



*Eye on the  
Environment*

# More Climate Change Coming

Be aware beef production may change, too.

by Barb Baylor Anderson

**G**lobal climate change talk has been around for years, but the 2012 drought may have provided just enough traction for producers to pay closer attention to what experts are saying: Without changes in human behavior, agriculture faces additional stress that may require a shift in management practices.

“Climate change is real, and extreme weather events will become more common,” says Don Wuebbles, University of Illinois atmospheric sciences professor. Wuebbles shares the 2007 Nobel Peace Prize for his work with the Intergovernmental Panel on Climate Change. “We see many indicators the climate is changing, and evidence clearly indicates it primarily is due to human activities — especially burning of fossil fuels and corresponding carbon dioxide and other greenhouse gas emissions.”

Wuebbles cites results from the U.S. National Climate Assessment, which in its 2009 report found that climate changes under way in the United States are projected to grow and bring:

- ▶ an increasing tendency for increasingly warm temperatures;
- ▶ increasing likelihood for heat waves and fewer cold waves;
- ▶ increasing amount of rainfall coming as intense downpours;
- ▶ rising sea level and changes in river flows;
- ▶ rapidly retreating glaciers and thawing permafrost;
- ▶ longer growing seasons;
- ▶ longer ice-free seasons in ocean, lakes and rivers and earlier snowmelt.

## General agriculture effects

“The U.S. is breaking twice as many heat as cold records, and more heat waves are likely,” he confirms. “We will face more drought and flood risk and have more large precipitation events.”

More specifically, Wuebbles says data from the last 50 years indicate the United States has seen a greater number of floods in the Midwest and Northeast and fewer floods in the Southwest. Because of a warmer atmosphere, such trends may continue. Drought has become more common in the West and Southeast.

“Climate change generally will alter our ability to achieve food security,” he says. “We will see direct effects on water, temperature, energy and weather extremes.”

Indirect effects on food security include changes with insects, weeds, diseases and food quality. For example, Wuebbles says weeds respond more to carbon dioxide than crops, which could increase their presence. Likewise, overall crop yields are likely to decrease by 2050 because yield potential is especially sensitive to high temperatures during pollination and the grain fill period. The exception could be an increase in soybean yield potential in the Midwest.

“Maximum yields are associated with water availability. No drought lines of any crop exist that can yield as much as a well-watered cultivar,” he says. “A recent study from Stanford University indicates all of the improvements we have made genetically in crops over the last 10 years may have been totally offset by changes in climate. That may lead to a negative impact on crop yields eventually, as well as affect livestock feeding capabilities and the ability for beef producers to market animals efficiently.”

## Beef production questions

Projecting the impact of climate change on beef production is still a work in progress. Wuebbles says part of the challenge is understanding how cattle might respond to temperature and heat stress changes.

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The National Climate Assessment and Development Advisory Committee (NCADAC), a 60-person federal advisory committee, has overseen recent development of a draft climate assessment report ([www.ncadac.globalchange.gov](http://www.ncadac.globalchange.gov)) for the third National Climate Assessment (NCA). The report is open for public review and comment until April 12, 2013. The National Academies of Sciences also is reviewing the report, which will be submitted to the White House and Congress after completion in December.

Within the draft report, agriculture chapter convening lead authors Jerry Hatfield, USDA plant physiologist, and Gene Takle, Iowa State University Climate Change Program director, and others outline several key messages:

- ▶ “Climate disruptions to agricultural production have increased in the recent past and are projected to increase further during the next 25 years. By mid-century and beyond, these impacts will be increasingly negative on most crops and livestock.
- ▶ Many agricultural regions will experience declines in crop and livestock production from increased stress due to weeds, diseases, insect pests and other climate change-induced stresses.
- ▶ Current loss and degradation of critical agricultural soil and water assets by increasing extremes in precipitation will continue to challenge both rain-fed and irrigated agriculture unless innovative conservation methods are implemented.

