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Communicating Climate Change to Agricultural Audiences

Zachary M. Easton, Professor and Extension Specialist, Biological Systems Engineering, Virginia Tech

Joshua W. Faulkner, Farming and Climate Change Program Coordinator, Center for Sustainable Agriculture, University of Vermont Extension

The objectives of this publication are (1) to outline some climate-related challenges facing agriculture, (2) to address challenges in communicating climate change issues, and (3) to propose best practices when attempting to communicate climate change issues to agricultural stakeholders. Extension educators and agricultural service providers can use the information presented here to develop outreach and educational programs focused on the impacts of climate change, the effects of climate change on agricultural production, and the best ways to motivate behavior change.

Why Climate Change Matters to Agricultural Producers

Agricultural producers have a long record of successful adaptation to a host of internal and external pressures, and they have made remarkable strides toward maintaining production in the face of these pressures. Still, the enormity of a changing climate puts our nation's food and fiber resources at risk.

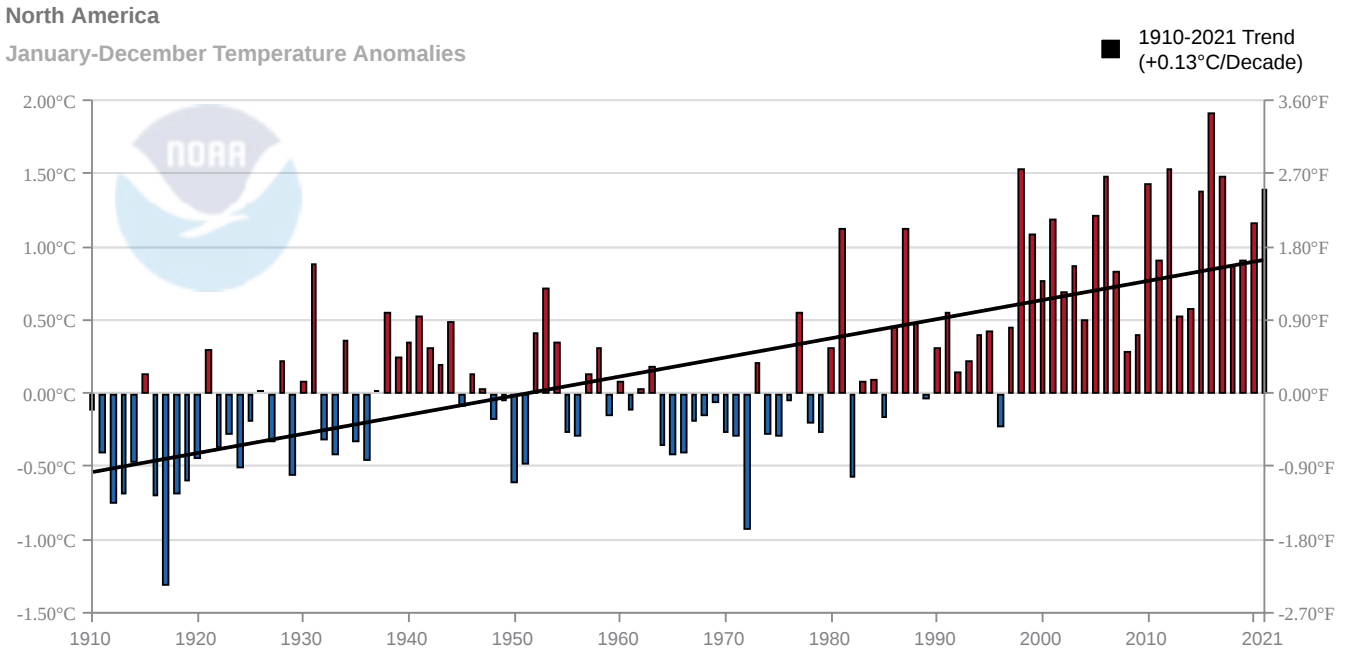

Figure 1. North America temperature averages for tthe period 1910-2021.

