarizes a workshop called "Ranching with Drought in the Southwest: Conditions, Challenges, and a Process to Meet the Challenges," held February 27 and 28, 2013 at the Santa Rita Experimental Range near Tucson, AZ. There were 36 workshop participants, including ranchers from Apache, Cochise, Coconino, Gila, Pima, Santa Cruz, and Yavapai Counties, representatives from the Forest Service (USFS), Bureau of Land Management (BLM), Natural Resources Conservation Service (NRCS), and Arizona State Land Department (ASLD), program managers from the National Institute for Food and Agriculture (NIFA) and Western Risk Management Education (WRME) in the Department of Agriculture and National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce, University of Arizona research and extension scientists and students, and guests from the Southeastern US, Kentucky, and California. The workshop was organized by Mitch McClaran, University of Arizona (UA) Professor of Range Management and the Director for Research at the Santa Rita Experimental Range; George Ruyle, UA Range Management Extension Specialist; Mike Crimmins, UA Climate Science Extension Specialist, and Julie Brugger, a social scientist with UA Climate Assessment for the Southwest.

The purpose of the workshop was to explore interest in a "co-development" process to address the challenges of ranching with drought on Southwest rangelands and gather suggestions from participants on how such a process could be organized.

Drought occurs regularly in the Southwest, however the region is currently experiencing drought conditions that began in the late 1990s and rival any in the instrumental record. While Southwest ranchers have been remarkably successful in adapting to drought, new strategies may be needed in the face of more extreme drought conditions. With climate change, drought conditions are projected to become more frequent, longer lasting, and warmer. Developing new strategies is challenging because ranching systems in the Southwest are extremely complex.

They include bio-physical and economic factors, such as rain, forage, and markets, as well as the government institutions responsible for managing public lands, and the livelihoods of rural communities that provide employees, schools, and other services, all of which are impacted by drought. Decisions about livestock management include not only the rancher, but the public land management agencies, as well as the consultative and cost-sharing provided by the NRCS. Under these circumstances, developing new strategies to improve preparation for and response to drought will require the participation and collaboration of all parties – ranchers, land management agencies, extensionists, and scientists – in a "co-development" process in order to ensure the relevance, usefulness, and viability of these strategies.

The workshop was organized as informal discussions in which ranchers, agency managers, and other participants shared their experiences with the challenges of drought and then used this understanding to begin to describe what a co-development process for ranching with drought in the Southwest would look like. As a way of introduction, the workshop included presentations by two groups of researchers, extensionists, and farmers from the Southeastern US and California who had experiences with similar processes. In addition, managers from funding programs in USDA and NOAA were invited to suggest where the group might obtain funds to support the process.

Outcomes

The key outcome from the workshop was the discovery of widespread and enthusiastic support among attendees for a co-development process to address the challenges of ranching with drought in the Southwest.

A priority identified by the group is to improve preparations for and responses to drought by developing better communication and relationships among ranchers and agencies.

Native American Tribes should be included in the future.

Activities in which the group could engage to simultaneously promote understanding, trust, and learning among participants might include:

- scenarios planning that includes ranchers and authorities in land management agencies;
- learning how to interpret seasonal and longer-term weather forecasts;
- identifying trigger points for action in drought plans;
- developing and sharing a list of drought planning and response tools;
- performing research to evaluate innovative practices applied by ranchers; and
- encouraging and supporting the next generation of ranchers, agency managers, extensionists, and researchers by including them in a co-development process.

Managers from federal funding programs identified opportunities from NOAA and USDA that could be used to support a co-development process.

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Introduction

This report describes a workshop called "Ranching with Drought in the Southwest: Conditions, Challenges, and a Process to Meet the Challenges," held February 27 and 28, 2013 at the Santa Rita Experimental Range near Tucson, AZ. There were 36 workshop participants, including ranchers from Apache, Cochise, Coconino, Gila, Pima, Santa Cruz, and Yavapai Counties, representatives from the Forest Service (USFS), Bureau of Land Management (BLM), Natural Resources Conservation Service (NRCS), and Arizona State Land Department (ASLD), program managers from the National Institute for Food and Agriculture (NIFA) and Western Risk Management Education (WRME) in the Department of Agriculture and National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce, University of Arizona research and extension scientists and students, and guests from the Southeastern US, Kentucky, and California. The workshop was organized by Mitch McClaran, University of Arizona (UA) Professor of Range Management and the Director for Research at the Santa Rita Experimental Range; George Ruyle, UA Range Management Extension Specialist; Mike Crimmins, UA Climate Science Extension Specialist, and Julie Brugger, a social scientist with UA Climate Assessment for the Southwest. The purpose of the workshop was to explore interest in a "co-development" process to address the challenges of drought on Southwest rangelands and gather suggestions from participants on how such a process could be organized. In the following sections we describe the rationale behind the workshop in more detail, the process used, the outcomes, and continuing efforts.

Purpose

Ranching is an extensive land use activity in the U.S. Southwest, involving approximately 80% of the 50 million hectare area of Arizona, New Mexico and far western Texas (Figure 1), despite the challenges posed by a climate characterized by heat, aridity, and extreme variability. Drought is a regular occurrence, however the region is currently experiencing drought conditions that began in the late 1990s and rival any in the instrumental record. The Palmer Drought Severity Index, a combination of precipitation and temperature, for the Santa Rita Experimental Range (near Tucson) since 1940, shows that ten of the fifteen driest years since 1940 have occurred since 1996 (Figure 2). The current Seasonal Drought Outlook for

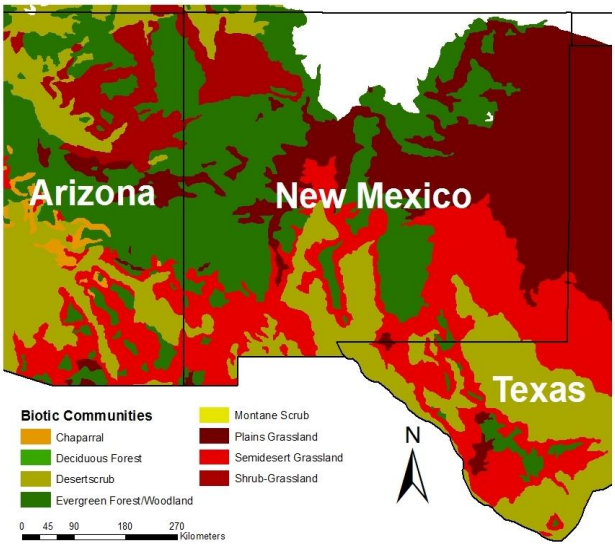

Figure 1. Southwestern US rangelands include New Mexico, eastern Arizona, and western Texas.

the region shows that the drought is projected to continue in the short-term (Figure 3), while projections of longer-term drought (more than 10 years) are supported by patterns of sea-surface circulation and temperatures in both the Atlantic and the Pacific oceans, which is reminiscent of conditions during the drought of the 1950s. Therefore, a decade or longer of continued drought conditions is not out of the question. In addition, with possible climate change, drought conditions are projected to become more frequent, longer lasting, and warmer (Karl et al 2009; Overpeck and Udall 2010). While Southwest ranchers have been remarkably successful in adapting to drought, new strategies may be needed in the face of more extreme drought.

