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## Scenario Planning for Resilient Agricultural Systems: A Process for Engaging Controversy

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### Cover Page Footnote

The scenario planning program was a joint project between Nebraska Extension and South Dakota State University Extension with funding provided by the USDA Northern Plains Climate Hub. The results are integrated into the Weather Ready Farms program from the University of Nebraska Extension Climate Issue Team. Nebraska Extension Climate, Beef, and Cropping teams: • Extension Educators: Tyler Williams, Troy Walz, Larry Howard, Karen DeBoer, Keith Glewen, Ashley Mueller, Nathan Mueller • Biological Systems Engineering: Crystal Powers, Rick Stowell • Animal Science: Galen Erickson, Matt Luebke • Agronomy: Daren Redfearn • Entomology: Justin McMechan • Climatology: Al Dutcher, Steve Hu, Eric Hunt, • High Plains Regional Climate Center: Natalie Umphlett • National Drought Mitigation Center: Tonya Haigh South Dakota State University Extension • Agricultural and Biosystems Engineering: Joseph Darrington, Erin Cortus • Agronomy: Anthony Bly • Climatology: Laura Edwards

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**Abstract.** Resiliency to weather extremes is already a part of farming in the Northern Plains, but now climate change is adding new uncertainties. Engaging farmers on this often controversial topic can be challenging given the wide range of beliefs farmers hold about climate change. Scenario planning provides a framework for Extension and agricultural system stakeholders to come together using the latest climate science to discover robust adaptive management options, prioritize Extension programming needs, and provide an open forum for starting the discussion.

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## INTRODUCTION

Resiliency to weather extremes is already a part of farming in the Northern Plains, but now climate change is adding new uncertainties. Engaging farmers on this often-controversial topic can be challenging, given the wide range of beliefs that farmers hold about climate change (Arbuckle et al., 2013).

Research has shown that 87% of farmers prefer discussion as a learning tool (Franz et al., 2010). Therefore, engaging agricultural audiences in dialogue and promoting co-learning between researchers and practitioners have been effective means for reducing communication barriers and helping the agriculture industry adapt to a changing climate (Doll et al., 2018; Fraisse et al., 2009; Layman et al., 2013).

Scenario planning is a process for structuring dialogue designed for managing futures that are characterized by rapid directional change and complex uncertainties (Peterson et al., 2003). The objective is to consider management options relative to a variety of plausible futures. Doing this proactively—essentially, rehearsing for multiple futures—strengthens the ability to recognize and adapt to changes over time.

Using this structured process for needs assessment can provide Extension professionals a tool for proactively engaging clients in setting priorities, co-learning, and developing an initial engagement strategy for controversial topics.

## SCENARIO-PLANNING PROCESS

Extension professionals previously used scenario planning to determine preferred futures for the agriculture industry (Rowntree et al., 2012). Here, we describe how scenario planning was expanded for use with climate-resiliency planning in beef and cropping systems.

### ORIENT

The scenario-planning process involved four stages adapted from the National Park Service (2013), shown in Table 1. To begin, we formed two lead teams. One focused on beef, and the other on cropping systems. We recruited Extension specialists selected for their expertise in climate and agricultural systems and Extension educators for local knowledge and trust. Each team established clear goals, scope, and outcomes.

**Table 1.** Stages of Scenario-Planning Process

Stage	Tasks			
<b>Orient</b>	<b>Goal:</b> A productive start to the climate change dialogue	<b>Scope:</b> Northern Plains agriculture system, climate in the next 10 years	<b>Outcomes:</b> Future scenarios, management options, programming needs	<b>Team:</b> Specialists, educators
<b>Explore</b>	<b>Meeting structure:</b> Short presentations (<10 min), participant engagement, facilitated small groups	<b>Data:</b> Historical climate trends, impacts to agriculture	<b>Participants:</b> 15–20 per location, about half in production agriculture, others from allied industries	
<b>Synthesize</b>	<b>Regional meetings</b>			
<b>Act</b>	<b>Graphics:</b> Same theoretical farm under each of the different scenarios	<b>Evaluation:</b> Robustness, priority, readiness	<b>Results</b>	

**EXPLORE**

Each lead team organized scenario-planning meetings with purposeful structure to encourage engagement. We did this with guidance from National Park Service (2013) methods and previous climate-change engagement (Powers et al., 2018). Meetings were discussion-focused to orient the group toward co-learning, valuing individual knowledge, and encouraging self-efficacy. A typical agenda included

1. introductions and ground rules,
2. an overview of scenario planning,
3. weather stories (i.e., memorable weather events and what made someone’s farm resilient),
4. historical weather trends and projected climate drivers,
5. scenario formation,
6. review of agriculture innovations and adaptations, and
7. management brainstorming.