Source: NOAA National Centers for Environmental Information. 2016. "Climate at a Glance: Time Series." http://www.ncdc.noaa.gov/cag/time-series/global/globe/land_ocean/ytd/12/1880-2016?trend=true&trende=10&firsttrendyear=1880&lasttrendyear=2016%22%20target=%22_blank%22%3Ewww.ncdc.noaa.gov/.../1880-2016

Recent years have demonstrated the vulnerability of our production systems to a changing climate and weather extremes. For example, 2012 was one of the most expensive years on record for crop damage ($15.7 billion) due to weather-related disasters (NOAA 2015). This included the historic drought that gripped much of the midwest and eastern U.S. that caused extensive crop damage and resulted in the largest-ever government crop insurance payout. And according to the National Oceanic and Atmospheric Administration National Center for Environmental Information, 2011 had a record-breaking 12 climate-related disasters that exceeded $1 billion each. The 16 warmest years on record globally (out of the last 135 years) occurred between 1998 and 2015 (fig. 1), which NOAA claims would be highly unlikely if climate change were not occurring.

For those trying to communicate climate change, these examples present the opportunity to start a conversation with stakeholders and to engage them in a discussion about adaptation solutions.

In a 2012 report, the USDA noted that climate change poses unique risks to agricultural production and natural resources (Walthall et al. 2012). The potential consequences of a changing climate include decreasing agricultural yields and economic returns as well as negative impacts on water quality due to increased soil and nutrient loss. The primary predicted climatic changes and associated agricultural impacts are briefly outlined in the following section. These projected impacts could present opportunities for extension educators to engage their stakeholders in discussions regarding climate effects on local or regional agricultural production systems. Localized climate change projections would better inform those discussions.

Key Climate Change Impacts on Agriculture

Climate change is expected to impact agriculture primarily through changes to temperature and precipitation. The expected impacts are outlined briefly below.

Temperature

1. The average global atmospheric temperature is expected to continue to rise (fig. 1). This will be accompanied by more very hot days in the summer (days above 90 F) and more relatively warm, frost-free days in the winter (USDA 2012).
2. Warming temperatures will likely lead to increased weed, pest, and disease pressure, and as a result, increased management and cost (Wolfe et al. 2008; Hatfield et al. 2008).
3. More frequent heat waves could result in livestock heat stress, which can inhibit fertility, reduce weight gain, and decrease milk production (Key and Sneering 2014).
4. Warmer winters could result in both inadequate dormancy and inadequate vernalization for some perennial crops, such as apples and pears (Pagter, Anderson, and Anderson 2015; Walthall et al. 2012).
5. A lengthening growing season might allow producers to adopt different varieties and crops that are currently only grown in warmer regions, or to double and even triple crop (Melillo, Richmond, and Yohe 2014; Farming Futures 2011).

Precipitation

1. Increasing temperatures will also intensify the water cycle, with increasing evapotranspiration leading to more intense rainfall or droughts, depending on the region (Huntington 2006). In the U.S., a northward shift in storm tracks is expected, resulting in decreased precipitation in areas such as the southwest U.S. (Loehman 2010) but increases in many areas to the north and east (Melillo, Richmond, and Yohe 2014).
2. Agricultural areas experiencing increases in annual precipitation might need to increase efforts and investments in drainage and water management to avoid saturated soils.
3. Forecasted periods of drought (both short- and long-term) could lead farmers to make significant investments in irrigation infrastructure (McDonald and Girvetz 2013). Strategies to improve soil quality to increase water-holding capacity might also be needed.
4. Many areas are likely to experience more frequent extreme storms, accompanied by high winds and floods that can damage crops and infrastructure.
5. High-intensity rain events can result in more erosion of topsoil and nutrient sources from farm fields, increasing risks for downstream water quality.

Sea Level Rise

1. Sea level rise is expected to impact coastal communities and farmland. The 2013 Intergovernmental Panel on Climate Change report (IPCC 2013) projected a global average rise in sea level of 1 to 2 feet by the end of this century, depending on greenhouse gas emissions.

2. Along the Atlantic coast in the eastern U.S., sea level rise is projected to be much greater due to the prevailing ocean currents slowing along the Atlantic coast, groundwater depletion in aquifers, which can lead to land subsidence (Climate Central 2013). This can threaten significant agricultural infrastructure on the coastal plain.