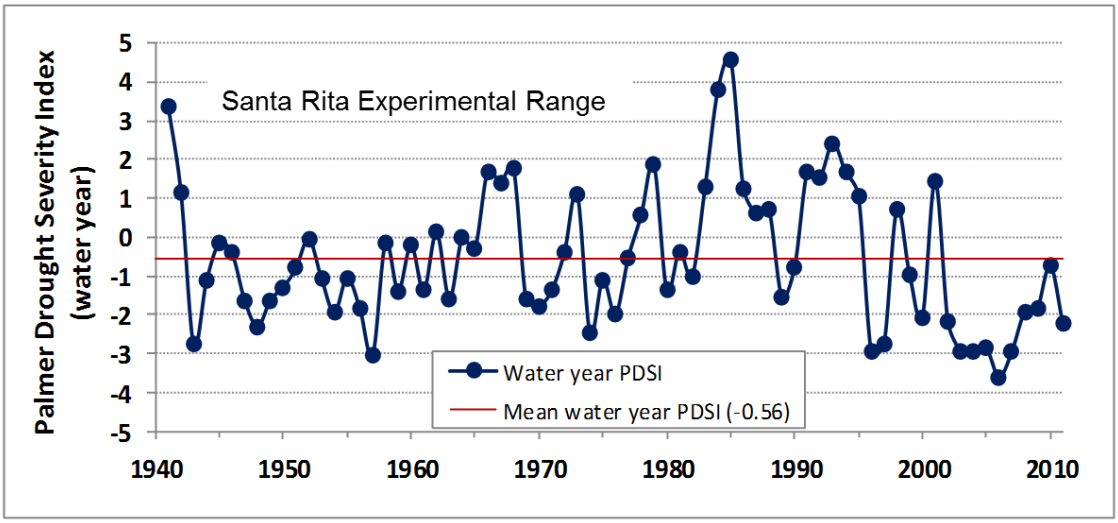

Figure 2. Drought patterns on the Santa Rita Experimental Range, near Tucson AZ since 1940. Palmer Drought Severity Index includes precipitation and temperature in the calculation, and a "water year" is the period from October through September (for example, the 1960 water year starts in October 1959).

Developing new strategies is challenging because ranching systems in the Southwest are extremely complex (Figure 4). They include bio-physical and economic factors, such as rain, forage, and markets, as well as the government institutions responsible for managing public lands, and the livelihoods of rural communities that provide employees, schools, and other services, all of which are impacted by drought. Decisions about livestock management include not only the rancher, but the public land management agencies (USFS, BLM, and ASLD), as well as the consultative and cost-sharing providing by the NRCS. Developing new strategies to improve preparation for and response to drought will require the participation and collaboration of all parties – ranchers, land management agencies, extensionists, and scientists – in a "co-development" process in order to ensure the relevance, usefulness, and viability of these strategies.

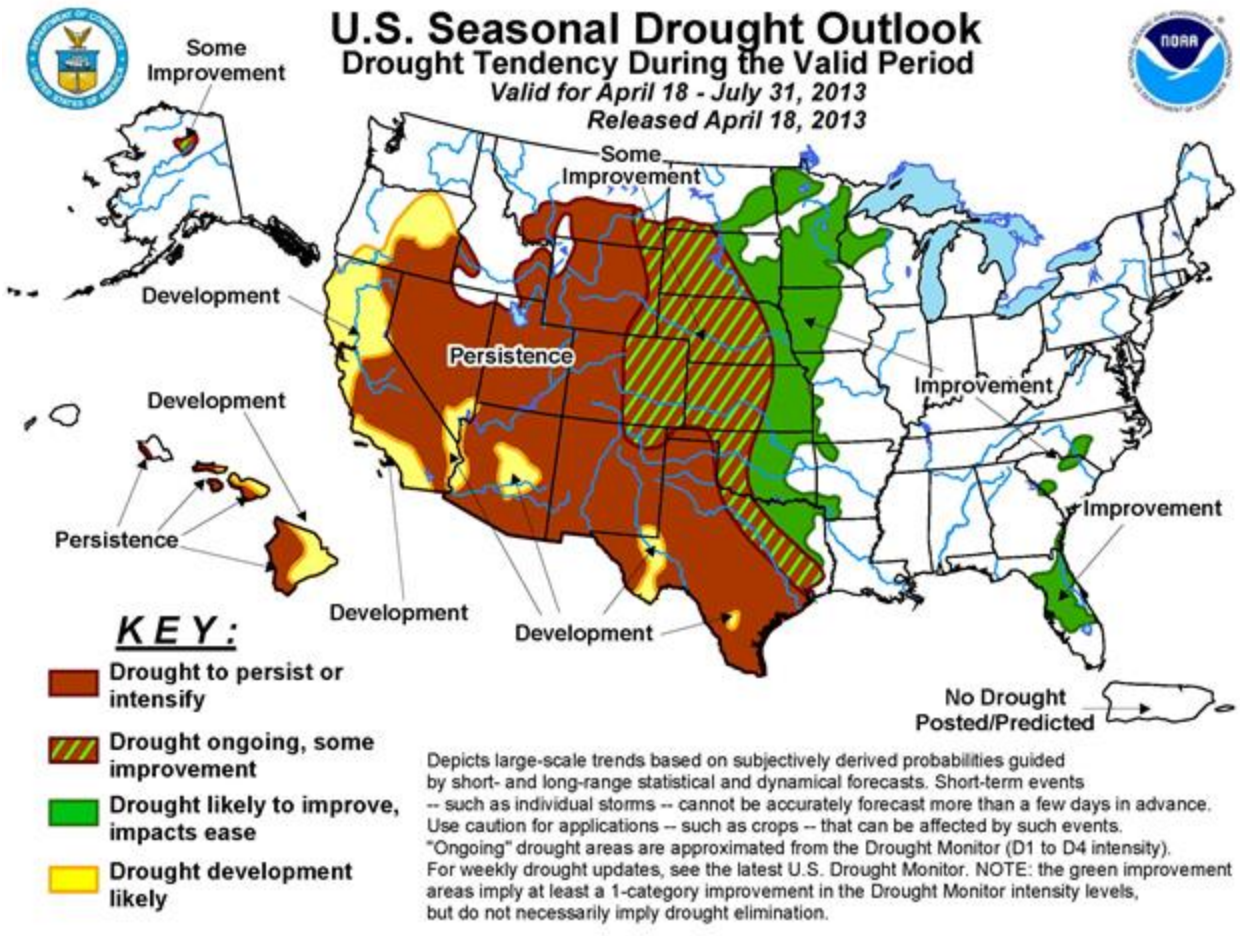

Figure 3. Three month drought outlook provided by the National Weather Service Climate Prediction Center on April 18, 2013 (http://www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.html).

