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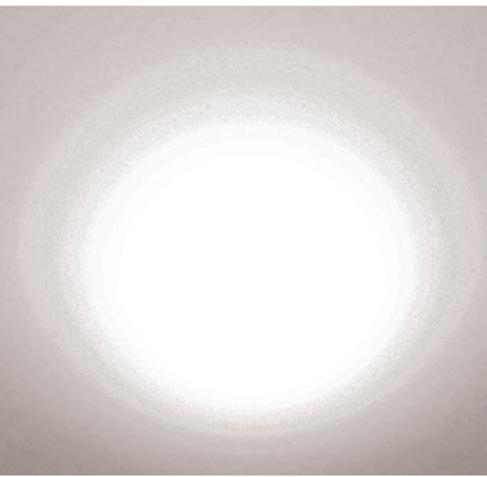


Social Considerations in Adaptation to Climate Variability

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Author's acknowledgment

In preparing this sociology aid, Ms. Cassandra Brown and Ms. Emelie McFarland provided invaluable assistance as Readers/Research Assistants. On many occasions, Ms. Brown and Ms. McFarland read scientific journal articles that were not accessibility compliant. I thank Ms. Brown and Ms. McFarland for their patience and thoroughness. In addition, I want to express my appreciation to Catherine Ulitsky, Visual Information Specialist, NRCS Massachusetts State Office, for the design and layout of this document. Also, I would like to extend my appreciation to Dr. Linda Prokopy, Associate Professor of Natural Resource Social Science at Purdue University, for contributing her extensive reference list in Social Sciences and Climate Variability.

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June 2015

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This is the second edition of a document that was first released in August, 2010.

PHOTO CREDITS:

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USDA NATURAL RESOURCES CONSERVATION SERVICE
EAST NATIONAL TECHNOLOGY SUPPORT CENTER
GREENSBORO, NORTH CAROLINA
JUNE 2015



Introduction



CHARLIE RAHM, NRCS,

The USDA Natural Resources Conservation Service (NRCS) uses a voluntary approach to work with producers to conserve, protect, and enhance their resources—soil, water, air, plant, animals and energy. This work is accomplished primarily through planning and implementing conservation practices/systems. Suffice it to say, that climatic conditions influence producers' decisions about how to manage their resources. Climate and climate change are currently on the front burner, whether in the media or as a prime area of attention in governmental and nongovernmental agencies and organizations. Climate change, as used in this document, refers to "any long-term, statistically significant change in the atmospheric conditions that a given region experiences over extended periods of time."¹ As noted, climate change is about long-term trends, while climate variability is concerned with the fluctuations from those trends.²

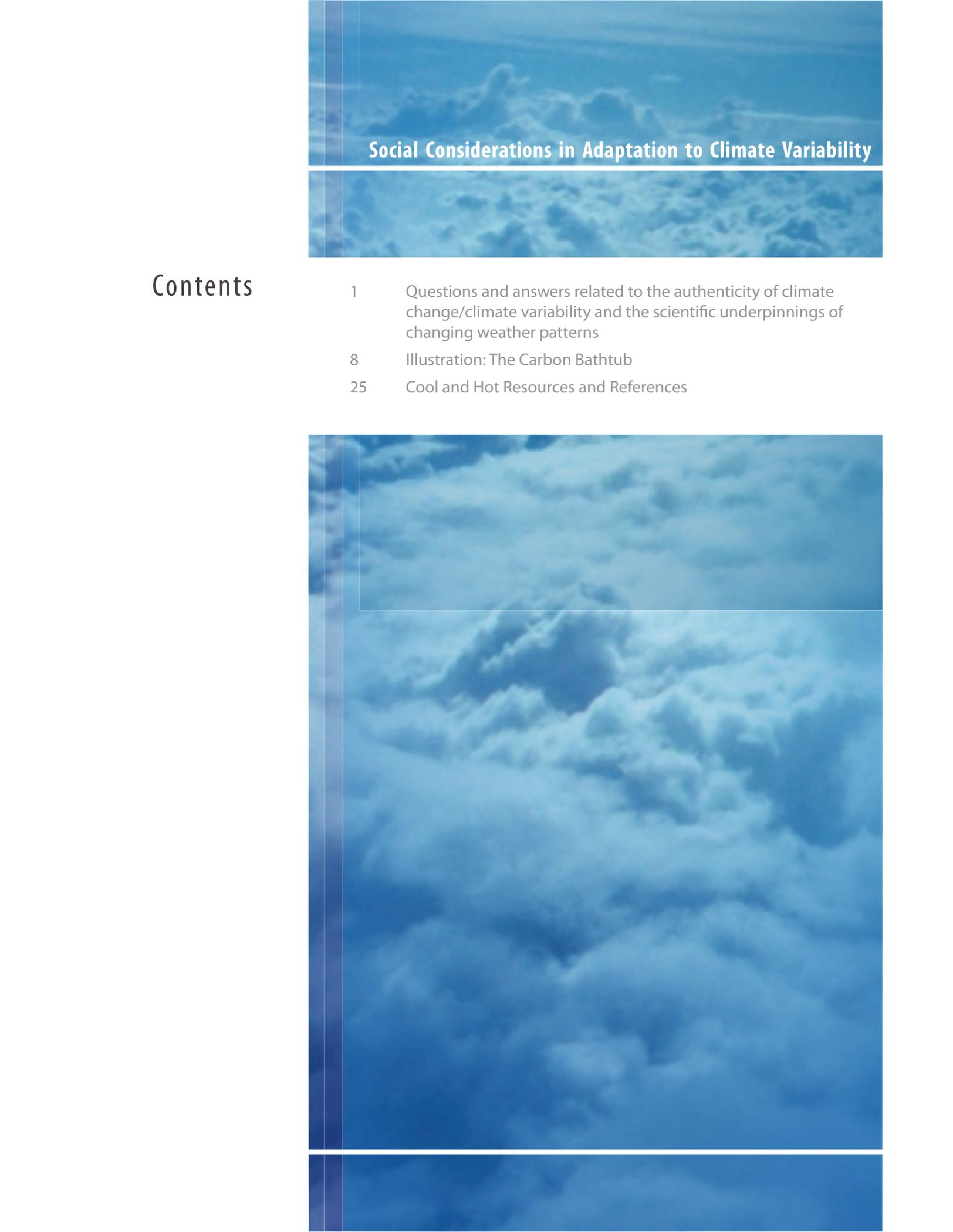
This sociological aid examines the social factors that shape a producer's decisions and conservation activities as part of adaptation to the impacts of changing weather patterns at the local level- droughts, excessive heat, growing and frost free seasons and other similar events. NRCS affects climate variability in the carrying out of its mission, most notably in providing technical assistance to producers. Over 175 conservation practices are available for use by NRCS staff to address the needs of producers in managing their resources. Additionally, producers may apply for participation in the implementation of several conservation programs outlined in *The Agricultural Act of 2014*. These programs include but are not limited to the Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), and the Healthy Forest Reserve Program (HFRP).