**“The U.S. is breaking twice as many heat as cold records, and more heat waves are likely.”**  
*— Don Wuebbles*

- ▶ The rising incidence of weather extremes will have increasingly negative impacts on crop and livestock productivity because critical thresholds are already being exceeded.
- ▶ Agriculture has been able to adapt to recent changes in climate; however, increased innovation will be needed to ensure the rate of adaptation of agriculture and the associated socioeconomic system can keep pace with future climate change.

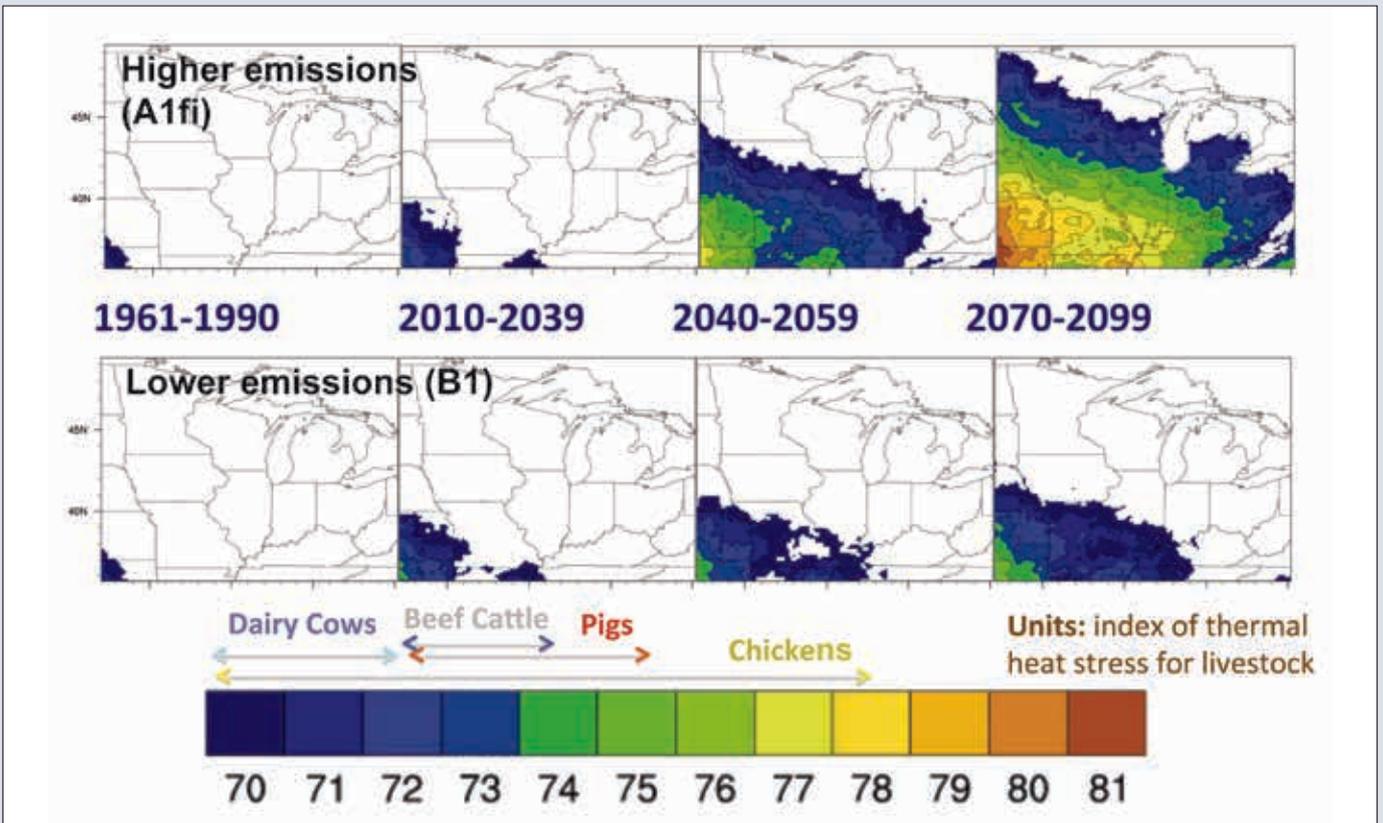
▶ Climate change effects on agriculture will have consequences for food security both in the United States and globally, not only through changes in crop yields, but also changes in the ways climate affects food processing, storage, transportation and retailing.”

