BEEF FACTS:
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Fact Sheet 3 in the Series: Tough Questions about Beef Sustainability

Would removing beef from the diet actually reduce greenhouse gas emissions?

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Some have proposed that simply removing beef from the human diet could significantly lower greenhouse gas (GHG) emissions. However, upon examination of the scientific evidence, completely removing beef from the diet would likely not result in huge declines in GHG emissions, and would likely have negative implications for the sustainability of the U.S. food system.

One must first consider the amount of beef consumed by Americans. The current U.S. Dietary Guidelines for Americans recommends 5.5 ounces of lean protein per day for a person consuming a 2,000-calorie diet.[1] Beef is one of the most common sources of lean protein in the United States, with 1.8 ounces of beef per day available to U.S. consumers in 2013, as reported in USDA's Economic Research Service (ERS) Loss-Adjusted Food Availability Data Series.[2] The ERS Loss-Adjusted Food Availability Data Series is derived from ERS's food availability data by adjusting for food spoilage, plate waste, and other losses to closely approximate actual intake. Per capita beef availability (loss adjusted) has actually been declining in the United States over the past 35 years (**Figure 1**) due in part to beef production not keeping pace with U.S. population growth. Along with being a significant source of lean protein, beef provides key nutrients such as iron, zinc, and B vitamins. Removing beef from the food chain would result in consumers having to seek alternative protein and micronutrient sources.

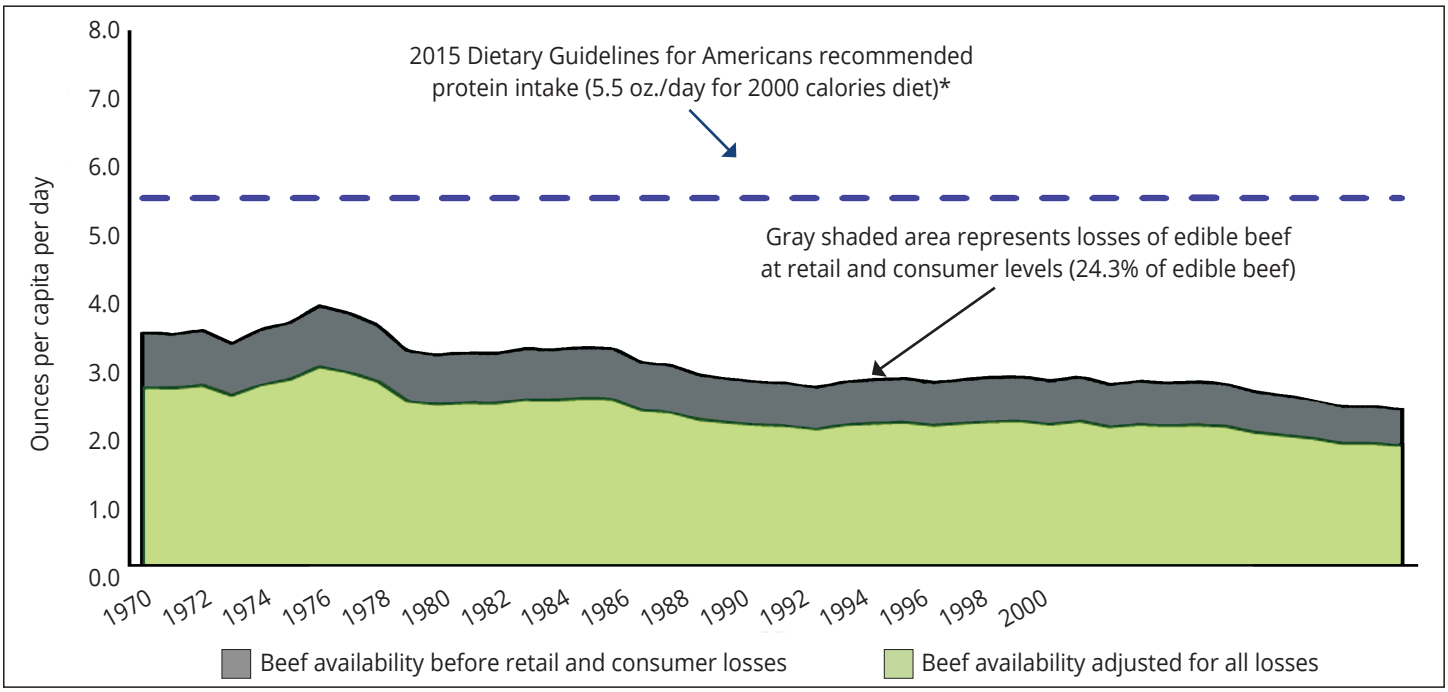

Figure 1. U.S. boneless beef availablitiy per capita[2] compared to U.S. Dietary Guidelines protein recommendations.[1]
Source: USDA-ERS. *Protein intake recommendation includes: meats, poultry, eggs (3.7 oz. - eqld),seafood (1.1 oz. - eqld), nuts, seeds, soy products (0.7 oz. - eqld).