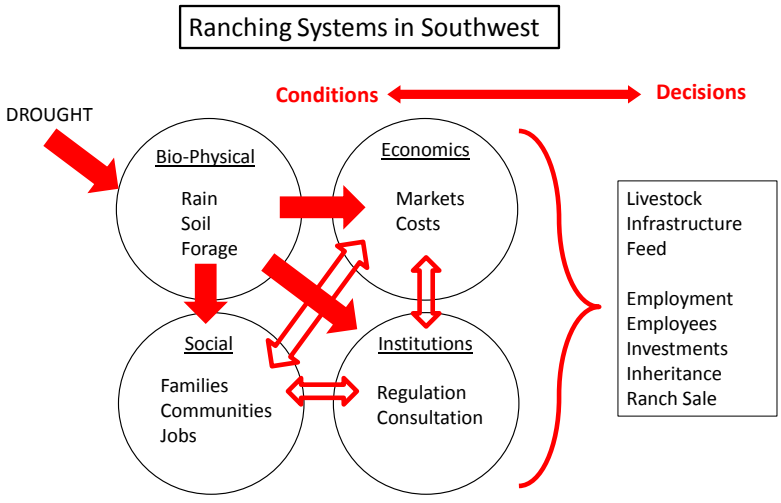

Figure 4: Direct and indirect impacts of drought on the complex ranching systems in the Southwest.

The idea of co-development arises from the confluence of two streams of thinking about the role of science in society. The first stems from recognition that the complexity and interconnectedness of socio-ecological systems today gives rise to "wicked" problems: problems which are difficult to solve because they involve complex systems, incomplete knowledge, uncertain consequences, competing interests and values, and high stakes (Lorenzoni et al. 2007; Ravetz 1999; Rittel and Webber 1973). To improve the quality and effectiveness of decision-making under these circumstances, more stakeholders should be involved in the decision-making process. Instead of relying solely on "expert" knowledge, a more participatory process would "construct a body of knowledge that will reflect the pluralistic and pragmatic context of its use" and "build common ground among competing beliefs and values" (Robertson and Hull 2003: 399). Bringing ranchers, land management agencies, extensionists, and scientists together in a co-development process would provide a format where all can learn from 1) the ranchers' long-term experience of meeting challenges of drought, 2) the land management agencies' requirements in their decision processes, 3) the coordinated planning and cost-sharing expertise of the NRCS, and 4) the new information available from research and extension.

The second stream of thinking stems from recognition that the "linear" or "loading dock" model of a one-way flow of knowledge from scientists to society often results in information that is not useful to decision-makers (Cash et al 2006; McNie 2007). Proponents of "usable" science call for a two-way, iterative process in which knowledge users actively collaborate in "co-producing" problem-oriented actionable science. To the extent that science is perceived as salient, credible, and legitimate by relevant stakeholders, it will be more effective in influencing social responses (Buizer et al. 2009; Cash et al. 2003; Cash et al. 2006; Dilling and Lemos 2011; Jacobs et al. 2010; McNie 2007).

Ranching with drought is a "wicked problem" because ranching systems in the Southwest are highly complex, involving biophysical, economic, social, and institutional components, with many sources of uncertainty, and drought is a reoccurring, but incompletely understood and unpredictable phenomenon in these systems. A co-development approach that brings together researchers, extentionists, ranchers, government land management agency personnel, and other stakeholders (Figure 5) has the potential to develop strategies for improving drought preparedness and response that are more effective than the traditional approach of land-grant institutions, in which knowledge produced by scientists is translated by extensionists into prescriptions for user action. To this end, the workshop brought these parties together to explore interest in a co-development approach to developing strategies for ranching with drought in the Southwest.

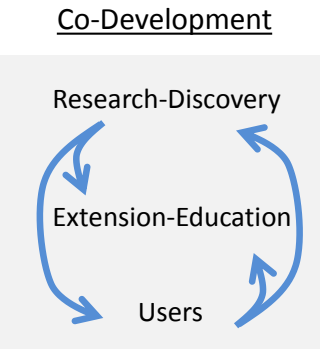

Figure 5. Co-development process of generating and disseminating information among researchers, extensionists, and users, rather than a one-way flow to users.

However, despite broad support for linking research with action through stakeholder engagement, few studies have examined the conditions that sustain such iterative encounters (Bartels et al. 2012). These conditions include the social mechanisms that shape interactions and learning among stakeholders and a deep understanding of what motivates stakeholder awareness

and action (Finucane 2009). Where co-development processes have been undertaken, they have often been limited to one or two workshops, which fail to develop the comfort levels needed to build trust and develop contextualized information (Finucane 2009, Cohen 2010, Dilling and Lemos 2011). Therefore, the workshop also served to elicit participants' views on how a co-development process for ranching with drought in the Southwest should be organized, i.e. who would be included, how often the group would meet, what would be its objectives, and in what activities it would engage. Additionally, it served to explore possibilities for funding a sustained co-development process.

Workshop Process

The workshop was organized as a co-development process and consisted primarily of a series of informal discussions in which ranchers, agency managers, and other participants shared their experiences with the challenges of drought and then used this understanding to begin to describe what a co-development process for ranching with drought in the Southwest would look like. An agenda was provided, but was not strictly followed (See Appendix A).

Workshop goals and process

McClaran opened the workshop by explaining its purpose in much the same way, and using the same figures and diagrams, as earlier in this report (Figure 6). Then, to serve as an ice-breaker and a way to get to know a little about one another, participants listened to each other's "weather stories," in which they described some way that weather had significantly impacted their lives. With participants from across the continental U.S., the stories ranged from extremes of heat (Tucson's record-breaking 117° day in 1990) and cold (towing a trailer from Fairbanks, AK to a new job in Tucson in mid-winter) to extremes of flood (one that took out corrals and outbuildings and killed 36 head of cattle) and drought ("so dry even the catfish have ticks"), illustrating the range of variability and extremes of weather and climate and the ways that people deal with them.

Figure 6: Mitch McClaran opens the workshop.

Experience with co-development process

Next, workshop participants heard presentations from two groups from the Southeast and California who were working on developing collaborative approaches to adapting agriculture to a changing climate. The organizers invited representatives of these groups to the workshop in order to provide concrete examples of what co-development might look like, and an opportunity to learn from the experiences of others. The first group, the Tri-state Climate Working Group for

Row Crop Agriculture, includes farmers, agricultural extension specialists, researchers, and climate scientists working in the Southeastern states of Alabama, Georgia, and Florida. Guests from this group included Wendy-Lin Bartels, a social scientist from the University of Florida, Florida Extension Agent Jed Dillard, and Alabama farmers Myron and Laura Johnson. They emphasized the importance of how the group interacts, and described some of the activities the group had engaged in to simultaneously promote understanding and trust and stimulate learning. Activities included: constructing a historical timeline to explore how families had adapted to changes in the past; imagining future climate situations, potential responses, and barriers to adaptation; producer-led farm tours, and an "adaptation exchange," where producers discussed their experiences implementing new technologies and practices expected to provide climate-related benefits. These activities could potentially be adapted for a ranching with drought co-development group. While the Tri-state climate differs greatly from that of Arizona, farmers and ranchers found they had much in common, including operating in a highly variable and uncertain environments, a lot of resistance to the idea of climate change, and their initial skepticism about the value of such a process. Readers can learn more about the Tri-state Working Group on these websites: http://seclimate.org, and http://www.climatewatch.noaa.gov/article2012/innovative-farmers-look-to-climate-forecasts-for-and-edge.

