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Climate Science Readiness and Training Needs of Nevada Extension Professionals

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Climate change poses major challenges to Nevadans. This publication summarizes results of a web-based survey of Nevada Extension professionals in 2018 to provide a baseline understanding of climate change attitudes, knowledge levels and programming needs. Our goal is to use this information to devise strategies for meeting these needs among our colleagues.

Introduction

In 2014, the United States Department of Agriculture Agricultural Research Service (USDA ARS) created a network of regional Climate Hubs to deliver science-based information for climate-informed decision-making by developing practical, region-specific information and technologies for local-level stakeholders (USDA Climate Hubs, n.d.). The Climate Hubs chose Cooperative Extension to be the outreach arm for their research.

In 2016, faculty from University of Nevada, Reno Extension partnered with Extension professionals in other southwest U.S. states and the USDA Southwest Climate Hub to organize a workshop for Extension professionals on the campus of The University of Arizona. The goals of the workshop were to identify the appropriate role for Extension to respond to climate change and to examine and improve Extension's capacity to address climate change at the local/state level (USDA Southwest Climate Hub, n.d.). The primary outcome of the 2016 workshop was establishment of the Southwest Extension Climate Partnership, supported by the USDA Southwest Climate Hub and created to facilitate sharing lessons learned from the separate climate change efforts of faculty from different western U.S. states. A secondary outcome was initiation of a plan to survey Nevada Extension professionals regarding the need for climate science education of constituents. This publication represents a summary of the results of that survey.

The two main categories of responses to climate change are adaptation and mitigation. Adaptation involves efforts to increase resilience to actual or expected climate change impacts, while not necessarily dealing with the underlying cause. Mitigation involves reducing the magnitude of climate change itself, primarily focusing on reducing emissions from burning fossil fuels and/or increasing carbon sequestration and storage (Intergovernmental Panel on Climate Change, 2007). It is important for Extension professionals to understand these concepts as they develop programs that incorporate climate change information. Members of some audience groups may be reluctant to accept the idea of mitigation, while recognizing the practical need to adapt to changes they can readily observe and that may affect their livelihood. For that reason, it is suggested that climate change education to such groups should focus on interventions that have both adaptive and mitigative effects (Arbuckle et al., 2015).

Survey Methods

In fall 2018, we administered a survey to Extension faculty and staff in Nevada. Our goals were to evaluate the needs and institutional desire for incorporating climate change information into existing Extension programming; and to assess attitudes, perceived knowledge levels, current efforts to address climate change and the need for training. Our survey questions were adapted from a survey completed by University of California Cooperative Extension (Grantham et al., 2017). The University of Nevada, Reno Institutional Review Board reviewed our survey instrument prior to its administration. We administered the survey by using the web-based Survey Monkey platform. The survey consisted of 17 questions, which were a mix of Likert-scale, multiple-choice and open-ended questions. All 190 Extension faculty and staff were invited to participate in the survey by an email sent to the institutional email list. Two reminders were sent over the course of four weeks. No further incentives to participate were provided. We received 44 replies, indicating a 23% response rate.

Survey Results

Most survey respondents believed it is important to include information in their programming about the impacts of (74%) (**Table 1A**) and options for adaptation to (63%) climate change (**Table 1B**). Extension professionals were less enthusiastic about including information about mitigation options, with only 44% responding positively to this option (**Table 1C**). Nearly 28% of respondents said information on mitigation is not important to include in our programs. Of the employee types, Extension specialists were the most likely to have positive opinions about incorporating different aspects of climate change in their programs. Six out of seven specialists agreed with including impact information (**Table 1A**) and adaptation options (**Table 1B**), and five out of seven agreed with including mitigation options (**Table 1C**).

Table 1. Respondent Opinions on Incorporation of Different Aspects of Climate Change Into Their Programs by Employee Type (N=43)

A. It is important to teach about *impacts* of climate change, such as rising temperatures and more extreme weather events.

Employee type	Yes		No		Not sure	
	n	%	n	%	n	%
Extension educator	4	57	1	14	2	29
Extension specialist	6	86	0	0	1	16
Administrative faculty	2	50	2	50	0	0
Classified staff	16	80	2	10	2	10
Other	4	80	1	20	0	0
Total	32	74	6	14	5	12

B. It is important to teach about *adaptation* to climate change – involves efforts to increase our resilience to climate change impacts, while not necessarily dealing with the underlying cause.

