



Sustainability





Green House Gases (GHG)



- Carbon dioxide (CO₂)
 - Key sources humans exhale, burning fossil fuels: transportation, electricity production, industry, heating houses, etc.
 - Long lifetime (approximately 1000 years) = any emission above zero increases amount in atmosphere indefinitely
 - 81% of U.S. GHG Emissions (EPA Green House Gas Emissions <u>https://www.epa.gov/ghgemissions/overview-greenhouse-gases</u>)
- Nitrous oxide (N_2O)
 - Key sources: land applied fertilizers (plant and animal ag), natural (vegetation, tundra, oceans) and human (soil cultivation, biomass or fossil fuels combustion, etc.)
 - 120 yr lifetime means it behaves more similar to CO₂
 - 7% U.S. GHG Emissions (EPA Green House Gas Emissions <u>https://www.epa.gov/ghgemissions/overview-greenhouse-gases</u>)
- Methane (CH₄)
 - Key sources: wetlands/swamps, paddy rice fields, ruminants, biomass burning, decomposition of waste in landfills, fossil methane emission during exploration and transport of fossil fuels
 - 12 yr lifetime = stable emissions lead to stable amount in atmosphere is potent, but short lived
 - 10% U.S. GHG Emissions (EPA Green House Gas Emissions <u>https://www.epa.gov/ghgemissions/overview-greenhouse-gases</u>)



Total U.S. emissions in 2018 = 6,677 million metric tons of carbon-dioxide equivalent

Source: USDA, Economic Research Service using data from the U.S. Environmental Protection Agency, April 2020: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2018. Top Agriculture GHG Emitters (2018)

- Soil management practices (55%)
- Enteric fermentation in livestock (29%)
 - Livestock manure management (13%)
- Rice cultivation (2%)

https://www.fb.org/market-intel/ghg



Agriculture Impact on GHG

- Agriculture in 2018 represented 10.5% of total U.S. GHG emissions
 - Enteric fermentation from livestock represented less than 3% of all emissions in 2018
 - When manure management is included, livestock-related emissions represented less than 4% of all emissions
- Global agricultural GHG emissions are 24%
 - Through use of conservation efforts and technology, US farmers have a lower GHG contribution than other farmers around the world, averaging 9% over the last decade



U.S. Agriculture's Share Of GHG Emissions, 2017 2/

Global agricultural GHG emissions are 24%, but because of **U.S. FARMERS' & RANCHERS' CONSERVATION** efforts and **IMPROVEMENTS** in **TECHNOLOGY**, U.S. farmers have a **LOWER GHG CONTRIBUTION** than other farmers around the world, averaging 9% over the last decade.









- Pork production accounts for less than 0.3% of U.S. GHG emissions, according to the American Farm Bureau, with data compiled by the Environmental Protection Agency (EPA)
- Compared to 1990, pork production has increased by 17%, while GHG emissions, energy, water, and land use have decreased or remained flat
- Pork producers are working to improve sustainability even more through a task force formed in 2018, comprised of leaders from across the industry to provide guidance



https://www.provisioneronline.com/proteinbythenumbers/Sustainability-and-Pork-Production

U.S. Pork's Sustainability Keeps Improving

Today's pig farmers embrace sustainability and new research from the University of Arkansas shows that pig farmers are using less land, water and energy. That also means a reduced overall carbon footprint.

From 1960 to 2015, continuous on-farm improvements in nutrition, genetics and overall pig care have made a positive difference.

Improvements Per Pound of Pork Produced (from 1960 to 2015)





Cattle GHG Emissions



- U.S. beef production accounted for 1.9% of GHG emissions in 2018 (Environmental Protection Agency, Farm Bureau Calculations; <u>https://www.fb.org/market-intel/ghg</u>)
 - Globally, U.S. beef is less than 0.5% of GHG emissions
- Ruminant livestock produce the most <u>methane</u>, not the most <u>GHG</u> emissions
 - Ruminant cattle produce methane based on their ability to convert forages or grasses from environments that cannot produce other crops into high quality protein
 - Methane emissions are naturally created by microorganisms in the rumen/digestive tract
 - 95-98% of the methane exits the animal's mouth

The Stomach for the Job





Typical U.S. Cattle Lifecycle



Broocks, A. et al.; Does grass-finished beef leave a lower carbon footprint than grain-finished beef? Available: beefresearch.org/beefsustainability.aspx (Tough Question #6)

Cattle Upcycling

- Livestock and their ability to "upcycle" is key to sustainability
- "Upcycling": harvesting solar energy that is unavailable to humans (because it is locked up in human inedible plants) and converting it into high quality proteins.
 - ~80% of U.S. beef animal's lifetime diet consists of non-human edible product







BEEF SUSTAINABILITY FACTS

Cattle Upcycling Super-power

The rumen microbes give cattle their upcycling super-power – cattle Energy upgrade plants of little to no nutritional value to people to high-quality From the protein, micronutrients, and other important products. Sun **High-quality Protein**, **Human-Inedible Plants** Leather & Other Products

CAST, 1999. Animal agriculture and global food supply. Task force report No. 135 July 1999.

