

# Connecting stakeholders with climate science: Farmer, rancher and forester climate data needs and climate change attitudes (PA13A-2174)

Albert Rango <sup>a</sup>, Emile H. Elias <sup>a</sup>, Caitriana Steele <sup>b</sup>, Mike Crimmins <sup>c</sup>, Jeremy Weiss <sup>c</sup>, and Ryann Smith <sup>b</sup>

<sup>a</sup> USDA/ARS Jornada Experimental Range, <sup>b</sup> New Mexico State University, Las Cruces, NM, <sup>c</sup> University of Arizona, Tucson, AZ

## Abstract

The mission of the USDA Southwest Regional Climate Hub is to provide farmers, ranchers and forest landowners with information and resources to cope with the impacts of climate change (CC). As such, a clear understanding of landowner needs for weather and climate data and their attitudes about CC are required. Here we present a summary of results from 27 peer-reviewed articles on studies pertaining to landowner needs and attitudes towards CC adaptation and mitigation. The studies span much of the continental U.S. and ideally represent a cross-section of different geographies. Approximately 55 to 79% of landowners and farm advisors believe CC is occurring, but disagree on the human contribution. Studies found that most farmers were supportive of adaptation responses, but fewer endorsed greenhouse gas reduction mitigation strategies. Adaptation is often driven by local concerns and requires *locally specific strategies and data*. Often farmers and ranchers rely on past experience and short-range forecasts (days to weeks) whereas some foresters request long-term predictions (years to decades). Forest advisors indicated that most of them (74%) are presently unable to find needed long-term information. We augment peer-reviewed literature with observations from landowner workshops conducted in Nevada and Arizona during 2014, the first year of Climate Hub operation. To better collect information about data needs and attitudes of farmers, ranchers, and foresters across the globe, we created a Climate Change Attitudes collection in JournalMap (<https://journalmap.org/usda-southwest-regional-climate-hub/climate-change-attitudes>). Users anywhere can add articles to this collection, ultimately generating a comprehensive spatial resource in support of CC adaptation and mitigation efforts on working lands.

## Introduction

For scientists to communicate to farmers, ranchers, and foresters about CC and likely CC impacts, the information must pass through a filter that the stakeholders can depend upon, namely, cooperative extension (CE) agents and other advisors. CE agents at Land Grant Universities are key messengers in the delivery of CC information because of a rapport that has previously been established between the field agents and the landowners on a variety of topics of common agricultural interest. If the landowners are convinced that their lands are being affected by changing climate and are interested in adopting adaptation responses to reduce, minimize, or eliminate impacts, the cause of CC may not be important. This approach side-steps any nonproductive debate on whether the CC is due to anthropogenic causes.

## Methods

We surveyed the literature regarding CC attitudes of farmers, ranchers, foresters and advisors (State forestry advisors, CE, and others working directly with landowners) to deduce beliefs. We also evaluated climate data needs as they understand changes that are occurring on their working lands. Generally the most effective way to transmit change information is for climatologists to discuss recent discoveries with stakeholder advisors as shown in Figure 1.

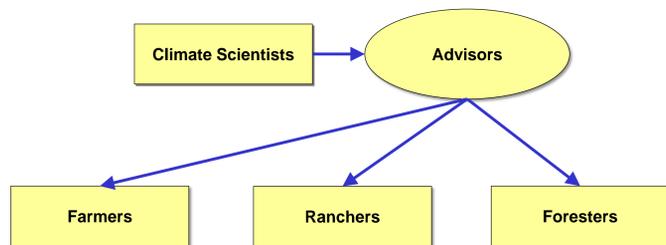


Figure 1. Common information pathway in communicating climate information.

Lessons from Landowner Workshops: During the first year of the USDA SW Climate Hub, we partnered with CE to host stakeholder workshops.

- At the workshops in AZ, ranchers were interested in improving local drought status depictions on the U.S. Drought Monitor through better communication and sharing of data and better use of drought and climate monitoring products. Farmers (largely tree crops and vineyards) were interested in learning about weather and climate forecast products that could be used to anticipate and prepare for freezing events in the spring.
- In NV, stakeholders were interested in water rights because of limited water resources. A second workshop was conducted to address these local needs. The lesson: local issues related to problems will emerge and multiple workshops may be necessary to support CC adaptation.