3. Adjacent farmland can be subject to inundation and saltwater intrusion into freshwater irrigation sources.

The Climate Debate

Despite agreement within the scientific community that the climate is changing and that the change is primarily attributable to greenhouse gas emissions from human activity, the socio-political debate about climate change is often polarizing. A recent Pew Research Center poll found that 60 percent of Americans did not believe that climate change was a major threat, and it was ranked near the bottom of the list of Americans' priorities (Motel 2014).

Other surveys of the general public have found slightly different views. For instance, a 2014 Gallup poll found that most people agree that climate change is a problem, yet it ranks low when compared to other environmental concerns (Riffkin 2014). One of the reasons cited was that people do not feel able to address climate change in their daily lives. This is perhaps because climate change itself is a difficult phenomenon to understand. First, it is a long-term process that has been occurring for decades and will continue to occur for hundreds of years into the future, and second, the general population has historically been ill-informed about the human-induced or anthropogenic causes of climate change (Bell 1994).

Another confounding factor is the timescale at which people experience climate change (i.e., most people want to relate climate change to their daily lives, while it can really only be experienced over the course of many years or lifetimes). It is difficult for people to conceptualize something so far-reaching.

Despite different interpretations of climate change and its causes, and in contrast to the general public, many in the agricultural community recognize that growing conditions and production risks are changing, and they are adapting or need to adapt to these changes. A recent study of almost 5,000 Midwestern farmers found that 66 percent believe climate change is occurring (Arbuckle et al. 2013). Even so, only 8 percent of the respondents attribute climate change primarily to human activity (33 percent attribute it to a combination of human and natural causes). Specifically related to adaptation, two-thirds of those surveyed agreed that steps should be taken to protect farmland from increased weather variability.

Climate Change Communication

Designing and delivering an effective educational program that addresses climate change and agriculture can be challenging. Some key climate change communication challenges are outlined by Monroe, Needham Bode, and Megalos (2015):

1. **Climate change is a very complex topic that involves a great deal of uncertainty and variability.** It is difficult to understate the complexity and scale of the global climate system and climate change. The subject matter often involves concepts very different from those typically presented by agricultural educators; including feedback loops and variables that must be accounted for to produce projections often further complicates attempts at explanation or simplification. The variables themselves also contribute to the communication challenge because they lead to uncertainty. When scientists attempt future simulations with variables that are influenced by forces such as government policy and economic markets (e.g., carbon emissions), a range of possible projections is inevitable. This uncertainty can then be exacerbated when projecting climate for regions within a state or more local areas because high-resolution predictions rarely exist. Uncertainty can often be an uncomfortable message for educators to embrace and incorporate into their programming.

2. **People learn, process information, and make decisions/choices in different ways.** There are different modes of learning, including visual, auditory, and experiential. Recent research has shown that experiential learning is perhaps the most powerful. This characteristic of human learning creates challenges when presenting climate change impacts that an audience has not actually experienced. For example, agricultural producers directly impacted

by numerous localized extreme events (e.g., flooding, drought) could be more receptive to climate change information than other producers in the same region who did not experience impacts or losses from the same events.

Another factor is the human characteristic that people will often dismiss information or perceive it differently if it does not agree with their previously held beliefs. Recognizing this characteristic and identifying any dominant audience beliefs concerning climate change are important first steps in considering how information is presented.

3. **People listen to those they trust and can identify with.** Extension educators often hold the respect and trust of a local audience for delivering reliable information. Previous interactions and information exchange contribute to this trust, but it is also partially attributable to the fact that educators often live and participate in the community in which they serve. If stakeholders view educators as similar to themselves, they are more likely to listen to the educator's message. Understanding this can help educators increase effectiveness if messages acknowledging shared values and a common culture can be integrated into the program. Educators should also recognize that other agricultural service providers, such as seed and fertilizer dealers, could be very influential sources of information for farmers (Davidson et al. 2015). Extension educators could choose to target these private-sector agricultural professionals for climate change education messages and programs in an indirect effort to serve farmers.

Communicating Climate Change More Effectively

1. **Become climate literate.** It is not possible to communicate climate change effectively without understanding how the climate works. Climate literacy includes understanding the principles of the climate system and knowing how and where to access scientifically defensible climate information. Becoming climate literate does not require becoming an expert in climate science, but it does require the ability to communicate complex and often contentious issues to agricultural audiences, some of which might not agree that the climate is changing or might not believe it is human-caused (Roser-Renouf and Maibach 2010). Without a basic understanding of the causes and effects of climate change, it will be difficult to assess proposed adaptation and mitigation options.

