

Draft Version 12.9.16

SW Extension Climate Change Workshop December 6-8, 2016

Recorders for plenary sessions:
Chris Knudson; Christina Kirchhoff; Kerrie Geil

Report prepared by:
Mary Black, Kathy Jacobs

Disclaimer: This summary is not verbatim and is intended only for the purpose of summarizing the main points of the discussion. Comments summarized here should not be attributed to individuals.

Introduction: Background and Motivation (Jeff Silvertooth, Mark Walker)

Cooperative Extension relies on trust and relationships built over the course of decades in order to convey information that is meaningful to its clientele. This meeting follows on conversations initiated in 2013 at University of California Davis to talk about drought. The Southwest Extension Climate Change Workshop (Workshop) was convened to address longer-term program needs, since drought and other climate impacts are expected to increase over time due to anthropogenic climate change. It represents an investment from the USDA Southwest Climate Hub, NIFA, and numerous state organizations and agencies, including Cooperative Extension throughout the West. The aim is to build an expanded network of expertise and resources for Extension and Extension personnel who need additional information or support, and to hear from those who have success stories to share about incorporating climate science into Extension programs.

The Workshop's stated purpose, therefore, was "To build Extension's capacity to develop climate-change preparedness and mitigation approaches that integrate cutting-edge climate science into existing and emerging efforts" with the goal of developing a regional partnership to enable the successful incorporation of climate-change information into Extension programs. Participants represented University-based Extension programs in Arizona, California, Nevada, New Mexico, Utah, Hawaii and the U.S.-affiliated Pacific islands, as well as some USDA Climate Hubs, DOI Climate Science Centers, and Sea Grant programs. A glossary of terms appears as Appendix A; the workshop agenda is Appendix B; and the list of participants is in Appendix C.

1. The Climate Toolbox: How Do We Know What We Know? (Katharine Jacobs, Gregg Garfin, Clay Trauernicht, Justin Derner)

In this session, **Kathy Jacobs** ([ppt link](#)) presented the main findings from the Third U.S. National Climate Assessment (NCA3; www.nca2014.globalchange.gov), describing its origin as an official, highly credible government document, its organization and its goals of expanding climate knowledge networks and initiating a sustained process of assessing climate change and impacts nationwide. She described the process as transparent and inclusive, and emphasized the very high level of review of the findings, including review from the National Academies, the public, and government and academic scientists. The NCA3 emphasizes the evidence of connections between climate trends and human activities, and the fact that there are now observable impacts

of climate change in every region and sector of the US. She summarized some of the most significant NCA3 report findings:

- Warming in the last 50 years is linked to human causes, and so are some kinds of extreme events, such as increased intensity of rainfall and heat waves.
- Climate change is directly linked to human health, water quality, and water supply availability.
- By mid-century farmers' ability to keep up with climate change with new technologies and management practices is expected to end, as crop yields decrease with increasing temperatures, drought, extreme events and invasive species.
- Indigenous people are particularly affected by climate change due to their close relationship with the land and natural resources, as well as economic vulnerability.
- The climate is greatly affecting oceans, including increases in temperature and acidity that are already affecting species distribution and biodiversity.
- The US Southwest, particularly the southern portions, will get drier and warmer overall. For the overall United States, the wet areas across the northern tier are expected to get wetter and the dry, southern areas will get drier in the context of increasing temperatures. There is a band in the middle, including the upper basin of the Colorado River, where trends in total precipitation are not yet known.
- The full NCA3 document is highly accessible, searchable, downloadable, and organized by geographic area and topic at nca2014.globalchange.gov

Gregg Garfin ([ppt link](#)) provided a summary of the historical climate, observed current climate trends, and climate projections for the Southwest U.S. mainland under various greenhouse gas emission scenarios, along with numerous informational resources. He also explained how climate projections are created using global models, scenarios, and downscaling techniques, and the relative merits of each approach to downscaling global models to the scale of local decisions. He emphasized the concept of non-stationarity (that past climate no longer represents future climate, because of the increased energy in the atmosphere associated with anthropogenic activities) and stated that there is high confidence that:

- The frequency and strength of extreme heat temperature events are increasing
- The risk of extreme cold is decreasing
- Snowpack across the west is decreasing, and there are consequently earlier peak flows in rivers
- The frequency of extreme precipitation is increasing
- The severity of drought is increasing (warmer temperatures mean more evaporation)

Clay Trauernicht ([ppt link](#)) summarized historical, observed, and projected climate for Hawaii and the U.S.-affiliated Pacific Islands, which is a very broad geographic region covering much of the western equatorial Pacific. He emphasized impacts to humans and ecosystems related to sea-level rise, salt-water intrusion into groundwater supplies, increasing ocean temperature and acidification, drought impacts on water resources, and higher air temperatures. Although the changing climate is challenging cultural practices, traditional staple crops are found to be more resilient than imports, and the region has a long history of diversified crops and of watershed-scale land management. This "traditional knowledge" is now being used to support adaptive capacity.

Justin Derner ([ppt link](#)) provided a perspective from the Northern Plains, describing the region's importance in terms of agricultural diversity and production, as well as the efforts of the Northern Plains Climate Hub to transfer information, tools, and best

practices to agricultural producers to enhance decision making in the face of climate change. A key component to NPCH's success was working with Extension because of its long-established and trusted relationships with farmers for over 100 years. Extension provides an excellent delivery mechanism to farmers for information on weather variability, reducing climate impact risks, and increasing resilience. Extension also provides an important feedback mechanism to the Climate Hub in informing it of farmers' needs. Some promising outputs: a primer on Northern Plains weather extremes; scenario planning for resilient beef systems; and sharing of success stories by early adopters with agricultural producers through short videos (<https://www.climatehubs.oce.usda.gov/northernplains>),

Jacobs ([ppt link](#)), followed with an introduction of the concept of "actionable information," stressing the importance of meaningful connections between science and decision-making, guided by research with a focus on information users need to inform their decisions. Actionable science was defined as including: an understanding of what is at risk; what is known vs. what is not known; what questions to ask and answer; how to use what is known; and how to characterize uncertainty. Those hoping to help decision-makers use scientific information need to help them understand that impacts may not be incremental, but abrupt, and that there are often "cascading impacts" in multiple sectors from single events such as heat waves or forest fires. A successful climate service would incorporate both actionable science and regional knowledge networks that build from existing adaptation capacity, with better articulation of needs and of existing tools, as well as stronger linkages between knowledge producers and users.

The panelists were asked how Extension agents should deal with different audiences; some need help, others don't want it. They advised putting oneself in their stakeholders' shoes to: understand their needs and perspectives, tailor the response to fit the clientele, make sure the conversation is two-way, seek common ground, and continue to build relationships over time.

2. Barriers, Solutions and Opportunities (Kathy Jacobs, session leader; Rob Davies, Caiti Steele, Mike Crimmins presenting panelists; [link to ppts](#))

a. Current challenges

The climate that humans are adapted to is dramatically different from where we are headed given current and past emissions of greenhouse gases. The changes are expected to be most substantial in precipitation type (rain vs snow) and timing, and for soil moisture projections, which are particularly relevant to agriculturalists. We produce carbon emissions when we produce energy, food, and wealth, and mitigation of this carbon production will likely require:

- A redesigned energy system more focused on renewable and distributed systems, with carbon pricing
- Redesigned food systems, with attention to soil, forests, and livestock
- Changes in the economy, with accompanying changes in consumption, lifestyles, and mindset

More mitigation of carbon production means less climate warming and fewer impacts to adapt to. Within the agricultural community, US Secretary of Agriculture Tom Vilsack's *Roadmap to Achieve America's Renewable Energy Goals* provided a plan

to develop regional strategies to increase the production, marketing, and distribution of biofuels, which has been difficult to implement in the Western region. Vilsack has stated [<https://www.whitehouse.gov/blog/2010/06/24/usda-unveils-roadmap-achieve-america-s-renewable-energy-goals>] that further investments are needed in the areas of R&D of feedstocks; sustainable production and management systems; efficient conversion technologies; and high-value bioproducts and analysis tools. Agricultural producers, however, have been more comfortable talking about climate adaptation than mitigation.

b. Motivation for forging new partnerships

The USDA Climate Hubs were established in 2014 “to deliver science-based knowledge, practical information and program support to farmers, ranchers, forest landowners, and resource managers to support climate-informed decision-making in light of the increased risks and vulnerabilities associated with a changing climate.” The Southwest Climate Hub, based at the Agricultural Research Service Rangeland Management Research Unit in Las Cruces, New Mexico, covers the Pacific Islands, Arizona, Hawaii, New Mexico, Nevada, and Utah. It also partners closely with the California Climate Hub at Davis. Its vision is a sustainable future, with healthy and productive working lands. As a new program, it has had to learn what its clients want, and found that a productive approach to that question is focusing on vulnerability assessment, starting with one for forests, using climate envelope modeling.

Looking at issues and needs at a more local level is also promising; this local focus can be implemented more readily by collaborating with Extension, which has a long history of working with diverse clientele and trusted, long-standing relationships within agricultural communities.

c. The role of the Southwest Climate Hub and Extension- and opportunities for extension

With over 3,000 county offices connected to over 100 land grant universities, Extension is well-connected but is sometimes seen as antiquated. The infusion of help from Climate Hubs is welcomed in addressing climate challenges in outreach work. New collaborations with NDMC and NIDIS, CLIMAS and NMSU Extension have, for example, allowed La Niña and drought workshops to be offered and the expansion of CoCoRaHs.

Extension is a boundary organization, working to bridge the science-society boundary, while ensuring salience, credibility, and legitimacy of its message through:

- convening of groups (such as master gardeners and watershed stewards)
- communication as knowledge brokers between universities/science and local communities
- translation of information and knowledge
- mediation as unbiased and trusted brokers. The challenge is to work in the climate arena, which has become political.

With its interdisciplinary focus, expertise in coproduction of knowledge, and flexibility, Extension has the social and political capital to incorporate climate science into its 21st century agenda. Clients who do not trust climate scientists often do trust Extension agents.

