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Risk Perception and Needs: Defining Extension's Climate Change Adaptation Role

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Many Extension professionals are unsure of the best approach to educate clients about climate adaptation. This fact sheet identifies differences in risk perception as a basis for addressing climate adaptation needs. It is the third in an Extension series and builds upon concepts covered in "Challenges in Communicating Climate Change to Extension Audiences," and "Strategies for Communicating Climate Change to Extension Audiences."



Climate variability threatens the productivity, profitability, and, potentially, the viability of traditional agriculture, livestock and forestry operations, and existing community infrastructure. Our clientele may be united in seeking solutions to offset risk, even though they differ in their views on the causes of climate variability. Addressing audiences' needs is the first step to successfully increase resilience or adopt new methods for minimizing loss, reducing temperature stress and diversifying management to avoid catastrophic crop, feed, livestock or capital loss. Perhaps more than ever, Extension professionals will be the research

conduit to farmers, communities and forest landowners on climate adaptation strategies and actions. This foray into adaptive changes on a grander scale may demand heightened use of facilitation and communication skill sets to assist farm and forest decision-making and dissemination (James, Estwick and Bryant, 2014).

After the challenge of communicating climate change, the biggest obstacle to climate adaptation programming is understanding audience perceptions of risk. Risk perception can be the common denominator for addressing appropriate adaptation programming. This discussion will begin with an overview of risk, then move on to unique client needs and broader audience concerns.

RISK PERCEPTION

Americans on the whole do not perceive climate change as a threat to their well-being. This moderate perception of risk

constrains the likelihood of political, economic and social actions (Leiserowitz, 2006). Two parallel modes help explain how individuals process information when perceiving risk: 1) Rational and 2) Experiential systems (Epstein, 1994). The two informational processing systems (modes) are contrasted below (Table 1.)

The relevance of this table is twofold. As Extensionists we are most comfortable in the rational mode--conveying science or research results in an effort to transfer new knowledge and better practices with numbers and words. However, in the case of climate adaptation, we are more likely to move individuals to action by adopting a more affective (emotionally influenced feeling) educational approach based on imagery, case-studies and stories. Stated more succinctly, "experientially derived knowledge is often more compelling and more likely to influence behavior than is abstract knowledge" (Epstein, 1994).

The experiential approach will seem straightforward in regions of the country where clientele have already begun to "experience" climate variability in the form of longer-growing seasons, higher temperatures and deviations in average precipitation, and less so in regions where climate variability is less pronounced. Fortunately our goal is to prompt climate adaptation actions, rather than change audience mental models or belief systems regarding political or religious views. In order to accomplish our adaptive mission, we will have to draw on historical success with innovation adoption (Rogers, 2003). This will entail fully utilizing communication networks, trusted expert delivery, opinion leaders, and the five diffusion stages: knowledge, persuasion, decision, implementation and confirmation.

More importantly, perhaps, is the likelihood that everyone

will be experimenting locally to find appropriate adaptive solutions that fit within the operational philosophy of the clientele that we serve. In essence, the roles of researcher and farmer, rancher, forest landowner will be reversed. Our role as change agent will be to encourage and support this experimentation, and then communicate solutions among producers (Westley et al. 2011). Researchers will be working to prove the scientific worth of local solutions that bubble up from producers. This wholesale change of the traditional land-grant delivery system is illustrated in the organic farming movement, where researchers are bringing scientific legitimacy to locally-derived management in cooperation with innovative growers--often after the local techniques are established or proven.

Below are examples of five such audiences and general trends for Extension programs that may be useful.

Farmers are keenly aware of weather patterns and trends, since their profitability depends on a successful harvest. Farmers are acutely aware of changing weather patterns, yet may not attribute changes in the earth's atmosphere to human activities. So, begin farm adaptation programming with observations of changes in flowering times, migration, or weather to encourage discussion and explore risk avoidance actions.

Changes in atmospheric carbon dioxide, temperature, and precipitation patterns will affect agricultural productivity in some areas of the nation more than others (Walthall et al. 2012). Some regions and crops will be "winners" whereas others may experience climate problems. Fortunately, there are low-cost, lower-risk management changes that farmers can make to respond to changing forecasts, including altered planting times, using a seed source from a different latitude, changing varieties, and altering

RATIONAL	EXPERIENTIAL
Factually based	Emotionally driven
Analytical	Holistic
Logical	Affective
Deliberative	Intuitive
Communicated as:	Communicated as:
Abstract symbols	Concrete images
Words	Metaphors
Numbers	Narratives

Table 1. Contrasting Two Dominant Risk Information Processing Modes



irrigation regimes. Encouraging farmers to experiment on a small scale may generate an experiential basis for local farming suggestions and successes. Using research from local universities combined with peer solutions may be more helpful than national guidelines. Changing climatic conditions are already impacting the ranges of weed and pest species, making some crops more vulnerable at their ecological margins.