The second group of guests, from the University of California Davis, described a collaborative process that was required by State law and a one-time effort. Extension Specialist Louise Jackson explained that the 2006 California Global Warming Solutions Act requires that by 2020, greenhouse gas emission have to be down to 1990 levels, and it also requires local governments to address climate change mitigation in their general land use plans. Separate legislation for land use planning requires land to be kept in uses that have low greenhouse gas emissions. As a mainly rural county, Yolo County wanted to include agricultural producers in their planning effort. This was a challenge because the agricultural community is less concerned about climate change but is more concerned about increasing regulations. To facilitate the planning, Yolo County held a series of stakeholder meetings where data on agricultural emissions sources and mitigation strategies were discussed by farmers, the county's agricultural commissioner, cooperative extension, university scientists, and others. Perhaps the most important contribution local stakeholders made was to observe that development of agricultural land into urban uses results in 100 times higher greenhouse gas emission rates per acre, therefore if mitigation requirements intended to reduce agricultural emissions put farmers out of business instead, they could actually increase emissions. Focusing on this aspect of planning served to draw more of the agricultural community into the process to explore potential adaptation strategies. To support these local efforts, a group of researchers from UC Davis is working on a study to explore planning scenarios that support the sustainability of agriculture and its adaptation to climate change in Yolo County. Readers can learn more at http://agadapt.ucdavis.edu/.

The take-home message from these presentations is the importance of processes that build understanding and trust among participants at the same time that they stimulate co-production of knowledge. The presentations also stimulated discussion among researchers and funding program managers in the group about the need to educate the research community about the co-development model. They observed that current reward system contributes to the disconnect between researchers and people on the ground because it does not give researchers

credit for working with producers, only for publications; it does not provide researchers with an opportunity to learn about the context in which their research is supposed to be used; it supports three to five-year projects instead of the longer-term research of interest to producers; and it encourages basic, rather than user-inspired applied research. The funding program managers from USDA and NOAA emphasized that input from constituents can make a big difference in changing their members' of Congress perceptions of the type of research that should be funded and encouraged participants to inform their representatives about the benefits and successes of user-inspired research. This discussion set the stage for the central focus of the workshop: ranchers and land management agency managers' perceptions of drought, which would inform a brainstorming session on how to design a co-development process for ranching with drought on Southwestern rangelands on the second day of the workshop.

Ranchers describe experiences with drought

After an outdoor lunch, McClaran started the discussion by presenting results of a survey of 161 ranchers in eastern and southern Arizona eliciting their perceptions of drought (Butler 2012). First, most ranchers don't consider it a drought until precipitation is 50% or more below average and most don't consider it a drought until it has been below average for 7 months or more (Figure 7).

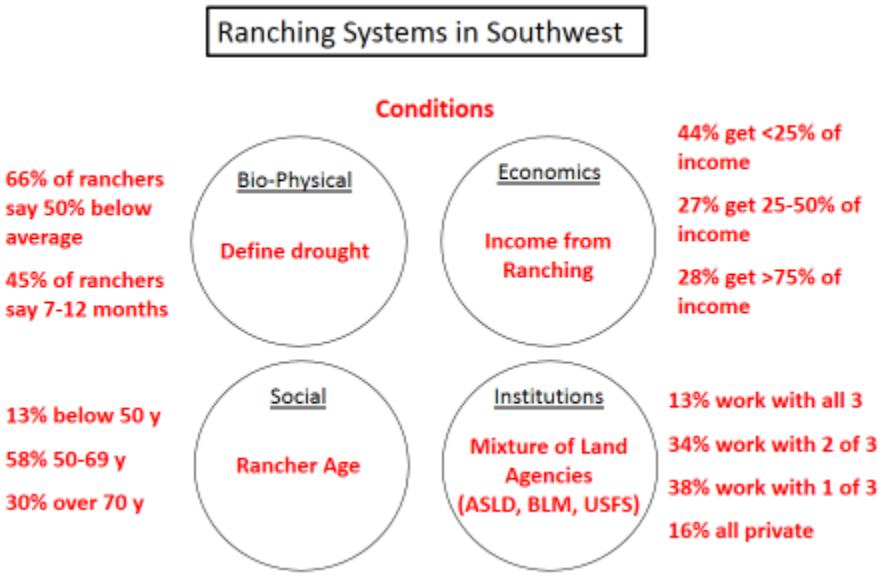

Figure 7. Attributes of ranchers and ranches that contribute to rangeland management systems in the Southwest.

"Why is that," McClaran asked? Ranchers explained that for them drought is now the normal condition. One rancher said that he felt like he had two ranching careers: one from the late seventies to the mid-nineties, and the other one since then. After nearly fifteen years of drought, ranchers no longer expect good years and rather than thinking in terms of responding to drought, they think about ways to increase their flexibility and resilience. They also pointed out that they are not just affected by drought, they are affected by multiple things at once: for example, loss of forage and infrastructure due to fire and the reintroduction of wolves. Although they emphasized that each ranch is unique, with unique geography, land tenure arrangements,

water sources, and economics, they all agreed that the primary way to be resilient to drought is to maintain a stocking rate well below carrying capacity. As a rancher from Pima County put it: "I'm so used to drought, I've been so used to managing for such average years at best that I think now that I need to stock my ranch at a level where I can go through all those years and do just fine and maybe build up from there. But I do not want to go to full stocking capacity and then ride this rollercoaster all the time because I'm so used to such poor years." By putting less pressure on drought-stressed vegetation, these ranchers are able to maintain flexibility in terms of numbers. They emphasize quality over quantity of livestock. For many, the goal is to maintain a core herd with genetics and behavior adapted to their country. Maintaining different classes of livestock, such as spring and fall calves, yearlings, and stockers can enhance flexibility in terms of livestock numbers. Staying out of debt also enhances the ability to remain flexible. A Cochise County rancher explained: "Being able to be flexible in terms of numbers I think is very important. And every ranch has to devise a way that they can do that that works for them. There's no one right way to do it, or a formula that says, 'Just do this.'"

These ranchers also increase drought resilience by maintaining low utilization of their pastures; adding new water points in order to be able to use more pasture and disperse the herd more widely; flexible pasture rotations; keeping some pastures in reserve; and, if possible, maintaining a one-year drought reserve of forage on their ranch. A final strategy is to graze cattle off the ranch. While ranchers agreed that there is always some degree of moisture each year and enough forage, if managed properly, to maintain a core herd, a more significant issue may be water for them to drink. Ranchers emphasized the need for reliable water sources: maintaining as many water sources as possible; deepening and lining dirt tanks to reduce evaporation and leakage; and hauling water. Some ranchers maintained that the most dependable water source is a well with solar pumps and a pipeline to distribute the water. However, others had experience with them freezing and bursting during cold weather and being vandalized.

The ranchers who participated in the workshop felt they had a good handle on ranching with drought for the most part. Their perceptions can be summarized by this statement from one of them: "Because the last ten years have been so pathetic, I think we've got a fairly decent formula on how to get through it." Table 1 summarizes the herd, pasture, and water management strategies these ranchers use to increase drought resilience.

Table 1. Herd, pasture, and water management strategies these ranchers use to increase drought resilience identified by rancher participants in the workshop.