Key social considerations that are relevant to the ongoing discussions about climate change/variability, and adaptation to changing weather conditions will be examined in this sociological aid. Relevant topics include producers' attitudes toward climate change, social factors influencing producers decision making, the authenticity of climate change/climate variability, the scientific underpinnings of changing weather patterns, producer observations and adaptive behaviors. A question and answer format will be used to address the topic areas. Data sources for this sociological aid include personal communication with technical experts, NRCS materials, and academic research findings.

A comprehensive reference list of materials related to social considerations in climate variability has been included in this revised edition.

¹Natural Resources Conservation Service, *Frequently Asked Questions*. (2014). <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/climatechange/?cid=stelprdb1047948>.

² IBID



Social Considerations in Adaptation to Climate Variability

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**What is climate change?
What is climate variability?**

“Climate change refers to a statistically significant variation in either the mean state of the *climate* or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the United Nations Framework Convention on Climate Change (UNFCCC) makes a distinction between ‘climate change’ attributable to human activities altering the atmospheric composition, and ‘climate variability’ attributable to natural causes.”³ NRCS refers to climate variability as, “the inherent fluctuations within the climate system.” These fluctuations can occur on a variety of timescales, from seasonal and annual, to longer term fluctuations.

What are key elements of climate change that can most directly effect the management of natural resources?



Of these elements, **temperature** and **precipitation** will be the primary elements that are addressed in this sociological aid.

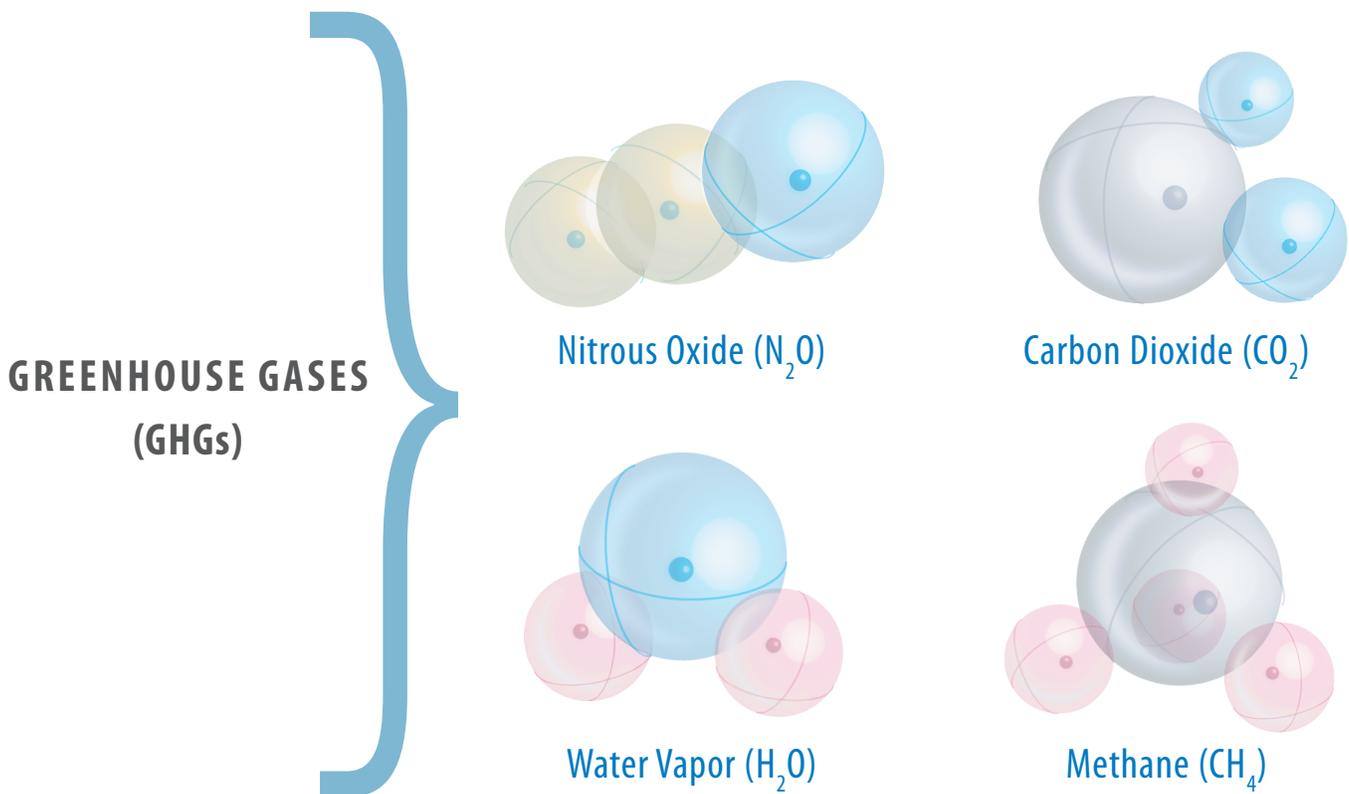
³ U.S. Department of Agriculture (2012). *Climate Change and Agriculture in the United States: Effects and Adaptation*. USDA Technical Bulletin 1935. Washington, DC. 186 pages.

PHOTOS, TOP TO BOTTOM: NOAA; JEFF VANUGA, NRCS; CATHERINE ULITSKY, NRCS; CAROL BALDWIN, NRCS; RALPH F. KREUGE, NOAA

Can climate change be attributed to human activity?

Several perspectives exist on whether climate change is caused by human activity or occurs naturally. For purposes of this discussion it is important to remark on human activity as it may effect climate change. Anthropogenic climate change refers to observed increase concentrations of CO_2 , CH_4 , N_2O , and H_2O , commonly known as greenhouse gases (GHGs).⁴ Adopted from the United Nations Framework Convention on Climate Change (UNFCCC), and cited in the USDA report titled *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity*, climate change, "...is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is, in addition to natural climate variability, observed over comparable time periods."⁵

Science has documented that an increase in concentrations of GHGs can be attributed to human activity, impacting temperature, drought conditions, rainfall and storm intensities.⁶ In contemporary discussions, most scientists agree that the dialogue addressing the causes of climate change needs to be on-going.



⁴ "Global Climate Change." Reducing Greenhouse Gas Emissions and Sequestering Carbon. *NRCS Soils*. http://soils.usda.gov/survey/global_climate_change.html.

⁵ P. Backlund et al. CCSP, 2008: *The effects of climate change on agriculture, land resources, water resources, and biodiversity in the United States*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. USDA, Washington, DC, USA, 362 pp.

