Adapting to Change

Southern Plains researchers tackle climate variability.

*by **Barb Baylor Anderson,** field editor*

Beef producers in the Southern Plains don't need to be reminded that drought conditions have hung on for more than three years. When it comes to helping those producers adapt to what may be considered extreme climate variability, resources are as sparse as raindrops.

A team of Southern Great Plains scientists and educators hope to change that during the next five years with a $9.6 million investment from USDA's National Institute of Food and Agriculture (NIFA). NIFA made the funds available to support development of climate solutions for beef production, and to better understand the vulnerability and resilience of beef production in an environment of increased climate variability, dynamic land use and fluctuating markets. NIFA formerly was known as the Cooperative State Research, Education and Extension Service.

"With being in the third year of a drought, we need better management to variance in climate," says Dave Engle, Oklahoma State University (OSU) Water Resources Center director and project co-director. "The team's approach is aimed at adaptation to climate. We have highly variable temperatures and precip, and want to give producers tools they need to cope with variability."

The team has 32 scientists from OSU; the University of Oklahoma; Kansas State University; Tarleton State University; the Samuel R. Noble Foundation; and USDA's Agricultural Research Service (ARS) laboratories in El Reno, Okla., and Bushland, Texas.

Engle says the integrated project is twofold: Researchers will direct data collection and validation, and Extension specialists will communicate findings to producers. The three-state team will cover animal science and nutrition, forages, wheat, pasture and rangeland, agronomy and soil science.

"It is important to perform life-cycle analysis of the beef industry's greenhouse gas emissions, which affect climate change, and to improve understanding about how everything works, from raising livestock to grazing management and practices to the beef purchased by consumers," says Jean Steiner, USDA-ARS Grazinglands Research Laboratory director, El Reno.

"We want to get basic information. Soils and vegetation are in equilibrium at our long-term sites, so we can get processes representative of beef production management systems in place," she says. "We also will conduct some field research with short-term focus on process details."

Exploring management systems

Intensive studies will begin in 2014.

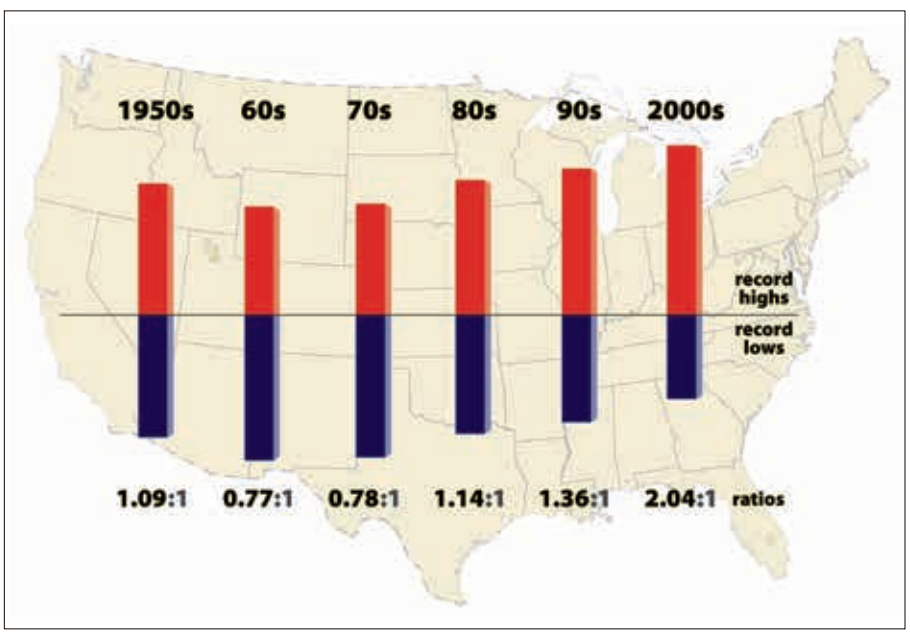
"Our assumption is that grazing is a beneficial and very environmentally friendly system and makes efficient use of grasses and landscapes not suited for row crops," says Steiner. "We want to know what major events, like late frost, do to the system."

Steiner says years two through four of the research will explore specific aspects of beef grazing management. Graduate students from the various institutions will work in the El Reno facilities to monitor water and nitrogen use, cattle and plants. The goal is to build a complete database that shows what actually occurs in various management systems.

Extension specialists involved with the project will review what decision tools already exist that can help beef producers adapt to climate change. Engle knows little exists about managing multi-year drought, so that is one hole that can be filled. The second phase will assess what other holes exist and will share ongoing research results through Extension programming.

"We may find what portions of the beef management system or segments of mixed systems have the greatest leakage of resources, whether that is water, carbon dioxide, methane, nitrous oxides or something else," he says. "After we find them, we can target

Fig. 1: Ratio of record highs to record lows
Increasing temperatures cause a corresponding increase in extreme high temperatures and heat waves. Over the past decade, record-high temperatures now occur about twice as often as record lows. In the 1950s this ratio was about one-to-one.



Source: UCAR, Mike Shibao (2009).

fixing them. We can train the next generation of producers and researchers to better address climatic effects."

Another particular interest for Engle is determination of what areas of beef production are most vulnerable to climate change, and how producers might use best management practices and technological advances to find balance between beef production and environmental stewardship.

"We will learn how management practices affect greenhouse gas emissions," he says. "We may be able to make more efficient use of water and fertilizer, for example. Then we can work with those variables to increase the resilience of beef cattle production."

Making the most of research

Engle adds that selection of the Southern Great Plains is ideal for the research, since the region accounts for a large and diverse share of total U.S. beef production.

"One particular challenge faced by beef producers here is that there is a greater change in annual precipitation within the region than exists from here to the East Coast," he says. "There is not only a great deal of variability in terms of geography, but also over time that makes the system more vulnerable to factors such as drought, flooding and high temperatures."