Employee type	Yes		No		Not sure	
	n	%	n	%	n	%
Extension educator	5	63	1	13	2	18
Extension specialist	6	86	1	14	0	0
Administrative faculty	3	75	1	25	0	0
Classified staff	11	55	2	10	7	35
Other	2	40	1	20	1	40
Total	27	63	6	14	10	23

C. It is important to teach about climate change *mitigation* – involves reducing the magnitude of climate change itself, primarily focused on reducing emissions from burning fossil fuels.

Employee type	Yes		No		Not sure	
	n	%	n	%	n	%
Extension educator	1	13	5	63	2	25
Extension specialist	5	71	1	14	1	14
Administrative faculty	2	50	2	50	0	0
Classified staff	9	47	3	16	7	37
Other	2	60	1	20	2	20
Total	19	44	12	28	12	28

Nearly half of all survey respondents (47%; n=20), representing all Extension program areas (agriculture; children, youth and family; community development; health and nutrition; horticulture; and natural resources), were already incorporating climate science into their Extension programming at the time of this survey (data not shown). Of those, more than half identified either children, youth and family (30%; n=6) or natural resources (25%; n=5) as their primary program area. Notably, 15% (n=6) were not incorporating climate science into their programming, but would like to do so. Respondents also provided examples of methods they currently use to incorporate climate science into their programming (**Table 2**).

Table 2. Examples of Methods Currently Used to Incorporate Climate Science Into Extension Programming (N=22)

Use the Experiential Learning Model (hands-on learning with manipulatives) to teach students in the afterschool program about scientific processes associated with climate change.
Promote landscape water conservation to professionals in the landscape industry.
Use a collaborative research design to incorporate the needs of local stakeholders (i.e. water managers) into our research agenda (one-on-one engagement, phone interviews, small focus groups/workshops).
Provide information on extended and extreme drought, drought impacts and mitigation. Information on drought impacts is solicited from stakeholders and the general public.
Partnered with DRI and UNR to present and distribute information and resources to farmers throughout the West.
Discuss climate change as it affects the plants and animals, particularly the ones that live in the Mohave Desert.
Vertical indoor farming through hydroponics.
Share climate change information in nutrition classes. Reference changing climate when referring to public health issues.
Discussion/demonstration of how increased building in our area has affected an increase in temperatures and less moisture, causing livestock raisers to purchase rather than grow hay, and effect of heat on poultry during the summer.
Work with the USDA ARS Southwest Climate Hub and Southwest Extension Climate Partnership. Work with local nonprofits to present evening forums on predicted impacts of climate change.
Share research-based, nonpartisan information on climate change on social media. A method that works well is to craft answers to “Why Should I Care?” and post answers with links to the research. People may not care that the world is changing, but they do care when things they care about are affected.

Programming relevant to the issue of planning for mega-fires and other regional planning issues. The challenge is to get the target group to recognize the impact of climate change and incorporate that into their decision-making.

Agriculture risk management education and STEM enrichment activities.

Address time and timing of grazing and determination of annual plant phenology. Determine evapotranspiration rates and growing conditions for crop production. Determine wildfire potential within and between years. Noxious weed tracking and treatment.

The main concerns regarding incorporating climate science into Extension programming included: “I am not sure that I can present complex climate change information accurately” (30%); “I do not have good sources of climate change information to share” (26%); and “I do not have access to climate change curriculum specific to my field” (26%) (**Table 3**). Close to one in five respondents (19%) were concerned about presenting a potentially contentious topic to their clients, and only 12% felt climate science is not solid enough on which to base decisions.