Agriculture in the United States has historically been most successful when dynamic and adaptive: changing to capitalize on emergent markets, vagaries of weather, input prices and market prices. While the climate has been relatively stable over last 100 years, increased climate variability will prompt flexibility, adaptation, farmer ingenuity and marketing prowess. Capturing and sharing success stories and examples of other useful solutions will be important; building a network of farmers willing to share their ideas and outcomes could be a critical Extension role for the future.

A small sample of projections for crop farmers follows: (James, Estwick and Bryant, 2014)

A shift in climate and agricultural zones toward the poles. A boost in agricultural productivity due to increased carbon dioxide in the atmosphere. Pronounced droughts and floods due to changing climatic conditions. 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. Numerous weeds, pests, and diseases thriving under warmer temperatures, wetter climates, and increased CO₂ levels.

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.

Drought-related significant reduction in quality of available pastures for livestock grazing and threaten pasture and feed supplies.

UNDERSTANDING FARMER ACCEPTANCE OF ADAPTIVE OPTIONS

Agents have always understood intuitively how the social acceptability of certain practices has direct bearing on their likelihood for adoption. By understanding farmer acceptance of adaptive techniques, educators can focus efforts on actions most likely to be deployed. For instance, a recent survey of Southeastern farmers showed that conservation tillage, high-residue cover crops, nitrogen management and web-based “Agroclimate” decision-making tools were significantly more likely to be deployed by farmers than four other techniques suggested by specialists and technology transfer agents (Bartels and others, 2012).

Ranchers are invested in their livestock. In some regions, temperature stress on livestock and poultry is a concern (Walthall, et al., 2012). Climate change will affect U.S. rangeland vegetation growth and distribution as temperature and precipitation variability affect. Climate extremes, drought and livestock stress will be distributed asymmetrically. Expected climate challenges to livestock operations include: increased diseases, pests, livestock stress, extreme weather and storm events, drought and market uncertainty (<http://animalagclimatechange.org/>). Uncertainty abounds within the agriculture sector and topics for further research include: regional climate variability, vegetation dynamics, and complicated

AGRICULTURE ON THE EDGE

Climate change also affects agriculture and crop yields around the world. With 40% of the Earth’s surface occupied by cropland and pastures, a shifting climate may alter agricultural locations, techniques, crop choices and yields.

IPPC reports predict that climate change will bring drier conditions to already dry areas while bringing more precipitation to temperate and tropical areas.

An increase in atmospheric CO₂ and temperature may have positive effects for one crop, while having negative effects on others. Scientists have shown that with an increase in atmospheric CO₂, there will be an increase in corn crop yields from an increase in net CO₂ assimilation by corn plants.

However, an increase in atmospheric CO₂ may cause a decrease in yields in grains such as rice and wheat. (Dovetail Partners, 2014)



interactions and feedbacks related to temperature and precipitation variability.

Climate changes on U.S. rangelands brought about by drought and extreme storms alter growing seasons. These changes will affect productivity/profitability most notably from the economic costs of adaptation (like shade, shelter, ventilation, misting and watering systems) and disease prevention. While predictions for northern latitudes seem beneficial with warming and increased precipitation, successful adaptation will involve capturing market advantage, emerging markets within an atmosphere of cost reduction and risk avoidance investments. Livestock vulnerability is a harbinger of threats to human populations from disease, heat-related illness and death, allergens and vector-borne diseases; thus, future research on climate drivers and confounding factors has potential benefits for human and animal agriculture sectors (National Academy of Science, 2011). Linking ranch/livestock programming to locally identified risks and audience needs will be key to success. Staying informed and instantaneously alerting producers of heat waves, extreme weather can be instrumental in becoming a trusted adaptation source and developing future program support and success.

Forests rely upon fewer human inputs than agricultural systems (less irrigation, fertilizer, and pesticide treatment) but are growing through climate variations over a much longer time. Forests may become more stressed by changes in atmospheric carbon dioxide, precipitation, temperature and nitrogen deposition, but the more significant changes are likely to be due to wildfires, insect pests, disease, erosion, flooding, and drought (Vose, Peterson, and Patel-Weynand 2012). Some areas will be more vulnerable than others. Forest landowners have an opportunity to manage their resources to help mitigate climate change by maximizing carbon sequestered in wood, root and forest soil. Some audiences may opt for carbon management over traditional wood products as carbon markets become established and provide income. Wood products may become more popular where they can replace materials that emit or generate carbon, such as concrete and steel in building construction and fossil fuels in energy production (Perez and others, 2005).