Herd management	Pasture management	Water management
understocking	low utilization	as many water points as possible
flexibility in terms of numbers	flexible pasture rotation	wells, solar pumps, and pipelines
maintain genetics, animals to fit your ranch	add water to use more pasture	deepen dirt tanks to reduce evaporation
quality over quantity	rest pastures	line dirt tanks to reduce leakage
different classes of livestock	one-year drought reserve	hauling water
use water to scatter herd	off-ranch grazing	

However, ranchers also mentioned constraints to being able to put some of these resilience strategies into practice. Most prominent among them is the lack of flexibility of the federal land management agencies from which they lease grazing lands: USFS and BLM. Agency managers may not be able to accommodate more flexible pasture rotation or other deviations from allotment management plans because of the requirements to follow procedures of internal review and public comment. One rancher explained her frustration this way: "We talk about adaptive management, but there's always some reason why we can't be adaptive. Either the go on date is such-and-such, or it's ecologically correct but it's not politically correct, or something." Another rancher explained that environmental groups can use the Endangered Species Act to throw a wrench into drought planning, as he learned when an endangered species was found on land he grazed: "You can make drought plans, but then all of a sudden you have a pasture taken away from you for something completely out of left field that you didn't even know was going on until you suddenly get an announcement." In addition, the agencies' drought management process is opaque to ranchers and left to the discretion of line officers. Finally, it is difficult for ranchers to develop new water sources because of the lengthy process associated with obtaining water rights for wells or because surface water rights are owned by the Salt River Project. What ranchers would like to see become the norm, is the way that a District Ranger on the Tonto National Forest handled drought conditions in 2007: calling all ranchers together for a discussion, and, in the words of a participant in that meeting, "really embracing adaptive management," "stepping outside of the norm," and being "willing to accommodate a break in the pattern," for example, "reversing rotations – starting high, coming low- because the effects were more pronounced down in the lower country."

Money and labor are also a constraint on resilience to drought because infrastructure improvements are expensive to build and maintain. One rancher suggested a college internship program that would simultaneously provide labor to help with "the tedious and never-ending slow work of healing a degraded landscape," give future scientists an understanding of the context in which their research would be used, and potentially instill in young people a passion for ranching.

Ranchers and land management agency representatives both expressed the need for better relationships and better communications among themselves. The Forest Service representative felt that these relationships were the weakest link in drought resilience: "When we talk about all of this, I look at it from where's the weakest link, what the thing that we could change that would really be important would be. I think for the most part we have avenues of funding in the state, we have technology, we have sources of science to go to. My point here is the weakest link in the chain is our collective ability to develop the human relationships it takes to bring all that into focus and manage effectively in the light of situations that we've heard brought out here. It's much more of a human element than it is a science or technology issue."

Rangeland managers describe experiences with drought

To introduce the listening session for agency rangeland managers' perceptions of drought, McClaran described the attributes of land management agencies that contribute to the rangeland management systems in the Southwest (Figure 8). He described the different information sources agencies use to define drought; sources of economic uncertainty that affect government agencies; the number of acres and allotments per staff person that each agency

manages; and where the agencies fall in the spectrum between regulation and consultation. This revealed some of the major challenges that agencies face, specifically very few staff to manage very many acres and grazing allotments, and many sources of economic uncertainty.

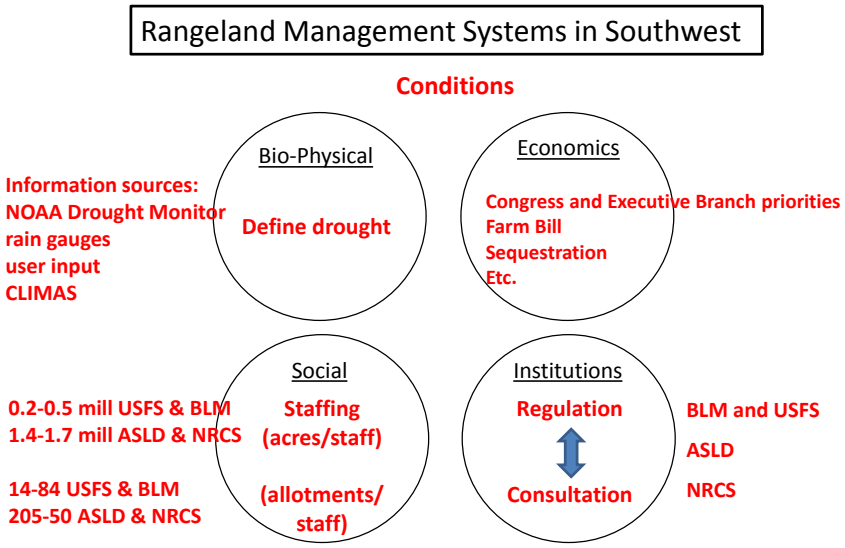

Figure 8. Attributes of land management agencies that contribute to rangeland management systems in the Southwest. This information was provided by the agency managers prior to the workshop.

Land management agencies representatives and ranchers identified additional challenges agencies face in managing with drought on Southwest rangelands. To begin with, the Forest Service is much better prepared for drought than it was fifteen years ago due to improved relationships with the livestock industry. In addition, they have a lot of discretion in implementing their regulations and the ability to be really creative, and encourage line officers to use it. However, their ability to do adaptive management is procedurally limited: "We can't adapt to the extent that we're outside the limits of what we disclosed through the procedural aspects of what we do, and that's NEPA and our consultation with Fish and Wildlife Service." But discretion can be a two-edged sword. While some ranchers related positive experience with agency personnel using their discretion, others gave examples of discretion being applied that limited opportunities. These comments, as well as a discussion about the turnover rate among agency personnel, reinforced the earlier observation about human relationships being the critical element. Not only are relationships broken when agency personnel leave, knowledge of the local environment is also lost to the field office or ranger district and to their replacement. In particular, the representative from BLM felt that her field office lacked place-based knowledge and a proactive approach to drought. Both agency personnel and ranchers also saw the Fish and Wildlife Service's emphasis on single species as opposed to habitat management as a constraint on drought resilience. The first day of the workshop ended with a barbeque supper and a campfire, around which those who were not too exhausted by the time change or the day's activities continued discussions.

Design a co-development process

The issues raised in the discussions about ranching with drought were meant to inform the next day's activity: designing a co-development process for ranching with drought on Southwestern rangelands by addressing questions such as: who would participate; what would be the goals; how would it be organized, and; what would be potential activities, products, and outcomes?

Workshop participants agreed that, in addition to ranchers, it was essential to include researchers, extensionists, and government land management agencies in the process. Having the agencies involved provides an opportunity to build relationships and enhance communication between agency personnel and ranchers, and to provide mentorship for new personnel and new ranchers. It also connects ranchers, researchers, and extensionists to the policy process. For example, the group could work with agencies to identify and avoid unnecessary agency restrictions on adaptive practices. The strength of such a group, according to one agency representative, is that, "through co-development of ideas, those then can be elevated up through the agency based on successful applications, and then we can take that – and the power of that for the agency is that it is a representative, collaborative group that represents a broad base of people from the science perspective and from a user perspective – and we can then take that information and incorporate it formally."

Participants also identified groups who were not present at the workshop and should be included in a co-development process: Native American ranchers; the National Fish and Wildlife Service; Society for Range Management, and Arizona Cattle Growers Association. They also discussed ways to encourage ranchers who were unlikely to participate in such a group to come.

The group identified two interrelated goals for the co-development process: increasing preparedness for drought and improving relationships among those involved in managing rangelands. These goals would be revisited and refined as part of a co-development process.

