Beef's role in a sustainable food system

Sara E. Place, Ph.D.

Senior Director, Sustainable Beef Production Research

National Cattlemen's Beef Association, a contractor with the Beef Checkoff

Funded by Beef Farmers & Ranchers

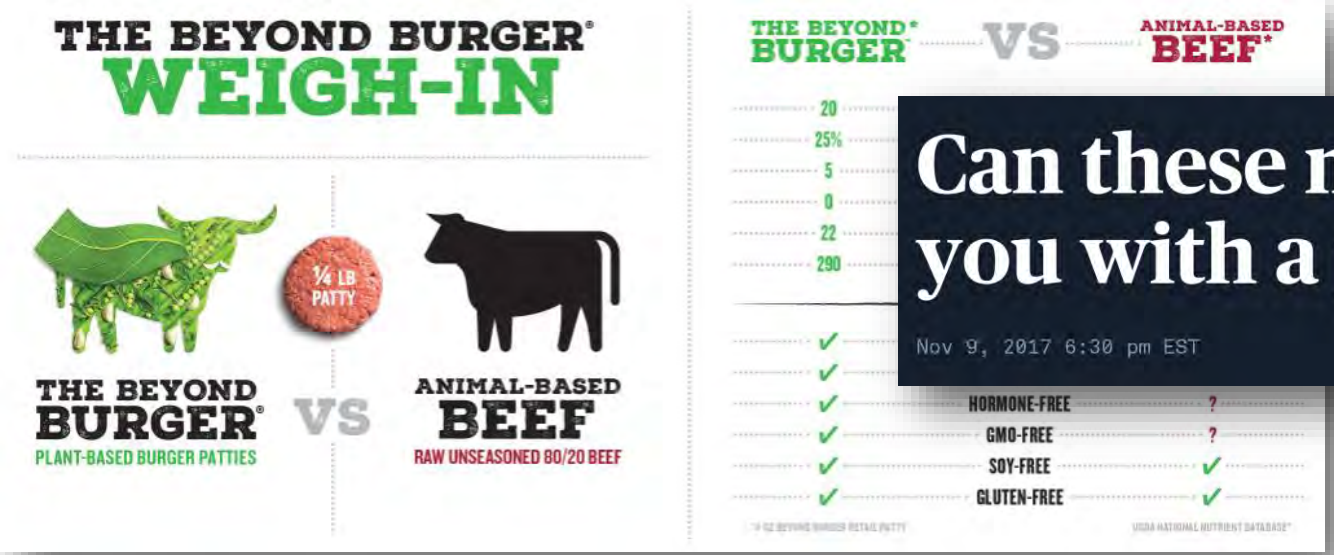
FOOD FOR THOUGHT

Silicon Valley's Bloody Plant Burger Smells, Tastes And Sizzles Like Meat

June 21, 2016 · 7:00 AM ET

LINDSEY HOSHAW

FROM KQE



Can these mock meat entrepreneurs fool you with a plant-based burger?