⁶ "Global Climate Change." IBID

When NRCS provides technical assistance to farmers and ranchers, is it important for field staff to enter into a scientific discussion about the role that humans play in climate change?

No.

Is it important for NRCS field staff to know and understand a producer’s beliefs about the causes of “climate change?”

No, it is not important to know what a producer believes about the causes of climate change.

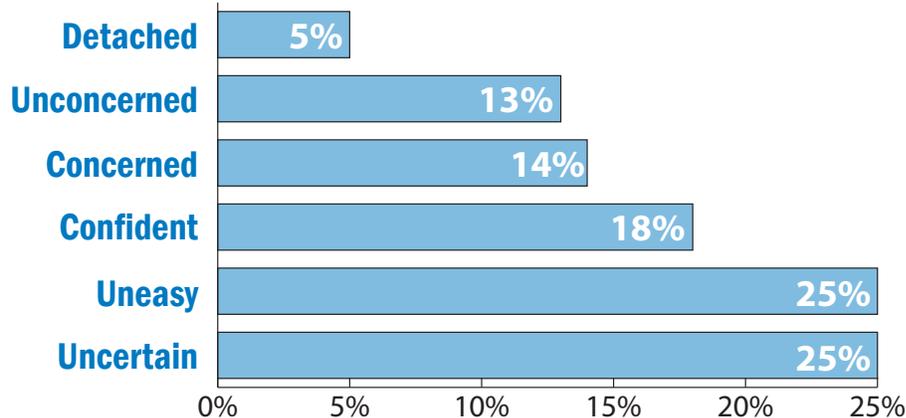


BIGSTOCK

Do producers share the same perspectives about the role of human activity and changing weather conditions on agricultural landscapes?

No. All producers do not have the same points of view about changing climate conditions and the role that humans play relative to these changes. In 2014, over 4,500 corn producers across 11 Midwestern states participated in a survey. The survey was composed of 34 elements that were grouped under five main topics. The topics included beliefs about climate change, that is, whether climate change is occurring because of human activity or because it is a natural occurrence. The additional topics included experience with extreme weather events such as drought, saturated soils and excessive soil erosion, perceived risk such as increased insect and weed pressure, confidence, knowledge and capability of maintaining a viable operation, and lastly support from private, government and non-profit entities such as seed companies and government technical assistance. It is important to note that survey results show that farmers lack agreement on the role that government agencies should play in reducing greenhouse gases and other potential sources of climate change.

The over 4,500 farmers who completed the survey were divided into six classes based on their responses to the 34 survey elements. For descriptive purposes, the six classes were identified along with the percentage of farmers comprising each class:



The preceding statements highlight the finding that there are differences across producer groups. However, the same study found that farmers do share a similar perspective on their knowledge, financial capability and technical know-how to meet challenges related to changing climate conditions. Additionally, the survey respondents were similar in their views about taking personal responsibility to protect their land. The majority of farmers surveyed also agreed that that seed companies should provide new crop varieties that can adapt to changing climate conditions.⁷

⁷ Arbuckle, J.G. Jr., J. Hobbs, A. Loy, L.W. Morton, L.S. Prokopy, J. Tyndall (2014). *Understanding Farmer Perspectives on Climate Change: Toward Effective Engagement Strategies for Adaptation and Mitigation in the Corn Belt*.

Table 1

In 2014, over 4,500 corn producers across 11 Midwestern states participated in a survey. The survey was composed of 34 elements that were grouped under five main topics. The topics included beliefs about climate change, that is, whether climate change is occurring because of human activity or because it is a natural occurrence, experienced hazards, perceived risks, efficacy, and support for action.

QUESTION	DESCRIPTION
Belief	Please select the statement that best reflects your beliefs about climate change:
	a. Climate change is occurring, and it is caused mostly by natural changes in the environment (0.5)
	b. Climate change is occurring, and it is caused mostly by human activities (1)
	c. Climate change is occurring, and it is caused more or less equally by natural changes in the environment and human activities (0.75)
	d. Climate change is not occurring (0)
	e. There is not sufficient evidence to know with certainty whether climate change is occurring or not (0.25)
Experienced Hazard	Experienced significant drought in the last five years
	Problems with saturated soils or ponding in the last five years
	Creeks, streams or rivers running through farmland
	Experienced stream/river flooding in the last five years
	Some land farmed has experienced significant soil erosion, last five years
Perceived Risk	Increased flooding
	Longer dry periods and drought
	Increased weed pressure
	Increased insect pressure
	Higher incidence of crop disease
	More frequent extreme rains
	Increases in saturated soils and ponded water
	Increased heat stress on crops
	Increased loss of nutrients into waterways
	Increased soil erosion
	My farm operation will likely benefit from climate change
	My farm operation will likely be harmed by climate change

Table 1 (continued)

QUESTION	DESCRIPTION
Efficacy	How confident are you that current practices will maintain the long-term success of your farm operation?
	I have the knowledge and technical skill to deal with any weather-related threats to the viability of my farm operation
	I have the financial capability to deal with any weather-related threats to the viability of my farm operation
	Climate change is not a big issue because human ingenuity will enable us to adapt to changes
	Crop insurance and other programs will protect the viability of my farm operation regardless of weather
	I am concerned that available best-management practice technologies are not effective enough to protect the land I farm from the impacts of climate change
Support for Action	Farmers should take additional steps to protect farmland from increased weather variability
	I should take additional steps to protect the land I farm from increased weather variability
	Seed companies should develop crop varieties adapted to increased weather variability
	University Extension should help farmers to prepare for increased weather variability
	State and federal agencies should help farmers to prepare for increased weather variability
	Farm organizations (e.g., Farm Bureau, Corn Growers) should help farmers to prepare for increased weather variability
	Government should do more to reduce greenhouse gas emissions and other potential sources of climate change
	I should reduce greenhouse gas emissions from my farm operation
	Farmers should invest more in agricultural drainage systems to prepare for increased precipitation
	Farmers should invest more in irrigation systems to prepare for more frequent drought

Does NRCS play a role in the science of climate change?

NRCS is involved in quantifying the effects of GHGs and carbon sequestration, assessing the impacts of incentives in conservation activities, promoting the adoption of conservation technologies that reduce GHGs.⁸

NRCS Field Office Technical Guide (FOTG) contains approximately 175 conservation practices, many of which have beneficial effects that address the impacts of changing weather conditions (2007b). These practices include, but are not limited to, conservation tillage, conservation crop rotation, cover crop, residue management, critical area planting, contour farming and contour buffer strips, nutrient management and various waste management practices, irrigation management and related pipeline and irrigation system practices, diversions, field borders, filter strips, riparian herbaceous cover and riparian forest buffers, grade stabilization structure, fencing (that facilitates grazing management), and livestock watering facilities, among many others.

