

Carol Owens

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The U.S. Meat Production System and the Global Environmental Impact

Americans consume 60% more meat than Europeans. US meat consumption has remained fairly constant in the last several years (or dropped) but other countries have markedly increased their meat consumption. Global meat production from 1971 to 2010 tripled while the global population increased by only 81% (Hamershalg, 2011). Because of this increase in the demand for meat, the environmental effects of the meat production system are likely to continue increasing in the coming years.

How does the U.S. Meat production system work?

Before the 1960s and 1970s small and mid-sized livestock producers existed which were often integrated with plant agriculture. This was a beneficial system since the livestock could feed on the remnants of leftover crops and produce manure right on the fields to provide natural fertilizer. In the last quarter of the 20th century confined animal feeding operations (CAFO) began to emerge. CAFOs are large operations with tens to hundreds of thousands of animals within a concentrated space, with little space for the animals to move around. These CAFOs have begun to dominate the market. Just ten companies produce more than 90% of the United States' poultry supply and 55% of the pigs raised for meat in the U.S. are owned by 110 companies (Facts about Pollution from Lifestock, 2013). Beef has perhaps been monopolized the least with 830,000 cattle operations in 2000, though this has decreased by 20% from 1986 (Beef Production, 2012).

Environmental Impact of CAFOs

Because of the close quarters of the CAFOs meat producers give animals low doses of "preventative" antibiotics to animals that are not sick in order to control the spread of diseases. Over 70% of antibiotics used in the U.S. are used for this purpose. Concerns have been raised by doctors over the use of antibiotics in livestock as it may lead to antibiotic resistance in humans (Starmer).

Manure management becomes a rather large and interesting problem when livestock productions have the number of animals they do in today's CAFOs. Hogs in the CAFOs in North Carolina produce more total fecal matter than the amount produced by the populations of LA, New York and Chicago combined. When so much manure is concentrated in one area it can contaminate surface and groundwater when it is accidentally leaked. Normally owners of CAFOs have large lagoons that hold the manure (Starmer).

Agriculture called "monoculture" is encouraged from large CAFOs. Monoculture is the practice of growing only one crop on large plots of land. CAFOs increase the demand for monoculture because of the demand for feed for their large number of livestock. Monoculture is bad for the soil because it continuously depletes the soil of the same nutrients. CAFOs usually get shipments of the feed trucked in from these large farms, instead of in the past when livestock were integrated onto farms and less trucking was required (Starmer).

Environmental benefits of CAFOs

Despite some of the negative consequences from the industrialization of livestock production, it isn't black and white. The increase in agriculture industrialization has increased the efficiency of the meat industry and reduced some of its environmental impacts. The most apparent change beneficial to the environment is the reduction in land use. A study found that cattle production in 2007 compared to 1977 uses 33% less land for the same amount of beef output. Also the total output of beef from the cattle raised has been increased, requiring 30% less cattle. The overall carbon footprint per kg of beef output has been reduced by 16% (Capper, 2011).

Overall Environmental Impact

Livestock production uses 30% of the total ice-free land area on the planet, making the meat industry the largest user of land globally. This number includes the land used to grow the feed for livestock. This land use contributes to deforestation and competes with biodiversity. In Latin America where deforestation is prevalent, 70% of the deforested land is used for grazing pastures (Steinfeld, et al., 2006).

The livestock sector is responsible for 18% of global greenhouse gas emissions when measured in CO₂ equivalent, contributing a greater amount to global emissions than the transportation sector (Steinfeld, et al., 2006). These greenhouse gas emissions come from several different sources. The biggest contribution to CO₂ emissions is caused by livestock's deforestation. Overall livestock production is responsible for 9% of global CO₂ emissions. Meat production also emits 37% of anthropogenic methane, which has a global warming potential 23 times that of CO₂. These methane emissions are a product of ruminants' digestive process, and released through belching or flatulence. Nitrous oxide is another byproduct of meat production, coming from the animal's manure. The meat industry emits 65% of anthropogenic nitrous oxide emissions, which have a global warming potential 296 times that of CO₂. In addition, livestock production is responsible for two-thirds of ammonia emissions which contribute to the production of acid rain (Steinfeld, et al., 2006).

Out of the most popular meats in the U.S., beef has the highest impact on the environment. When compared to other meat products such as chicken, turkey, pork, eggs, and dairy, beef production involves 28 times more land, 11 times more irrigation water, releases 5 times as many greenhouse gas emissions, and six times as much nitrogen fertilizer. The impact of poultry, pork, eggs, and dairy based on these factors are all similar, to within a factor of two (Eshel, Shepon, Makov, & Milo, 2014). Let's call this group the "low impact meats".

In comparison with non-meat products, other plant-based agricultural crops generally have a lower environmental impact per consumed Mcal. This means that non-meat, plant-based foods usually use resources more efficiently. Crops like rice, wheat, and potatoes, need on average six times less land than the low impact meats, release half as many greenhouse gas emissions, and use three times less nitrogen fertilizer, though they do use double the irrigation water.

Beef is much more environmentally intense than the other popular meats in the U.S. like chicken and pork, as well as livestock products like dairy and eggs. These lower impact livestock products use more resources and pollute more than popular agricultural crops like rice, wheat and potatoes, though these crops do use about twice as much irrigation water. Meat production uses more resources than plant-based agriculture since more resources must be used to feed the livestock. For the

amount of food we get out, beef is the least efficient in turning these resources into protein that people eat.

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