

Fact Sheet:

Tough Questions about Beef Sustainability

Project Title:	How Does the Carbon Footprint of U.S. Beef Compare to Global Beef?
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The production of food in all forms results in emissions of greenhouse gases. Carbon footprints are a measure that quantify 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 (CO₂) 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 CO₂ equivalent emissions per unit of beef.

Comparing the U.S. beef industry's carbon footprint to other nations is challenging for two main reasons: 1) the methodologies used in different published studies to calculate carbon footprints within and across nations vary in ways that can influence their estimated carbon footprint, and 2) the efficiency of practices in how beef cattle are raised varies greatly across countries (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. To overcome these challenges, one can examine the results from individual studies that use the same methodology to estimate CO₂ equivalent emissions across the wide range of beef production systems found in the world.

In two recent analyses of global livestock systems,^{1,2} 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 CO₂ equivalent emissions are expressed per kg of protein, the U.S. and other developed nations have lower carbon footprints (**10 to 50 times lower**) as compared to many nations in sub-Saharan Africa and the Indian subcontinent.²

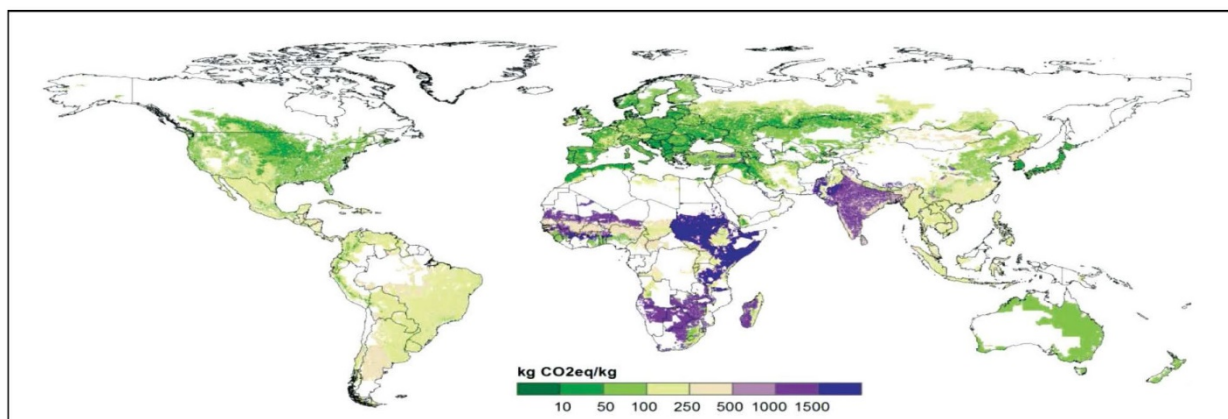


Figure 1. Greenhouse gas emissions from beef production expressed as kg of CO₂ equivalents per kg of protein. From reference 2: Herrero et al., 2013 PNAS 110: 20888-20893.

The lower CO₂ 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 as compared to regions with higher carbon footprints.^{1,2} These heightened efficiencies have not come at the expense of animal welfare, but have accompanied a simultaneous commitment to improve the welfare of the animals. Combined, all of the above-mentioned factors impact production efficiencies while decreasing the use of natural resources and the 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 9-16% from the 1970's to the present day.^{3,4} 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.

Bottom line: 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

1. 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.
2. 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.
3. Capper, J.L. 2011. The environmental impact of beef production in the United States: 1977 compared with 2007. *J. Anim. Sci.* 89:4249-4261.
4. 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.