Within the report, the authors working in collaboration with other scientists, submit changing climatic conditions could affect beef production in terms of animal health, growth, reproduction, disease and pests, as well as through feed-grain, pasture and forage-crop production, availability and price.

“Livestock will be at increased risk of exposure to extreme heat events. Projected increases in the occurrence of extreme heat events will expose production systems to conditions exceeding maximum thresholds for beef cattle managed in extensive outdoor facilities,” the report reads. “Within physiological limits, animals can adapt to and cope with gradual thermal changes, though shifts in thermoregulation may result in a loss of productivity. Lack of prior conditioning

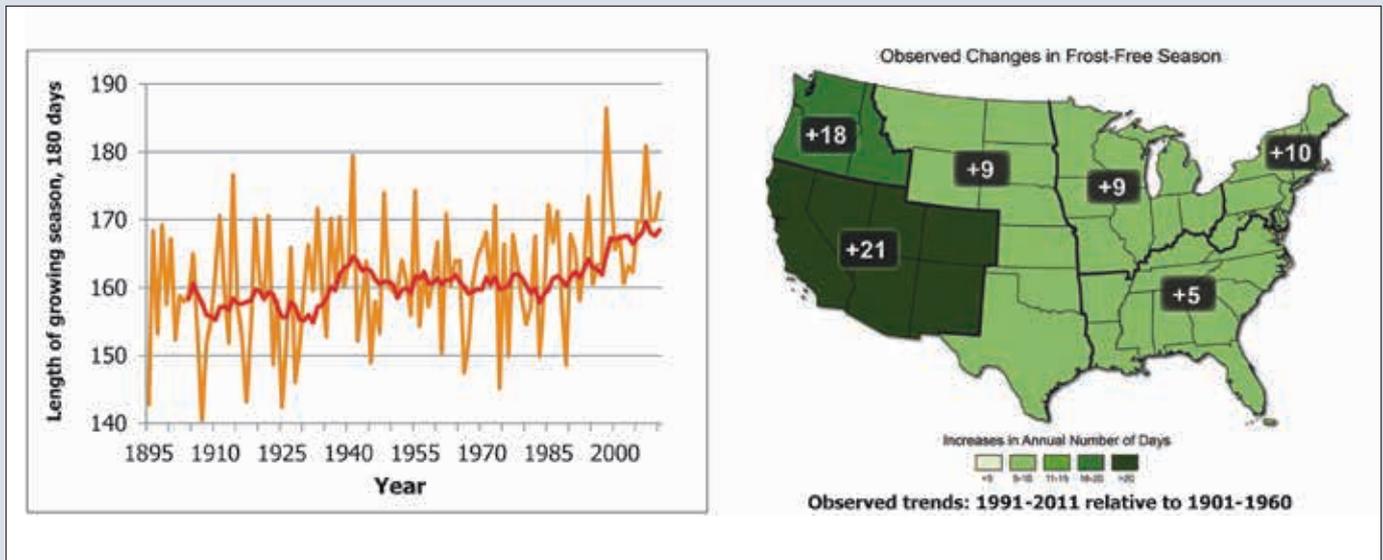
**Fig. 1: Thermal heat index: livestock**

Beef cattle in the Midwest are likely to be subject to ever-increasing concerns about heat effects. The higher emissions time progression is a worst-case scenario illustration of the possible impact. Should humans make changes in behavior, the lower emissions scenario is more likely.



Source: Don Wuebbles.

**Fig. 2: Midwest growing season is lengthening**



to rapidly changing or adverse weather events, however, often results in catastrophic deaths.”