With respect to how the group would be organized, two approaches were discussed. One followed the model of the Federal Emergency Management Agency (FEMA), in which the group operates differently during non-crisis and crisis phases of drought. In a non-crisis phase, the group would focus on relationship-building, learning about ways to become more resilient, and preparing and planning for a crisis phase. Then during a crisis phase there would be an organization in place, better communication among ranchers and agencies, and a plan co-developed with agencies, so everyone would have a much better idea what to expect. This would alleviate much of the stress and uncertainty that ranchers and agency personnel experience during such times. A second model envisioned different roles for each group: ranchers' role would be documenting drought strategies that work; the agencies' role would be to talk about processes they can use; researchers' role would be to share what research shows with respect to drought and what to expect; and Extension's role would be combining the research, the practical experiences, and the collaborative process in some type of educational programming in which everyone in the co-development group would participate in the delivery of information.

A variety of potential activities were suggested:

- Scenario planning, where ranchers, agencies, researchers, and extensionists would discuss what to do under potential future drought conditions;
- Develop triggers for declaring drought and responses to it;
- Create a "generic drought plan" that individual ranchers could tailor to their ranch;
- Organize an "adaptation exchange" similar to the one the Tri-state Climate Working Group held, where ranchers would discuss their experience with drought preparedness strategies and mitigation practices they are using, and give ranch tours to see these strategies at work;
- Have researchers evaluate and validate innovative practices and strategies being applied by ranchers and agencies;
- Collect, compile, and distribute information about these practices and strategies for other ranchers and agency managers;
- Have climate scientists assist with interpreting seasonal and longer-term forecasts and what reasonably reliable predictors of drought and trigger points for action might be; and
- Develop mechanisms to encourage and support the next generation of ranchers, agency managers, researchers, and extension professionals.

Program managers reflect on utility of co-development and prospects for funding

In the last session of the workshop the funding program managers from NIFA, NOAA, and WRME each explained how a co-development approach would fit into their current funding priorities and the funding programs for which it would be most appropriate to apply. They expressed enthusiastic support for the co-development approach, but lamented the lack of financial support for it in most federally-funded programs. Its value is difficult to communicate to agency heads, however input from workshops like this one help them develop future funding priorities. They also reminded participants that they can affect funding agencies' ability to fund co-development by communicating the need for it to elected officials. The workshop also provided an opportunity for the program managers to interact and come up with ways that their agencies could work together to better support co-development.

Jim Dobrowolski from NIFA suggested a co-development group could apply for funding from an Agriculture and Food Research Initiative (AFRI) challenge area grant for climate change, Agriculture and Natural Resources Science for Climate Variability and Change (5 years, $5,000,000), an Agricultural Economics and Rural Communities grant ($5,000,000), or a Rangeland Research grant, although its continued funding was uncertain.

Adam Parris from the NOAA Climate and Societal Interactions Division (CSI) of the Climate Programs Office stressed that "everything that CSI funds is directly focused on co-development and co-production." He suggested the group could apply for a Sectoral Applications and Research Program (SARP) grant (1-3 years, $150-300,000) or for occasional additional grants to the Regional Integrated Sciences and Assessment programs which are focused on specific topics (1-2 years, $75-200,000). The National Integrated Drought Information System (NIDIS), whose goal is to help people prepare for and cope with drought, also has a funding opportunity in SARP. The next SARP competition will be announced this summer.

Jo Ann Warner from WRME explained that her agency administers a small, competitive grants program at the regional level (18 months, $50,000) whose purpose is to help farmers and ranchers improve economic viability through targeted risk management education that is delivered by public and private organizations. Doug Tolleson with UA Extension described his WREM funded project to support range monitoring by ranchers and build relationships with the Forest Service so they would feel comfortable using the discretion they have on adapting grazing plans, thereby reducing the risk to ranchers of having the number of livestock they were allowed to graze decreased by the agency. McClaran pointed out that these funding sources could be coordinated to support smaller projects focused on users, then build toward bigger projects that support research and training of new researchers and users.

Workshop conclusion and Field Tour

The workshop concluded with a review of the suggested activities that a ranching with drought co-development group could undertake and additional suggestion and a reminder to fill out and return (by mail) the workshop evaluation, in which that participants would have the opportunity to make further suggestions about how to organize a co-development process. McClaran explained that the organizers would write a workshop summary and an article on the workshop for the Arizona Cattlelog, the publication of the Arizona Cattle Growers' Association. The organizers thanked workshop participants for their time and their contributions, and Kelsey Hawkes and Amber Dalke for logistical support. Then everyone thanked McClaran and gave him a big round of applause for an outstanding job facilitating the workshop. The group assembled outside for a group photo before sharing a last outdoor lunch together (Figure 9).

Some participants stayed for a tour led by Andrew McGibbon, a rancher participant who owns and operates the Santa Rita Ranch. This gave potential co-development group participants a foretaste of what could come as Andrew explained his operation, including his state-of-the-art electronic identification system and how he uses it to keep detailed records on his cattle (Figure 10), and Mary Nichols, a participant from the Agricultural Research Service, explained a study she was conducting on the ranch on reducing evaporation from water tanks.

Figure 9. After the Workshop, participants assembled outside the meeting room.

Figure 10. Andrew McGibbon led a tour of livestock facilities on his Santa Rita Ranch after the workshop.

Mail-in Workshop Evaluations

A large majority (14 of 19) of those who returned the mail-in evaluations indicated they were "very interested" in a continuing process to develop ways to meet the challenges of ranching with drought in the Southwest (complete results of evaluations appear in Appendix B). The evaluations also revealed that some participants (5 of 19) would have liked to have seen more progress made toward establishing such a group. The common response to the question, "What would you have liked to get from the workshop that you did not?", was, in the words of one respondent, "to have gotten further along the path toward establishing a permanent group to address the problems associated with drought in Arizona."

Summary

1. The key outcome from the workshop was the discovery of widespread and enthusiastic support for a co-development process to address the challenges of ranching with drought in the Southwest.

2. Improving preparations for and responses to drought will require developing better communication and relationships among ranchers and agencies, and that should be a priority of a co-development group.

3. A number of activities were proposed for the group which could simultaneously promote understanding and trust among participants and group learning.
    a. "Scenario planning," in which ranchers and agency personnel consider and discuss possible actions that could be taken under a range of possible future drought conditions and how to be prepared to take those actions;
    b. Learning how to interpret seasonal and longer-term weather forecasts;
    c. Identifying trigger points for action in drought plans;
    d. Developing and sharing a list of drought planning and response tools; and
    e. Performing research to evaluate innovative practices applied by ranchers.

4. There is an urgent need to encourage and support the next generation of ranchers, agency managers, extensionists, and researchers, and that including them in a co-development process would provide mentorship and continuity of place-based knowledge within agencies and the ranching community.

5. Additional participants should be included from: Native American tribes; Arizona Cattle Growers' Association, Society for Range Management; Fish and Wildlife Service; wildlife or conservation groups; and ranchers who would not normally attend such a group.

6. Participants preferred meetings in person and semi-annual meetings a day to a day and a half in length would satisfy most respondents' preferences.