2. **Know the audience.** Before engaging with an audience, a good communicator should gather as much information about the audience members as possible and tailor the message for those individuals. If the audience is made up of agricultural producers, try to interact in advance with other extension agents, conservation personnel, or service providers to learn more about them. Determine, to the extent possible, what the audience knows and does not know about climate change. Many stakeholders might be skeptical of climate change or the fact that humans are its primary cause. This is an opportunity to engage the audience in a productive dialogue.

   Understand that there could be many different mental models — sets of deeply held beliefs — of climate change in any given audience (Lorenzoni and Pidgeon 2006). Communicators can boost engagement by tailoring their communication strategies to the mental models or worldviews of their audiences. As an example, someone who has an individualistic mental model or who favors self-reliance might react well to a message that focuses on individual responsibility to address climate change, while that same person might respond poorly if the message focuses only on climate change solutions that require government-organized action or regulation because these solutions are perceived to weaken the role of individual responsibility.

   Communicators should start by identifying the principal identities of their audiences. Some of these identities might be clear, but other identities could be more difficult to recognize. For example, it might be readily apparent that someone is a farmer but not apparent that he or she is interested in religion or associated with a particular political party. Effective communicators should try to determine whether a certain identity is already linked to a stance on climate change and, if so, how that will influence support for or opposition to climate solutions. Either way, effective communicators should help people identify how supporting action on climate change is in line with their identities. A helpful way to accomplish this is to appropriately frame the issue.

3. **Frame the issue.** Framing the issue of climate change in an appropriate context means organizing central ideas on the issue so that stakeholders can make their own informed decisions. When framing the issue of climate change, it might be useful to condense complex subject matter into more easily

understood pieces. While there are many potential frames an educator could use, there are three common approaches to framing the climate change issue: (1) use local examples, (2) use economics, and (3) use shared values.

Educators can frame the issue using local observations and local impacts (Center for Research on Environmental Decisions and ecoAmerica 2014). That is, stakeholders in the mountains might identify more strongly with links between climate change and the ski industry, while stakeholders in coastal regions will be more concerned about the links between climate change and sea level rise. Including audience voices and stakeholder anecdotes can aid greatly in giving additional context and impact to a climate change message. Using projections for the local impacts of climate change can help promote the sense of local ownership necessary to motivate behavior change. For instance, the use of historical local weather data can demonstrate how the climate has already changed, and references to extreme precipitation events should use accounts of crop loss and structural damage encountered by local producers, rather than events occurring internationally or elsewhere in the country.

Framing climate change impacts as an economic issue can also motivate people to modify behavior. Most people discount future gains more than future losses; that is, they are more risk-averse if they stand to lose something than if they stand to gain something of equal value (Kahneman and Tversky 1979). It follows that producers might care more about reducing the chance of future crop failure due to climate change than they care about potential increases in crop yield from higher atmospheric carbon dioxide levels or increased temperatures.

Broadly framing climate change using commonly held values can be an effective communication strategy when addressing diverse audiences. Value-based frames that cross a variety of audience beliefs, backgrounds, and attitudes can be used in this approach. Research has shown that several frames work well (Needham Bode, Monroe, and Megalos 2015):

- We can improve our children's futures by making changes in our energy sources and reducing greenhouse gas emissions.
- We should be responsible with our resources and not waste them.
- A shift to a greener economy will make us more competitive.

An effective educator will help stakeholders identify shared values because discovering why they should care about impacts to others is one of the key ways to smooth a controversial issue.

4. **Use simple terms.** Scientists often overestimate the level of detail nonscientists can assimilate. This can lead to an audience having difficulty sorting out what is important (i.e., the more one says, the less the audience hears). Speak in plain language and avoid jargon. For example, "uncertainty" means variability to a scientist, but it might be interpreted as ignorance by nonscientists. "Bias," which means a systematic difference to a scientist, could be translated as distortion or falsification to a nonscientist. Also use familiar units; for most U.S. audiences, that means using feet instead of meters and Fahrenheit instead of Celsius.