3. Actionable Science: What Works, When, Where, and Why? (session 4) (Mark Walker, facilitator)

For this discussion and as a resource for Extension agents, John Cobourn and Ted Grantham developed a listing of Extension programs that incorporate climate change information, including brief descriptions, URLs, and contacts for each program. The list is updated regularly and is posted at [XXXXX](#).

Youth and Family: **Martha Monroe** ([link to ppt](#)) noted the following successful Extension youth and family programs related to climate change that have been implemented in the Southeastern US:

- Project Learning Tree curriculum on Southeastern Forests and Climate Change – for E-H students
- Citizen science through the National Phenology Network
- Adult extension programs, e.g., Sustainable Floridians
- The Kettering Foundation's National Issues Environmental Issues Forum (NAEE), with a town-hall format on climate change
- Extension Sea Grant programs that address infrastructure issues related to climate impacts, particularly as related to sea level rise.

Water, Floods, and Drought: **John Cobourn** ([link to ppt](#)) found there were few Extension programs that address water in the context of climate. Nevertheless, *some* success stories related to climate adaption include:

- Flood awareness weeks in Nevada (Div. of Emergency Management)
- Nevada Extension public education campaign with Watershed Coalition on protecting riverine floodplains
- Tours of flooded areas with municipal and county officials
- Storyboards that simulate runoff projections (Minnesota and Wisconsin Nonpoint Education for Municipal Officials [NEMO])
- Climate Ready Communities climate adaptation community planning in Dane County, Wisconsin
- Rutgers' Preparing New Jersey for Climate Change identified best practices for watershed management

Fire, Range, and Forestry: **Susie Kocher** ([link to ppt](#)) reported that half of the US forestry Extension programs increased their instruction in climate change topics in the last five years. Information about forests and climate change is targeted at climate-driven events, such as increased high-severity wildfire, drought, and bark beetle mortality. Successful approaches to the topic have included translating research to policy for managed forests, such as addressing how the carbon cycle interacts with best practices on managed forests (e.g., ways to promote carbon sequestration through forest and soil management). The Pine Integrated Network: Education, Mitigation, and Adaptation Project (PineMAP) is a new boundary organization working on these topics. The Association of Natural Resources Extension Professionals (ANREP) leads a new Climate Science Initiative, which promotes system-wide responses to climate impacts to ecosystems. And eXtension Climate Collaborative (http://articles.extension.org/climate_forests_woodlands) provides a learning environment to assist forest managers in changing climate.

Agriculture: **Tapan Pathak** ([link to ppt](#)) described several existing Ag Extension programs that incorporate climate change:

- Ensuring Sustainable Agriculture in the Face of Climate Change (a SARE professional development program) for extension educators includes a resource handbook, core curriculum, and webinar series.
- A Climate Masters' degree in Nebraska and Oregon was modeled on Master Gardeners, providing 10-week curriculum on energy, green building, water conservation, etc., and resulted in more than 1000 hours of volunteer work. The structure is flexible and customizable to local audience needs, and can be initiated with a single coordinator who has expertise and several volunteers.
- UC Office of the President's Carbon Neutrality Initiative: the goal was to increase sustainability education across the entire UC system.
- A collaboration of University of California's Agriculture and Natural Resources, UC Merced, the California Climate Hub, and the Lawrence Berkeley National Laboratory aims to understand and bridge gaps in almond farmers' climate information needs and provide decision support for almond growers, including calculating metrics of relevance for climate models and evaluating the skill of climate models. The most relevant metrics from the growers' perspective is quantifying risk.

Commented [KJI]: Is this an extension program?

Urban Programs: **Chris Jones** ([link to ppt](#)) described an effort to incorporate climate education into Arizona Master Gardeners and Watershed Steward Master's Programs, beginning with a Climate and Vegetation working group. Perhaps a Climate Master's or Sustainability Master's programs should be instituted? Program performance measures should include how much is accomplished (quantitative), how well it worked (qualitative), and whether the results benefit anyone (quantitative and qualitative).

In general, panelists acknowledged difficulties in involving minorities in their programs, which were partly overcome in some cases by translating materials and giving trainings in Spanish and by working with NGOs such as Latino Outdoors.

Discussion also addressed the need to take advantage of teachable moments about climate change, such as mass tree die-offs, while being careful about attributing events solely to climate change or oversimplifying complex causation. Dave Breshears' work¹ comparing 1950s drought to current drought and discussing the differences and ties to climate change was cited as a good example of how to draw people in to more nuanced discussions. Attendee Mark Thorne stressed that the ranchers he works with do not have the luxury of worrying about long-term climate risks or carbon mitigation, but instead are involved deeply in day-to-day management of their herds and lands. Making this information relevant to people who have plenty of other issues on their hands is a significant challenge.

4. Lessons Learned in Programs

Three workshop sessions sought to identify lessons learned in moving from vulnerability to resilience, beginning with a facilitated discussion with a panel of presenters (General Presentations), followed by back-to-back World Café discussion sessions (brainstorming ideas within two separate groups, building towards combined suggestions) focused by

¹ Breshears DD, Cobb NS, Rich PM, Price KP, Allen CD, Balice RG, RommeWH, Kastens JH, Floyd ML, Belnap J et al. 2005. Regional vegetation die-off in response to global-change-type drought. Proceedings of the National Academy of Sciences, USA

topic area.

a. General Presentations

John Stevenson ([link to ppt](#)) presented lessons learned in climate extension in the Pacific Northwest. He warned against aligning climate change issues and solutions with political perspectives and advocated neutrality, focusing instead on how different indicators/aspects of change impact lives and livelihood. Global climate projections should be viewed in the context of how they intersect with communities. For example, how will or should growing degree-day changes affect management decisions on which crops/varieties are grown, when they are harvested, and how they are irrigated?

Heidi Brown ([link to ppt](#)) gave a perspective on climate change impacts to human health. In her research, she focuses on the relationship between diseases like dengue and Zika and the behavior of specific mosquito vectors; different types of water sources are amenable to breeding of different mosquito species and so act as conduits for different diseases. Climate influences the survival, development, and distribution of mosquitoes. Science can help target where interventions are necessary to protect human health. A particular concern is the management of water harvesting systems (a popular climate adaptation technique) to limit mosquito activity.

Rob Davies ([it's only possible to link to video of his Keynote presentation](#)) emphasized that climate mitigation has had its share of successes: we know what is happening with the climate and why; the COP 21 Paris Agreement sponsored by the United Nations to combat global climate change includes individual country commitments to limiting emissions so that global temperature increases do not exceed 2 degrees, but also includes a recommendation to limit global temperature increases to 1.5° C above pre-industrial levels. It has been ratified by 117 nations, including the United States; we have capacity to develop and deploy renewable energy sources; and cities are already setting low-carbon goals. However, difficult conversations about mitigation are necessary with the agricultural sector, which has much to gain from engaging on this topic.

Justin Derner advocated for Extension work on climate change that links science to what producers need to know, with a focus on interpreting probabilities of future conditions. Knowing the actual agricultural decisions that need to be made will increase the relevance of the climate information that can be provided. Utilizing an economic argument can, for example, persuade ranchers to make operational changes to adjust to drought and wet years, or better match forage availability with long-term forage need. Seasonal forecasts can also be used in conjunction with production calendars to find areas where ranchers can add flexibility to cattle production and range management. Producers want to hear about adaptation measures because they see the opportunities they present; mitigation is a dead-end conversation with them because it focuses on constraints and regulations (at least in the approaches used to date).

Faith Kearns ([link to ppt](#)) provided a framework for climate work by scientists that is relationship-centered. Although climate science has improved in its ability to communicate across academic disciplines, for real social change climate scientists

Commented [MB2]: Note: he did not use a ppt

need to communicate better with non-scientists. She encouraged scientists to call on their subjective skills in working with stakeholders, with listening becoming an equally important element of communication. Her framework² emphasizes relationship building, conflict tolerance, collaboration, the ability to contextualize, self-awareness, empathy and compassion, active listening, contemplation, mindfulness, self-reflection, and appreciative inquiry. She suggested that science experts should not be afraid to think like a psychotherapist, identifying their own long-term anxieties and opening this topic to discussion.

A considerable amount of the discussion centered on how climate mitigation can be introduced and discussed by Extension agents and their clients and whether it is an appropriate topic to address. How can Extension empower people to find their own answers? Perhaps by focusing on helping agricultural producers to build their skills rather than providing them with answers. Some felt fear of regulations should not stop the discussion; more regulations are inevitable if the issue is not addressed. Others advocated a more cautious approach, worrying that established relationships with clients could be jeopardized by pushing mitigation. Appropriate bipartisan regulation followed by an Extension policy that helps to implement it is an idealistic goal but perhaps unrealistic. Respect must be maintained for those who resist having this conversation. Most agreed it is important to know your audience and target your message. Peer-to-peer and producer-to-producer training is also very impactful: Extension educators can be facilitators and identify producers who are doing effective mitigation or adaptation and line up tours for people to learn from each other. Sometimes mitigation and adaptation are not mutually exclusive: forest restoration, for example, is an adaptation practice for improving ecosystem resilience of the landscape but also allows for mitigation by maintaining carbon stock. With a difficult audience one can focus on adaptation and let mitigation piggyback until the more difficult conversation can occur. Mitigation can also be introduced and successfully into child and family programs, as was the case with recycling.

A change of terminology can also allow conversations to take place about climate impacts with those who are averse to the term, e.g., talk about what drought means for water supplies rather than focusing on climate change per se.

b. Specific Success Stories in Programs/World Cafes

Youth and Family (Martha Monroe and Kerri Jean Ormerod, facilitators; Christina Greene and Lynn Rae, recorders)

Key messages that emerged from the two breakout sessions on this topic:

- Working with youth is especially important because they are most affected, most at risk, likely to be dealing with this issue, and open-minded.
- Mainstreaming climate change topics into existing education efforts is better and more effective than instituting a stand-alone curriculum.
- Youth must be engaged in interesting and relevant ways such as through outdoor activities, food-related activities, citizen science, gardening.
- Coordinate across Extension so that county needs can be addressed from the bottom up. Regional, state, and district initiatives could incentivize

² Kearns, F., Relational approach to climate change, in *Climate Change Across the Curriculum*, ed. by E.J. Fretz et al., Rowman & Littlefield, 2015.

curriculum development and teacher participation

- Peer-to-peer and near-peer teaching and mentoring is most effective with youth.