Farmers can also retire cropland in sensitive areas and improve or restore wetlands, and other sensitive areas such as springs, seeps and sinkholes (karst topography features) to filter sediment and nutrients. Many of our management and vegetative practices contribute to building soil quality/health and soil health is essential for creating productive and resilient production systems that can better deal with extreme weather events. In addition, many of our enduring engineering/structural practices can harden critical landscape features such as drainage-ways and grade changes, so that farm fields are better able to cope with extreme rainfall events.⁹

Carbon sequestration is carbon stored in soils, biomass and harvested products to prevent a return to the atmosphere as carbon dioxide.



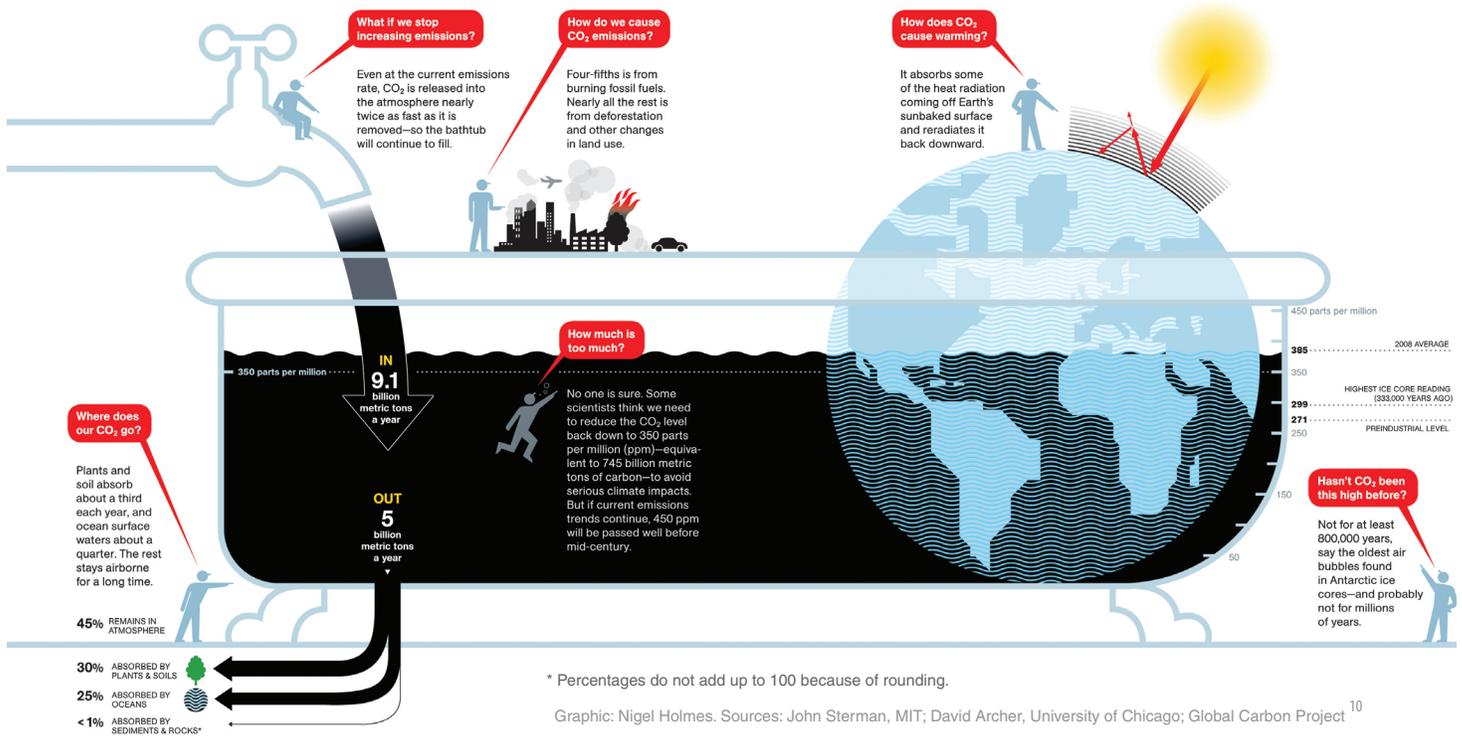
GARY KRAMER, NRCS

⁸ Arbuckle, J.G. Jr., J. Hobbs, A. Loy, L.W. Morton, L.S. Prokopy, J. Tyndall (2014). *Understanding Farmer Perspectives on Climate Change: Toward Effective Engagement Strategies for Adaptation and Mitigation in the Corn Belt*.

⁹David Faulkner, Virginia State Economist, Personal Communication, October, 2014.

The Carbon Bathtub

It's simple, really: As long as we pour CO₂ into the atmosphere faster than nature drains it out, the planet warms. And that extra carbon takes a long time to drain out of the tub.



¹⁰ Nigel Holmes (Illustrator). "The Carbon Bathtub." In R. Kunzig "The Carbon Bathtub." *National Geographic Magazine*, January 2009.

What are the key social considerations that effect a producer’s decisions about adaptation to climate variability?

Social science research has documented several categories of social factors that influence a producer’s decisions about the adoption/adaption of conservation technologies.

<p>PERSONAL</p>	<ul style="list-style-type: none"> ▶ above average income ▶ greater number of years of formal education ▶ high number of agency contacts ▶ high participation rates in agricultural organization ▶ greater reliance on mass media ▶ high awareness of conservation problems ▶ willingness to take risks ▶ full-time operator ▶ desire to pass farm/ranch to children 	<p>DIANE PETIT, NRCS</p>
<p>FARM</p>	<ul style="list-style-type: none"> ▶ size of farm ▶ amount of farm sales ▶ owner vs. renter 	<p>C. ULITSKY, NRCS</p>
<p>INFORMATION</p>	<ul style="list-style-type: none"> ▶ timely ▶ accurate ▶ inexpensive ▶ easily obtainable ▶ place specific 	<p>RON NICHOLS, NRCS</p>
<p>PRACTICE</p>	<ul style="list-style-type: none"> ▶ economically feasible ▶ observable ▶ simple to use and divisible into manageable parts ▶ compatible with a farmer’s beliefs, ideas and management style ▶ flexible: easily fitting into the producer’s management of the operation 	<p>GARY KRAMER, NRCS</p>
<p>COMMUNITY</p>	<ul style="list-style-type: none"> ▶ bonding networks based on trust ▶ bridging Networks- tying science to field application. ▶ open and equal access to information links ▶ high value on local knowledge and personal experience ▶ effective leadership comes from “within” ▶ evaluation relies on others like ourselves, similar in ethnicity, status and agricultural situations 	<p>RON NICHOLS, NRCS</p>

Are there other social considerations that influence a farmers' attitudes and behaviors associated with adaptation to climate variability?

