Monthly Labor Review
January 2018

How climate change is moving the needle for livestock and agricultural production

McLeod Brown

While climate change has been a popular topic for years now, its legitimacy and how best to assess its potential impact on the United States have come into even greater focus in American politics this past year. Politicians are not alone in their interest on the subject; industries dependent on a stable climate have a vested interest in monitoring developments. With the Earth's surface temperature consistently rising, the effect of climate change on the world's agricultural industry is of particular concern.

In a June 2017 study, "Impacts of climate change and extreme weather on U.S. agricultural productivity: evidence and projection" (National Bureau of Economic Research, working paper no. 23533), authors Richard Nehring, Ryan Williams, and Truong Chau examine how climate change and extreme weather affect U.S. agricultural productivity. The authors believe that their work represents the first empirical study of the climatic effect on agricultural productivity from the perspective of the entire farm sector, including both livestock and crop production.

The authors use 1941–70 historical weather data (mean and variation of temperature, humidity, and precipitation) to create a temperature–humidity index (THI) and an Oury index. The THI combines temperature and humidity to measure the degree of discomfort experienced during warm weather. Environments with a higher THI make it more likely that livestock will experience heat stress, negatively affecting fertility, feed efficiency, weight gain, and other factors. The Oury index is an aridity index that combines temperature and precipitation to connect climatic effects to crop growth. A lower Oury index indicates drier conditions that would be less favorable to crop production. These two indices are then applied to regional weather patterns from 1960 through 2010 to measure the degree of deviation from historical annual variations.

Overall, the study yielded four major findings:

- States with higher THI values and lower Oury index values produced less agricultural output. These results, however, become less significant as more state variables are modeled.
- From 1960 through 2010, patterns of climate change varied from region to region. Some states became drier or warmer, while others experienced little average change but increased volatility.
- Because producers in states tend to adapt to the prevailing conditions, frequent variations from the norm represent a greater threat than even persistent unfavorable conditions.
- Temperatures will rise and shocks will increase into the 2030s. The effects will not be linear, but rather will vary across regions. The most pronounced effects will occur in the Delta, Northeast, and Southeast regions.

The underlying point, however, is that unexpected climatic shocks play the wild-card role. They can cause an increased use of input or decreased production, depending on when and where they hit, which is difficult to pinpoint.

The authors close their paper with a note informing the audience of the importance of studying the effects of climate change at the state level, rather than just the national and global levels. From there, state level agricultural productivity changes can affect state-specific agricultural policy decisions, and possibly move up the chain to the national and global levels.