4-H was seen as the most promising entryway for climate information. High-school students can be enlisted and educated to provide trainings for middle-school or elementary students, and are more likely to be paid attention to than to teachers. A facilitator can help with initial sessions, but hearing from high school students is impactful and can be supplemented by experts to make sure critical points have been covered. 4-H's National Youth Science Day could be a great venue for this information. 4-H afterschool programs also provide an informal environment that is conducive to learning. Maker fairs also are good conduits for citizen science.

Within schools, teachers are more comfortable with having others come in and provide the education. There may be no political will to introduce climate units into the curriculum but relevant topics can be integrated into studies of ecology and earth science as well as math and literature. It's important to link to existing teaching standards. The Climate Hubs have developed some materials that can be utilized (and many other sources of climate-related curricula exist).

Possible topics for programs: Gardening can be a topic that leads to discussions about local food, then can lead in to mapping where food comes from and the mileage it travels to tables, and discussions of associated energy implications; can also provide school garden food to the cafeterias. Discussing energy use is another entryway.

Utah and California have youth sustainability camps that are quite successful. For families, neighborhood-scale organizations provide structure and social connections; informal meetings such as potlucks and fairs can provide forums for discussions on imminent concerns such as drought and fire – stressing personal safety and using and strengthening existing social bonds.

"One mistake I made was not fully trusting that an audience was ready for the information. Even the youngest kids can do something and I should not hold back."

Natural Resources: Water, Floods and Drought (Kathy Jacobs, facilitator; Kerrie Geil and Jacob Petersen-Perlman, recorders)

Key messages that emerged from the two breakout sessions on this topic:

Integrating climate-resilient thinking into programs:

- Water integrates across Extension programs to help resilient thinking, because almost all Extension programs connect to this topic and water availability is closely connected to climate issues.
- Monitoring and benchmarking should be used to quantify benefits and for adaptive learning/management. The only way you can tell if you are making progress in adaptation is through objective assessments of progress – and these require good monitoring.

- Use systems thinking. Talk about how agriculture is connected to water supplies, transportation, global markets, etc., and how climate affects these things at multiple scales.
- Learn from indigenous cultures about resilience. There are multiple examples (including those shared at this conference from the Pacific Islands) of how native peoples have developed approaches to managing multiple stresses over centuries.

Maximizing opportunities

- Partner with other sectors. For example, biofuels and forest thinning to reduce wildfire threats can increase revenues from existing agricultural and forest management practices.
- Agro-tourism and organic and sustainable practices all have economic benefits.
- Solve problems through economies of scale; working together on solutions across communities may improve cost-efficiency.
- Extension can serve as a bridge between policy, regulatory agencies, and farmers. Inject input from on-the ground managers into policy discussions.

Minimizing emissions

- Biomass, cover crops, piped irrigation (rather than unlined ditches), solar panels, green water systems, food labels, etc. were all suggested as ways to limit emissions.

Mistakes

- Conservation can lead to risk in some cases; for example, highly efficient water systems have no buffer during drought.
- Lack of preparation for climate change communication can be a problem – better to know how you will manage challenges to scientific information.

Water supply impacts from climate change vary from overabundance (floods) to scarcity (droughts). In the Pacific Islands, the problem is usually drought-induced, though there are also issues concerning effluent discharge and recirculating/reusing tailwater. One effective project was a partnership of Extension and the Natural Resources Conservation Service (NRCS) to help a tilapia farmer grow vegetables from water previously used for aquaculture; this water contains a lot of nutrients. There is a lot of interest in rethinking crop management. In the Russian River Basin of California, flows are low in summer but necessary for keeping salmon and trout populations alive, so one new water management strategy is for landowners to build reservoirs or basins to improve water security during times of low flows.

In New Mexico, the problem is too little water; they are experiencing groundwater depletion and the need is for better irrigation water and saline soil management.

Extension agents need to be more aware of local conditions and the needs of their stakeholders. Growing cover crops in Texas and New Mexico can dry out soil for the next round of crops, but in other contexts, as in California, it can be effective to grow cover crops in winter before spring vegetable production to

retain soil moisture. Urban vegetation can be used to address both adaptation and mitigation, e.g., by using gravity-fed irrigation, water-efficient landscaping, or shade trees. Solutions must be very localized. It's important for Extension agents to exercise humility and acknowledge they are not the prime knowledge holders. Know your audience. People on the ground are doing good work, e.g., ranchers are adapting to drought by not stocking at full capacity and developing their water resources, looking at ways to improve delivery efficiency, but often *"The term climate change to my guys is a bad word."* Peer-to-peer collaborative learning is very effective, however.

Indigenous knowledge should be given attention and respect. In Palau, the traditional 4,000-year-old industry is agro-forestry and does not use fertilizers and pesticides. They know about climate variations, adjust to drought, and expect food production to decline in the context of climate change. Extension agents should be sensitive to this knowledge and can reinforce the idea that traditional practices can help native farmers adjust their farming techniques to capitalize on tourist food demands. It is not helpful to impose "Western" agricultural practices in places where they are not useful.

Some opportunities/positives: solar panels to shade irrigation canals and gravity-fed rainwater harvesting systems are win/wins for adaptation and mitigation. There is also big interest in local foods and the potential to initiate and integrate agrotourism (producer tours for urban audiences connected to advocacy stories), building partnerships with the private sector to increase opportunities side of the equation. Transitioning to organic systems can create much better financial returns. Sale of biomass from forests (as from thinning projects) has great potential but has some opposition; regulatory obstacles need to be overcome.

"If we listed water and energy use on our food labels, things would really change." The idea here is that food labeling to show water/energy footprint would affect consumer behavior.

Water limitations make farmers focus on high-value crops, which lead to increasing risk in response to a shortage. Demand hardens.

Natural Resources: Fire, Range, and Forestry (Clay Trauernicht, facilitator; Chad Marchand, reporter)

Key messages that emerged from the two breakout sessions on this topic:

- We must remain flexible and frame our conversations in light of the new political environment.
- We must understand what clientele priorities are and how we can work within their goals; climate change is often at the bottom rung but can be framed as an opportunity.
- There is no magic bullet for effective conversations. Maintain relationships by understanding the consumer. Sometimes we may not be able to use the term "climate change."

The Extension clientele is broad and diverse. It can be helpful to address communities of clients with shared problems rather than large, generic groups. The

clientele includes people who shut down at the mention of climate change. Best to get them talking about what they do, the issues that they face, and possible solutions. People may know what they need to do but can't afford it. It is best to refrain from getting pulled into the politics of the issue and solicit ways to work together rather than against each other.

Session participants agreed that language and terminology is important. "Climate change" is often a non-starter, as is "climate resilience." Identify issues that are most visibly impacting the farmer and address those first. You can reframe the issues in less threatening terms or initiate discussion in the form of questions rather than statements. In contrast, others felt that Extension is neglecting its responsibility by dancing around the issues and should be more straightforward in their discussions with their clientele about climate change.

Ranchers take care of their lands; stewardship is already understood. We need to find ways to turn early adopters into peer leaders. There may be too many Ph.D.s in Extension work; need a less hierarchical style of communication.

Agriculture (Steve Lewis, facilitator; Chris Knudson, reporter)

Key messages that emerged from the two breakout sessions on this topic:

- We must frame our conversations around what matters to our audience. Recognize the needs of the clients.
- We need to tell stories using the language relevant to our clients rather than academic approaches.
- Seize the moment and momentum to have difficult conversations.
- Present the message respectfully and in a way that maintains the relationship.
- Prove and document the efficacy of what we do, both to farmers and our bosses.

Some participants advocated "stealth Extension," letting the stakeholders themselves explore how to integrate climate change science into their work without using "climate change" terminology. Stakeholders will talk about drought or old practices that are no longer working; use language they are comfortable with. Hawaiian farmers have noted that grazing lands have moved up in elevation as temperature changes and ask Extension why this is happening; this provides an opportunity to talk about a changing climate with higher temperature and drier conditions. Others found success by being explicit about the links between climate change and pests and food production, for example, in a recent conference on climate-resilient agriculture. It's also possible to talk about climate change without talking about attribution: this is more palatable to some and also allows management changes in at least a small scale.

Discussion about longer-term change is possible by sharing information with stakeholders on future trends: this normalizes the idea, especially if it comes from people they have a trusted relationship with. Farmers who are fourth- and fifth-generation agriculturalists have already proven their resiliency in running their farms; they need to hear how the future will be different and harder to predict.

Some Workshop participants thought that discussions about minimizing emissions are only possible if that is the stated focus of a meeting. Ranching was seen by some as an activity that has more potential for mitigation, compared to farming. Waste lagoons from pigs, dairy, and feedlots impact the methane in the atmosphere and ranchers can put in digesters that convert methane to burnable fuels. Farmers instead are generally concerned with water supply and water quality and need more information. Carbon calculators are available for farmers that can be used to see which changes will have the biggest impacts, but there are “supply chain” boundary problems. The amount of fertilizer used in agriculture is an issue being debated in California and Utah.

It is more important to help farmers become more climate-resilient in their practices than make them political converts. Look at the information they lack when they make management decisions and try and provide it in a climate context. The needs are local. Farmers can use climate data for yield forecasting to help them decide what to plant annually. We need to understand the risk tolerance for a poor forecast. Growing degree days are also a concern. Conversations with certified crop advisors (CCAs) can be productive, e.g., discussions about depressed corn yields, seasonality. In California, fewer chill hours have been a problem and present an information need, especially for specialty crops like fruit and nut trees and grapes. The answers vary by region and by cultivar. With minimum temperatures rising more than the maximums, last year’s pistachio and pecan crops were adversely affected. Seasonal change is an easy entryway into communities; talk about seasons and allow that to lead into discussion of longer-term change.

We can make better use of data by: giving people the specific data sets they need; making summary sheets of data; hosting workshops for wildlife managers where we give them GIS-ready info they can plug into their species distribution models. The key point is that data use is context-specific. We need to be ready with the data so we can give it to different groups when they ask.