Continuing efforts

The organizers have sent several follow-up emails to workshop participants and completed evaluation of the workshop. They plan to create a web site for participants for the co-development group. An article describing the workshop and inviting others interested in joining a co-development group appeared in the June 2013 edition of the Arizona Cattlelog and the June 2013 edition of the newsletter for the Arizona Section of the Society for Range Management.

Organizers are in the process of seeking funding from USDA, NOAA and other sources to support a continuing co-development process. As part of this process they will schedule a meeting with workshop participants who indicated they would play an organizing and leadership role in a co-development group to help develop funding proposals

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APPENDIX A: Workshop Agenda

Ranching with Drought in the Southwest:
Conditions, Challenges, and a Process to Meet the Challenges
27-28 February 2013
Santa Rita Experimental Range (Tucson), Arizona

Agenda

TUESDAY (26 February)

5:30-7:30	Evening dinner (La Placita, Green Valley) for those traveling into Tucson

WEDESDAY (27 February)

8:00-9:30	Workshop Goals and Process- why are we here, how will we work together Ice Breaker- introduce yourself with a story about an experience with weather
9:30-9:45	Break
9:45-10:30	Experience with Co-Development Process in Southeastern US and California: Bartels and Jackson, 15-20 minutes each
10:30-12:00	Ranchers describe experiences with recent prolonged drought, including response, preparation, constraints-challenges, and info needs/gaps
12:00-1:00	Lunch (provided)
1:00-2:30	Rangeland Managers (Forest Serv., Bur. Land Manage, AZ State Land, and Natural Resources Conserv. Serv.) describe experiences with recent prolonged drought, including response, preparation, constraints-challenges, and info needs/gaps
2:30-2:45	Break
2:45-4:00	Comparison and Advice from Southeastern US and California Experiences: Bartels, Dillard, Johnsons, Jackson and Bowles compare our situation to the early phases of their efforts, including identifying opportunities and advice about next steps in the process of working toward improved understanding and communication as well as identification of extension and research programs
4:15-4:30	Open discussion
5:30-	Dinner provided

THURSDAY (28 February)

8:00-9:30	Design a Co-development process for Ranching with Drought on Southwestern Rangelands: For example, who are members, how is the group organized including leadership, what is discussed, what are expectations, and what are goals.
9:30-9:45	Break
9:45-11:00	USDA and NOAA program managers reflect on utility of co-development process, and prospects for funding to support the continuation of such a process
11:00-12:00	Summary and Next Steps
12:00-1:00	Lunch Provided
1:00	Depart as needed; optional tour of McGibbon's Santa Rita Ranch

Ranching with Drought in the Southwest: Conditions, Challenges, and a Process to Meet the Challenges

27-28 February 2013

Santa Rita Experimental Range (Tucson), Arizona

Post-Workshop Evaluation

Number of evaluations received: 21 (plus 1 handwritten comments not included in tabulation)
Number of attendees: 36 (including organizers)

Overall Impressions

1. How valuable was this workshop? (Check one.)

____ not valuable_ 2 somewhat valuable __4_ moderately valuable _15_ very valuable

2. Has your thinking about drought changed in any way as a result of the workshop?

__9_ no _12_ yes

Please describe one way it has changed.

Much more aware of the long term drought realities of the SW.
I now understand there are many resources available to a producer/rancher to assist in drought planning and management.
We realize that we don't deal with extreme drought.
Perhaps it is the realization that drought is now the normal climatic condition in which we live, and exceptions to drought are amazing, remarkable, noteworthy, and rare.
It's more of a prevailing condition in the Southwest than a temporary phenomenon.
Be more decisive in planning for maintenance or core herd and more flexible in planning for a transient herd – yearlings, replacement heifers, etc.
I more fully understand the different variables that drive management decisions.
Knowing that there is great interest in identifying problems and finding solutions to rangeland issues associated with persistent drought.
Came to the conclusion we can better plan for drought if we have the right tools available.
Primarily increased awareness of the need to plan for drought and the variety of ways producers do this (or choose not to).
I'm much more accepting of the fact that farmers and ranchers simply don't want to talk about climate change.
A stronger belief that ranchers can adapt to drought, often in very site-specific ways, without much support from institutions.

Thinking maybe the last ten years may be the norm and not the wet years.
Reaffirmed my opinion that adaptive management for drought requires real cooperation between agencies and producers. The agency people in attendance know that. Unfortunately, sometimes new agency employees don't realize this. This was discussed somewhat. Also, co-development is a topic I am passionate about. It was good to see that you are too.

3. What aspect of the workshop did you find most valuable?

Seeing similar ranching issues to our own in a drastically different environment.
The ranchers' perspective on drought and how they are managing.
Listening to ranchers' concerns.
The examples of California and Southeastern co-development processes and the possibility that AZ could establish a similar program.
Hearing how different people overcome their personal challenges.
I enjoyed interacting with the other participants.
Sharing and hearing "weather stories."
The opportunity to hear the ranchers' and agency representatives' concerns/perspectives was VERY valuable.
Exchange with ranchers and forming new relationships with people from USDA.
Learning what is going on in other parts of the country. Hearing that Extension would like to see research geared more to producer need – more relevance to problem solving.
a. The camaraderie. b. Manner of facilitation. c. Idea of a collaborative support group for more info, drought monitoring, etc.
Learning that ranchers need assistance with planning and good communication from land management agencies.
Hearing perspectives from a diverse set of ranchers, managers, scientists and others involved in one form or another with issues and challenges associated with drought.
Having such a wide variety of people with varying backgrounds and hearing their comments.
Networking.
The open discussion with ranchers.
Focused; realistic expectations; reasonable length (1.5 days).
Networking; rancher reactions.
The group had a sense of mutual respect and interest. The diversity of types of people and their willingness to listen to each other was unusual. People felt comfortable telling their stories. There were no 'know-it-alls.'
The personal interactions between all attending people.
Feedback from rancher participants.

4. What aspect of the workshop did you find least valuable?

This was the most intellectually stimulating meeting I have been to in years. Everybody brought something unfamiliar to me to the table. I can't think of any part I would have done without.
Hearing from SE group – didn't have many of the same issues.

I learned only one thing of practical value and it isn't terribly important to me – soda ash to seal dirt tanks.

Process regarding forming climate groups.

The research presentation on organic crop production – interesting but not a fit with the workshop.

The only problem was running short on time which sometimes constrained discussion. This is to be expected with a large, dynamic group. I must say, however, that the facilitators adapted to the time crunch.

5. What would you have liked to get from the workshop that you didn't get?

More climate info: where to find it; what it tells us. Triggers on when drought is really affecting plant production and how much rain is enough for grazing to continue.

I would like to have gotten further along the path toward establishing a permanent group to address the problems associated with drought in Arizona.

Would like to have heard more of the producers' practices.

I did not have high expectations but attended out of respect for those who put the workshop on and because of the impressive list of participants.

As always, we participate in these activities, enjoying social enrichment, relief from our routines, and the stimulation inherent in creative thought and interaction. I always hope for a minor "silver bullet" that will fundamentally improve reality. No-te-va!

I think there are other ranchers in AZ or the Southwest who would have good information to share.

A better perspective of what future follow-up to this workshop will be. What might a co-development process for ranching with drought on SW rangelands actually look like?

More specifics on how to predict, prepare for, and survive drought.