Nov 9, 2017 6:30 pm EST

Photo courtesy of Oklahoma State University

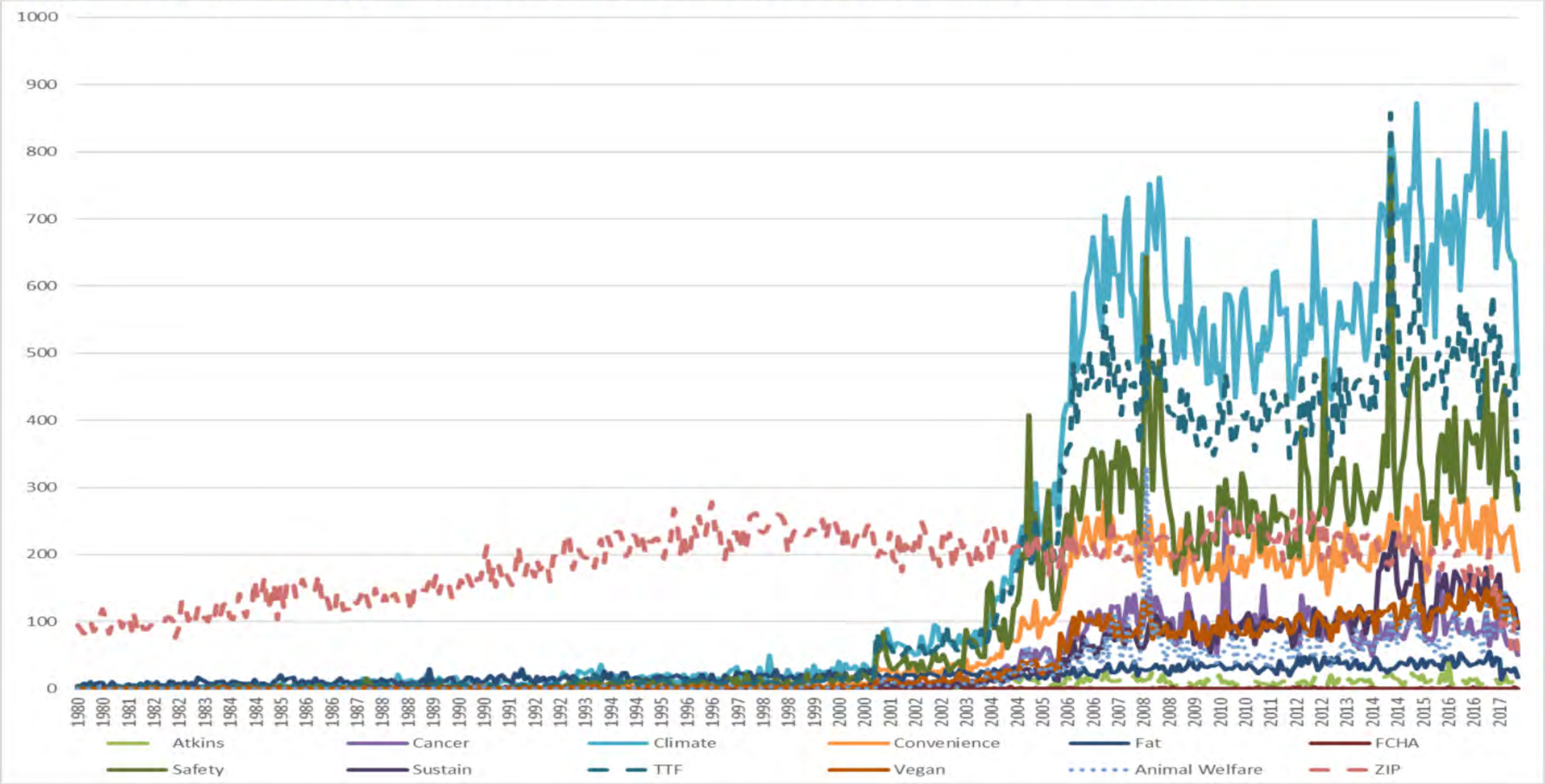
Beef’s cattle’s upcycling superpower

Livestock's Long Shadow

"The Livestock sector is a major player, responsible for 18% of GHG emissions measured in CO_2e. This is a higher share than transport" (FAO 2006)

- Used Life Cycle Assessment
  - Included "land use change"

Figure 3.1. Beef Industry, Monthly Media and Medical Counts: Jan. 1980 – Nov. 2017



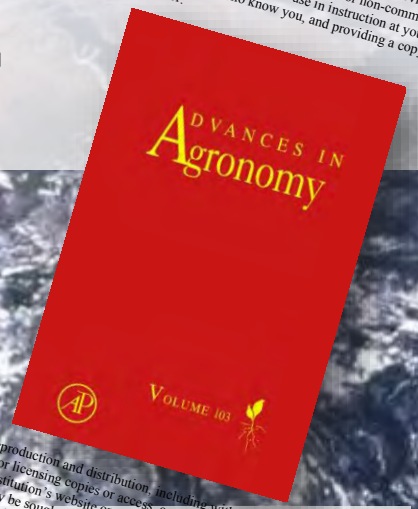
Tonsor, Lusk, and Schroeder, 2018

Clearing the air…


CHAPTER ONE

CLEARING THE AIR: LIVESTOCK'S CONTRIBUTION TO CLIMATE CHANGE

Maurice E. Pitesky,* Kimberly R. Stackhouse,† and Frank M. Mitloehner†,1




Page last updated at 00:15 GMT, Wednesday, 24 March 2010

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UN body to look at meat and climate link