Cattle Production

- The U.S. has the most environmentally-efficient beef production system in the world Source: US Beef Sustainability Assessment
- Comparing 2007 beef production to 1977, each pound of beef raised used (J.L. Capper, 2011):
 - 19% 📕 feed
 - 33% 📕 land
 - 12% 🖡 water
 - 9% 📕 fossil fuel energy
 - With an overall carbon footprint reduction of 16 %
- Compared to the 1970's, today's beef farmers use 36% fewer cattle to produce the same amount of beef



https://www.beefitswhatsfordinner.com/resources/infographiclibrary#RaisingBeef





Grass vs Grain Finished



- Grain finished cattle spend most of their lives eating grass or roughage, only final ~4 months is grain-based diet
 - Grain is rich in energy and finishes the cattle quicker than those on a grass finishing diet. Therefore, the cattle will utilize less water, have less emissions and produce less manure in their lifetime.
 - However, grain (corn in most cases) is only 7% of the animal's lifetime diet, the other 93% is forages, like grass from grazing in a pasture (https://www.beefresearch.org/CMDocs/BeefResearch/Sustainability_FactSheet_TopicBriefs/ToughQA/FS7CornToHumans.pdf)
- High fiber-forages increase methane emissions while grain decreases methane emissions.
- Discourage argument that grass finished automatically has lower carbon footprint
 - Slaughter age is ~26-30 mo (2x as old as grain finished)
 - More water, feed, and methane emissions over a longer period of time
- Disadvantage of grain finished is that you have to take into account growing grains, transport of feedgrains, etc.



Beef Sustainability



White and Hall, 2017. Proc. Natl. Aca. Sci. 114:E10301-E10308.

- If all Americans were to cut out beef one day a week, it would reduce their carbon footprint by just 0.37%
- Research has demonstrated that removing all livestock and poultry from the U.S. food system would reduce global GHG emissions by only 0.36%



https://www.beefitswhatsfordinner.com/raising-beef/beef-in-a-sustainable-diet; White and Hall, 2017.





- Cattle allow us to produce food on land unsuitable for cultivation, while enhancing ecosystems
- Cattle are ruminants that have the ability to convert forages into a human-edible protein
 - 800 million acres of rangeland, or 35% of the U.S., is unsuitable for any sort of crop production



Nebraska Sandhills





Texas Panhandle

Land

- Maintaining grasslands and preventing conversion to other uses (farming, urban sprawl) prevents the carbon in soil from being released into the atmosphere. Research indicates that improving or reinstating native grasslands holds high potential for storing millions of tons more carbon.
 - 140,000,000 total acres U.S. farmers have enrolled in conservation programs (equal to the total land area of New York and California)
- 2/3 of land in U.S. is used for livestock
 - 70% of this land is "marginal" (insufficient soil quality or moisture to grow crops)
 - $\frac{1}{2}$ of fertilizers used are chemical; $\frac{1}{2}$ are organic (i.e. manure) = organic/vegan are buying products that rely on animal production for fertilizer supply
- Plants, soils, and oceans are only carbon sinks in the world
 - Properly managed grazing systems can be powerful sinks
 - The Great Plains of North America is the largest prairie in the world and acts as America's "carbon vault"



Water

- On average, it takes 308 gallons of water, most of which is recycled, to produce a pound of boneless beef
- Crop irrigation for the production of feed for cattle is the single largest source of water consumption in the beef value chain at approximately 95%
- Water consumed by beef is only around 5%



Consumptive Water Use

https://www.beefresearch.org/CMDocs/BeefResearch/Sustainability%20White% 20Papers%20and%20Infographics/SustainabilityExecutiveSummaryWeb1.pdf



in-sustainable-diet

Water





go into the

production of

one cotton T-shirt.

441 gallons

to produce

one pound of

boneless beef.



to manufacture

a new car.



36 million gallons per day is leaked from The New York City water supply system.



The Environmental Impact of Beef Production in the United States: 1977 Compared with 2007 by Jude Capper

Food Waste

- The U.S. wastes around 40% of food produce and globally 1 in 3 calories produced is wasted (Sustainability Executive Summary, BeefBoard.org, 2015)
 - 50-60% of vegetables/fruits and 10-20% of meat is wasted globally
- Food waste costs the average American family approximately \$2,500 annually (Sustainability Executive Summary, BeefBoard.org, 2015)
- If beef waste were cut in half, the sustainability of the whole industry could be improved by 10 %





NCBA:

https://www.beefresearch.org/sustainability/index.html https://www.beefitswhatsfordinner.com/raising-beef/beef-in-asustainable-diet

https://www.beefitswhatsfordinner.com/resources/infographic-library https://www.agriculture.com/livestock/cattle/qa-sara-place-of-ncba

NPB:

https://www.pork.org/environment/

Dr. Frank Mitloehner – UC Davis <u>https://ghgguru.faculty.ucdavis.edu/about/</u> Twitter - @GHGGuru

U.S. Roundtable for Sustainable Beef

Twitter - @USRSBeef

U.S. Sustainability Alliance

https://thesustainabilityalliance.us/

Twitter - @SustainableUSAg

American Farm Bureau

https://www.fb.org/market-intel/ghg https://www.fb.org/files/FFASF Flyer.pdf

North American Meat Institute

https://www.meatinstitute.org/index.php?ht=a/GetDocumentAction/i/11 7575





Roundtable for Sustainable Beef



- U.S. Roundtable for Sustainable Beef (USRSB)
 - Formed in 2015
 - Large part of US industry is committed to continuous improvement and wants to make consumers feel good about eating U.S. beef
 - Associated with the Global Roundtable for Sustainable Beef
 - https://www.usrsb.org/
- Global Roundtable for Sustainable Beef (GRSB)
 - Developed to advance continuous improvement in sustainability of the global beef value chain through leadership, science and multistakeholder engagement and collaboration
 - <u>https://grsbeef.org/</u>