

What size is our environmental footprint?

Study evaluates environmental impacts of U.S. beef cattle production.

by Troy Smith

It's the kind of talk that can make cattle people cringe. They might get a little aggravated, hearing urbanites discuss how the environmental impact of beef cattle production makes it unsustainable and the land involved should be converted to crops for human consumption. Suspecting that corny online dating service slogan may be accurate, and "city folks just don't get it," a red-blooded beef producer might want to interrupt the conversation and voice a different point of view.

A cattleman could speak up, explaining how some 800 million acres of land in the U.S. are unsuitable for cultivation but will produce forages that ruminant animals (mostly cattle) convert into a high-quality human-edible protein. A beef industry advocate could also explain how cattle utilize by-product feeds derived from the production of human food, fiber and biofuels. He or she could explain how cattle produce more than beef — including a long list of products ranging from leather to pharmaceuticals.

How and how much?

Those are a few facts that a champion for the beef industry could share with city cousins. Also a fact, however, is that beef production does have an environmental impact.

It's the "how" and "how much" of the impact that are subjects of disagreement. It's often due to a confusion or conflation of statistical information, according to Sara Place, the senior director of Sustainable Beef Production Research for the National Cattlemen's Beef Association (NCBA).

cattle enteric fermentation and manure represents only 2% of all U.S. GHG emissions and 0.27% of global emissions.

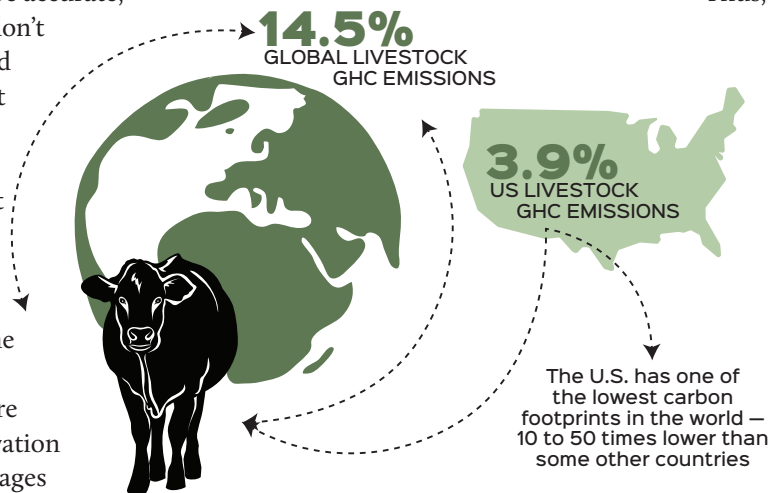
To add context, Place notes that U.S. carbon sequestration from land use, land use change and forestry completely offset all agricultural emissions of GHG.

Thus, U.S. agriculture and forestry combined represented a net sink of carbon emissions in 2016. So, the U.S. has one of the lowest carbon footprints in the world — 10 to 50 times lower than some other countries. But could the U.S. beef industry do even better? If so, how?

The USDA-Agricultural Research Service (ARS), the University of Arkansas and NCBA have collaborated to further

study the environmental impact of beef. Noting that carbon footprint, or GHG emissions, is not the only measure of sustainability, USDA-ARS researcher Alan Rotz says the study was designed to quantify all important environmental impacts of beef cattle production systems, on a regional basis.

Researchers looked at the diverse management practices that have evolved in response to prevailing climate, available resources and regional culture, not only to evaluate impacts, but to help identify opportunities for improving sustainability in each region.



For example, people often get the numbers mixed up when talking about greenhouse gas (GHG) emissions, considered a contributor to climate change. Place says the United Nations Food and Agriculture Organization's latest estimate of total worldwide livestock emissions, using life cycle assessment (feed production and deforestation included), was 14.5% of global GHG emissions. Global beef production's share was estimated at 6%.