5. **Establish trust.** Effective communication with stakeholders requires trust or — said another way — trust is the communicator's best asset. To be a trusted source of information on climate change requires the educator to be knowledgeable on the topic and honest about what he or she does and does not know. Establishing shared values can develop rapport and trust; stakeholders need to know the educator cares about the issues they are facing and has many of the same concerns they do. Acknowledging appreciation for agriculture's role in the local economy and culture can build good will and help remove apprehension. Some helpful rules of thumb include encouraging dialogue, talking less, and listening more.

   Long-term relationships between producers and extension personnel are most effective at creating this level of trust, especially those where extension can provide producers with relevant information they might not be able to easily access otherwise.

6. **Offer solutions.** Research shows that scare tactics do not motivate people to adapt to climate change. Instead, base statements related to climate change on sound scientific information. Although some studies show that the use of fear can catalyze a response in an audience, the consensus is that what grabs people's attention is often not what enables action. An added negative consequence of using fear is that it could lead people into a sense of despair, which can lead to climate denial or — at the very least — a sense of hopelessness (Gardner et al. 2009).

Effective climate communicators offer solutions to specific problems that help stakeholders translate their own concerns (fears) into effective solutions (actions). Stay positive, maintain that adaptation is necessary, and emphasize that it is possible. Enumerating the research on agricultural adaptation practices at land-grant universities while also recommending currently accepted practices for adaptation is a good way to show the future investment in stakeholder viability while also responding to current needs for management changes (Vincelli, McCulley, and Humble 2013).

7. **Address uncertainty.** Communicating climate change necessarily involves acknowledging and discussing uncertainty. Although scientists have gained significant insight into how the climate system functions, they do not have total confidence in climate change projections, and this should be recognized upfront. What scientists can do is to make predictions based on the best-available data while quantifying the uncertainties associated with those data and predictions. Uncertainty can be uncomfortable because humans desire predictability, but humans are also experts at dealing with uncertainty. People know how to respond to a weather forecast that predicts a 60 percent chance of snow (e.g., wear boots and a coat), despite the uncertainty in the prediction. Another effective analogy is talking about climate change as a risk. For example, we insure our homes and crops even though the chance of loss is small, but we recognize that when it happens it can be catastrophic; thus, we want to minimize the risk of loss.

   Discussing solutions that involve little uncertainty should also be a goal of climate communicators. Focus on the science where there is a strong consensus: the increasing greenhouse gas levels in the atmosphere, rising sea levels, etc. Be direct and clear that the overwhelming majority of climate scientists are convinced that human-caused climate change is happening. Most Americans are not aware of this.

8. **Facilitate behavior change.** Ultimately, the goal of any climate change program should be to help stakeholders adapt to a changing climate or to minimize further climate change. One of the best ways is to engage with influential members of the community; one influential early adopter can go a long way toward changing people's viewpoints and behavior. Some strategies that have proven effective at facilitating behavior change include:

   - Show that the behavior change is compatible or consistent with their existing values.
   - Demonstrate that the change can be simple to adopt.
   - Explain that people can see rapid results after the behavior change.
   - Illustrate that the risk of losing financial or social capital as a result of the change has been minimized.
   - Have people test out the new behaviors in a safe environment.

9. **Consider programmatic issues.** Because climate change and climate impacts can be challenging to communicate (and few people attend standalone programs about the climate), it can be easier and more productive to incorporate climate change impacts and adaptation education efforts into existing educational programming. For instance, an agronomic extension program could include a session on climate change impacts to production systems or on climate risk management. This can allow an extension educator to have a greater impact by reaching more people and more varied audiences than a standalone climate change program could.

Conclusions

This publication distills commonly held best practices that, if implemented, can make it easier to communicate complex subject matter such as climate change. Developing and delivering climate change programing can be challenging, but given the importance of the subject, extension educators have the opportunity to have a considerable impact on the livelihoods of their agricultural clientele and the future of agricultural production. Given that there are few well-developed, agricultural-focused climate change or climate change adaptation extension programs available, educators can use the information in this publication to begin tailoring programs to their specific audiences.

Resources

Additional Resources

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