

It may have never crossed your mind exactly how much goes into that hamburger that you ate for lunch today, your meal may have much more of an environmental impact than you think. You probably know that cattle need land on which to graze, and that they need to be taken care of by their owners. However, you probably don't know all of the details going on behind the scenes of the livestock industry. Livestock production is one of the leading contributors of greenhouse gas (GHG) emissions, loss of biodiversity and water pollution¹. While raising meat products is known to contribute GHG emissions, there are other detrimental impacts to our environment from the process, such as an increase in water and energy consumption, as well as higher levels of antibiotic resistance from treating livestock. Current and increasing beef consumption rates in the United States, and spreading globally, contribute to these problems, but, a change of diet, mindset, and lifestyle could help to curb the effects on the environment.

Greenhouse Gas Emissions

Global livestock production accounts for roughly 14.5% of anthropogenic GHG emissions, with beef representing 65% of global livestock output². Anthropogenic greenhouse gases are any air pollutants that are caused by human activity. A 2016 study found that the carbon footprint from dairy based cows was 10 - 13 kg CO₂ equivalent / kg edible product, and the carbon footprint from beef breed cows was 30 - 45 kg CO₂ equivalent / kg edible product³. CO₂ equivalent is the standard measurement of carbon footprints. This measurement is a way to show how much of an impact many other greenhouse gases would have, by comparing them to CO₂. These numbers are only representative of the production system from the farm through to the slaughtering process, they do not consider the transportation of the finished products. To put this into perspective; for your car to produce the same amount of pollution as one kg of beef (which is a roast large enough to feed about 4 people) or even one gallon of milk, you would need to drive roughly 124 miles⁴. The distance between Berea, KY and Cincinnati, OH (at 119 miles) wouldn't cause quite the same amount of GHG emissions as that roast. In 2015, about 24.8 billion pounds of beef were consumed in the United States, which equates to roughly 435 billion kg GHG annually from the production of beef alone^{5,6}. Greenhouse gases are important to the Earth in moderation, as they help to keep some of the heat energy from the sun in the atmosphere. But with more and more greenhouse gases being emitted into the atmosphere, too much heat is being trapped. This is leading to changes in climates around the world. Many of you are probably aware of this already. Most major news companies have presented scientific research findings that show greenhouse gases are causing the Earth to warm at a steady rate⁷.

Water and Energy Consumption

Livestock production is responsible for consuming roughly 30% of the world's fresh water supply⁸. It is estimated that it takes 442 gallons of water to produce just one pound of boneless meat from beef cattle in the United States⁹. With 40 state managers expecting a water shortage in some portion of their states in the next 10 years, it may be necessary to reconsider whether or not it is worth allocation that water to something like beef cattle¹⁰. By reducing the amount of beef consumed in the United States, there would be a large amount of freshwater that could be used in many other applications. That water could be used for growing more vegetables, or even brought to parts of the country where clean drinking water isn't easily found. We should ask ourselves; do we need that porterhouse? Or do we need to make sure our water supply remains stable? Energy consumption of the livestock industry is not as exorbitant as water consumption, however its impact is worth discussion. The raising of livestock alone makes up roughly 1% of all energy consumption in the United States, this includes fossil fuels, nuclear, biomass, hydroelectric, wind, and nuclear energy¹¹. Beef consumption rates continue to rise, meaning that the amount of energy used to feed that demand will also increase.

Antibiotic Resistance

Antibiotics historically have been a lifesaving discovery, and when used correctly and sparingly they can remain as such. Antibiotics were first discovered when Alexander Fleming returned from a family vacation and noticed a mold which prevented staphylococcus from growing in his Petri dishes. He had effectively discovered penicillin, a drug that went on to change the world of medicine entirely. When they are overused, they can cause adaptations in the bacteria that they were designed to attack, this is called antibiotic resistance, which is becoming a prevalent global issue¹². The year 2011 saw the sale of 13.6 million kilograms of antimicrobials for use in food producing animals, which accounts for 80% of all antibiotics sold in the United States¹³. With so many antibiotics being used just in the livestock sector, the number of antibiotic resistant bacteria is increasing at rates faster than new antibiotics can be discovered. These antibiotic resistant bacteria can easily be spread to humans through the handling of raw, contaminated meat, or simply caring for a contaminated animal¹⁴. A rise in antibiotic resistance means that these infections will become more difficult to treat with current antibiotics, leading to ill-equipped medical centers, and increased mortality¹⁵.