By Richard Black
Environment correspondent, BBC News

SEE ALSO

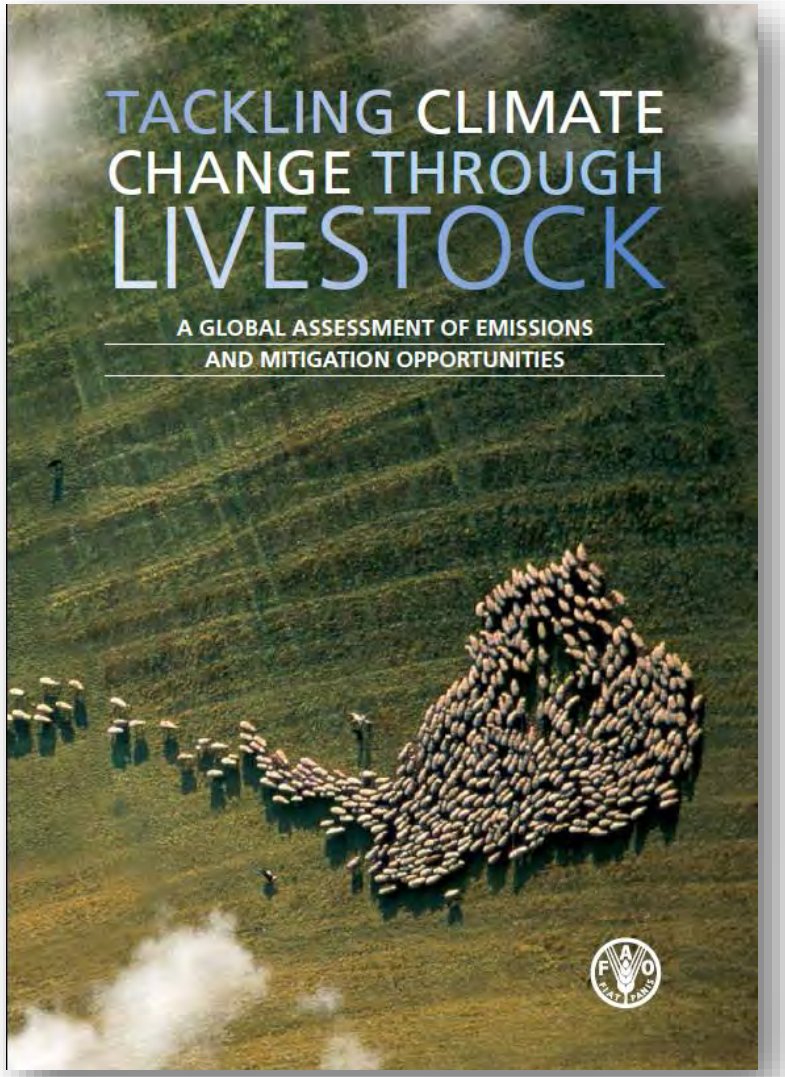
- Livestock's Long Shadow is a global assessment, should not be applied regionally
  - US: 3.8% of GHG emissions **(beef = 2%)**
  - Paraguay: ~50%
  - Ethiopia: ~90%
- Transport was not analyzed with LCA method

One of the authors of Livestock's Long Shadow, FAO livestock policy officer Pierre Gerber, told BBC News he accepted Dr Mitloehner's criticism.

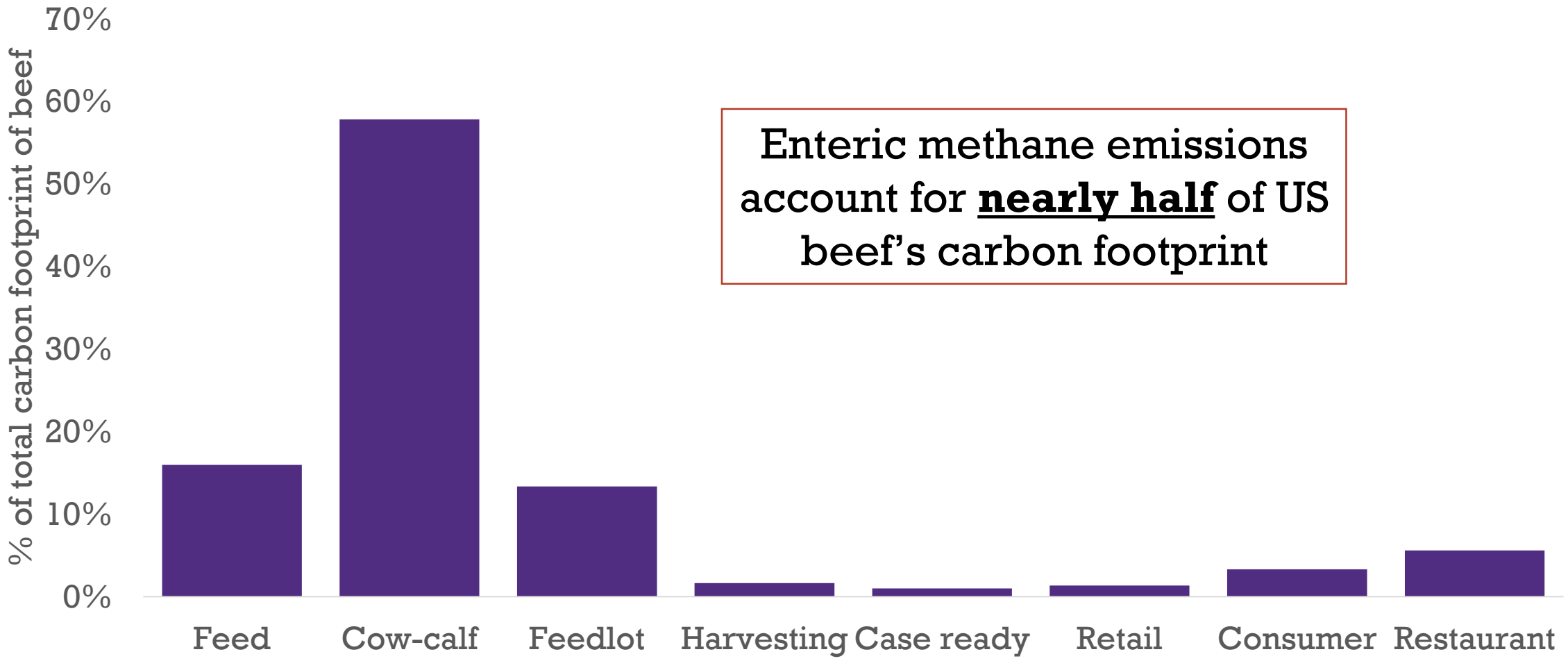
"**I must say honestly that he has a point - we factored in everything for meat emissions, and we didn't do the same thing with transport, we just used the figure from the IPCC,**" he said.