Table 3. Respondent Concerns About Incorporating Climate Change Into Extension Programming (N=43)

Response	n	%
I am not sure that I can present complex climate change information accurately.	13	30
I do not have good sources of climate change information to share.	11	26
I do not have access to climate change curriculum specific to my field.	11	26
I am concerned about the reaction of my clientele to climate change information.	9	21
I don't feel I have adequate support from the university to work on this topic.	8	19
I am not comfortable presenting on a contentious topic to my clientele.	8	19
Climate change is not relevant to my program.	6	14
I am not sure that climate change science is solid enough to base decisions on.	5	12
I am not comfortable presenting climate change information to a youth audience.	5	12
Other	11	26
None of the above	9	21

We asked respondents to indicate their level of agreement with a variety of training options based on their utility for incorporating climate change into their Extension programming (respondents could select all that applied) (**Table 4**). The majority of respondents signified agreement with most options, including training on 1) climate change information sources and resources (60%), 2) how to effectively present controversial subjects to clientele (60%), and 3) monitoring and forecasting current weather and climate (60%). More than half of respondents (57%) also supported training on basic climate science and its effects on Nevada, and on understanding extreme events in the context of climate change (57%). Respondents indicated less support (43%) for developing climate change networks of colleagues.

Table 4. Concepts Respondents Would Find Useful for Incorporating Climate Science into Their Extension Programming (N=42)

Response	Agree		Neutral		Disagree	
	n	%	n	%	n	%
Basic climate science and effects on Nevada	24	57	16	38	2	5
Climate science information sources and resources	25	60	14	33	3	7
How to effectively present controversial subjects to clients	25	60	12	29	5	12
Developing climate science networks of colleagues	18	43	18	43	6	14
Understanding extreme events in the context of climate change	24	57	14	33	4	10
Tools for understanding, monitoring and forecasting current weather and climate	25	60	11	26	6	14

The top four climate science topics respondents felt their target audiences would want to know about included: 1) water issues, including drought/flooding/snowpack/water conservation (19%); 2) local information at geographic scales useful to individuals or managers (19%); 3) effects on agriculture/food systems (17%); and 4) general information on climate science, such as weather versus climate (11%) (**Table 5**).

Table 5. Climate Science Topics Respondents Believe Their Program Audience Want to Know About (N=36)

Response	n^z	%
Water issues, including drought/flooding/snowpack/water conservation	7	19
Local information at scales useful to individuals or managers	7	19
Effects on agriculture/food systems	6	17
General information on climate science, such as weather versus. climate	4	11
Impacts on public/governmental policy	3	8
Risk of/preparing for wildfire	3	8
Economic costs of climate change	3	8
Renewable energy sources	2	6
Public health effects of climate change	2	6
How the Earth will be affected (topography/rising sea levels)	2	6
How rangelands/wildlife will be affected	2	6
Youth as change agents	1	3
<i>^z Some respondents expressed more than one idea. Many ideas were combined into a unifying theme.</i>		

Educational materials respondents thought would best help them reach their program audiences with climate science information included: fact sheets (69%; n=29), websites (60%; n= 25), Power Point slides (50%; n=21), train-the-trainer course package with accompanying materials (50%; n=21), videos (48%; n=20), and social media posts from reputable accounts (45%; n=19). Other ideas for educational materials were also mentioned (**Table 6**).

Table 6. Educational Materials Respondents Thought Would Help Them Reach Their Program Audience with Climate Science Information (N=42)

Response	n	%
Fact sheets	29	69
Websites	25	60
Power Point slides	21	50
Train-the-trainer course package with accompanying materials	21	50
Videos	20	48
Social media posts from reputable sources	19	45
Training kits for educators and other school-aged youth curricula	3	7
Webinar series	1	2
Train-the-trainer course (such as “Climate Masters” modeled after the Master Gardener Program)	1	2
“Share best practices” environment for the farming community	1	2
Whatever it is needs to be turnkey and ready to go	1	2
Stories of farmers making changes to adapt to new situations	1	2
ADA-accessible materials so they can be shared	1	2

Respondents were asked to select the three most important things the Southwest Extension Climate Partnership could offer to support their Extension climate change programming (data not shown). Three answer choices (of 10 options) clearly garnered the most support from respondents. A strong majority (70%) of respondents would like the Partnership to sponsor climate-change-related trainings for program areas, such as youth development, water, agriculture, horticulture, forestry and wildfire. Almost half (46%) of respondents want the Partnership to share experiences, including 1) lessons learned about progress, setbacks and approaches for reaching various audience groups; and 2) ideas for field trips, hands-on activities and other teaching methods from different states. More than half of respondents (58%) also expressed interest in receiving the Partnership newsletter, which

signals a considerable amount of institutional interest in harnessing the power of interstate collaboration to access information and close knowledge gaps.