Climate Smart Farming (from the Cornell Institute for Smart Solutions, climatesmartfarming.com) provides a relevant and helpful factsheet, “Farming in an Uncertain Future.” Other good types of information sources: Climate Wisconsin has an ice thickness tool that can plug in data to tailor it locally. CalAdapt in California is another good resource.

“We need to find convincing and quantifiable ways to convince people of the usefulness of climate work.” – Extension agent from Guam

Urban Programs (Chris Jones, facilitator; Sandra Bernal, reporter)

Key messages that emerged from the two breakout sessions on this topic:

- Bringing awareness to the topic of climate change is a challenge.
- Young people are the key to successful dissemination of knowledge because they are the future decision-makers.
- Urban programs are an important element in this equation because of the numbers of people who can be reached.

Creative strategies are required in the context of climate change. The topic must be linked with discussion that is tangible for stakeholders to engage with. Interactive

tools are helpful. Also, it is best to hold conferences and events that focus on very specific impacts (e.g., drought) rather than complex topics related to climate change. The economics of climate change needs to be communicated.

Young people are considered the key to advancing knowledge on how to adapt to climate change and also to mitigate. Creation of curriculum similar to what was created for recycling holds promise. Master Gardeners are learning from youth groups about what works best in transferring knowledge. Critical thinking skills can be promoted that will help in solving problems.

Because urban populations are by nature highly concentrated, this group is an important focus area for Extension programs.

5. Climate Communications (session 6)

What is Extension's role in communicating climate information in a contested context? How should mitigation (carbon management) topics be addressed, if at all? Panelists Rob Davies, Chris Jones, Mike Crimmins, Martha Monroe, and John Stevenson provided some suggestions on how to handle claims sometimes posed by climate deniers, facilitated by Steve Lewis. [Examples of such claims are:-](#)

- *"The climate is always changing."* In a group setting, acknowledge the sentiment. In an individual context it is possible to engage more about how to distinguish natural variability from human contributions to climate change and note that it is changing faster than can be explained naturally. If people want to argue and make assertions during a question and answer period, ask if they have a question.
- *"Thousands of scientists don't believe in CC."* Ask the person to explain why they believe this or where they got that information.
- *"We can't cut back on carbon production without killing the economy."* This comment is about policy, not science; you can redirect back to science if it's in the context of a talk about climate change. There are plenty of economically viable options, including alternative energy sources that aren't economically harmful.
- *"So what can we/I do?"* This is a welcome question. Emphasize that climate change is an all-of-us issue, not a science versus community problem. Suggest that the questioner start talking about it with family, friends, colleagues, peers. Don't tell people they are doing something wrong; acknowledge your own carbon sins and make your own efforts to make personal changes.

Skepticalscience.com was cited as a particularly helpful curated website and mobile app, and presents scientific facts at different literacy levels, with primary literature links. Most individuals want facts rather than hypotheses, even if it means a later follow-up.

There is also utility in discussing the basic facts of climate change. We need to focus discussions so that they are appropriate to different audiences and help people articulate

what they are feeling. Listening to groups allows us to figure out what they are thinking about climate and weather so we can meet them where they are. People will come along if we give them the scientific background for what they have already noticed, e.g., changing weather patterns. It can be useful to survey both clientele and other Extension agents within one's region to determine what they understand about climate change, then use the information to develop climate literacy programming relevant to both groups.

What is Extension's role in approaching adaptation? Extension agents need to trust their instincts in determining whether they can offer information on climate change adaptation or simply engage by asking questions. Events such as drought offer an opening for discussion about climate change because people want to understand what is occurring. We need to translate science to the public through risk management. Uncertainty prevents us from providing perfect answers to specific individuals or about specific lands, but we can empower and encourage landowners to experiment and talk to their neighbors about a range of possible future conditions. If we alienate stakeholders or politicize issues it hinders the exchange of free market ideas.

Extension clients need access to climate-change-science specialists, but not all the time. Extension personnel should have fundamental literacy about climate change, but it is sometimes easier to bring in scientists or the campus-based Extension personnel to impart climate change information. The scientists can take the hits from skeptical audiences, provide sound facts and expertise, and preserve county Extension/client relationships. But as long as you are delivering good scientific information you should not fear confrontation. Extension should help communities explain their science needs to the academic/research community so appropriate and actionable science can be undertaken.

To improve communication between Extension and research, in proposal writing Extension representatives should be bolder and more deliberate about determining the questions that need answers. An open line of communication between Extension and research is needed.

One Extension specialist advocated approaching climate naysayers as equals. *"My clientele is overwhelmingly polite and knowledgeable about what they do. Most haven't thought about climate change that much or really thought about how they can be part of the solution. Those are the folks I can probably approach. I have to approach the naysayer as an equal. I have to maintain my good relationships."*

One speaker felt that scientists pay too much attention to the 2 percent of the public who are outspoken naysayers. The real audience is the other 98 percent...*"Arming yourself with facts is okay but it is arming yourself for battle."*

Extension's role is always to understand and translate science; when you simplify, make sure the answer is still accurate. Listen to client needs and balance the two.

Presentations and events that deal with climate change should begin with basic facts. *"I've always felt the climate change talk right out of the gate is like skipping to chapter 13 in a text when you don't even know the basics. I think it is partly a literacy issue. The clientele we work with, everyone is a weather nerd. If we start there, it all makes sense and they come along quite easily."*

Commented [MB3]: Kathy suggests deleting this sentence but I thought it was especially compelling and not objectionable.

To make quicker progress on building awareness of climate change in the agricultural community, one participant advocated starting at a higher level: in Utah, for example, it would be by starting with the leaders in the Utah Department of Agriculture and Food and the Farm Bureau. Talk to them about the seriousness of the problem; if they want to promote preparedness, they have contacts in the state legislature that can facilitate much more rapid progress than working with individual clients can.

Multi-state projects focused on climate change within the Southwest region that are developed collaboratively with the Cooperative Research and Extension system and the Climate Hub could provide additional funding and allow cross-pollination among personnel.

6. Strategies Session (sessions 11 and 12)

a. Creating a SW Regional Network

By rallying around the shared problem of climate change, we each have an opportunity as well as a responsibility to do something, however small, to affect something important. The level of knowledge and sophistication needed to mainstream climate change across all Extension programs is not yet adequate. However, by facilitating two-way or multiple-way communication between scientists and producers and managers, Extension can make lands work harder and also healthier under climate change. Extension does not have to do all the work. Extension can also benefit from and build on already existing climate science networks (NOAA RISAs, Landscape Conservation Cooperatives, Climate Hubs, Climate Science Centers, American Society of Adaptation Professionals). Networking can also be extended to other systems, so that food producers and consumers are better connected, for example, or agriculturalists who share watersheds across wide regions.

Producers also need some incentives for recognizing and addressing climate change. Citizen science provides an entryway: Collecting and sharing data through CoCoRaHs, for example, allowed discussions about how precipitation changes are affecting pasture systems, and gave producers respect for the integrity of data.

A regional network will allow Extension personnel to leverage each others' expertise and also facilitate the development of collaborative grant proposals, which institutes such as NIFA welcome. However, some funding will be required for a partnership to be established and hold together. Extension needs to do a better job of marketing ourselves in terms of what we offer and what we can provide.

b. Advice and Priorities (sticky wall)

To determine their priorities and preferences for what a new Southwestern Partnership would provide, and how these outcomes and outputs can be achieved, workshop participants engaged in an interactive brainstorming activity facilitated by Steve Lewis. This activity was based on a logic model and proceeded through a series of questions posed to all participants:

- What **outcomes** do we foresee from the Partnership?
- With these outcomes in mind what **functions/products** should the Partnership provide?

- What are some **strategies** to initiate these functions/products and keep them ongoing and effective?
- How shall we **measure** the impacts of the Partnership?

For each of these subject areas, participants were asked to submit their ideas on “sticky notes” that were subsequently arranged into similar groups of ideas.

What Outcomes or Vision do we foresee from the Partnership? (greenish yellow sticky notes)

Awareness

- Increased coverage at public events; higher profile for Extension on climate issues; speaker’s bureau; possible XXX; improved Extension programs that are useful in several states; build knowledge of Extension needs; increased knowledge on climate change for non-climate Extension personnel

Funding

- co-authored proposals and projects; successful proposals to develop and deliver regional programs that incorporate climate; broader network of collaborators on grants; competitive funding seekers; collaboration in grant applications; coordinated regional products; use network to leverage external funding

Capacity building

- Better ability to prepare for change; increased climate and environmental literacy; climate literacy for Extension; increased level of citizen participation in XXXX; increase majors in STEM fields; producers doing BPs for climate change

Practical solutions

- reduced carbon emissions; adaptable communities; BMPs; a food production system that is sustainable despite changing climate; resilient agriculture

Knowledge

- multi-state coordinated Extension; increased faculty knowledge and comfort with subject; increased capacity; increased technical capacity; identified content experts and existing data and science to build a climate science library; resource support; region-wide publications on XXX of climate change; better science communication

Networking

- Collaboration with climate science initiative of ANREP to host another conference perhaps annually; sustained communication network; regional rolodex; westwide active research network

Collaboration

- Synergy; collaboration among universities and partners to continue or start broader Extension efforts; increased networking/collaboration; climate engagement; state-regional collaboration; stronger interdisciplinary collaboration; strengthen our network to work collaboratively and across disciplines; identify partnerships with sister organizations; climate engagement

What Functions/Products/Outputs should the Partnership provide, given the desired outcomes? (red)

Funding

- Joint grant proposals; promote and encourage interstate projects; regional approach to forest resilience to disturbance (fire and insects); regional approach to genetic resilience for forests

Commented [MB4]: Should these be more summarized? Suggestions on how to handle this?

Commented [MB5]: Color coding mentioned here only temporarily; I need to double-check with Kathy’s pics some of the language because mine were not completely legible.