The authors note that deviations from optimum animal core body temperature can cause disruptions in performance, production and fertility, and limit beef production. For cattle bred during spring and summer months, exposure to high temperatures reduces conception rates.

“Production is more affected by the number of days of extreme heat than by increases in average temperature. Elevated humidity exacerbates the impact of high temperatures on animal health and performance,” the report reads. “Meat animals are managed for a high rate of weight gain, which increases their potential risk when exposed to high-temperature conditions. Exposure to heat stress causes problems for animals, and exposure to high temperature events can be costly.”

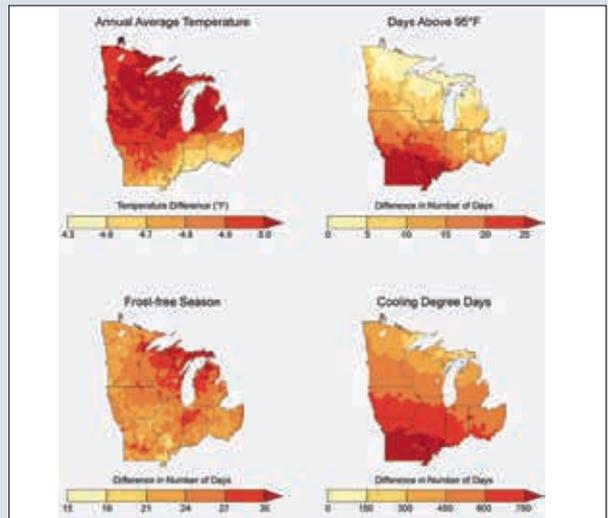
**Prepare for possible changes**

While Wuebbles and other climate-change experts do not have a crystal ball to predict the magnitude of future changes, they do offer some sense of the risks associated with the types of changes that may occur and have suggestions that may help beef producers plan for the long run.

“Based on projected climate change impacts, U.S. agricultural systems may have to undergo more transformative changes to remain productive

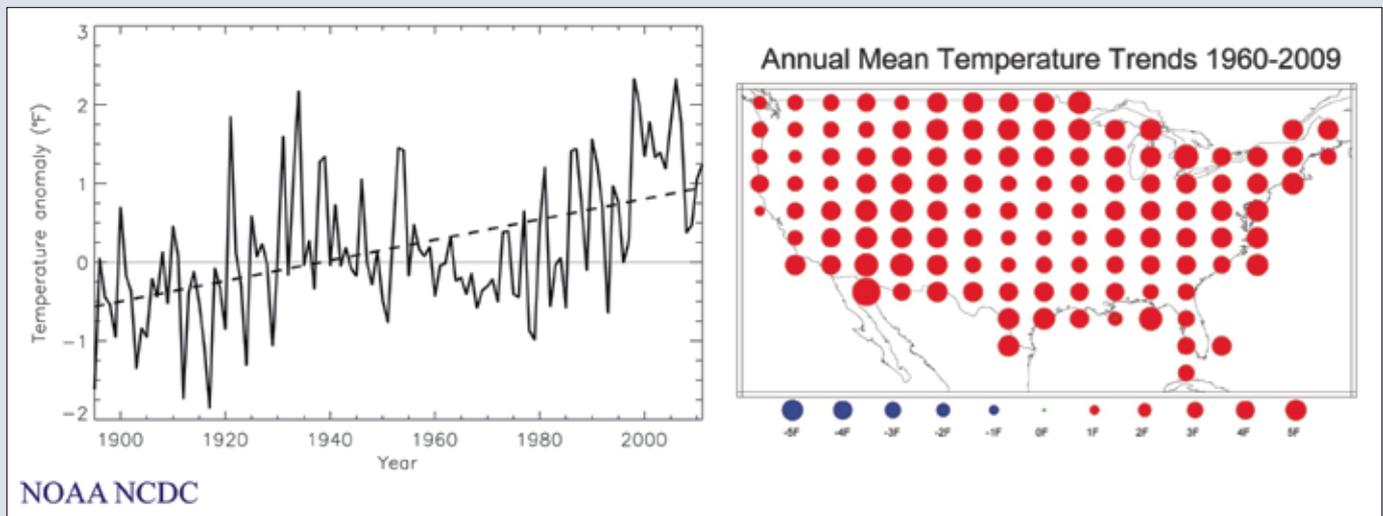
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**Fig. 4: Temperature projections: Higher**  
Midwest temperature changes 2041-2070 (compared to 1980-2011) in a high-emissions scenario.