Yes, in the 2014 *Connecting on Climate: A Guide to Effective Climate Change Communication*, the authors described how personal identities based on core values influence attitudes related to climate variability.¹¹ Promoting the use of a conservation technology must be personally meaningful to the farmer and compatible with both their short and long term goals. As an example, a farmer may not readily adopt cover crops in a locale that is subject to drought and has no irrigation. In all likelihood, the farmer would reject the use of cover crops because of the perceived risk to economic returns and the management challenges associated with installing and maintaining a cover crop.

Examples of producer values:

- ▶ honesty
- ▶ hard work
- ▶ loyalty
- ▶ privacy
- ▶ patriotism
- ▶ fairness
- ▶ interdependence
- ▶ opportunity



RON NICHOLS, NRCS

¹¹ Center for Research on Environmental Decisions and ecoAmerica. (2014). *Connecting on Climate: A Guide to Effective Climate Change Communication*. New York and Washington, D.C.

What barriers impact producer adaptation to climate variability? What strategies can field staff use to address the identified barriers?

COMMONLY CITED BARRIERS

INCLUDE, BUT ARE NOT LIMITED TO:

CONSIDER THE FOLLOWING STRATEGIES:

▶ **Lack of detailed information on heat stress, pest infestation and disease rates.**

▶ Provide data for different levels of impacts specifically increased heat stress, pest infestation and disease rates.

▶ **Lack of agronomic and economic costs associated with changing climate conditions.**

▶ Provide agronomic and economic costs and benefits associated with impacts on crop production under different scenarios, specifically the factors of length of growing season, timing of frosts, heat accumulation, precipitation, evaporation and moisture availability.

▶ **Lack of understanding relative to extremes in weather patterns.**

▶ Assess current conditions and forecast alternatives based on available climate data as this data impacts more frequent and severe droughts, heat waves, violent storms, flash flooding, growing and frost free seasons, seasonal values for temperature, growing degree days, corn heat units, precipitation and moisture deficits.

▶ **Increasing heat and dryness.**

▶ Work with local farmers to adopt/adapt conservation tillage, alternative plant varieties and hybrids and irrigation systems. For each of these practices farmers need detailed dollar, time, labor and energy costs.

▶ **Changing conditions for livestock producers (temperature increase, decrease in moisture).**

▶ Promote grazing systems that will include the use of native grasses and the preparation of pasture management budgets for appropriate levels of forage production.

▶ **Lack of detailed data on changing climate conditions for cash crop production.**

▶ Provide farmers with information/data related to their specific cash crop-impact of short-term weather events on pesticide, herbicide, fungicide and fertilizer applications, nitrogen management, harvesting and long-term storage of selected cash crops, irrigation management and increased conservation tillage.

COMMONLY CITED BARRIERS INCLUDE, BUT ARE NOT LIMITED TO:	CONSIDER THE FOLLOWING STRATEGIES:
▶ Loss of efficiency in current management practices resulting from noticeable weather variations during the past five years.	▶ Modify current management practices by growing different crops and or crop varieties, altering tile drainage, employing conservation tillage, changing timing of planting, installing irrigation systems, planting new or improved crop varieties that stand up under adverse climate and weather conditions, and adopting crop rotation.
▶ Lack of consistent water flows.	▶ Establish “irrigation advisory committees” consisting of farmers and local water managers to establish equitable sharing and to ensure constant water flows to ecosystems.
▶ Constraints associated with crop diversification include new and additional costs associated with technology required for different production systems, the pressure to specialize for meeting economies of scale, better returns from diversifying “off the farm” through pluriactivity, and biophysical and locational limitations related to soil type and distance from markets.	▶ Request assistance of economic marketing specialist to identify and calculate the cost and benefits associated with these constraints.
▶ Lack of timely accurate and easily accessible information sources associated with the adoption/adaptation of practices/systems.	▶ Identify key information sources specific to type of operation, personal, farm, community characteristics and geographic areas experiencing extreme weather patterns in order to customize conservation practices.
▶ Lack of timely and accurate information on the impact of climate variabilities at the farm level: yield, water quantity and quality, fertilizer application and pesticides. ¹²	▶ Farm level data is not routinely available. Field staff can continue to work in close coordination with universities, USGS and other local, state and federal agencies, and private organizations such as watershed coalitions to collect and distribute local climate data.

¹² Perarnaud, V., Seguin, B., Malezieux, E., Deque, M., and Loustau, D. 2005. Agrometeorological Research and Applications Needed to Prepare Agriculture and Forestry to 21st Century Climate Change. *Climatic Change* 70(1/2), 319-340.

What information will be useful in adapting to variations in weather conditions?

NRCS customers want data that is specific to their local geographic area. Within a specific locale, there are communication networks, known as bonding networks, which are based on trust between family, friends and neighbors. One underlying characteristic of bonding networks is the maintenance of social norms; however, relying exclusively on bonding networks can discourage change and decrease the likelihood that new information or opinions will be readily accepted. Adaptation to climate change will not occur at the local level unless NRCS field staff can determine who and what information will be trusted. Concurrently, field staff must be aware of the role of bridging networks in the adaptation process. Bridging networks are the outside communication links that allow opportunities to expand and obtain new scientific information. To adapt to changing climate conditions, both bonding and bridging networks are necessary.

A real world example of the role that bridging networks play includes access to information from state weather networks that are run out of the state university that gives daily data. Having easily accessible, accurate and “real time” data, including weather forecasts can influence “if and how” producers adapt their conservation behavior. Effective adaptive behavior depends upon information that will assist producers in making decisions about “if and when” planting dates should be changed or whether to modify current production by adopting alternative crop varieties and/or crop or livestock species- the cost of increased use of water, fertilizer, herbicide, and pesticide. Specifically, an increase in water consumption during droughts using higher amounts of chemical inputs will impact at minimum the quantity and quality of water. This information including a detailed economic analysis is necessary for sound decision making.

Examples of data that will likely be useful to NRCS customers

Consider providing customers with quantitative data on:

- ▶ temperature
- ▶ precipitation
- ▶ evaporation
- ▶ soil moisture and runoff
- ▶ stream flow (spring and summer)
- ▶ snowfall and snow cover
- ▶ growing season and freeze date
- ▶ first growth on trees, shrubs and grasses
- ▶ fruit and flower blooms



DAVE MENKE, U.S. FISH & WILDLIFE, WESTERN BLUEBIRD

What information will be useful in adapting to variations in weather conditions?
(continued)

In addition, if producers are to make decisions that involve transitioning to a different type of operation they will need a comprehensive analysis of large capital investments such as irrigation systems, livestock cooling facilities, and new or expanded crop storage facilities.¹³ To ensure that effective decisions are being made, producers will want a detailed analysis of the agronomic, economic, environmental, and management costs and benefits associated with any change under consideration.