Discussion

Our survey indicated that Extension professionals at the University of Nevada, Reno believe it is important to include information about impacts of, and adaptations to, climate change in their Extension programming (**Table 1**). Further, nearly half of respondents are already incorporating climate science concepts into their programming, and of those that are not, 15% would like to do so (**Table 2**). These data indicate a need for Extension professionals at the University, and within the Southwest Extension Climate Partnership, to provide professional development training opportunities to build additional capacity of Nevada communities to respond to projected climate change impacts.

Scholars recognize that national-level strategies provide valuable support for local-level adaptation of information, which is necessary to coordinate effective and appropriate responses to the various impacts of climate change (Brugger & Crimmins, 2015). Extension is an ideal organization for distributing locally relevant climate change information and conducting outreach (Breuer, Fraise, & Cabrera, 2010; Grantham, Kearns, Kocher, Roche, & Pathak, 2017; Morris, Megalos, Vuola, Adams, & Monroe, 2014), in part because the impacts of climate change affect all Extension program areas, including agriculture, natural resources, community development, horticulture, nutrition and youth development. In the case of Nevada, expressed needs for institutional training are high and disclose a need for continued federal support to allow regional-level organizations, such as the Southwest Extension Climate Partnership, to work in coordination with the USDA Southwest Climate Hub.

Nearly 28% of our survey respondents said information on mitigation is not important to include in our programs (**Table 1C**). Notably, the same number of respondents said they were not sure if it was important to include information about mitigation. A similar number were not sure about the importance of including information about adaptation. This indicates there was less understanding of what is meant by climate change mitigation and adaptation, or that respondents simply did not have enough information to decide whether to mention these issues in their Extension programs. Since the two main categories of responses to climate change are adaptation and mitigation, a discussion of these terms, and how recognizing the difference between adaptive and mitigative responses can help them better connect with their target audience, could be included in our future Extension professional trainings.

Similar to our study, Clifford and Monroe (2018) found that, in many rural communities, audiences tended to be more open to discussing adaptation to climate change impacts than they were to discussing mitigation based on evidence that climate change is human-caused. Bowers,

Monroe and Adams (2016) also found that the topic of climate adaptation was broadly supported by Extension professionals in southern U.S. states, as it was for Extension professionals in our study.

There is clearly concern among our respondents about the fact that climate change is potentially a controversial topic in some communities. Twenty-one percent of respondents to our survey indicated they were concerned about the reaction of their clientele to climate change information (**Table 3**). Gustafson, Leiserowitz and Maibach (2019) found in their 2018 Yale University “Six Americas” survey that those sectors of the American public who are doubtful or dismissive of the importance of climate change represented 18% of the population (down from 28% in 2013.) Their analysis suggested that audiences that are cautious or disengaged from discussions about climate change are more likely to be open to climate change information than audiences that are doubtful or dismissive. Clifford and Monroe (2018) suggested that Extension professionals should be sensitive to such feelings. They suggested that, in many cases, such audiences should be approached first in answer to their sector-specific questions about potential symptoms of climate change, such as new invading pests or extreme weather events, rather than leading with presentations on climate change in general.

Around one in five respondents to our survey were uncomfortable presenting on a contentious topic (**Table 3**), and 60% indicated they would like to receive training on presenting controversial subjects (**Table 4**). According to Morris et al. (2014), many Extension professionals already know they need to carefully consider their audience when discussing climate change. Other studies have suggested Extension professionals need additional training on climate change and appropriate science-based adaptation strategies in order to serve their communities effectively (Diehl et al., 2015). Attention to adaptation strategies and specific local impacts are considered critical to breaking the ice for addressing climate change, especially with agricultural audiences (Clifford & Monroe, 2018). As we prepare to develop desired trainings (**Tables 5 and 6**) for Nevada faculty, it is clear that our survey indicated a need to include sessions on climate communications, with special sensitivity to gauging the varying opinions and perspectives of potential audiences.

