

Climate Change Impacts on Agriculture and Their Effective Communication by Extension Agents

Abstract

Agriculture is an important sector of the U.S. economy, contributing at least \$200 billion to the economy each year. It is considered to be one of the sectors most vulnerable to climate change and represents a key sector for international trade. Climate change is a global problem with widespread effects and implications. This phenomenon could make it more difficult to grow crops, raise animals, and catch fish in the same ways and same places as in the past. Therefore, it is critical that climate change messages are communicated effectively by Extension agents to farmers and the farming community.

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Introduction

Agriculture contributes at least \$200 billion to the United States economy each year (USGCRP, 2009). It provides much of the food, crops, livestock, and seafood that are grown, produced, and caught in the United States. Agriculture is considered to be one of the sectors most vulnerable to climate change. Climate change will likely affect agricultural practices in the United States through more frequent water shortages, extreme weather events, flooding, and shifts in growing seasons. Communicating the right message across about climate change by Extension agents to the farming community will make farmers understand why climate change issues are so important in their daily activities, and they will, in return become less vulnerable to climate change (Mwazi & Ndokosho, 2011).

What Is Climate Change and Is It a Reality?

Climate change refers to any distinct change in measures of climate lasting for a long period of time. In other words, "climate change" means major changes in temperature, rainfall, snow, or wind patterns lasting for decades or longer (EPA, 2009). It may be as a result of:

1. Natural factors, such as changes in the sun's energy or slow changes in the Earth's orbit around the sun.
2. Natural processes within the climate system (e.g., changes in ocean circulation).
3. Human activities that change the atmosphere's make-up (burning fossil fuels) and the land surface (cutting down forests, planting trees, the built environment) (EPA, 2009).

Global climate also varies naturally in response to shorter-term events, such as volcanoes, which throw sun-blocking particles into the stratosphere to cool the Earth, or the Pacific Ocean event known as El Niño, which transfers thermal energy from one part of the earth to another (Fraisse, Breuer, Zierden, & Ingram, 2009).

Climate change has emerged as one of the most intensely investigated and discussed environmental issues around the globe. Many climate change studies and reviews point to more and frequent future weather-related disasters, with unparalleled consequences on the global population. However, this information is only known and well understood by a small number of scientists and those who interact with them. While climate change has been discussed broadly in workshops and meetings, and at conferences, the question remains whether a significant portion of the public is aware of its vulnerability to climate change (Mwazi & Ndokosho, 2011).

The global temperature record shows an average warming of about 1.3°F over the past century. According to the National Oceanic and Atmospheric Administration (NOAA, 2007), seven of the eight warmest years on record have occurred since 2001. Within the past 30 years, the rate of warming across the globe has been approximately three times greater than the rate over the last 100 years (EPA, 2009). The Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report (2007) concluded that warming of the Earth's climate system is now "unequivocal." The IPCC bases this conclusion on observations of increases in average air and ocean temperatures, melting of snow and ice, and rising global average sea level. Global average precipitation has also increased due to increased evaporation from oceans and land as a result of warmer surface temperatures. Scientific studies also indicate that extreme weather events such as storms, floods, and hurricanes are likely to become more intense.

Does Climate Change Matter?

Climate variations can directly or indirectly affect many aspects of society both positively and negatively. For example, warmer average temperatures reduce heating costs and improve conditions for growing some crops; yet extreme heat can damage crops and increase illnesses and deaths among vulnerable populations. Precipitation can replenish water supplies and support agriculture, but intense storms can damage property and cause loss of life.

Researchers have shown that increased temperatures can enable the insect-pest population to extend their geographic reach from tropics and subtropics to temperate regions, including higher elevations, as well as shifts in cultivated areas of host plants (Fand, Kamble, & Kumar, 2012). It is believed that these conditions could have adverse effects such as increased abundance of tropical

insect pest species, which could result in sudden outbreaks of pests, thus eliminating certain crop species. Consequently, more crop damage will occur due to increased pest populations per year (Fand, Kamble, & Kumar, 2012).