When working with socially disadvantaged (SDAs) farmers and ranchers, it will be important to remember that SDAs do not routinely use the same bonding and bridging networks, as do traditional NRCS customers. To ensure that SDAs receive timely and accurate information necessary for adapting to climate change, field staff will need to develop and implement an outreach plan. This plan will help identify which community members are reliable sources of information. Results from a 2012 survey of Midwestern corn producers conducted by Useful to Usable (U2U) and SustainableCorn.org.¹⁴



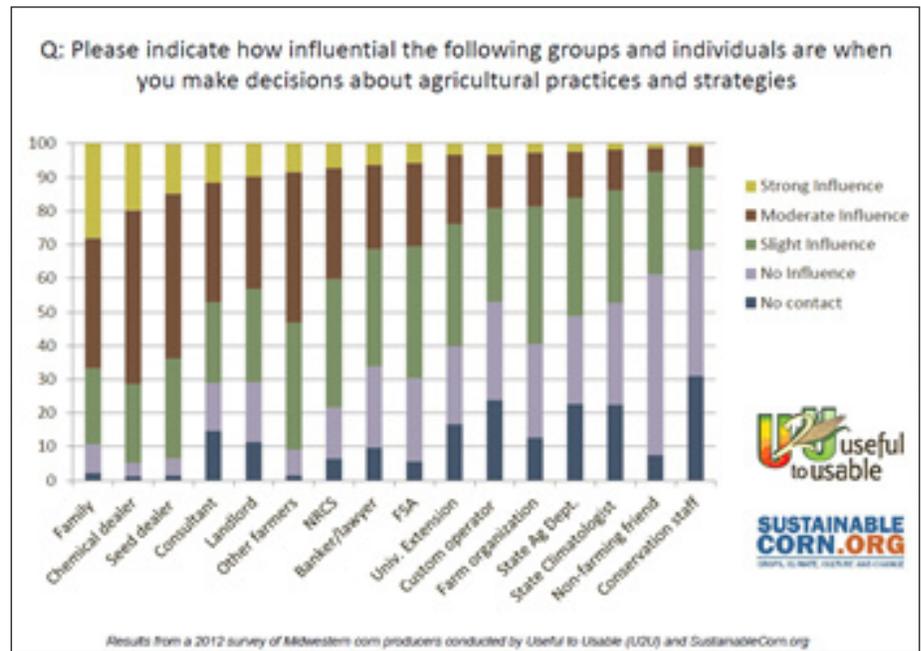
JASON JOHNSON, NRCS

¹³ Wolfe, David W. et al. Projected change in climate thresholds in the Northeastern U.S.: implications for crops, pests, livestock, and farmers. *Springer Science + Business Media B.V.* 2007. *Mitig Adapt Strat Glob Change* (2008) 13:555–575

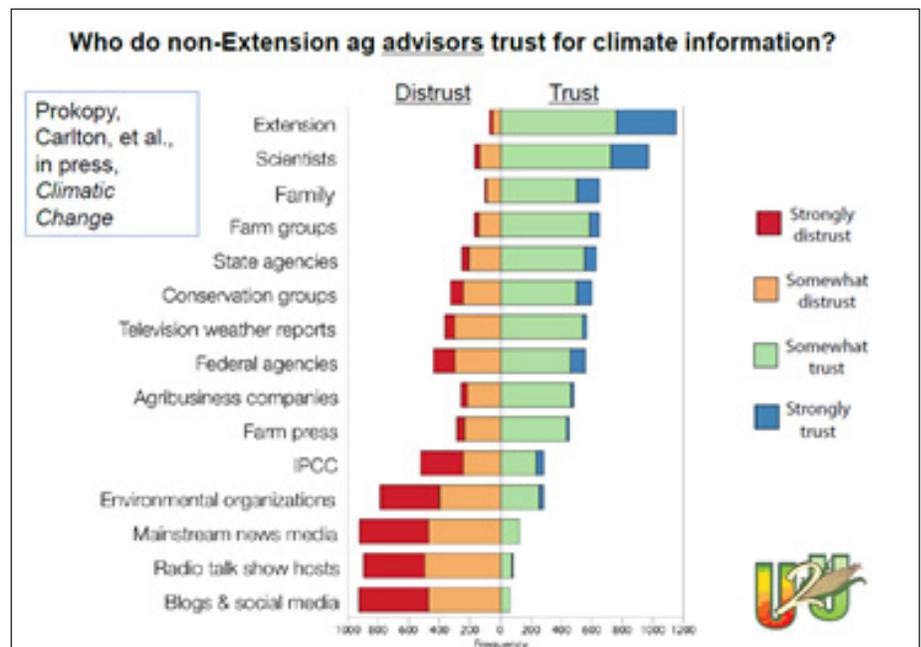
¹⁴ Prokopy et al. 2014. "Adoption of Agricultural Conservation Practices: Insights from Research and Practice" Purdue Extension Publication FNR-488-W.

What information sources influence farmers' decisions about the adoption of agricultural technologies?

In a 2014 study of over 4,000 farmers within the Corn Belt region of the United States, farmers identified the information sources that they use when making decisions about agricultural practices. This research finding shows that both bonding and bridging communication networks are used in a farmer's decision making process. It is worth noting that not all producers across the various geographical regions of the United States would evaluate the influence of the information sources at the same levels as were reported in this study.



In the same 2014 study, Ag advisors were asked to identify those individuals or groups that they most trust. It is interesting to note that Ag advisors identified two trusted sources of information: Extension and Scientists. The implication of this finding is that NRCS and their partners must ensure that the conservation message is reflected in extension and scientific activities related to agricultural technologies.¹⁵



¹⁵ Prokopy, S. L. (2015, January 20). Useful to Usable: Lessons learned about selling conservation [Webinar]. In Science & Technology Training Library. Retrieved from <http://www.conservationswebinars.net/webinars/useful-to-usable-lessons-learned-about-selling-conservation>

What do we need to remember to more effectively engage producers who are experiencing changing, and sometimes extreme, weather conditions?

First and foremost, let's remember that producers, on a daily basis, manage their operations under varying weather conditions; too little rain, excessive and sustained wind speed, etc. Overcoming the challenges associated with such weather conditions reinforces a producer's ability to remain resilient. Current research underscores the need to engage producers as the *first line problem solver*.

As technical experts, let's remember that our role is to *support* producers, rather than *tell* them how to adapt. Whether we are conducting field days and tours, setting up a demonstration or having a one on one conversation, remember that producers have met and overcome weather related challenges. Producers' on site experiences are their knowledge base.