Training

- Process/method guidance; training modules; agricultural professional education event; continuing professional development; educate agents on climate change; hold or host trainings and share best practices; common language of climate change; identify CES program information needs

Media

- Press releases; listserv community of practice; shared social media campaign; success and innovation stories; regional newsletter; provide knowledge through electronic library; multiple media resources; dynamic network; website; printed and electronic media publications; database of speakers in the region; resource access points

Tools

- Tools to facilitate climate smart land management; hire platform DST's/DSP's code; Climate-smart tools; resource toolbox

Curricula

- Curricula for resiliency; consultation for policymakers; youth climate curriculum related to local/regional issues; educational resource about impact of climate change on natural resources and agriculture and adaptation and mitigation options

Products

- Briefs; publications (fact sheets, policy briefs); publications to build climate literacy; joint paper on role of Extension in advancing climate science/adaptation; practical and useful publications; science-based content that can be repurposed; increase climate literacy across all sectors of Extension; peer-reviewed literature; ; field guides

Process

- Annual working meetings; regular meetings (within existing society?); build profile with other national/international adaptation organizations; meet regularly to share ideas; expert rolodex

BMPs

- BMPs for producers (easy to understand pieces of info we can share with clients); revised natural resources and agricultural MPS to reflect climate adaptation and mitigation; relevant research and Extension programming for agriculture; BMPs for conservation; implementation strategies

What are some Strategies or inputs to initiate these functions/products and keep them ongoing and effective? (orange)

Training/learning

- Continuing professional development; innovative hands-on education activities; ongoing learning opportunities; state and regional in-service training; include climate change education in all Extension programming

Collaboration / synergy

- Sustained interaction; regional team building; active, regular collaborative outreach events; multilateral strategic planning

Leadership/administrative support

- Develop leadership team; establish state leads to communicate within each state and with other states; state point of contact / change agent; advisory council; advisory committees; paid staff whose job is to keep people connected and engaged; identify/fund regional coordinator

Funding

- Funding obtained

Process

- Create and match incentives to tasks (and people) – not just money – consider authorship, promotion, recognition, conference travel, etc.; annual or semi-annual meetings; regular communication and information sharing; maintain interest; share needs/wants/ideas with your regional Climate Hub; Hubs can connect people with similar thoughts; regular meetings; multistate coordination call; ongoing communication through various channels; build shared contact list of experts; positive incentives for Extension people; social media (Twitter)

Planning

- Strategic/action planning; define a roadmap with priority subject areas; structure subcommittees with leaders; set up a conference call in Dec or early Jan; develop plan of work

Internal and external partners

- Reach out to state Extension work groups; connecting with other regions in the US; interdisciplinary working groups

Written, expressed support from Extension Directors

How shall we Measure the impacts of the Partnership? (yellow)

Funding

- Money raised from grants; number of successful grants received by Partnership; more \$ available for climate change funding; funded grants

Products

- Number of resources (publications, etc.); accepted peer-reviewed journal publications, presentation, etc.; number of producers, farmers, and ranchers helped; increased number of Extension clientele reached with climate change information; Extension fact sheets and downloads that address climate change; presentations and posters at professional meetings; collaborative outputs (number of papers, tweets, meetings, etc.); publications; changes in production practices; tangible resources to use with clientele; increased climate change mention in programs a robust “hardware store of knowledge” that provides tools for transformation; well-attended regular meetings, calls, and webinars

Improved technologies

- Changes in agricultural technologies; number, e.g., of changed practices re GHGs, agricultural improvements, etc.

Integration of climate information

- Extension faculty knowingly incorporate climate change adaptation into programs (survey); surveys of Extension personnel in the counties; number of integrating climate change in programs; annual evaluation and surveys; number of CES programs incorporating climate change; tracking student and family engagement in programming with climate info in it; number of funded and unfunded climate change-related programs that involve multi-state partnerships

Stakeholder metrics

- Survey clients (collect further data on existing research); survey clientele practices; survey clientele knowledge; evidence of changed behaviors; survey producers—are we helping?; Is anyone better off?; stakeholder requests for info or advice; changes in attitude; client testimonials (Extension, producers, kids, etc.); increase in public awareness of climate change scientific findings; success stories; \$ saved to producers via programs; empowered climate action events

Develop/use common metrics

- Benchmarking surveys with tangible metrics; social scientists identifying potential for adoption; regional indicators; number of climate-resilient practices taught; progress reports from states; ripple effects mapping (evaluation)

Some commonalities were identified across these categories. General discussion revealed the following priorities: [There are no notes from this discussion; perhaps Steve can expand this text?]

Vision	Inputs	Outputs	Measurement
Funding	Funding	Funding	Funding
Practical solutions		Products	Products
		Tools	Improved technologies
			Common metrics
			Stakeholder metrics
Awareness		Media	
Networking/collab	Collab/synergy		
	Partners		
Capacity building	Training/learning	Training	
	Leadership/admin		
	Planning		
Knowledge	Process	Process	Integration of climate info
		Curricula	

7. State Commitments (session 13)

Participants met with attendees from their states (and the extended Pacific Island region) to agree on priority actions to take, as well as responsibilities and milestones. (The individual state representatives may want to add more detail here).

Nevadans want to make sure that climate change becomes incorporated into statements and included in job advertisements and interviews. John Cobourn has agreed to convene the leadership team.

Pacific Islanders are in the process of building capacity to incorporate climate change into their programs. They would like feedback on how they can take the lead in assessing needs of stakeholders.

Utahans will request an explicit written statement from their higher administration to work climate change into programming. They want feedback from Extension agents on how they are doing this work, professional rewards and recognition for this extra effort. They would like to see more information on climate change incorporated into Family and Consumer Sciences.

New Mexicans expressed a strong commitment to creating materials to help Extension agents to share in schools and 4H programs. They feel they must be realistic in showing people how to reduce their carbon footprint while also reducing cost and time in production.

Californians intend to survey their own cooperative network to see what is being done and assess needs for more focused training and resources. They have an existing webinar series for drought that can be expanded to climate-change-focused talks. To achieve these goals, mechanisms include their climate change team and the University of California carbon neutrality challenge. They want to author a joint paper on how extension can advance mitigation/adaptation after their survey work. They will work with the California Climate Hub to see who else wants to expand their work in this area.

Arizonans want to initiate youth and 4H programs that include climate change, including rural and urban 4H groups on food and sustainability issues. Arizona holds two conferences a year and the summer 2017 meeting will be partly driven by what has been learned at this conference.

8. Conclusions and Next Steps

Participants felt empowered to engage with colleagues at home to build capacity to incorporate climate change issues into their Extension programs. Managing risk means engaging with opportunities as well, so conversations will need to emphasize the importance of both activities and encourage a pro-active stance. Dominant themes emerging from the workshop were the importance of: linking adaptation with mitigation through an interconnected solution set; listening and valuing relationships; and being prepared to help when there is an extreme weather/climate event. The new Partnership should also work to take care of its members, given the wider political context.

9. Appendices

- a. Glossary
- b. Agenda
- c. Participant List
- d. Resources (this should be a link to resources provided before the workshop and to the list of programs that John and Ted identified and posted)

APPENDIX A Glossary and Abbreviations

Actionable science

Actionable science provides data, analyses, projections, or tools that can support decisions regarding the management of the risks and impacts of climate change. It is ideally co-produced by scientists and decision-makers and creates rigorous and accessible products to meet the needs of stakeholders. (from Advisory Committee on Climate Change and Natural Resource Science, ACCCNRS)

Adaptation

Increasing the readiness and resilience of sectors to reduce the impacts of climate change; preparing and planning for climate change, minimizing those impacts that cannot be avoided and turning expected climate changes into opportunities wherever possible (Garfin et al. 2013)

ANREP

Association of Natural Resources Extension Professionals

Bottom-up approaches

Analysis or scenario methods that begin with analysis of the details of a system or decision that is of interest and then identifies general contextual trends or conditions that affect the system or decision

Boundary organizations

Organizations that facilitate collaboration and information flow between diverse research disciplines and between the research and public policy community. (National Socio-Environmental Synthesis Center)

CLIMAS

Climate Assessment for the Southwest, Climate Assessment for the Southwest – one of seven RISA centers funded by NOAA, based at UA and in partnership with NMSU.

Climate Hubs

USDA-funded centers established in 2014 to deliver science-based knowledge, practical information and program support to farmers, ranchers, forest landowners, and resource managers to support climate-informed decision-making in light of the increased risks and vulnerabilities associated with a changing climate. In the Southwest region covered by this workshop, the relevant Climate Hubs are: Southwest (based in Las Cruces, NM and covers NV, UT, AZ, NM, and Pacific region); and California (based in Davis, CA and covers CA)

Climate scenarios

plausible representations of future climate conditions (temperature, precipitation, and other factors) produced using a variety of techniques, including but not limited to modeling or use of analogs of climates from other locations or time periods as example future conditions. (adapted from Moss et al. 2011).

Climate Science Centers

DOI-funded centers that partner closely with natural and cultural resource managers and scientists from inside and outside government to gather information and build tools to help fish and wildlife and their habitats and ecosystems adapt to the impacts of climate change. In the Southwest region covered by this workshop, the relevant CSCs are: Pacific Islands (based in Honolulu, HI); Southwest (based in Tucson, AZ and covers CA, NV, UT, AZ); and South Central (based in Norman, OK and covers NM)

Climate services

Transforming climate-related data and other information into customized products such as projections, trends, economic analysis, advice on best practices, development and evaluation of solutions, and any other climate-related service liable to benefit that may be of use for the society. (EC 2015)

Climate variability

Natural fluctuations in annual climate conditions, such as amount of precipitation in a year or the average temperature in a year

CoCoRaHs

Community Collaborative Rain, Hail and Snow Network – a nonprofit community-based network of volunteers that measures and maps precipitation (www.cocorahs.org)

Coproduction of knowledge

the process of producing usable, or actionable, science through collaboration between scientists and those who use science to make policy and management decisions (Meadow et al. 2015)

Decision context

A clear definition of what question or problem is being addressed by the planning or decision process; it establishes the scope and limits of the effort (Gregory et al. 2012)

Downscaling

Using data from global climate models and observations to get climate information for more localized areas, such as the U.S. Southwest.