## Contact

Albert Rango USDA-ARS,  
Jornada Experimental Range  
Las Cruces, New Mexico  
alrango@nmsu.edu  
575-646-2120

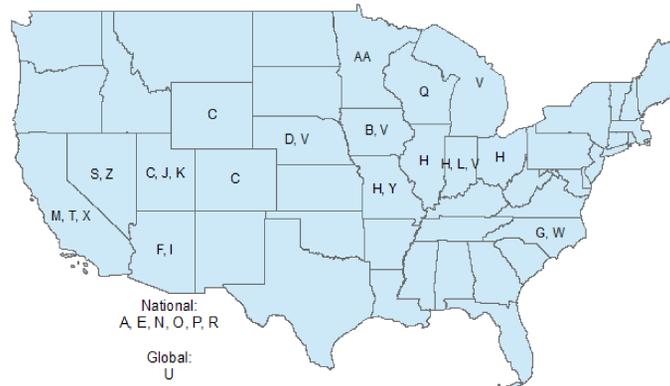


Figure 2. General locations of studies of stakeholder attitudes and data needs.

Table 1. Studies summarized by group and location

Study	Primary Author	Year	Group	Location
A	Andrews	2013	farmers	National
B	Arbuckle	2015	farmers	Iowa
C	Archie	2012	land managers	Colorado, Utah, Wyoming
D	Artikov	2006	farmers	Nebraska
E	Brant	2015	agricultural	National
F	Brugger	2012	agricultural	Arizona
G	Burnett	2014	advisor	North Carolina
H	Carlton	2014	forestry advisor	Illinois, Indiana, Missouri, Ohio
I	Coles	2009	agricultural	Arizona
J	Cook	2014	ranchers	Utah
K	Coppock	2011	ranchers	Utah
L	Gramig	2013	farmers	Indiana
M	Haden	2012	farmers	California
N	Howe	2015	general public	National
O	James	2014	advisor	National
P	Jones	2014	forestry advisor	National
Q	Klink	2015	advisor	Wisconsin
R	Lenart	2014	forestry advisor	National
S	Liu	2014	agricultural	Nevada
T	Lubell	2012	ranchers	California
U	Lyle	2015	agricultural	Global
V	Mase	2015	advisor	Indiana, Iowa, Michigan, Nebraska
W	Morris	2014	advisor	North Carolina
X	Niles	2013	farmers	California
Y	Prokopy	2014	agricultural	Midwest
Z	Saleh Safi	2012	agricultural	Nevada
AA	Wilke	2014	agricultural	Midwest

## Farmer, Rancher, Forester and Advisor Climate Attitudes

We separated CC beliefs into three categories: 1) CC is occurring (regardless of the cause) 2) CC is not occurring and 3) Unsure. Not all producers have the same opinions about CC. Nationally, 63% of Americans believe global warming is happening, but county-level estimates range from 43 – 80%, suggesting a likely disparity in the challenges faced by advisors in adaptation (Figure 3). Unlike the general population, farmers in the two studies of California had a lower belief that CC is occurring (55%) than farmers of other regions (68-79%) (Figure 4). In both the agricultural and forestry sectors, the percentage of advisors believing in CC was lower than the client percentage, indicating that it is necessary to provide CC information and education to both agricultural advisors and landowners. In some states, stakeholders were less likely to believe the anthropogenic sources of CC than the general population (L).

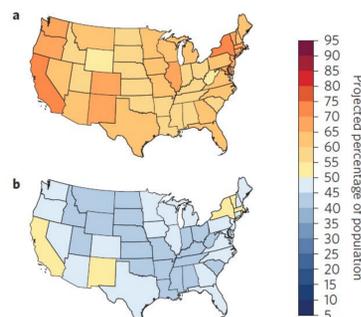


Figure 3. Percentage of American adults that believe CC is happening (a) and believe global warming is mostly human-caused (b). (N)

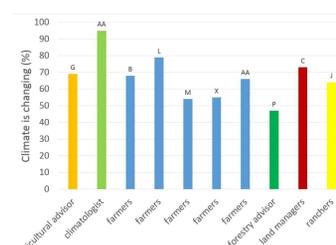


Figure 4. Percentage of agricultural group stating CC is occurring, regardless of anthropogenic contribution.

