



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*



Economic Research Service  
United States Department of Agriculture

## Climatic Trends Dampened Recent Productivity Growth on Wisconsin Dairy Farms

*Finding: Agricultural Research and Productivity*

October 05, 2020

# Climatic Trends Dampened Recent Productivity Growth on Wisconsin Dairy Farms

by Eric Njuki



In 2019, Wisconsin was the second-largest producer of fluid milk in the country. According to 2019 data compiled by USDA's National Agricultural Statistics Service, Wisconsin generated 30,601 million pounds of milk from about 1,267,000 milk cows, with milk sales totaling \$5 billion. Dairy production was the single largest agricultural activity in the State in 2019, with an average of 7,720 licensed dairy herds, 96 percent of which were family owned. In recent years, Wisconsin dairy farms have been exposed to substantial weather volatility characterized by frequent droughts, storms, and temperature extremes (both hot and cold). This has resulted in considerable fluctuations in dairy productivity.

Weather volatility affects dairy production in various ways, such as:

- reducing the yield of feed grain;
- lowering the availability and quality of pasture and forage;
- affecting the normal physiological functioning of dairy cows, as well as their reproductive health; and

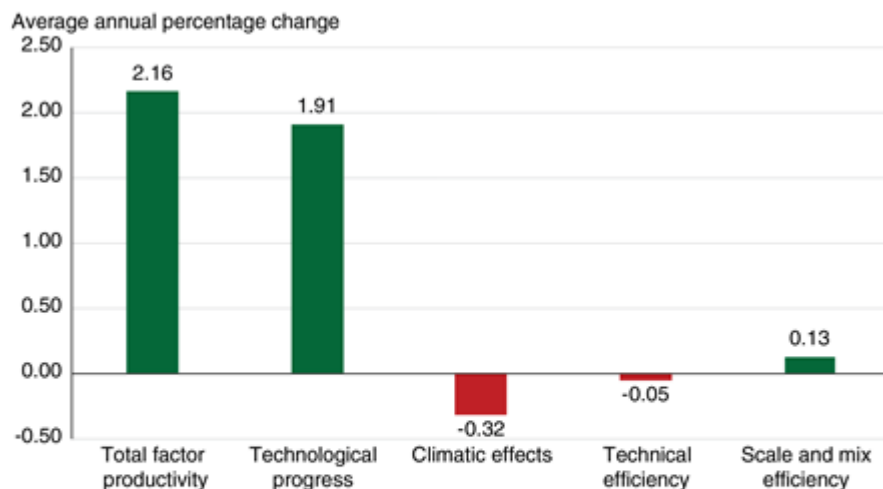
- fostering the distribution and resiliency of parasites and pathogens that impact animal health.

To gain a better understanding of climate effects on dairy production, researchers tracked the growth of milk output over time while controlling for inputs such as herd size, labor hours, feed, and capital, at the same time focusing on the characteristics of the production environment, such as rainfall and temperature. The result is annual total factor productivity (TFP), a measure of the rate of growth in total output relative to the rate of growth in total inputs.

Researchers found that, between 1996 and 2012, TFP increased at an average annual rate of 2.16 percent for Wisconsin dairy farms, with considerable variation across individual farms. This productivity increase was primarily driven by technological progress at an annual average rate of 1.9 percent. Technological progress happens when producers introduce new processes and systems in dairy production, such as improved herd genetics, advanced feed formulations, and steady improvements in milking and feed handling equipment among other mechanical advances.

Notwithstanding technological progress, TFP growth was hampered by the negative effects of climate variability. Trends in rainfall and temperature variation were responsible for a 0.32 percent annual decline in the productivity of Wisconsin dairy farms between 1996 and 2012. Put another way, an average increase in temperature of 1.5 degrees Fahrenheit reduced milk output for the average Wisconsin dairy farm by 20.1 metric tons per year. This is equivalent to reducing the herd size of the average farm by 1.6 cows every year.

### Climatic effects contributed negatively to total factor productivity on Wisconsin dairy farms between 1996 and 2012



Notes: "Total factor productivity" measures the rate of growth in total output (aggregate milk produced) relative to the rate of growth in total inputs (such as the number of cows, farm labor, feed, and machinery). "Technological progress" is productivity gains associated with the introduction of new processes and systems in production. "Climatic effects" measure the contribution of long-term temperature trends to productivity. "Technical efficiency" measures how successful producers are at combining various inputs in order to maximize output. "Scale and mix efficiency" captures productivity gains associated with expansion of dairy production capacity. Source: USDA, Economic Research Service calculations using data from the University of Wisconsin, Center for Dairy Profitability.

Embed this chart

Download higher resolution chart (2539 pixels by 2336, 300 dpi)

This article is drawn from...

USDA, National Agricultural Statistics Service (NASS). "Milk Production," No. 1949-1557, NASS, U.S. Department of Agriculture, 2020

Njuki, E., B.E. Bravo-Ureta, and V.E. Cabrera. "Climatic Effects and Total Factor Productivity: Econometric Evidence for Wisconsin Dairy Farms", *European Review of Agricultural Economics*:1-26, 2020

You may also be interested in...

*Agricultural Research and Productivity*, by Keith Fuglie, Sun Ling Wang, and Eric Njuki, USDA, Economic Research Service, January 2020

*Agricultural Productivity in the U.S.*, by Sun Ling Wang, Roberto Mosheim, Richard Nehring, and Eric Njuki, USDA, Economic Research Service, January 2020

*Agricultural Research in High-Income Countries Faces New Challenges as Public Funding Stalls*, by Paul Heisey and Keith Fuglie, USDA, Economic Research Service, May 2018

*Climate Change*, by Ron Sands, USDA, Economic Research Service, August 2020

*Climate Change and Agricultural Risk Management Into the 21st Century*, by Andrew Crane-Droesch, Elizabeth Marshall, Stephanie Rosch, Anne Riddle, Joseph Cooper, and Steven Wallander, ERS, July 2019

*Climate Change Likely to Have Uneven Impacts on Agricultural Productivity*, by Sun Ling Wang, Richard Nehring, and Ryan Williams, USDA, Economic Research Service, August 2019

*Dairy*, by Jerry Cessna, USDA, Economic Research Service, August 2020

## ERS

[ERS Home](#)

[Accessibility](#)

[Careers](#)

[Contact Us](#)

[E-Mail Updates](#)

[Help](#)

[Information Quality](#)

[Site Map](#)

[Privacy Policy & Nondiscrimination Statement](#)

## EXTERNAL

[FOIA](#)

[Report Fraud](#)

[USDA.gov](#)

[USA.gov](#)

[White House](#)

## E-NEWSLETTER

[SUBSCRIBE](#)