Impacts of Climate Change on Agriculture

Solar radiation, temperature, and precipitation are the main impetus of crop growth. Agriculture has always been extremely dependent on climate patterns and variations, and thus it is considered to be particularly at risk to the influences of climate change. The Declaration of the World Summit on Food from November 2009 stated: "Climate change poses additional severe risks to food security and the agriculture sector. Its expected impact is particularly fraught with danger for smallholder farmers in developing countries, notably the Least Developed Countries (LDCs), and for already vulnerable populations" (WSFS, 2009). In a newly published report the WTO and UNEP (2009) stated that in low-latitude regions, even a small temperature increase of 1.8°F would lead to reductions of 5-10 percent in the yields of major cereal crops. Climate change is projected to have significant impacts on agricultural conditions, food supply, and food security. This phenomenon has started to significantly affect agriculture in numerous ways to include ([Climate Institute](#), 2010):

1. A shift in climate and agricultural zones towards the poles.
2. A boost in agricultural productivity due to increased carbon dioxide in the atmosphere.
3. Pronounced droughts and floods due to changing climatic conditions.
4. Rising temperatures, which are expected to bring heat waves, melting glaciers, and ice sheets; and rising sea levels, with major consequences for global food security.
5. Numerous weeds, pests, and diseases thriving under warmer temperatures, wetter climates, and increased CO₂ levels.
6. An increase in heat waves, which could negatively affect the livestock industry and eventually increase livestock susceptibility to disease, reduce fertility, and reduce milk production.
7. Drought-related significant reduction in quality of available pastures for livestock grazing and threaten pasture and feed supplies.

The Role of Extension Agents in a Climate Change Communications Campaign

Extension activities are to convey change in farmers' way of thinking, attitude, knowledge, and application of technology. Agricultural Extension agents are the conduit between research and farmers. They function as facilitators and communicators, assisting farmers in their decision-making process and ensuring that appropriate information is disseminated and applied for best results. They often play a critical role in propagating new farming methods and techniques through training workshops, field days, demonstrations, lectures, and factsheets, as well as informing the media.

Franz, Piercy, Donaldson, Westbrook, and Richard (2010) conducted a study to investigate the preferred learning methods of farmers in three states, and results indicated that of the 86 participants surveyed, 99% preferred hands-on, 96% demonstrations, 94% farm visits, and 88% field day.

The best method, though, is through personal contact with farmers on their farms. However, in order to be effective, agents must possess good communication and interpersonal skills, be persuasive and tactful, and have a keen interest and knowledge of farming and the environment.

Climate change is a global problem with widespread effects and implications. Therefore, it is critical that climate change messages are communicated effectively by Extension agents to the farming community. The objective of a climate change communications campaign for farmers is to change attitudes and behavior. According to GTZ (2009), specific rules to communicate climate change impacts include:

1. Avoid alarmism—statements should be based on sound scientific findings.
2. Stress the importance of both interpreting climate change and managing uncertainty—use possibility ranges (several plausible and reasonable futures). That is the most important lesson for every decision maker to learn.
3. Provide a background of basic climate change science and interpretation of information.
4. Be transparent and specific. When discussing uncertainty, clearly indicate the major sources of uncertainty).
5. Get support from experts who can answer critical questions, thereby increasing credibility.
6. Be aware of and transparent about the conflict you are in. On the one hand, you might be aware of your own uncertainty and possess inadequate knowledge; on the other hand, you want to convince people.

Therefore, effective communication of climate change information requires a good understanding of the issues and concepts before communicating to others. The use of technical climate jargon should be limited; messages should be simple, concise, accurate, and clear. Link climate change with other environmental and social issues that might be familiar to people, so that they can understand how the issues are connected (Mwazi & Ndokosho, 2011).

Conclusion

Agriculture has always been extremely dependent on climate patterns and variations, and is considered to be particularly at risk to the influences of climate change. Climate change is projected to have significant impacts on agricultural conditions, food supply, and food security. Therefore, the effective communication of climate change information requires a good understanding of the issues and concepts before communicating to others.

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