## Weather and Climate Data Needs

Working lands managers and advisors request information at different spatial and temporal scales. There is a temporal continuum of weather-climate decision and data needs by user group related to events such as drought, floods, heat waves, forest fires, frost/freeze, and winter chilling hours. The spatial scale of weather and climate data to inform decision-making ranges from the individual and farm level to the hazardscape, defined as a climatic region where potential impacts of CC are defined (U; Figure 5). The hazardscape allows for planners to address regional uncertainties e.g., narratives from the IPCC special report. CC adaptation is voluntary and personal, so weather and climate information must be tailored to the local scale.

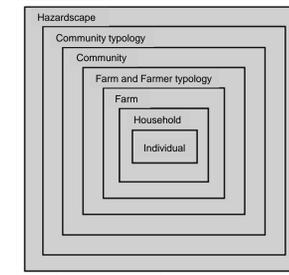


Figure 5. Scales within the nested spatial hierarchy for agricultural landscapes (U). Climate change information is often provided at the hazardscape, but decisions are made at the farm scale. Information flows in both directions.

## Farmer and Rancher Data Needs

- Timely and accurate information on the impact of climate variables at the farm level (D).
- Outreach programs to deliver recent scientific information regarding how CC will affect the agricultural community (K).
- Weather and climate information tailored to specific areas, better local-scale monitoring of precipitation (E).
- More accurate, localized near-term forecasting of extreme events (D, E).
- Projections for the intermediate-term (~10 years) for infrastructure and investment decisions, and longer-term projections for future adaptation and planning (E).

## Forester and Forest Advisor Data Needs

- Long-term climate information (H)
- Seasonal and intermediate-term climate forecasts (H)
- Accurate short-term forecasts (H)
- Future extreme events (H)
- Foresters considered weather station observations on temperature and precipitation to be more important than information source on future climate (P, R).
- Records, proxy records and projections of precipitation were more important those of temperature (R).

Table 2. Types of weather and climate data desired by state foresters in the Midwestern U.S. (H)

Type of weather or climate information	% respondents
Seasonal and intermediate-term climate forecasts	41.9
Long-term future climatic conditions	17.7
Insect and disease pattern changes	9.7
Accurate short-term forecasts	9.7
Historical comparisons	9.7
Forest climate response and vulnerability	8.1
Future extreme events	8.1

Column values do not sum to 100% because responses could be categorized in multiple categories.

## Cooperative Extension Data Needs

- Program and educational resources on climate and CC
- Help interpreting CC information for stakeholders and educators
- Climate and weather data: current accurate weather data, CC predictions with an estimated timeline, weather data coupled with soils information, and maps of expected future changes (Q).

## Recommendations for Scientists and Advisors

*Climatologists:* 1) Work with advisors to translate information for stakeholders (H) 2) devise ways to provide farm scale data 3) improve perceptions of accuracy of short-term forecasts 4) provide long-term climate information to forest advisors to support current adaptation 5) provide long-term climate information to farmers and ranchers to support future planning 6) host continuing education programs for advisors.

*Advisors:* 1) agreement about the human contribution to CC is not necessary to engage in adaptation 2) most farmers support adaptation, but few endorsed GHG reduction, suggesting that outreach should focus on adaptation options with mitigation benefits. (B).

## Help create a shared database of climate data needs and attitudes:

To add to this database on climate data needs and CC attitudes, send citations of peer-reviewed research to Ryann Smith at [climate\\_hub@nmsu.edu](mailto:climate_hub@nmsu.edu) to build a shared spatial JournalMap collection. (<https://journalmap.org/usda-southwest-regional-climate-hub/climate-change-attitudes>)