Forest landowners constitute a challenge to interpreting climate change needs because of their diversity in ownership objectives and the scarcity of research. The National Woodland Owner Survey offers a unique insight on the interest and needs of this audience. The 2011-2013

FORESTS AT RISK

1. Rising temperatures, drought, and fires may lead to forests becoming a weaker sink or a net carbon source by 2100, and as soon as 2030 in some U.S. Regions, USDA, 2012.
2. Pervasive droughts, fire and insect outbreaks put mitigation benefits of the forests at risk.
3. Forest disturbances and climate extremes will effect carbon balance- some forest ecosystems already responding.
4. In North America, growing seasons are lengthening, which are causing an increase in carbon intake through photosynthesis.
5. In North America increased growing season will cause a northward shift of the geographic ranges of many species affecting landscapes and habitats. (see USFS Climate Change Tree Atlas)
6. Droughts and precipitation increases will likely alter the range of forest species at their ecological edge.
7. Projections of 24 and 38 million acres of forests will likely be converted to other uses between 1997 and 2060- with more than half of the forecasted forest losses in the South, more than 90 percent to occur in the Eastern United States (Urbanization and Development).

Citations: 1,2,3 (IPCC AR5,2014.Ch11. Agriculture, Forestry and other Land Use 179 p, p 45. 4,5,6 (Dovetail Partners,2014). 5 Prasad and others,2007. USFS Climate Change Tree Atlas. 7 (Wear,2011)



preliminary data from North Carolina suggests the top five “environmental” concerns all have a link to future climate variability, in descending order they listed: wildfire, insects and disease, wind and ice storms, water pollution and invasive species (Butler and others, 2014). Forest owners tend a long-term resource that typically requires very little management suggesting that forest landowners may perceive that there is not much they can do, and thus may not have not invested much energy to learn about the problem or solutions (Krantz and Monroe 2013).

Interested private landowners who are Extension audiences may be motivated less by income from their forest and more by being a good steward of their forest resources (Krantz 2014). Targeting economic and stewardship objectives can foster management strategies that increase forest resilience and solutions that yield multiple benefits, like maintaining healthy forests for wildlife, water quality or to minimize invasive plants or disease. Landowners who are motivated by stewardship of the land may value the results of adaptive climate actions regardless of resistance to climate change acceptance.

Coastal Residents and Planners are in the beginning stages of planning for sea level rise, extreme weather, coastal storm surge and flood from extreme events. Risk and vulnerability assessment are often spurred by the local threat: such as devastating storm surges, hurricanes, seasonal high tides, subsidence and eroding shorelines

(Burkett and Davidson, 2013). The adaptive decision to stop repairing or reinforcing infrastructure (transportation systems, water systems, waste treatment facilities, etc.) is most often financially constrained but the priority to plan for such events is being prompted by federal grants and visionary decision makers.

Leadership, facilitation and community involvement are strengths that Extensionists can bring to the table once threats are prioritized, such as saltwater intrusion to water supplies, flooding and inundation, faltering estuary ecosystems, or compromised waste water treatment systems. One noteworthy Extension effort for community adaptive capacity building is Vulnerability and Consequences Adaptation Planning Scenario (VCAPS). The VCAPS process prompts community decision-makers to diagram potential climate stressors, impacts, and consequence on municipal management issues. The result is a diagram of locally tailored information about climate change issues, impacts and potential consequences for coastal communities (VCAPS, 2011).

Homeowners and Citizens who are not specifically connected to any of the above audiences may wish to be engaged in climate solutions. Their sense of moral responsibility or their interest in maintaining a comfortable world for future generations may fuel this concern. They may wish to mitigate their contribution to greenhouse gas emissions by conserving energy, reducing reliance on fossil