- *Dynamical downscaling* models climate by using a limited-area, regional climate model that takes the output from a GCM as input to model climate at a finer spatial scale. Its grid spacing is in tens of miles, and so better represents complex topography, but is quite expensive to use. (modified from Garfin et al. 2013)
- *Statistical downscaling* uses mathematical relationships between global climate model data and historical data to adapt global projections to local conditions. (modified from Garfin et al. 2013)

Mitigation

Reducing the causes of climate change; often this refers to reducing greenhouse gas emissions. Examples of mitigation measures include reduction of greenhouse gas emissions through improved home energy conservation, improved automobile gas mileage, or development of low-emission alternative energy power plants (SW tech input)

NAAEE

National Issues Environmental Issues Forum, a program of the North American Association for Environmental Education

NCA3

Third National Climate Assessment (www.nca2014.globalchange.gov)

NDMC

National Drought Mitigation Center (drought.unl.edu)

NIDIS

National Integrated Drought Information Program (www.drought.gov)

NIFA

National Institute of Food and Agriculture

Resilience

The ability of a system to respond and adapt to shocks or pressures in order to prevent a qualitative, negative change in the state of a system. (National Socio-Environmental Synthesis Center)

Resilience strategies

Management strategies that enhance the capacity to withstand and recover from emergencies and disasters (Garfin et al. 2013)

Draft Version 12.9.16

RISAs

Regional Integrated Sciences and Assessments centers funded by the National Oceanic and Atmospheric Administration (NOAA). In the Southwest region covered by this workshop, the relevant RISAs are Climate Assessment for the Southwest (CLIMAS, based in Tucson, AZ and covers AZ and NM); Pacific RISA (based in Honolulu, HI); and Western Water Assessment (based in Boulder, CO and covers CO and UT).

SARE

Sustainable Agriculture Research and Education Program of the USDA and NIFA

Scenario planning

A scenario is a description of a possible future state of the world. Scenario planning is a process designed for managing into the future under conditions of high uncertainty and lack of control. Its objective is to develop and test decisions under a variety of plausible futures. (modified from Garfin et al. 2013)

Top-down approaches

Methods that analyze general trends or properties of a system (e.g., global socioeconomic trends that give rise to emissions, then climate scenarios) to depict the broad context of future conditions which impact specific places, entities, or how decisions play out. (Garfin et al. 2013)

Vulnerability assessment

A systematic evaluation of projected or observed exposure to negative impacts from an event or process, analyzing sensitivity and capacity to adapt, and on those bases creating a ranking of impacts to assist in planning. (Moore 2013)

Glossary Sources:

Advisory Committee on Climate Change and Natural Resource Science.
<https://nccwsc.usgs.gov/content/actionable-science>

European Commission. A European research and innovation roadmap for climate services. Doi:10.2777/702151 Brussels: European Union, 2015.

Garfin, G., A. Jardine, R. Merideth, M. Black, and S LeRoy, eds. *Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment*. Washington, DC: Island Press, 2013.

Gregory, R., L. Failing, M. Harstone, G. Long, T. McDaniels, D. Ohlson, 2012. *Structured Decision Making: A Practical Guide to Environmental Management Choices*. John Wiley & Sons, Ltd. United Kingdom. 299 pp.

Meadow, A., D. Ferguson, Z. Guido, A. Horangic, G. Owen, and T. Wall, 2015. Moving toward the deliberate co-production of climate science knowledge. *Weather, Climate, and Society* 7(2):179–191. doi: <http://dx.doi.org/10.1175/WCAS-D-14-00050.1>

Moore, S.S., N.E. Seavy, M. Gerhart. 2013. Scenario planning for climate change adaptation: A guidance for resource managers. Point Blue Conservation Science and California Coastal Conservancy. http://www.prbo.org/refs/files/12263_Moore2013.pdf

Moss, R.H., N.L. Engle, J. Hall, K. Jacobs, R. Lempert, L.O. Mearns, J. Melillo, P. Mote, P., S. O'Brien, C. Rozenzweig, A. Ruane, S. Sheppard, R.W. Vallario, A. Wiek, and T. Wilbanks, 2011. US National Climate Assessment (NCA) Scenarios for Assessing our Climate Future:

Draft Version 12.9.16

Issues and Methodological Perspectives Background Whitepaper for Participants. PNLL SA20040. 39 pp. http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-20040.pdf

National Socio-Environmental Synthesis Center, glossary at climate-services.org



**SW
EXTENSION**
CLIMATE CHANGE WORKSHOP

2016 DECEMBER 6-8
TUCSON, ARIZONA
UNIVERSITY OF ARIZONA
ENVIRONMENT & NATURAL RESOURCES BUILDING 2 ROOM S107



Center for Climate Adaptation Science and Solutions | The University of Arizona Cooperative Extension | USDA United States Department of Agriculture Southern Climate Hub | INR | Institute of the ENVIRONMENT | University of California Agriculture and Natural Resources | EXTENSION | UNIVERSITY OF ARIZONA | COLLEGE OF TECHNICAL EDUCATION AND COMMUNITY SERVICES | UNIVERSITY OF GUAM

SW Extension Climate Change Workshop December 6-8, 2016

Agenda

SW EXTENSION

CLIMATE CHANGE WORKSHOP

2016 DECEMBER 6-8

TUCSON, ARIZONA

UNIVERSITY OF ARIZONA

ENVIRONMENT & NATURAL RESOURCES BUILDING 2 ROOM S107



THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE & LIFE SCIENCES
Cooperative Extension



United States Department of Agriculture
Southwest Climate Hub



UNIVERSITY OF NEVADA, RENO



THE UNIVERSITY OF ARIZONA
Institute of the
ENVIRONMENT

University of California
Agriculture and Natural Resources



EXTENSION
Utah State University



COLLEGE OF TROPICAL AGRICULTURE
AND HUMAN RESOURCES
COOPERATIVE EXTENSION



UNIVERSITY OF
GUAM
COOPERATIVE EXTENSION

Workshop Agenda

Our Purpose:

To build Extension's capacity to develop climate-change preparedness and mitigation approaches that integrate cutting edge climate science into existing and emerging efforts

Our Goal:

To develop a regional partnership to enable us to incorporate climate-change information into our programs successfully

Notes:

Background materials and suggested readings for all participants may be found on the Workshop Website: <http://swclimatehub.info/swext>



Day 1: Tuesday December 6, 2016 – Sessions 1-3 in Room S107

Time (MST)	Session Title	Session Content
12:30-1:00	Gather at ENR2 Room S107	Registration and participant packet pick-up in Rooms S120A & S120B adjacent to Room S107 in the café. Light snacks available in Room S107.
1:00-1:20	Introductions and Initial	<ul style="list-style-type: none"> Welcome and purpose of conference – Mark Walker and Jeff Silvertooth Brief self-introductions
1:20-2:40	Session 1: The Climate Toolbox: How do we know what we know? [panel session talks/facilitated group discussion]	(Session leader: Kathy Jacobs) <ul style="list-style-type: none"> Main findings from the US National Climate Assessment (15 min) (Kathy Jacobs) Summary of historical climate, current trends and climate projections for the SW (and sources, including SW Climate Assessment) (15 min) (Gregg Garfin) Basics re climate projections: global models, scenarios, downscaling techniques (10 min) (Gregg Garfin) Summary of historical climate, current trends, and climate projections for the Pacific (and sources) (10 min) (Clay Trauernicht) On Extension/Climate Hub partnerships (15 min) (Justin Derner) What is “actionable information”? (10 min) (Kathy Jacobs)
2:40-3:25	Session 2: Extension and Climate Hubs in the Context of Climate Change Adaptation and Mitigation [panel session talks]	What is our role and how do we do it? What barriers need to be overcome? Who are the current or possible partners? (Session leader: Kathy Jacobs) <ul style="list-style-type: none"> Definitions of Adaptation and Mitigation and motivations for engagement in these topics. How should we address adaptation and mitigation topics and potential actions to enhance resilience? (15 min) (Rob Davies) What is the SW Climate Hub? What work is it doing on adaptation and mitigation? (10 min) (Caiti Steele) What are possible roles for Extension in addressing adaptation and mitigation? What are its strengths? Where do we fit into the broader adaptation/mitigation world? (20 min)
3:25-3:40	Afternoon Break: Refreshments available in Room S107	
3:40-5:15	Session 3: Moving from Vulnerability to Resilience: Lessons Learned [brief talks, panel]	Success stories and new ideas. (Facilitator: Steve Lewis; Presenters: John Stevenson, Heidi Brown, Rob Davies, Justin Derner, Faith Kearns) Topics may include: <ul style="list-style-type: none"> Extension work that incorporates climate planning/impacts/mitigation/education Connecting with audiences
5:15	Adjourn; dinner and activities on your own	

Day 2: Wednesday December 6, 2016 – Sessions 4-6, 9-10 in Room S107*

**Participants will travel to assigned breakout rooms for Sessions 7 & 8*

Time (MST)	Session Title	Session Content
8:00-8:30	Continental	Continental Breakfast will be provided in Room S107
8:30-10:00	Session 4: Actionable Science: What Works, When, Where, and Why? [10- min. talks followed by	Group sharing of lessons learned, building on last session from Tuesday. Within each program area, what can individuals and extension agents do to address climate change? (Facilitator: Mark Walker) <ul style="list-style-type: none"> Youth and Family programs (Martha Monroe) Natural resources: Water, floods and drought (John Cobourn) Natural Resources: Fire, range, and forestry (Susie Kocher) Agriculture (Tapan Pathak)
10:00-10:15	Session 5: How to Get Started Back	Questions to prime the pump: program objectives that are good fits for climate adaptation/mitigation. (Session Leads - Steve Lewis and John Cobourn)
10:15-10:30	Morning Break : Refreshments available in room S107	
10:30-11:45	Session 6: Lessons Learned in Climate Communications [panel session and group discussion] Travel to LTRR for lunch break	What is Extension's role in communicating climate information in a contested context and/or how do we approach mitigation (carbon management) topics? (Facilitator: Steve Lewis; panelists: Rob Davies, Chris Jones, Mike Crimmins, Martha Monroe, John Stevenson) <ul style="list-style-type: none"> How to address naysayers? Who can agents/specialists work with to get more info/put more projects into action? What is appropriate for communicating to different Extension audiences? Are some audiences more suited to mitigation education than others? Do some audiences require handling adaptation and mitigation differently?
12:00-12:50	Lunch at the UA Laboratory of Tree-Ring Research (LTRR), 1215 E. Lowell St., UA Campus (east of ENR2) Reminder: Go directly to your breakout session after lunch!	
1:00-1:50	Session 7: Topical Breakouts I: Integrating Climate- Resilient Thinking into Program Areas	Breakout sessions in rooms as assigned; see the World Café Breakout Sessions document in your packet <ul style="list-style-type: none"> Youth and Family Programs (Facilitators: Martha Monroe & Kerri Jean Ormerod) N585 Natural Resources: Water, floods and drought (Facilitator: Kathy Jacobs) S225 Natural Resources: Fire, range, and forestry (Facilitator: Clay Trauernicht) S215