According to the U.S. Environmental Protection Agency (EPA), beef cattle production was responsible for 1.9% of total U.S. GHG emissions in 2013.[3] By comparison, GHG emissions from transportation and electricity accounted for 25.8% and 30.6% of total U.S. GHG emissions in the same year (**Table 1**).[3] Comparing food production (essential for human life) to transportation and electricity (non-essential for human survival, but important to our modern lifestyles) is problematic. However, the comparison is instructive because though electricity and transportation produce much of the GHG emissions in the United States, most people do not call for the elimination of electricity or transportation. Rather, efforts are made to lower the GHG emissions produced to provide the same energy and transportation services (e.g. switching to renewable energy sources for electricity generation). Using this frame of reference, another way to consider GHG emissions from beef production would be, "How can the same amount of human nutritional value be produced by the beef system while producing fewer GHG emissions?" Studying the different ways inputs (feed, water, and land) can be used more efficiently throughout the beef value chain to reduce GHG emissions per pound of beef would provide the means to maintain the same level of food production while reducing GHG emissions. Over time, beef production has made impressive advances to meet the protein demands of a growing population while reducing the amount of natural resources required to produce a pound of beef.[4,5,6] For example, due to improved genetics (of cattle and the plants they consume), animal nutrition, management, and the use of growth promoting technologies, the U.S. beef industry has decreased its GHG emissions per pound of beef 9-16% from the 1970s to today.[5,7] Further improvements in the efficiency of beef production are being continuously evaluated and researched at universities and research institutions, in the United States and globally.

Another key component of reducing GHG emissions from the whole beef system is the role of the consumer. Over 20% of edible beef is wasted at grocery stores, restaurants, and in the home (**Figure 1**).[8] As with other foods, the amount of non-renewable resources used and the environmental impacts that went into producing the portions of beef that are being sent to a landfill are often overlooked. Consumers could improve beef sustainability by 10% if beef waste were reduced by half.[8]

Beef production makes many positive contributions to the sustainability of our food system that are often overlooked by analyses of GHG emissions' impact of removing beef from the diet. Cattle have the ability to utilize forages (e.g., grass) and by-products (e.g., distillers grains) that are unfit for human consumption. Specifically cattle can utilize cellulose, one of the world's most abundant organic (carbon containing) molecules, that is indigestible by humans.[6] Consequently, U.S. beef producers feed their cattle feed sources that are not in direct competition with humans and/or would have gone to waste (by-products).[6] Cattle can also convert low-quality feeds into high-quality protein from land not suited for cultivation, thereby reducing soil erosion and enhancing soil carbon storage.[6] Furthermore, integrated crop and beef systems (e.g., using cattle to graze crop residues and cover crops) can lead to many positive environmental sustainability outcomes including increased soil water-holding capacity and enhanced nutrient cycling.[9]

Bottom Line: **Beef is a valuable asset to the human diet; it is an affordable, nutrient-dense source of lean protein. As with the production of all foods, the production of beef results in GHG emissions; however, direct emissions from the U.S. beef industry are only estimated to be 1.9% of the total U.S. GHG emissions.[3] Thus, even without consideration of the unintended consequences and impacts of alternative protein sources, completely removing beef from the U.S. diet would likely have**

Table 1. U.S. EPS GHG Emissions Inventory for 2013

Item	CO2-eq emissions (Million Metric Tons)	Percent of U.S. total CO2-eq emissions
Enteric Methane Emissions from Beef Cattle (from their digestive tracts)	117.1	1.75%
Beef Cattle Manure Nitrous Oxide Emissions	7.6	0.11%
Beef Cattle Manure Methane Emissions	3.0	0.04%
Total Direct Emissions from U.S. Beef Cattle	**127.7**	**1.9%**
Burning fossil fuels for transportation carbon dioxide emissions	1,718.4	25.8%
Burning fossil fuels for electricity generation carbon dioxide emissions	2,039.8	30.6%
All other GHG sources	**2,787.8**	**41.7%**
2013 U.S. Total CO2-eq Emissions	**6,673**	**100%**

Source: U.S. EPS Executive Summary 2015

a minimal impact on GHG emissions. However, as historical progress has demonstrated (GHG emissions per lb. of beef have been reduced 9-16% since the 1970s[5,6]), there are opportunities to reduce beef's impact, chief among them being reducing consumer waste.

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