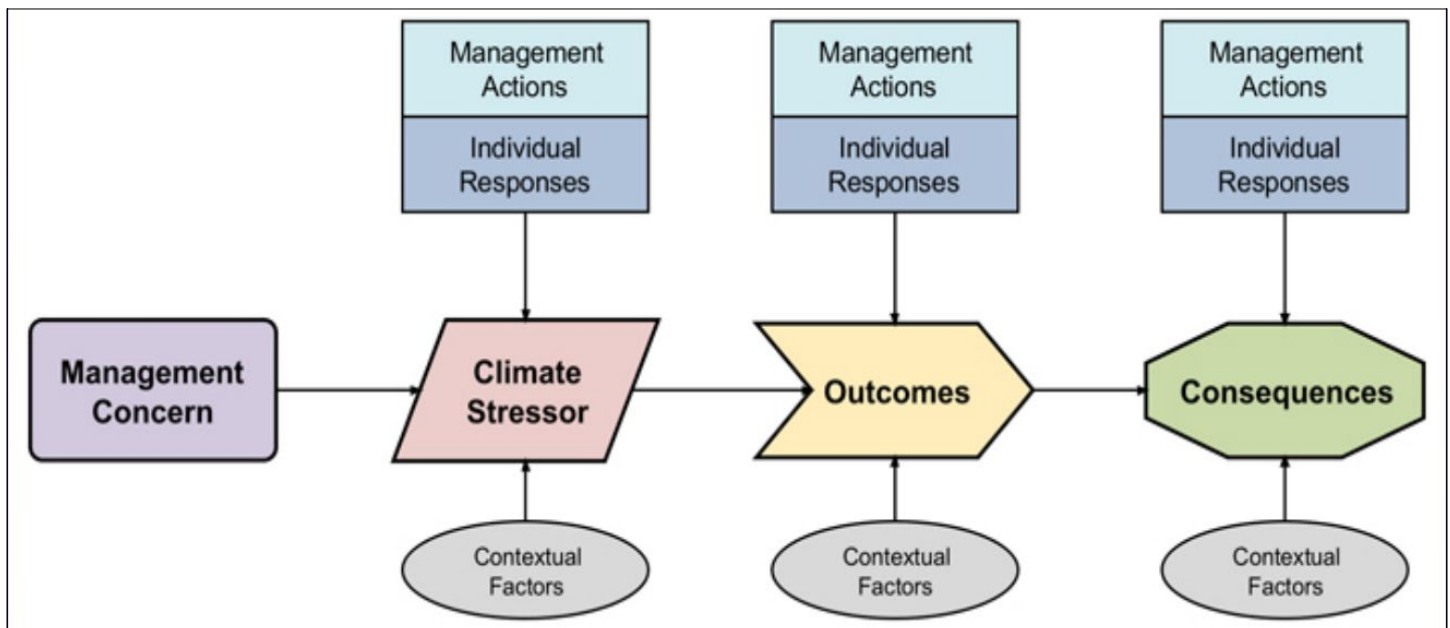


Figure 1. VCAP Vulnerability Diagramming Process for Community Climate Change Stressors



fuels (installing solar panels or water heaters; investing in a hybrid vehicle), reducing consumption of products in general, relying more on locally produced food and resources, and helping to build a community of concerned and responsible citizens. Extension can support all of these efforts by providing information about local resources and strategies for making decisions about preferred products. The Sustainable Living program, now Living Green (livinggreen.ifas.ufl.edu), offers suggestions for resources, workshops, and strategies for leading groups to consider a variety of options for mitigating climate changes, including: carpooling, public transit or bike commuting, insulation, weather stripping, replacing energy inefficient appliances, lighter roofing colors in warmer climates, opting for fuel efficiency at next car replacement, and energy saving replacement windows (Apel and others, 2010).

Best Practices for Climate Communication:

Once Extension professionals have established trust as a source of useful adaptation strategies, clients will likely request additional climate background information for decision-making in context. Colleagues from across the U.S. have noted successful practices that can advance clientele toward climate resilience. Fischhoff (2007) suggests that climate change communication campaigns (4C) are best approached as a team effort (with interdisciplinary focus):

- Climate scientists (Know the nature of the risks and potential responses),
- Social and decision scientists (Know how to craft useful information to target audience), and
- Communication professionals (Know how to get the information conveyed (reach and frequency) to be noticed and considered by target audience).

For additional insight on successful communication strategies please see the first two factsheets in this series: “Challenges in Communicating Climate Change to Extension Audiences,” and “Strategies for Communicating Climate Change to Extension Audiences.”

This interdisciplinary approach has been successful with Extension organizations across the U.S. and is ideally suited for presenting adaptive climate actions which must work and “sell” locally where they are proposed.

SUMMARY

The Cooperative Extension Service has a cherished legacy of helping communities and individuals solve problems and reduce risks by providing information and skills. Addressing climate change is the grand current challenge and will involve many existing and new skills to address pest management, family finance, emergency response, community planning, farm efficiency, and forest resilience. Providing this information in a manner that respects audience values, interests, and concerns will always be critical, and suggests that Extension agents may wish to engage their audiences in conversations about what concerns them as well as perceived or experiential changes in weather patterns, growing seasons and the legacy they will leave their children. People do not need to accept anthropogenic climate change to be willing to adapt to current changing conditions. Those who care about sustainability, natural resources and their community do not require economic incentives to make changes in their management or lifestyles. Providing people with the information they need and desire, in a manner that makes sense to them, is our challenge, as always.

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