1:50-2:05	Break to get to your next assigned session	
2:05-2:45	Session 8: Topical Breakouts II	Breakout sessions in rooms as assigned. Topic locations/facilitators stay in place; participants move to their second assigned session. <ul style="list-style-type: none"> Youth and Family Programs (Facilitator: Kerri Jean Ormerod) N585 Natural Resources: Water, floods and drought (Facilitator: Kathy Jacobs) S225 Natural Resources: Fire, range, and forestry (Facilitator: Clay Trauernicht) S215 Agriculture (Facilitator: Steve Lewis) S210 Urban Programs (Facilitator: Chris Jones) N578
2:45-3:20	Extended networking break	(Facilitators and assistants return to S107 and use this time to prepare your summary reports) Refreshments available in room S107
3:25-4:15	Session 9: Summary reports from World Café	Reports from Breakout sessions 7 and 8 (Facilitator: Kathy Jacobs)
4:15-5:00	Session 10: Action Planning [brainstorming breakout sessions,	What can I do when I get home? Participants discuss ways to begin to incorporate climate change into programs, identifying needs, resources, and barriers. (Facilitators: Steve Lewis (lead), John Cobourn (lead), Kathy Jacobs, Kerri Jean Ormerod, Julian Reyes) <ul style="list-style-type: none"> Initial steps Opportunities and barriers Needs and resources
5:00	Adjourn; dinner and activities on your own	

Day 3: Thursday December 8, 2016 – Sessions 11-14 in Room S107

Time (MST)	Session Title	Session Content
7:30-8:00	Continental Breakfast	Continental Breakfast will be provided in Room S107
8:00-8:45	Session 11: Building a Strategy for a Southwestern Regional Network/Community of Practice [introduction and panel response]	Theoretical discussion of following topics, with focus on interstate or regional partnership building: (Facilitator: Mark Walker; Panelists: Caiti Steele, Mike Crimmins, Jim Hollyer, Gregg Garfin) <ul style="list-style-type: none"> • What is the problem we hope to solve? • What do we hope to accomplish with a Regional Network? • Other interstate Extension Partnership models—strengths and weaknesses • What strengths should Extension build on? • What products could the Southwest Climate Hub provide? • How do partners/states stay connected?
11:0:15	Session 12: Actions and Outcomes: Where to Next for the Partnership? [group brainstorming]	(Facilitator: Steve Lewis) Possible topics: <ul style="list-style-type: none"> • What outcomes do we foresee from the Partnership? • With these outcomes in mind what functions/products should the Partnership provide? • What are some strategies to initiate these functions/products and keep them ongoing and effective? • How shall we measure the impacts of the Partnership?
10:15-10:30	Morning Break: Refreshments available in room S107	
10:30-11:15	Session 13: State groups	State and Pacific region groups meet together to assess what has been learned, and identify next steps
11:15-12:00	Session 14: Concluding Session	Next steps in partnership/collaboration; summary of what has been accomplished/learned (Session leads by Mark Walker, Kathy Jacobs) <ul style="list-style-type: none"> • What actions should we agree to take? • Responsibilities and milestones: Who does what and in what timeline?
12:00-1:00	Working Lunch - Boxed lunches and beverages will be provided. Final thoughts on the conference, evaluation, next steps. Feedback on conference format and outcomes.	
1:00	Workshop adjourns*	

*Interested participants are welcome to join the planning committee in room 604 of ENR2 for a post-workshop debriefing and initial drafting of the workshop report, 2 to 4 pm.

**SW
EXTENSION**
CLIMATE CHANGE WORKSHOP

2016 DECEMBER 6-8
TUCSON, ARIZONA
UNIVERSITY OF ARIZONA
ENVIRONMENT & NATURAL RESOURCES BUILDING 2 ROOM S107



SW Extension Climate Change Workshop December 6-8, 2016

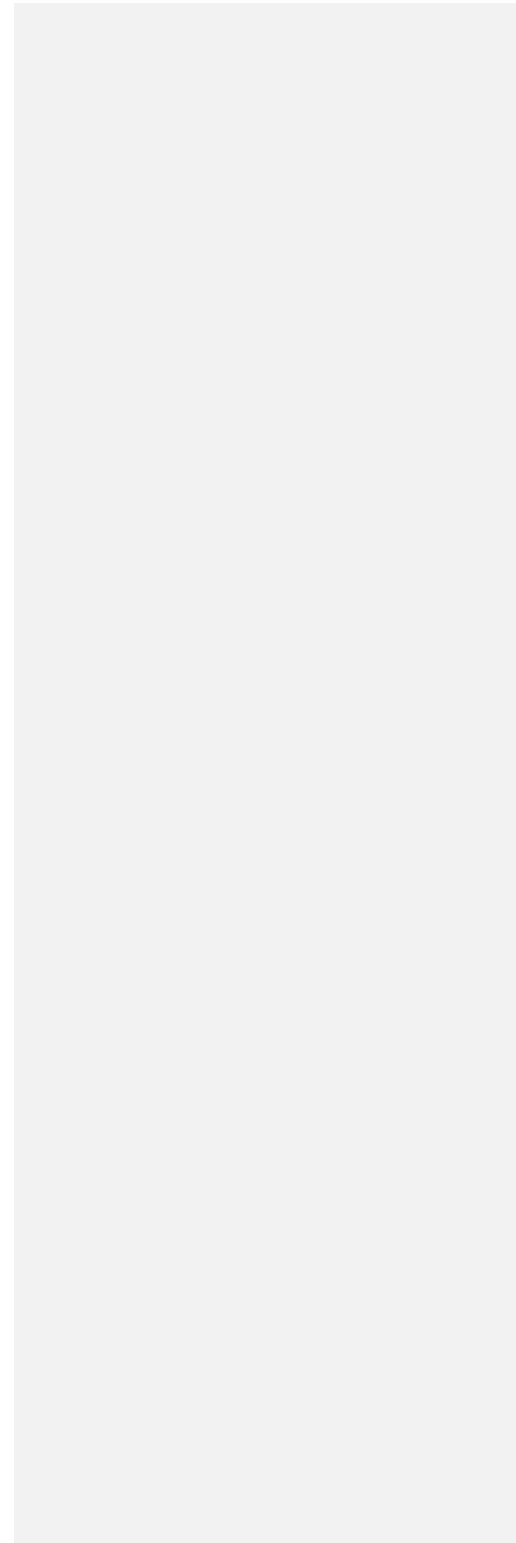
World Cafés

World Café Breakout Sessions

Wednesday December 7, 2016



- World Café 1 :** 1:00-1:50pm
- Break:** 1:50-2:05pm – Travel to session 2
- World Café 2:** 2:05-2:45pm
- Break:** 2:45pm-3:15pm
- Return to S107:** 3:20pm for Participants, *2:50pm for Facilitators & Assistants



**World Café Facilitators and assistants will use this time to prepare summary reports in S107*



The "World Café" is a structured conversational process intended to facilitate open and intimate discussion, and link ideas within a larger group to access the "collective intelligence" or collective wisdom in the room. Participants move between a series of tables where they continue the discussion in response to a set of questions, which are predetermined and focused on the specific goals of each table. The atmosphere is created in order to facilitate conversation and collaboration. As well as speaking and listening, individuals are encouraged to write or doodle on a paper tablecloth so that when people change tables they can see what previous members have expressed in their own words and images.

Natural Resources: Water, Floods & Drought in Room: S225

- ✓ **Facilitation Team:** Kathy Jacobs (F) Jacob Petersen-Perlman (R) Kerrie Geil (R)

Natural Resources: Fire, Forestry & Range in Room: S215

- ✓ **Facilitation Team:** Clay Trauernicht (F) Chad Marchand(R)

Agriculture in Room: S210

- ✓ **Facilitation Team:** Steve Lewis (F) Chris Knudson(R)

Urban Programs in Room N578

- ✓ **Facilitation Team:** Chris Jones (F) Sandra Bernal(R)

Youth & Family Programs in Room N585

- ✓ **Facilitation Team:** Martha Monroe (F) Kerri Jean Ormerod (F) Lynn Rae(R)