In the U.S., however, direct emissions from all livestock represent 3.9% of the country's GHG emissions in 2016. Direct emissions from beef

According to Rotz, surveys were collected from nearly 2,300 operations — farms, ranches and feedlots throughout the seven NCBA regions (Northeast, Southeast, Midwest, Northern Plains, Southern Plains, Northwest and Southwest). Additionally, onsite visits were made to 20 ranches and feedlots of various sizes, within each of the regions, observing management responses to differences in both climate and resource availability.

Rotz says the data was used to create 150 representative production systems

throughout the country. Using ARS's sophisticated software, called the Integrated Farm System Model, researchers ran simulations of the production systems' operation over multiple years, to compile a life cycle assessment tracking inputs and outputs related to beef cattle production. The life cycle assessment quantified resource use and environmental impacts, including GHG emissions for all production systems representing beef cattle plus the dairy industry' contribution to beef production.

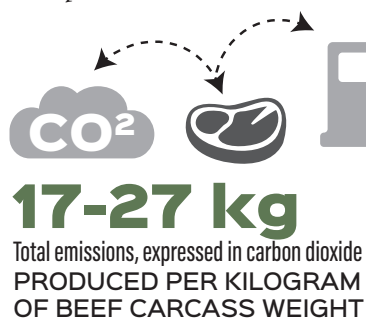
Beef's GHG contribution

So, what did the life cycle assessment reveal about beef production's contribution to GHG? Rotz says total emissions, expressed in carbon dioxide equivalent terms, ranges from 17 to 27 kilograms produced per kilogram of beef carcass weight. The range is wide due to significant differences among regions.

"On average, though, total greenhouse gas emissions for

producing one finished steer is about the same as emissions produced from driving a pickup truck for one year," explains Rotz, noting how the similarity ends when you look at the kind of GHG each produces.

The emissions from a pickup truck consist primarily of carbon dioxide, while methane is the primary emission from cattle. Rotz says methane does have greater "global



Beef Production's Total Fossil Fuel Energy Use

40-60 megajoules
PER KILOGRAM CARCASS WEIGHT

"On average, though, total greenhouse gas emissions for producing one finished steer is about the same as emissions produced from driving a pickup truck for one year." — Alan Rotz

warming" potential than carbon dioxide, but methane's presence in the atmosphere is temporary.

"So, the long-term impact of GHG from cattle is minimal," states Rotz.

Of more concern is the 121 to 257 kilograms (per kilogram of carcass weight) of reactive nitrogen attributed to beef production. Reactive nitrogen includes nitrogen compounds such as nitrous oxide, nitrate, ammonia and ammonium, which are capable of bonding with other compounds, in the atmosphere, and contribute to nasty things like smog and acid rain. According to Rotz, the reactive nitrogen loss associated with producing one steer is roughly equivalent to 215 to 450 pounds (lb.) of urea.

The study estimates beef production's total fossil fuel energy use at 40 to 60 megajoules per kilogram of carcass weight produced. That's the equivalent of about 130 gallons of diesel fuel used for every steer produced. Rotz calls fossil energy use relatively consistent among various regions of the

country. The primary uses of fossil fuels is electricity and fertilizer production, with about 25% of that used to produce animal feed and deliver it.


Much more variable among regions is consumption of blue water (ground and surface water but excluding precipitation) required to produce beef, ranging from 200 to 5,800 liters per kilogram of carcass

weight. Rotz says that's anywhere from one to 25 residential swimming pools for each finished steer.

"Nearly all blue water consumption is

for irrigation of feed crops," explains Rotz, noting that consumption is highest in the western, more arid part of the U.S. "Water use is a big deal," he adds.

A little disconcerting for cow-calf producers, perhaps, is how study results indicate that GHG emissions, reactive nitrogen loss, fossil energy use and blue water consumption are greatest for the cow-calf segment of the beef industry. The greatest environmental impacts, generally speaking, are associated with maintaining a breeding herd.

Rotz says the study data provide a baseline for comparison to additional research. Specifically, it provides information to support an even more extensive life cycle assessment, including beef packing, processing, marketing and consumption. This ongoing "full chain" assessment should help more fully evaluate opportunities for improving the sustainability of beef production. 

Editor's note: Troy Smith is a freelance writer from Sargent, Neb.