Perhaps producer/manager/scientist case studies: what has worked what hasn't, why?

Nothing. However one regret is that I didn't speak up about extending the gains at the workshop to others. I agree with the idea of inviting leading ranchers to the workshop and with having an ongoing relationship with them and with involving them in the planning. However, if the project never offers value to ranchers beyond that circle, it isn't a suitable use of tax dollars. I am sure you know this already, but I think it is important to be on the same page among all participants. Extension can and should work with community leaders, but it cannot be a publicly funded private consulting service. I trust you will find the right balance.

Short list of expectations, deliverables, a goal or task to begin working toward.

Work/project topics.

Since I am a researcher, I would have liked to hear more about what research was essential and how it be co-designed by the group: what data, what scale, what time frames.

More Arizona farm input.

A plan of action. This would have required another day perhaps. I am concerned that the momentum gained from this workshop will be lost as time advances.

Continuing process interest

6. Would you be interested in participating in a continuing process to develop ways to meet the challenges of ranching with drought in the Southwest? (Check one.)

__2_ not interested __3_ somewhat interested _14_ very interested

Why or why not?

Why comments from somewhat and very interested

Working with SW ranchers would help me transfer ideas back and for the with FL folks and SW folks.

Directly relates to my job as a range management specialist.

When serious drought hits my livestock operation, I want to have all available resources at my fingertips to help me manage the situation.

We adapt to reality as it is served to us every day. Somehow just talking about it doesn't help us get much done that will mitigate, or remedy the problems. However, sometimes the exchange of ideas reveals a nugget…

I think that direct feedback from ranchers and agency land manager is critical for designing and conducting applied research to meet the needs and challenges of rangeland managers.

I work elsewhere but would like to keep tabs on the work.

It is an ongoing problem. Would like to learn better methods of grazing management and help other ranchers as well.

I am involved with land management on more than 8 million acres in AZ and have a professional interest in range management.

The Forest Service is always looking to collaborative efforts and possible solutions to deal with the challenges of drought. Federal agencies cannot figure this out in a vacuum and these types of efforts can bring better support and credibility to our policies.

Think I can both learn from and contribute to the process.

Fits perfectly with what I do.

Drought is somewhat reliable but other factors such as economy, trade practices, regulation, change. Producers need to be able to meet those challenges.

I believe the only way agriculture can sustain is with continued support and involvement from all parties.

To make a difference on the ground and to help bridge the divide between producers, agencies, and the public.

Why not from those not interested

Not practical for us.

I would be willing to endorse the approach (collaborative) to new ranchers or agency folks who really don't know their options. I can't think of a reason to encourage veteran ranchers to attend except to pass along knowledge and experience.

I think I got a great education from seeing how you do things, but since I don't work with ranchers I have little to offer. Of course, if you see a way I can be helpful, I am at your service.
I'd be very interested in seeing how this evolves!

7. What would you like to get out of the process? (Check all that apply.)
_13__ Staying informed and connected to new research and policy.
_12__ Learning new ways to meet the challenges of ranching with drought in the Southwest.
_12__ Influencing the direction of research and extension programs.
_12__ Networking with other ranchers and resource managers.
_10__ Participating in research projects.
__5__ Organizing and leading efforts.
_____ Other (Please describe):

8. What suggestions do you have for the format of the process?
How would you like to meet? (Check all that apply.)

_15__ meetings in person __4__ teleconferences __5__ webinars

Additional comments:
Our group meets in a different region each time.
On the land. Not inside.
Whatever works.
1 annual meeting in person; 2 webinar per year.

9. How often would you like to meet? __1__ monthly __5__ quarterly __7__ annually
__6_ other (specify frequency)___2 x a year___
Additional comments:
Probably start quarterly and as process matures move into a 6-month-annual meeting.

10. How long should meetings be? __1__ 1-3 hours __4__ half-day _10__ full day
__4_ other (specify frequency)_____
Based on need.
2 days.
Depending on number of participants and topics to be covered may need 1½ - 2 days.
Half- day, full day, half-day works well for these type seminars.
Half-day for webinars; full day for annual meeting.
May need to be 1.5 days until goals and objectives defined. Combine with .5 day presentations when meeting for 1.5 days.

11. Who else should be involved? (list additional groups/people that should be invited into this process)
AZ Cattlemen's Association
Tribal

It might be interesting/helpful to have some experienced older ranchers who would usually not attend this type of workshop.
Looked like you had everyone.
I think that this should be focused on new ranchers and new agency folks.
Hands on practical examples of adaptation for drought mitigation – check dams, cover strategies, grazing management protocols, water storage and conservation, appropriate use of waste products, successful vegetation management, livestock breeding and genetics, etc. But then it would overlap with SRM and other groups doing the same thing?
Perhaps move it to different locations around the state as more ranchers would come.
Perhaps a few representatives from other collaborative groups with ideas to expand the concept of co-development.
Arizona Cattlegrowers; Society for Range Management; American Indian Tribes; Governor's Office.
Representation similar to that at this workshop. Possibly a direct representative of the Arizona Cattlegrowers' Association would be helpful.
A couple of ranchers did not stay for the second day. If they are not interested or unable to participate we should do our best to keep the number of ranchers constant.
Wildlife and/or conservation groups. This sort of thing could be very "eye opening."
Someone with experience in marketing/communications.
Farmer producers.
Researchers and specialists with projects pertinent to the group.

12. What types of activities would you like to see? (Check all that apply.)

_10_ Formal presentations followed by question and answer
_11_ Informal discussion
_11__ Brainstorming
_12_ Site visits
_8__ Hands-on exercises
_1__ Other suggestions, please specify:
1) Analyze predictions of drought for most accurate, i.e. NOAA, CLIMAS, ADWR, Old Farmers' Almanac. 2) Identify "trigger points" –when is action needed before running out of feed and/or water. 3) Develop methods and practices to mitigate effects of drought. 4) Remove land management agencies' barriers to drought preparedness and their reluctance to deviate from policy in the face of drought. 5) Define what climate change looks like in Arizona for Arizona ranchers. Yes it will be hotter and our A/C bills will be higher, but does it mean less precipitation or more precipitation. Hotter air holds more moisture and at least our summer monsoons depend on rising hot moist air to spawn thunderstorms – does that mean more summer precip and what about winter.
If we get funding to develop it, exercise with a "virtual" ranch/drought management game.

Additional comments:
I'm not clear what the concept is – I did have to leave early so missed next steps.
There is merit in all these activities. A variety is great and invigorating.

Additional comments
I think there would be real value in having the group, or a similar group, continue to meet in Arizona. During times of non-drought, all the things you mention in paragraph 7could be accomplished. But, when serious drought occurs, either in the entire state or just a portion of it, the group could assemble and address the situation. At that time, ranchers/producers who would normally not become involved with drought planning meetings, would likely be in attendance. Equally as important, meeting during drought would enable scientists, climatologists, educations, Extension personnel and producers to meet and work on solutions to the problem, preventing a 2002 scenario when decisions were made without sound analysis or discussion.

Please provide your contact information to stay connected to this effort

Name _____

Address _____
_____

City _____ State _____
Zip _____

Phone _____

Email _____

Preferred method of communication (please check one):

Mail _____ Phone _____ Email _____