Extension specialists prepared short (<10 min) presentations on historical climate trends, impacts on agriculture, and climate adaptations. Local Extension educators recruited participants. We relied on their guidance and established trust to overcome skepticism and to seek out productive participants who represented either beef or cropping systems. The participants were primarily farmers but also included consultants, bankers, veterinarians, and equipment dealers.

**SYNTHESIZE**

During the each of the meetings, small groups of five to eight participants created the scenarios. Participants identified critical climate drivers, explored combinations of these drivers, and listed agricultural impacts to create future scenarios. Participants then prioritized the top three to five most challenging scenarios. Finally, participants brainstormed management options to address the priority scenarios.

**ACT**

After the meetings, the lead teams compiled and crafted the scenarios and management options into visuals. We then evaluated the management options for

1. robustness (i.e., can the management practice address multiple scenarios?),
2. priority (i.e., how frequently was the option discussed by the small groups?), and
3. readiness (i.e., do we have the needed extension and research?).

## OUTCOMES

The beef systems team met with 40 participants at three representative locations in Nebraska and South Dakota. The cropping systems team met with 85 participants across four representative locations.

Discussions generated hundreds of climate-scenario impacts and potential management strategies. Participants explored several climate drivers, but changes in temperature and precipitation dominated the discussion. Four priority scenarios were selected (Hot/Dry, Hot/Wet, Cold/Dry, Cold/Wet) for each of the seasons in the year.

The lead teams created graphics, as seen in Figures 1 and 2, to illustrate the impacts of temperature and precipitation scenarios on beef and cropping systems. Both graphics can be found at [weather-ready.unl.edu](http://weather-ready.unl.edu).

Discussion of impact management strategies focused on risk management through planning and diversifying. We then grouped the options according to robustness and priority, as seen in Figure 3. Green options were the most robust, applying in all scenarios, with priority options shown in bold. Finally, we sorted the options according to Extension readiness. For beef systems scenarios (Figure 3), participants identified 283 management options. For 53% of the options, at least some Extension materials were available; for 36%, Extension materials had not been developed; and for 25%, more research was needed.

## CONCLUSION

For controversial topics, getting participants in the door is often the hardest step. Much of our success was the trust that our local Extension had established with its clients. Scenario planning further provided a framework for structuring productive initial conversations around complex and controversial topics, such as climate-change impacts on agriculture. It also provided a robust, client-driven needs assessment to guide future research and