As agency representatives, we can support the adaptation process by providing the mechanisms that will allow producers to share their hands on experiences. Such experiences build and validate the local knowledge base. Simultaneously, NRCS field staff receive feedback on conservation practices/ systems that facilitate adaptation to changing weather conditions.^{16, 17}



RON NICHOLS, NRCS

¹⁶ Arbuckle, J.G. Jr., J. Hobbs, A. Loy, L.W. Morton, L.S. Prokopy, J. Tyndall (2014). *Understanding Farmer Perspectives on Climate Change: Toward Effective Engagement Strategies for Adaptation and Mitigation in the Corn Belt*.

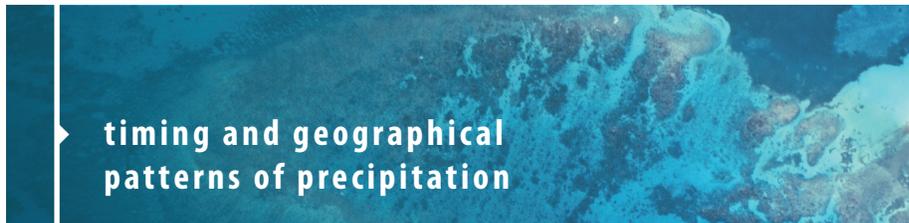
¹⁷ Nowak, P. 2013. Thinking about a future conservation agenda. *Journal of Soil and Water Conservation* 68(2):50A-52A.

What weather related factors will most likely affect agricultural producers' adaptation to changing climate conditions in their local area?

Some weather related factors include:



BUREAU OF LAND MANAGEMENT, CALIFORNIA



NOAA, ST. CROIX & VIRGIN ISLANDS



RON NICHOLS, NRCS



TIM MCCABE, NRCS



JEFF VANUGA, NRCS



NOAA IMAGE

In what ways can climate variability directly impact the day-to-day operations of producers?

Variability in weather conditions – especially temperature, rainfall and snow accumulation – can result in crop losses due to “increased frequency of high temperature stress, inadequate winter chill period for optimum fruiting in spring, increased pressure from marginally over-wintering and/or invasive weeds, insects, or disease, or frequency of summer droughts.” Such impacts of weather variability have been documented, particularly in the Northeast.¹⁸

What benefits can accrue when producers change conservation practices/systems in response to climate variability?

Some of the documented benefits include:

- ▶ conserved energy and reduced greenhouse gas emissions (increased profit margin and minimized contribution to climate change)
- ▶ increased soil organic matter
- ▶ improved nitrogen use efficiency
- ▶ marginal land used for alternative energy sources (e.g., wind energy, and biomass fuels) for marginal land¹⁹

Will producers readily observe the benefits associated with the adaptation of conservation practices and systems in response to climate variability?

Producers may not observe the long-term benefits that can accrue from the adaptation of conservation practices and systems. However, long-term benefits such as reduction in GHGs and carbon sequestration are not of greatest concern to producers. The “here and now” of short-term benefits that result from the installation of conservation practices (including cover crops and conservation tillage) are observable.

The ability to readily see the benefits of conservation assists the producer in meeting the goals of his or her operation. Social science research has documented that the observability of benefits is necessary in the adoption/adaptation of conservation practices/systems. In addition, technical experts do not always know or agree on what benefits can be achieved if current conservation technologies are to be modified in light of adaptation to climate variability.

¹⁸ Wolfe, David W. et al. Projected change in climate thresholds in the Northeastern U.S.: implications for crops, pests, livestock, and farmers. *Springer Science + Business Media B.V.* 2007. *Mitig Adapt Strat Glob Change* (2008) 13:555–575

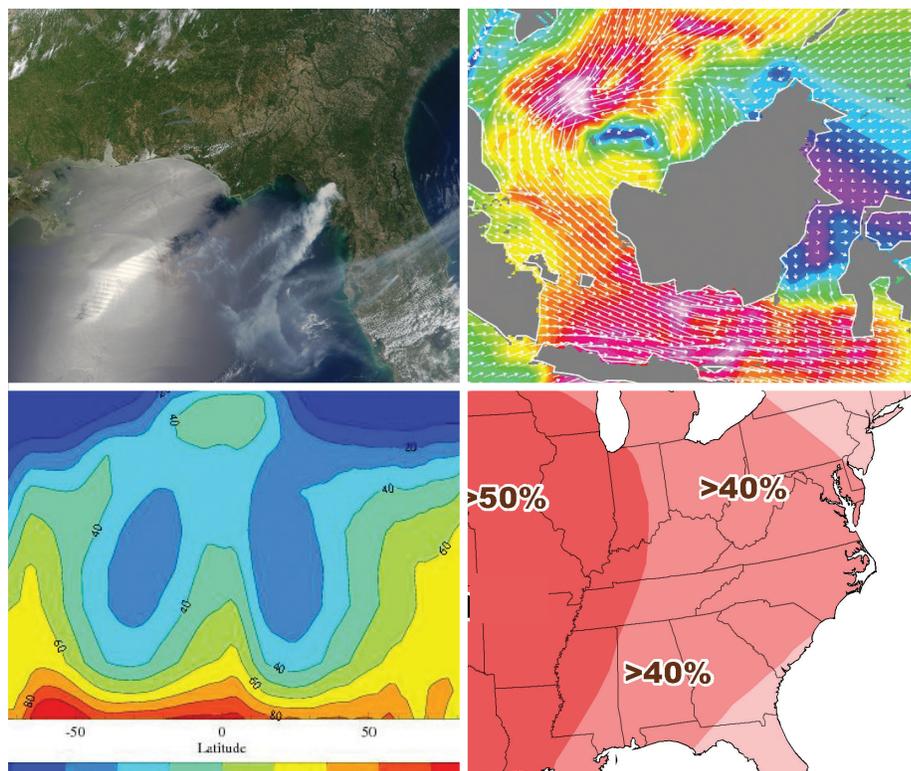
¹⁹ IBID

What risks can producers incur when adapting to climate variability in day-to-day operations?

Producers can incur both dollar and time costs associated with crop losses and/or the transition to alternative crops. Transitioning to alternative crop production could entail risk both in terms of dollars and management of new crops. These same costs and risks can apply to livestock and dairy producers.²⁰ Given the risk, it is important that producers have timely, accurate and easily accessible climate projections.

Note that if new crops are grown as a response to changing weather conditions, the landscape of rural communities will also change. Examples of changes in the rural landscape may include but are not limited to: the need for businesses to change their products and services, a change in revenues resulting from potential decreases during the transition which could affect local tax-based and community services, and environmental impact changes such as water quality and quantity.

Examples of weather data include daily extremes and daily data for each month.



For detailed weather data, producers can access the National Oceanic Atmospheric Administration (NOAA) Weather Data at: <http://sercc.com/nowdata.html>

²⁰ NOAA Online Weather Data (2007). Southeast Regional Climate Center, University of North Carolina at Chapel Hill. <https://www.sercc.com/nowdatamap>.