**Fig. 3: Contiguous U.S. temperature trends**

U.S. average temperature has risen more than 2° F during the past 50 years.



NOAA NCDC

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and profitable in the long term. Research and development of sustainable natural resource management strategies (may offer) adaptation options for U.S. agriculture. Strategies, such as conversion to integrated crop-livestock farming, may reduce environmental impacts, improve profitability and sustainability, and enhance ecological resilience to climate change in U.S. livestock production systems,” note the report authors.

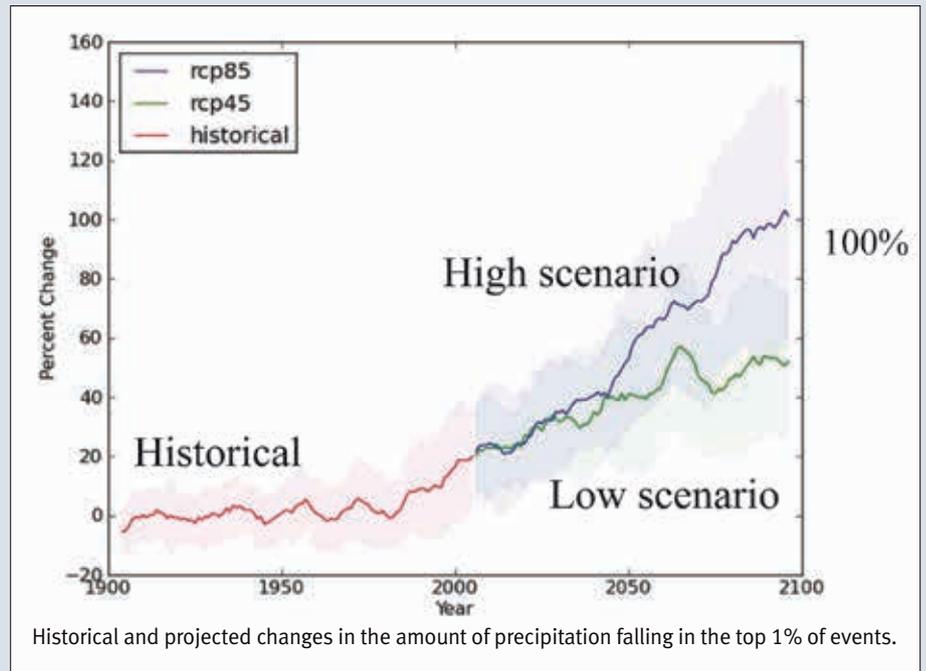
“Beef producers should be aware that climate change can affect not only their livelihoods, but their families and lifestyles, in many ways,” says Wuebbles. “We may not know enough to make specific recommendations yet, but as scientists we will work to get to the truth.”

Wuebbles welcomes constructive input, and encourages producers to contact him with climate change questions the industry needs answered. He can be reached at 217-244-1568 or wuebbles@illinois.edu.



**Editor's Note:** Barb Baylor Anderson is a freelancer based out of Edwardsville, Ill. She is a former director of the National Junior Angus Board.

**Fig. 5: Midwest: Severe precipitation events likely to increase (new CMIP5 analyses)**  
Percent change in annual fraction of simulated precipitation totals above 99<sup>th</sup> percentile, Midwest, 9-year running average



Historical and projected changes in the amount of precipitation falling in the top 1% of events.