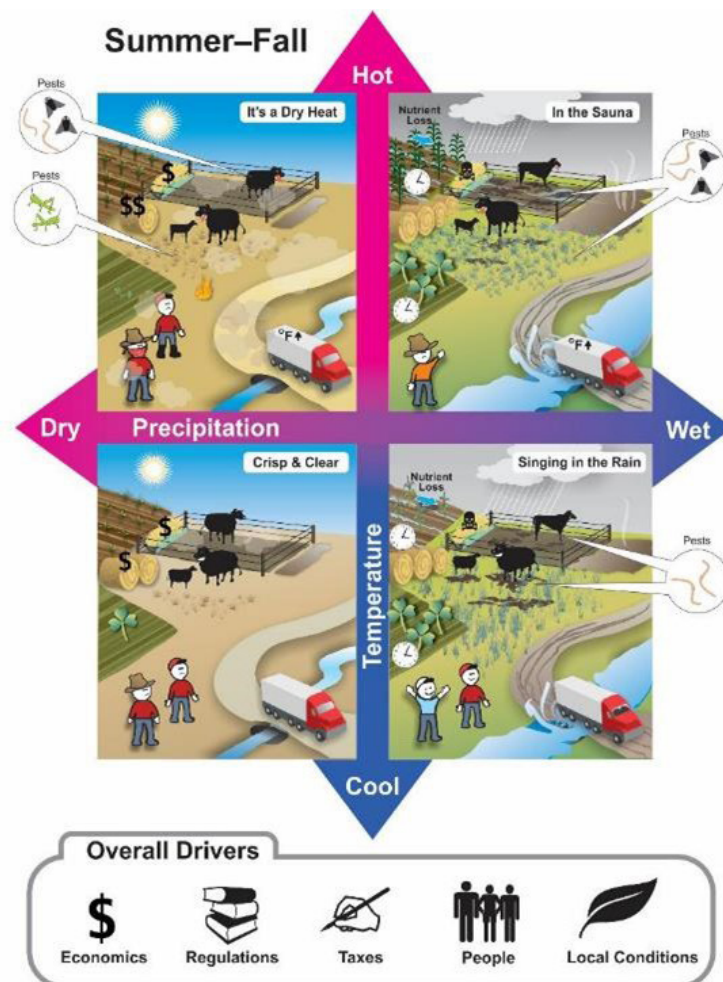


Figure 1. Beef climate scenario.



Figure 2. Cropping scenarios and impacts.

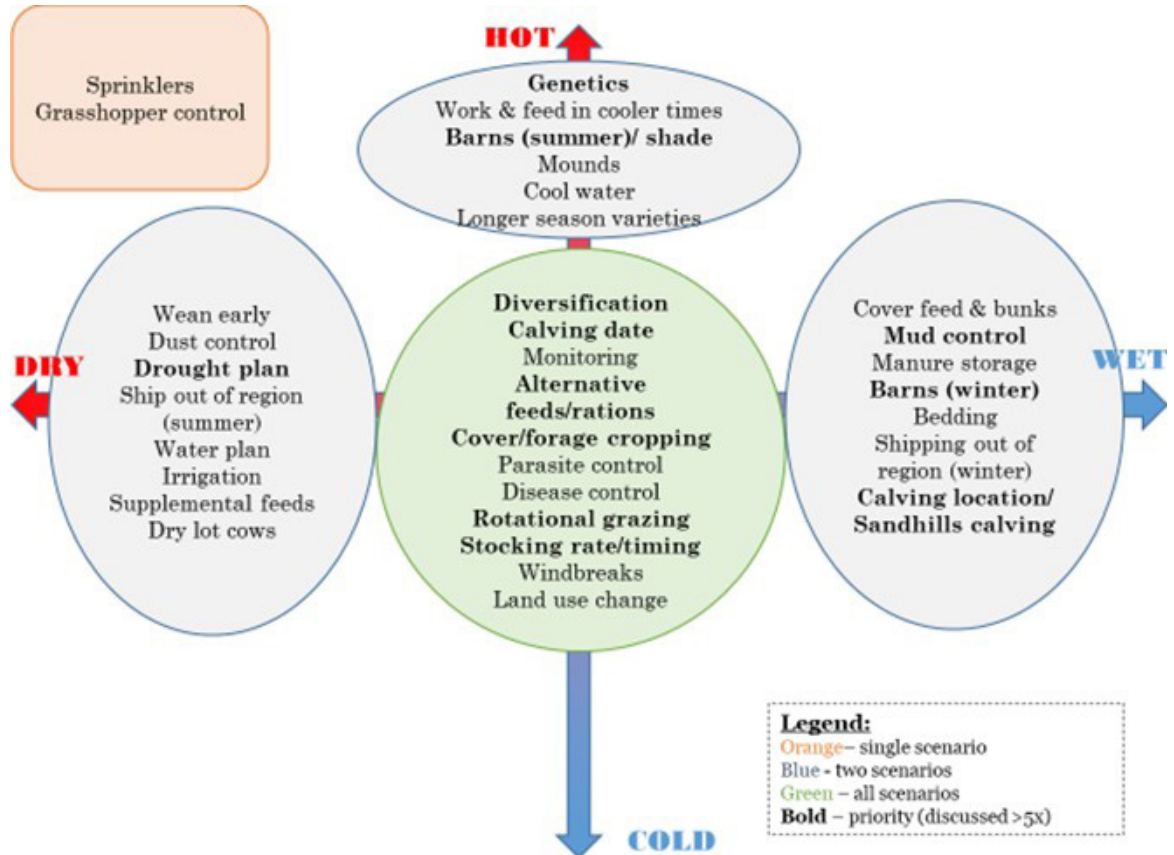


Figure 3. Beef scenario management options.



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extension programming. Using this tool, we were able to bring together trusted local Extension educators, present specialists' expertise, and tap into decades of experience that farmers have in managing extreme weather events. Scenario planning helped us establish an atmosphere of co-creation to find solutions and provided a strong foundation of efficacy and trust for future Extension programming.

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