World Café Session Assignments by Topic & Room						
		Youth and Family	Agriculture	NR Water, Floods, Drought	NR Fire, Forests, Range	Urban
Session 1 1:00-1:50pm	1	Sarah Chvilicek	Robert P Flynn	Andrew Brischke	Justin Derner	Andree' Walker Bravo
	2	Roslynn Brain	William J. McGuire	Jason Lamb	Mark S. Thorne	Richard Heflebower
	3	Dave Francis	John Stevenson	Ted Grantham	Elise Gornish	Jennifer Balachowski
	4	Robert Davies	Stephanie J. Walker	Jeremy Weiss	Ashley Wright	Omololu John Idowu
	5	Lindsay Chichester	James Barnhill	Susie Kocher	Faith Kearns	John Cobourn
	6	Caiti Steele	Steven Ostoja	Jairo Diaz	Lawerence J. Duponcheel	Andrea Kawabata
	7	Julian Reyes	Jim Hollyer	Michael M. Ogo	Gerardo (Jerry) Lopez	Kevin Heaton
	8		Mike Crimmins	Jonathan Deenik	John R. Allen	Mark Walker
	9		Patricia Fifita	Jensen Uyeda	Leslie Roche	
	10		Joshua Sherman	Daniele Zaccaria	Gregg Marc Garfin	
		Youth and Family	Agriculture	NR Water, Floods, Drought	NR Fire, Forests, Range	Urban Programs
Session 2 2:05-2:50pm	1	Patricia Fifita	Elise Gornish	John Cobourn	Andrew Brischke	Robert P Flynn
	2	John R. Allen	Mark S. Thorne	Andree' Walker Bravo	Mike Crimmins	Stephanie J. Walker
	3	Gregg Marc Garfin	Lindsay Chichester	William J. McGuire	Ted Grantham	Daniele Zaccaria
	4	John Cobourn	Jairo Diaz	John Stevenson	Caiti Steele	Dave Francis
	5	Jennifer	Lawerence J.	Ashley Wright	Susie Kocher	Leslie Roche
	6	Kevin Heaton	Michael M. Ogo	Faith Kearns	Jim Hollyer	Sarah Chvilicek
	7	Mark Walker	Richard Heflebower	Roslynn Brain	Joshua Sherman	Julian Reyes
	8		Jonathan Deenik	James Barnhill	Omololu John Idowu	Jeremy Weiss
	9		Robert Davies	Steven Ostoja	Jason Lamb	
	10		Jensen Uyeda	Gerardo (Jerry) Lopez	Andrea Kawabata	
Facilitation Teams	1	Martha Monroe (F)	Steve Lewis (F)	Kathy Jacobs (F)	Clay Trauernicht (F)	Chris Jones (F)
	2	Kerri Jean Oremerod	<i>Chris Knudson</i>	<i>Kerrie Geil</i>	<i>Chad Marchand</i>	<i>Sandra Bernal</i>
	3	<i>Lynn Rae</i>		<i>Jacob Petersen-Perlman</i>		
	4	<i>Christina Greene</i>				

SW EXTENSION

CLIMATE CHANGE WORKSHOP

2016 DECEMBER 6-8

TUCSON, ARIZONA

UNIVERSITY OF ARIZONA

ENVIRONMENT & NATURAL RESOURCES BUILDING 2 ROOM S107



SW Extension Climate Change Workshop December 6-8, 2016

Participant List



**Southwest Extension Climate Change Workshop: Incorporating
Climate Information into Diverse Program Areas** University of Arizona, Tucson, AZ,

Dec. 6 – 8, 2016

Participant List

Last Name	First	Email Address	Organization	Position/Title
Allen	John	allenj@nmsu.edu	NMSU	County Program Director, Hidalgo County
Balachowski	Jen	Jennifer.Balachowski@ars.usda.gov	USDA ARS	California Climate Hub
Barnhill	James	james.barnhill@usu.edu	USU Ext	Morgan Co. Director / Ag
Bernal	Sandra	sbernal@email.arizona.edu	UA	Graduate Student (workshop volunteer)
Black	Mary	mblack@email.arizona.edu	UA	Adaptation Program Manager, CCASS
Blanch	Marie	marieblanche@email.arizona.edu	UA	Graduate Student (workshop volunteer)
Brain	Roslynn	roslynn.brain@usu.edu	USU Ext	Sustainable Communities Specialist
Brischke	Andrew	brischke@cals.arizona.edu	UA Ext	Area Asst. Agent, (Mohave and Coconino
Brown	Heidi	heidibrown@email.arizona.edu	UA	Asst. Prof., Epidemiology and Biostatistics
Chew	Schuyler	esschew@gmail.com	UA	Graduate Student (workshop volunteer)
Chichester	Lindsay	chichesterl@unce.unr.edu	UNR	County Extension Educator
Chvilicek	Sarah	chviliceks@unce.unr.edu	UNR	Youth and 4-H
Cobourn	John	cobournj@unce.unr.edu	UNR	Water Resource Specialist
Crimmins	Mike	crimmins@email.arizona.edu	UA Ext	Prof. & Extension Specialist, Climate Science
Davies	Robert	robert.davies@usu.edu	UCU / UCC	Physicist / Extension Climatology
Deenik	Jonathon	jdeenik@hawaii.edu	UH	Soil Fertility and Soil Quality Specialist
Derner	Justin	justin.derner@ars.usda.gov	USDA ARS	Research Scientist, High Plains Grasslands Research Station
Diaz	Jairo	jdiazr@ucanr.edu	UC ANR	Director, Research and Extension Center
Duponcheel	Lawerenc	lawerence.duponcheel@marianas.edu	NMC	Agriculture Extension Agent
Enquist	Caroline	cenquist@usgs.gov	SW CSC	Deputy Director, DOI Southwest Climate
Fifita	Patricia	pfifita@hawaii.edu	UH	Postdoctoral Researcher
Flynn	Robert	rfflynn@nmsu.edu	NMSU	Ext. Faculty, Asst. Prof., Acting
Francis	Dave	dave.francis@usu.edu	USU Ext	Extension Assoc. Prof. / 4H
Garfin	Gregg	gmgarfin@email.arizona.edu	UA Ext, CCASS	Prof. & Extension Specialist, Climate Science
Geil	Kerrie	kgeil@email.arizona.edu	UA	Graduate Student (workshop volunteer)
Gornish	Elise	egornish@plantsciences.ucdavis.edu	UC Davis	Extension Specialist
Grantham	Ted	tgrantham@berkeley.edu	UC Berkeley	Extension Specialist

Greene	Christina	cgreene@email.arizona.edu	UA	Graduate Student (workshop volunteer)
Haverland	Arin	arin@email.arizona.edu	UA	Postdoctoral Research Assoc., Institute of the Environment
Heaton	Kevin	kevin.heaton@usu.edu	USU Ext	Garfield Co. Director / Ag, 4-H
Heflebower	Rick	rick.h@usu.edu	USU Ext	Washington Co. Director / Horticulture
Hollyer	Jim	hollyer.uog.cnas.ext@gmail.com	U Guam	Extension Program Lead
Idowu	John	jidowu@ad.nmsu.edu	NMSU	Associate Professor, Extension
Jackson	Steve	stjackson@usgs.gov	SWCSC	Federal Director DOI Southwest Climate Science Center
Jacobs	Kathy	jacobsk@email.arizona.edu	UA Ext, CCASS	Director, CCASS
Jones	Chris	ckjones@cals.arizona.edu	UA Ext	Associate Extension Agent, Gila County
Kawabata	Andrea	andreak@hawaii.edu	UH	Assistant Extension Agent
Kearns	Faith	faith.kearns@ucop.edu	UC ANR	Water Program Analyst
Kirchhoff	Christine	ckirchhoff@engr.uconn.edu	U Connecticut	Asst. Professor, Civil and Env Eng
Knudson	Chris	chrisknudson@email.arizona.edu	UA	Postdoctoral Research Assoc. (workshop)
Kocher	Susie	sdkocher@ucanr.edu	UC ANR	Farm Advisor
Lamb	Jason	jalamb@ad.nmsu.edu	NMSU	Quay County Agricultural Extension
Lewis	Steve	lewiss@unce.unr.edu	UNR	County Extension Educator
Lopez	Jerry	lopezg3@email.arizona.edu	UA Ext	Asst. Professor/Extension Specialist 4-H
Marchand	Chad	csm15@email.arizona.edu	UA,	Project Coordinator (workshop volunteer)
McGuire	Bill	bmcguire@nmsu.edu	NMSU	County Program Director, Mora County Ext.
Monroe	Martha	mcmunroe@ufl.edu	U Florida	Environmental Education and Extension
Ogo	Michael	michael.ogo@marianas.edu	NMC	Extension Aquaculture Specialist
Ormerod	Kerri Jean	kormerod@unr.edu	UNR	Asst. Professor
Ostoja	Steve	smostoja@ucdavis.edu	USDA ARS	Director, California Climate Hub
Pathak	Tapan	tpathak@ucanr.edu	UC ANR	Extension Specialist
Peters	Jacob	jacobpp@email.arizona.edu	UA	Research Analyst, WRRRC (workshop volunteer)
Rae	Lynn	lynnrae@email.arizona.edu	UA	Graduate Student (workshop volunteer)
Reyes	Julian	julian.reyes@ars.usda.gov	WSU	Fellow, SW Regional Climate Hub
Roche	Leslie	lmroche@ucdavis.edu	UC Davis	Extension Specialist
Sherman	Josh	jdsherman@email.arizona.edu	UA Ext	Commercial Horticulture agent, Cochise
Silvertooth	Jeff	silver@ag.arizona.edu	UA Ext	Assoc. Dean and Director, Economic Development and Extension
Steele	Caiti	caiti@nmsu.edu	NMSU	Deputy Director, USDA SW Regional Climate
Stevenson	John	jstevenson@coas.oregonstate.edu	OSU	Extension Climate Specialist, Oregon Sea
Thorne	Mark	thornem@hawaii.edu	UH	Human Nutrition, Food, and Animal Sciences
Trauernicht	Clay	trauerni@hawaii.edu	UH	Wildfire Management Extension
Uyeda	Jensen	juyeda@hawaii.edu	UH	Junior Extension Agent

Walker	Mark	walkerm@unce.unr.edu	UNR Ext	Director
Walker	Stephanie	swalker@ad.nmsu.edu	NMSU	Extension faculty, Associate Professor
Walker Bravo	Andree	andree.walker@usu.edu	USU Ext	Urban Extension Director
Weiss	Jeremy	jlweiss@email.arizona.edu	UA Ext	Climate and Geospatial Extension Scientist
Wright	Ashley	awright134@email.arizona.edu	UA Ext	Area Assistant Agent, Livestock
Zaccaria	Daniele	dzaccaria@ucdavis.edu	UC Davis	Extension Specialist

ANR = Agriculture and Natural Resources ARS = Agricultural Research Service
 CCASS = Center for Climate Adaptation
 Science and Solutions NMC = Northern
 Marianas College
 NMSU = New Mexico State University OSU = Oregon State University
 SW CSC = DOI USGS Southwest Climate
 Science Center UA = University of Arizona
 UC = University of
 California
 UCC = Utah
 Conservation Corps
 UH = University of Hawaii
 at Manoa UNR = University
 of Nevada Reno USU =
 Utah State University
 WSU = Washington State
 University

Please note that many participants hold additional titles at their home institutions.