Which type of assistance – technical (TA), financial (FA) or educational (EA) – is basic to producers’ adaptation to recorded variations in weather patterns?

Educational assistance (EA) is basic to increase the awareness and understanding of what adaptive behavior strategies are most suitable in response to extreme weather variations at the local level. NRCS and the Conservation Partnership will want to provide educational opportunities to ensure that producers have a basic understanding of key terms such as greenhouse gas emissions and carbon sequestration.

There are many “tried and true” educational assistance activities that have been used by the agency. Additional educational opportunities are available through NRCS formal training. Newly available courses in the area of climate change include *Air Quality, Climate Change and Energy, Why Should We Care About Air Quality?, Air Quality Resource Concerns, and Greenhouse Gases and Carbon Sequestration*. These courses are available to the public outside of the NRCS formal training system.

Remember that educational assistance is most effective if social factors such as income levels, formal educational attainment, tenure as operator, short and long term plans for the operation, information sources, community leadership, etc. are considered in designing and implementing educational activities.

EA activities may include demonstrations, testimonies, short courses, conferences, field days and farmer-to-farmer networks



PHOTOS: (CLOCKWISE FROM UPPER LEFT) RON NICHOLS, NRCS; DIANE PETIT, NRCS; RON NICHOLS, NRCS; DIANE PETIT, NRCS

When working with Socially Disadvantaged (SDAs) and Limited Resource Farmers (LRFs) is there a need for the agency to focus its efforts on adaptation to climate variability?

Yes. SDAs and LRFs do not routinely use the same information sources as do mainstream producers. SDAs and LRFs rely on family, friends and leaders from within their own community to obtain and evaluate information. The size of operations of SDAs and LRFs are usually smaller than those of other producers in the county. Any TA, EA and FA activities relative to climate variability will be most effective if assistance activities are based on the characteristics of the group such as income, number of formal years of education, experience with conservation practices/systems, etc.

Identifying specific social characteristics (personal, farm, practice, community leadership) will help NRCS specialists to customize assistance items like brochures, job sheets and other materials with special type, language and formatting for local clientele. Written materials should contain as little jargon as possible. Where appropriate, pictures and other illustrations can supplement narrative descriptions/explanations.

Additional considerations will be necessary based on the social characteristics of the group.

Is it useful to discuss the varied perspectives on the causes of climate variability?

There are many perspectives on the *causes* of climate variability. Engaging producers in conversation about such *causes* may not be important in addressing resource concerns. Of relevance to producers are the observed and documented changes resulting from extreme changes in weather conditions.

Examples of changes include but are not limited to warming temperatures causing heat stress on livestock, shorter or longer growing seasons, decreased rainfall impacting crop yields, increased runoff and flooding, and pest management. At the individual farm or ranch level, it may be most helpful to center discussions on the observable or documented changes and how best to provide assistance that address the resource concerns.



RON NICHOLS, NRCS

What steps promote effective dialogue between climate scientists and members of the agricultural community?

In a 2015 article, Wilkie and Morton presented and analyzed research findings that addressed the communication of scientific information to the public. The specific focus was on how to effectively disseminate climate information to the agriculture community. Several factors were cited as important considerations when communicating climate information.

Among the most important factors noted were the complexity of the climate science data, the varying attitudes and behavioral responses to risk and uncertainty associated with the impacts of weather events and who the agriculturalists view as trusted sources on climate information. The authors use the foundational work of Fischhoff's typology of uncertainty and risk to emphasize that "good" or effective dialogue with the agricultural community must include the "numbers and facts" and that the scientific data must be customized for a specific agricultural group within their defined geographic locale.

In addition to facts and figures having local meaning, scientists will want to encourage feedback and value the personal experiences of the local farming and ranching community. The writers of the article note that when using Fischhoff's typology, each of the seven "tasks" build one upon the other and no one step should be taken out of sequence.²¹

Seven Stages of Uncertain Risk Communication: Fischhoff's Typology

1. All we have to do is get the numbers right.
2. All we have to do is tell them the numbers.
3. All we have to do is explain what we mean by the numbers.
4. All we have to do is show them that they've accepted similar risks in the past.
5. All we have to do is show them that it's a good deal for them.
6. All we have to do is treat them nice.
7. All we have to do is make them partners.

SOURCE: FISCHOFF (1995)

²¹ Wilke, A. K., & Morton, L. W. (2015). Climatologists' Communication of Climate Science to the Agricultural Sector. *Science Communication*, 1075547015581927.

Where can producers begin to get support in their efforts to adapt to climate variability?

The East NTSC provides technical assistance. Upon request from key Center staff, direct technical assistance can be provided in the areas of agronomy, wild life biology, forestry, engineering, plant materials and other related natural resource management specialties.

ENTSC staff do not address climate variability as a separate and unique resource concern. Rather, issues in weather variability such as water management, integrated pest management, and other resource concerns are considered in the planning and implementation of conservation practices and systems and/or designated Farm Bill programs. Similarly, impacts from changing weather conditions are addressed in specific recommendations to producers based on current conditions within a defined operation or watershed.

Contact information for ENTSC is at the beginning of this document.



RON NICHOLS, NRC

Is there a take-home message that can be derived from the preceding discussions about the social considerations in adaptation to climate variability?

Weigh social and physical factors equally

Yes. Producers are first line problem solvers when facing challenges resulting from the effects of extreme weather conditions. As conservationists, we provide support to producers requesting assistance in conserving, maintaining and enhancing their natural resource base. In so doing, we help to meet global, national, regional and local goals to reduce GHGs by building and maintaining healthy soils.

It will be well to remember that adaptation to the effects of extreme weather conditions must be examined and understood in terms of the social context, that is, the integration of the social and physical resource factors that shape and reshape the attitudes and behaviors of producers.

Spanning several decades, sociological research has shown that producers' decisions about the management of their operation are influenced by a myriad of social factors. Such factors include, but are not limited to:

- ▶ plans for the land
- ▶ tenure and experiences as an operator
- ▶ size of operation
- ▶ compatibility of conservation technology with producer goals
- ▶ economic, agronomic and environmental costs and benefits
- ▶ income and education
- ▶ information sources
- ▶ educational assistance
- ▶ timely, accurate, easily obtainable and place-specific weather data

Current sociological research tells members of the Conservation Partnership that producers differ in their beliefs about the occurrence of climate change and the role that humans play in changing climate conditions. For conservationists, the divergent perspectives are of little significance in comparison to the common desire for support in meeting weather related challenges. Efficient and effective support in adaptation to climate variability can best be accomplished when social and physical resource factors are given equal weight in the adaptation process.



RON NICHOLS, NRCS

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