Call to Action

Action needs to be taken to curb the devastating effects of the livestock industry on the natural environment and our own health. Cut back on the amount of beef you consume in order to pollute the air less, save some water for more efficient causes, and

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keep our medicines working. Just by cutting beef out of one meal a week for a year would be equivalent to driving about 532 miles fewer (which is roughly the distance from Berea, KY to Washington, DC).

Conclusion

A change of diet, mindset, and lifestyle could greatly reduce an individual's carbon footprint. Cutting beef out of one meal a week for a year would save 156 kg of CO₂ equivalent. Reducing the amount of meat consumed and produced in the world, could help to curb environmental stress. Greenhouse gas emissions would be reduced. This could help alleviate the pressure of existing water management groups. Antibiotic resistance could also be curtailed, allowing time for further advances in treating infections caused by microorganisms.

1Steinfeld, Henning, Pierre Gerber, T. Wassenaar, V. Castel, Mauricio Rosales, and C. de Haan. "Livestock's Long Shadow," 2006.

2Gerber, P.J, H Steinfeld, B Henderson, A Mottet, C Opio, J Dijkman, A Falcucci, and G Tempio. "Tackling Climate Change through Livestock." Accessed April 11, 2017.

3Mogensen, Lisbeth, Thu Lan T. Nguyen, Niels T. Madsen, Ole Pontoppidan, Teodora Preda, and John E. Hermansen. "Environmental Impact of Beef Sourced from Different Production Systems - Focus on the Slaughtering Stage: Input and Output." *Journal of Cleaner Production* 133 (October 2016): 284-93

4"Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends Report Overview," Reports and Assessments (United States Environmental Protection Agency, November 2016), <https://www.epa.gov/fueleconomy/trends-report>.

5"Population Estimates, July 1, 2016, (V2016)," accessed April 12, 2017, <http://www.census.gov/quickfacts/>.

6"USDA ERS - Statistics & Information," accessed April 12, 2017, <https://www.ers.usda.gov/topics/animal-products/cattle-beef/statistics-information.aspx>.

7 Montzka, S. A., E. J. Dlugokencky, and J. H. Butler. "Non-CO2 greenhouse gases and climate change." *Nature* 476, no. 7358 (2011): 43-50. doi:10.1038/nature10322.

8P. W. Gerbens-Leenes, M. M. Mekonnen, and A. Y. Hoekstra, "The Water Footprint of Poultry, Pork and Beef: A Comparative Study in Different Countries and Production Systems," *Water Resources and Industry*, Water Footprint Assessment (WFA) for better water governance and sustainable development, 1-2 (March 2013): 25-36

9J. L. Capper, "The Environmental Impact of Beef Production in the United States: 1977 Compared with 2007," *Journal of Animal Science* 89, no. 12 (December 1, 2011)

10U. S. Government Accountability Office, "Freshwater: Supply Concerns Continue, and Uncertainties Complicate Planning," no. GAO-14-430 (May 22, 2014), <http://www.gao.gov/products/GAO-14-430>.

11Patrick Canning et al., "Energy Use in the U.S. Food System," Economic Research (United States Department of Agriculture), accessed April 11, 2017, <https://www.ers.usda.gov/publications/pub-details/?pubid=46377>.

12"Antimicrobial Resistance," *WHO*, accessed April 11, 2017, <http://www.who.int/mediacentre/factsheets/fs194/en/>.

13"Antibacterial Drug Use Review" (Food and Drug Administration, n.d.), <https://www.fda.gov/downloads/drugs/drugsafety/informationbydrugclass/ucm319435.pdf>.

14Centers for Disease Control and Prevention, "NARMS - Combating Antibiotic Resistance with Surveillance," accessed April 11, 2017, <https://www.cdc.gov/narms/faq.html>.

15"Antibiotic Resistance." *WHO*. Accessed April 11, 2017. <http://www.who.int/mediacentre/factsheets/antibiotic-resistance/en/>.