



# The Carbon Footprint of U.S. Beef Compared to Global Beef

Ashley Brooks  
Graduate Student

Kimberly Branham  
Graduate Student

Megan Rolf  
Assistant Professor

Sara Place  
Assistant Professor, Sustainable Beef Cattle Systems

Michelle Calvo-Lorenzo  
Assistant Professor

Oklahoma Cooperative Extension Fact Sheets are also available on our website at: <http://osufacts.okstate.edu>

Comparing the U.S. beef industry's carbon footprint to other nations is challenging for two main reasons:

1. Methodologies used by different published studies to calculate carbon footprints within and across nations vary in ways that can influence their estimated carbon footprint.
2. Efficiency of practices in how beef cattle are raised across countries vary greatly (i.e., productive use of resources to maximize the total amount of beef produced), and efficiency is a key driver of beef's carbon footprint.

The production of food in all forms results in emissions of greenhouse gases. Carbon footprints are a measure quantifying the greenhouse gas emissions that result from the production of any given food item, or for a given product, activity or industry. A carbon footprint refers to all the greenhouse gas emissions produced and are expressed as carbon dioxide (CO<sub>2</sub>) equivalent emissions to account for the different greenhouse gases' potential to trap heat in the earth's atmosphere. For beef production, a carbon footprint refers to CO<sub>2</sub> equivalent emissions per unit of beef.

To overcome these challenges, one can examine the results from individual studies using the same methodology to estimate CO<sub>2</sub> equivalent emissions across the wide range of beef production systems found in the world.

In two recent analyses of global livestock systems<sup>1,2</sup>, North American beef production systems (including the U.S.) were found to have some of the lowest carbon footprints. As seen in Figure 1, when CO<sub>2</sub>-equivalent emissions are expressed per kg of protein, the U.S. and other developed nations have lower carbon footprints (10 to 50 times lower), compared to many

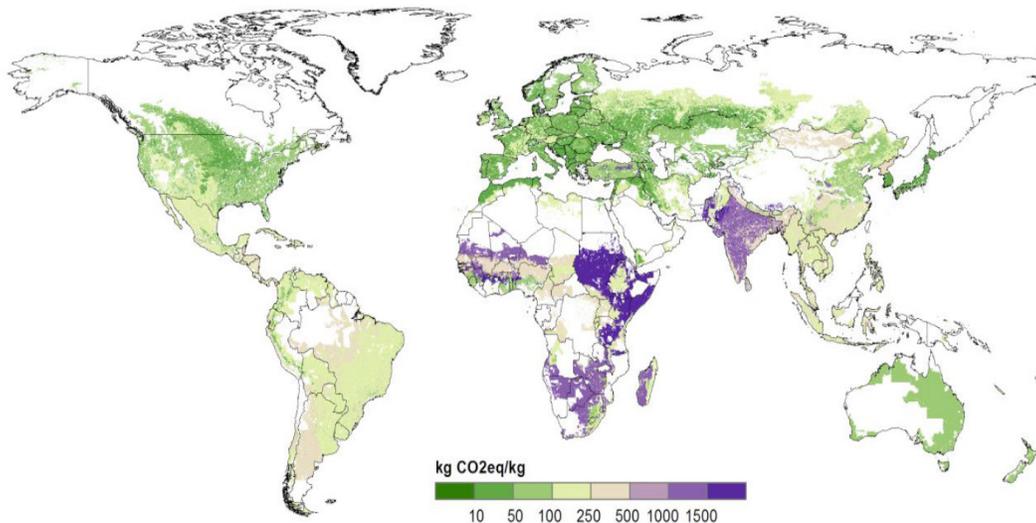


Figure 1. Greenhouse gas emissions from beef production expressed as kg of CO<sub>2</sub> equivalents per gram of protein. Source: Herrero et al., 2013 PNAS 110: 20888-20893

nations in sub-Saharan Africa and the Indian subcontinent<sup>2</sup>.

The lower CO<sub>2</sub> equivalent emissions per kg of protein for beef production systems in the developed world are driven by higher quality (more digestible) feeds, lower impacts of climate stress (heat) on animals, improved animal genetics, advancements in reproductive performance and the reduced time required for an animal to reach its slaughter weight compared to regions with higher carbon footprints<sup>1,2</sup>. Combined, all of the above-mentioned factors drive improvements in the efficiency of beef production, while decreasing the use of natural resources and production of environmental emissions per unit of beef produced. Furthermore, it is these factors that are responsible for reducing the U.S. carbon footprint of beef by an estimated 9 to 16 percent from the 1970's to the present day<sup>3,4</sup>. Using management techniques and technologies developed through scientific research is key to achieving improvements in beef production efficiency and further reducing beef's carbon footprint.

## Summary

The U.S. beef industry has one of the lowest carbon footprints in the world due to cattle genetics, the quality of cattle feeds, animal management techniques and the use of technology.

## Literature Cited

- <sup>1</sup> Opio, C., P. Gerber, A. Mottet, A. Falcucci, G. Tempio, M. MacLeod, T. Vellinga, B. Henderson, and H. Steinfeld. 2013. Greenhouse gas emissions from ruminant supply chains – A global life cycle assessment. Food and Agriculture Organization of the United Nations (FAO), Rome.
- <sup>2</sup> Herrero, M., P. Havlík, H. Valin, A. Notenbaert, M.C. Rufino, P. K. Thornton, M. Blümmel, F. Weiss, D. Grace, and M. Obersteiner. 2013. Biomass use, production, feed efficiencies, and greenhouse gas emissions from global livestock systems. *Proc. Natl. Acad. Sci.* 110: 20888-20893.
- <sup>3</sup> Capper, J.L. 2011. The environmental impact of beef production in the United States: 1977 compared with 2007. *J. Anim. Sci.* 89:4249-4261.
- <sup>4</sup> Rotz, C.A., B.J. Isenberg, K.R. Stackhouse-Lawson, and E.J. Pollak. 2013. A simulation-based approach for evaluating and comparing the environmental footprints of beef production systems. *J. Anim. Sci.* 91(11):5427-5437.

Oklahoma State University, in compliance with Title VI and VII of the Civil Rights Act of 1964, Executive Order 11246 as amended, and Title IX of the Education Amendments of 1972 (Higher Education Act), the Americans with Disabilities Act of 1990, and other federal and state laws and regulations, does not discriminate on the basis of race, color, national origin, genetic information, sex, age, sexual orientation, gender identity, religion, disability, or status as a veteran, in any of its policies, practices or procedures. This provision includes, but is not limited to admissions, employment, financial aid, and educational services. The Director of Equal Opportunity, 408 Whitehurst, OSU, Stillwater, OK 74078-1035; Phone 405-744-5371; email: eeo@okstate.edu has been designated to handle inquiries regarding non-discrimination policies: Director of Equal Opportunity. Any person (student, faculty, or staff) who believes that discriminatory practices have been engaged in based on gender may discuss his or her concerns and file informal or formal complaints of possible violations of Title IX with OSU's Title IX Coordinator 405-744-9154.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President for Agricultural Programs and has been prepared and distributed at a cost of 42 cents per copy. 0416 GH.