Weaknesses of our sampling design include our relatively low response rate and the fact that we cannot discount the possibility of nonresponse bias among our colleagues. We were not able to offer incentives for Extension professionals to participate in our survey. It is possible our results are biased toward Extension professionals who already had strong opinions about this topic, or who were already attempting to offer climate change content to their clients. However, since one of our goals was to identify whether University of Nevada, Reno Extension professionals want to provide climate change information and are seeking assistance and tools that will help them do so, we believe we have achieved our objective. We found that faculty are interested in learning how to address climate

change in various programs areas, and we are using our data to devise a strategy for meeting this need among our colleagues.

Conclusions

Our survey results signified the desire of many Nevada Extension faculty and staff to incorporate climate change and climate science information into their local programming. They were also eager to receive training to increase their climate science literacy. While many Extension professionals in Nevada want to serve community needs in regard to climate change, some are hesitant to incorporate climate information due to a lack of training in basic climate science and/or access to information. Overall interest in climate change information is high among Nevada Extension professionals, and there is strong support for getting started. The success of this endeavor will be enhanced by building collaborative relationships across the region, such as engaging with the Southwest Extension Climate Partnership; forging better campus-county connections; and continuing ongoing communication among federal, state and local partners.

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Literature Cited

Arbuckle, Jr., J. G., Morton, L. W., & Hobbs, J. (2015). Understanding farmer perspectives on climate change adaptation and mitigation: The roles of trust in sources of climate information, climate change beliefs and perceived risk. *Environment and Behavior*, *47*(2), 205-324.

Bowers, A. W., Monroe, M. C., & Adams, D. C. (2016). Climate change communication insights from Cooperative Extension professionals in the U.S. Southern states: Finding common ground. *Environmental Communication*, *10*(5), 656-670.

Breuer, N. E., Fraisse, C. W., & Cabrera, V. E. (2010). The Cooperative Extension Service as a boundary organization for diffusion of climate forecasts: A 5-year study. *Journal of Extension*, *48*(4), Article 4RIB7. Available at: <https://www.joe.org/joe/2010august/rb7.php>

Brugger, J. V., & Crimmins, M. (2015). Designing institutions to support local-level climate change adaptation: Insights from a case study of the U.S. Cooperative Extension System. *Weather, Climate, and Society*, *7*(1), 18-38. doi.org/10.1175/WCAS-D-13-00036.1

Clifford, M., & Monroe, M. (2018). Improving climate literacy within Extension by understanding diverse climate-related informational needs. *Journal of Extension*, 56(7), Article 7FEA1. Available at: <https://joe.org/joe/2018december/a1.php>

Diehl, D. C., Galindo-Gonzalez, S., Dourte, D. R., Sloan, N. L., Bartels, W. L., Furman, C., & Fraisse, C. W. (2015). Toward engagement in climate training: Findings from interviews with agriculture Extension professionals. *Journal of Rural Social Sciences*, 30(1), 25-50.

Grantham, T., Kearns, F., Kocher, S., Roche, L. M., & Pathak, T. B. (2017). Building climate change resilience in California through UC Cooperative Extension. *California Agriculture*, 71(4), 197-200. doi.org/10.3733/ca.2017a0045

Gustafson, A., Leiserowitz, A., & Maibach, E. (2019). Yale Program on Climate Change Communication, Americans are increasingly “alarmed” about global warming. <http://climatecommunication.yale.edu/publications/americans-are-increasingly-alarmed-about-global-warming/>

IPCC (Intergovernmental Panel on Climate Change). (2007). Climate change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (B. Metz, O. R. Davidson, P. R. Bosch, R. Dave, & L. A. Meyer, Eds.). Cambridge, UK; New York, NY: Cambridge University Press.

Morris, H. L. C., Megalos, M. A., Vuola, A. J., Adams, D. C., & Monroe, M. C. (2014). Cooperative Extension and climate change: Successful program delivery. *Journal of Extension*, 52(2), Article 2COM3. Available at: <https://joe.org/joe/2014april/comm3.php>

USDA Climate Hubs. (n.d.). About Us. Retrieved from <https://www.climatehubs.oce.usda.gov/about-us>

USDA Southwest Climate Hub. (n.d.). Southwest Extension Partners Page. Retrieved from <https://swclimatehub.info/swext>

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