In addition, beef cattle production is not performed under a single management system in the Plains. "This is a fairly complex system. Southern Plains beef cattle production is very heterogeneous, and includes all phases of beef cattle production," says Steiner. "We are looking at grazing from the cow-calf phase through to the stocker phase."

What may work best for one segment may not be the best choice for another, economically or environmentally, adds Engle. Feedstuffs for grazing come from three forage sources — winter wheat grazed in winter and harvested for grain in summer, known as dual-purpose wheat; monocultures of grasses like Bermuda grass; and rangeland, or uncultured native plants.

"With a mixed system, it will be hard to find answers. But the variability and diversity mean answers we find are applicable for more producers and in other parts of the country," he says. "Ultimately, we want producers to be able to optimize scarce resources in a variable climate."

Steiner says that at some point during the study, researchers will collaborate with producers in the region.

"We will find producers with long-term management in place using certain production practices. We will collect plant and soil samples to understand climate drivers and the productivity of grasses and livestock," she says. "We want producers to be able to explore long-term opportunities to better manage risk in a changing environment."

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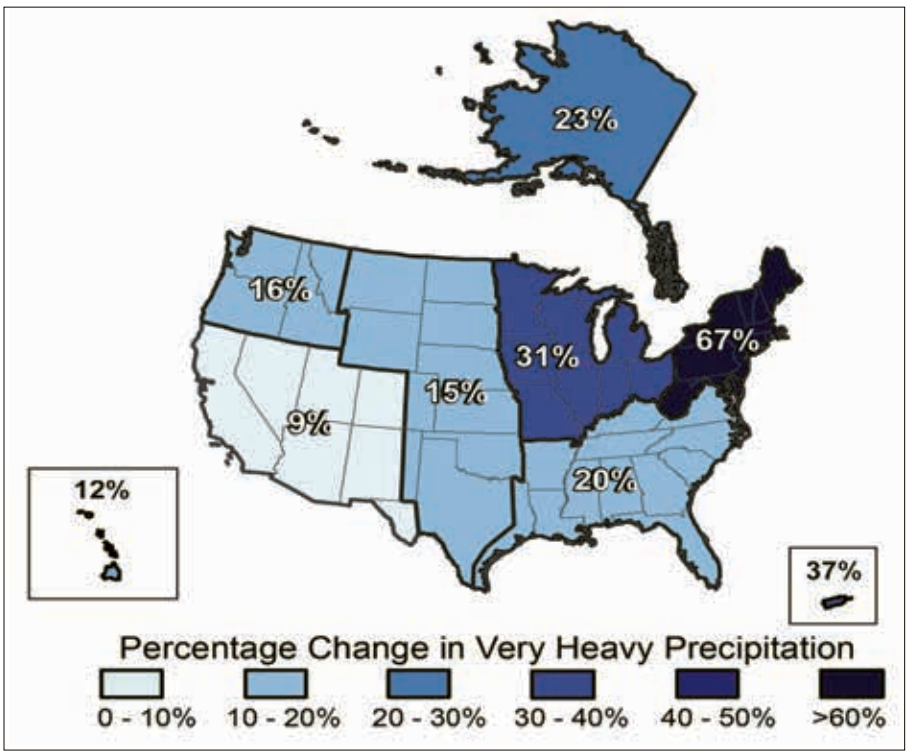
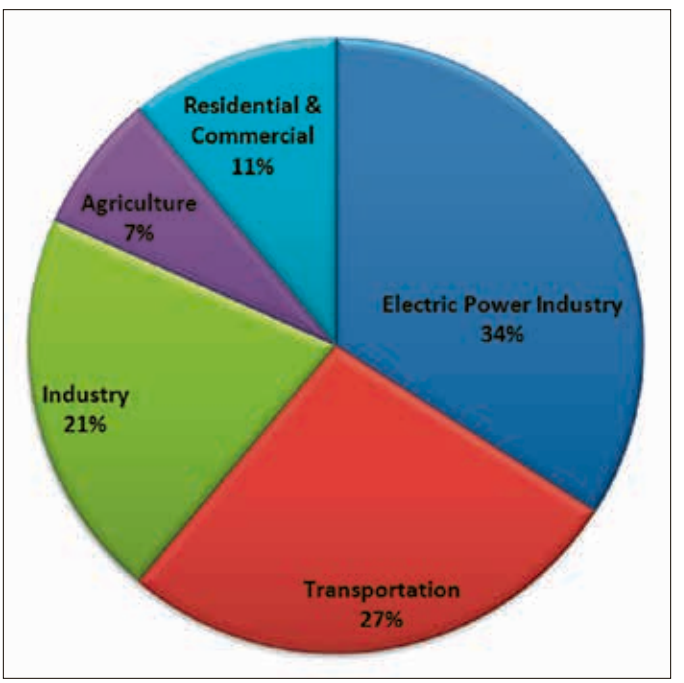
Editor's Note: *A former National Junior Angus Board member, Barb Baylor Anderson is a freelancer out of Edwardsville, Ill.*

Fig. 2: Increases in the number of days with very heavy precipitation, 1958-2007
Increased moisture in the atmosphere as a result of warming temperatures increases the risk of extreme precipitation events. In the United States, the frequency of heavy downpours has increased by almost 20% on average. The following figure shows changes in the number of days with heavy precipitation since 1958 on a regional basis.



Source: US GCRP, Groisman et al. (2009).

Fig. 3: U.S. greenhouse gas emissions by sector, 2010
In 2010, the United States emitted more than 6.8 billion metric tons of greenhouse gases (CO_2e). Greenhouse gases are emitted by all sectors of the economy.



Source: Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2010 (EPA 2012).