New UN FAO report

- 14.5% of global anthropogenic GHG
- Regions with more modern, intensive production systems have lower GHG emissions per unit of beef



Global warming potential % contribution across the supply chain



Enteric methane emissions account for **nearly half** of US beef's carbon footprint

Source: US Beef Sustainability Assessment

Enteric methane emissions in the context of US GHG emissions

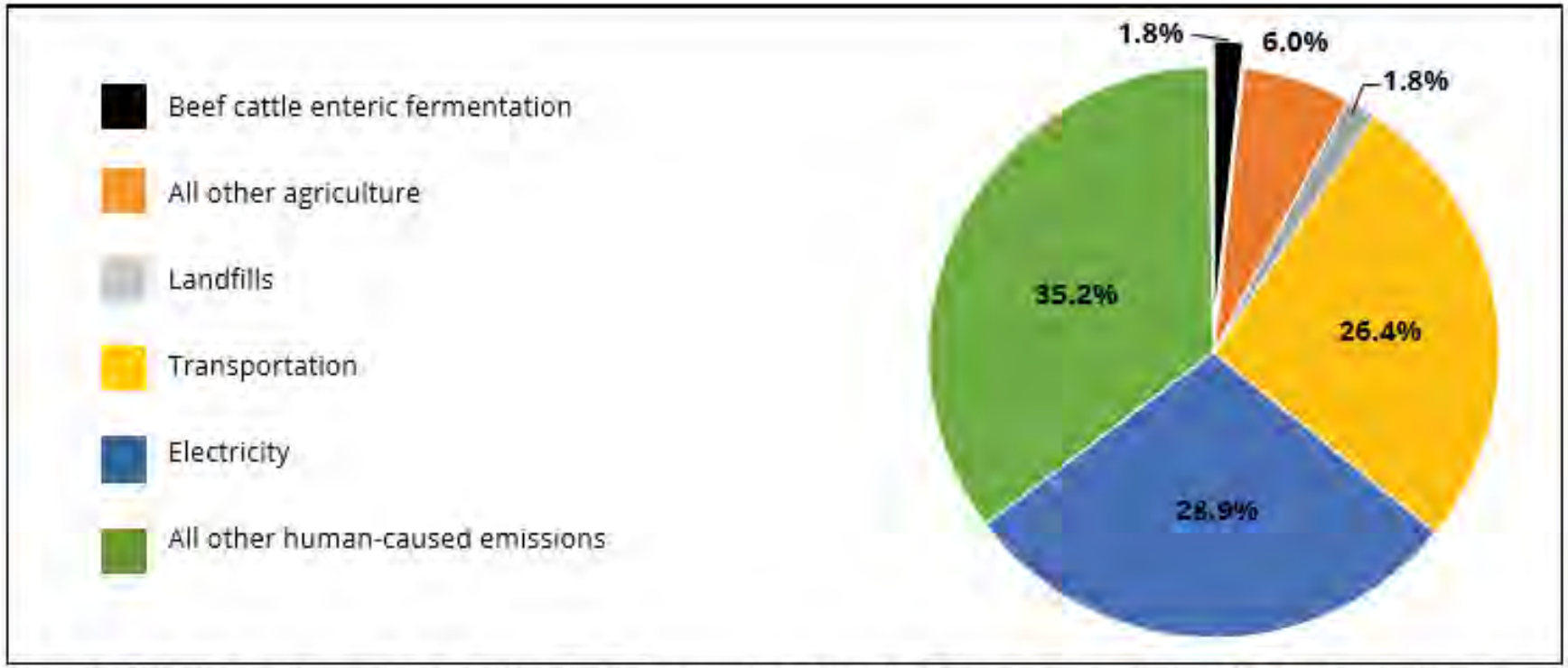
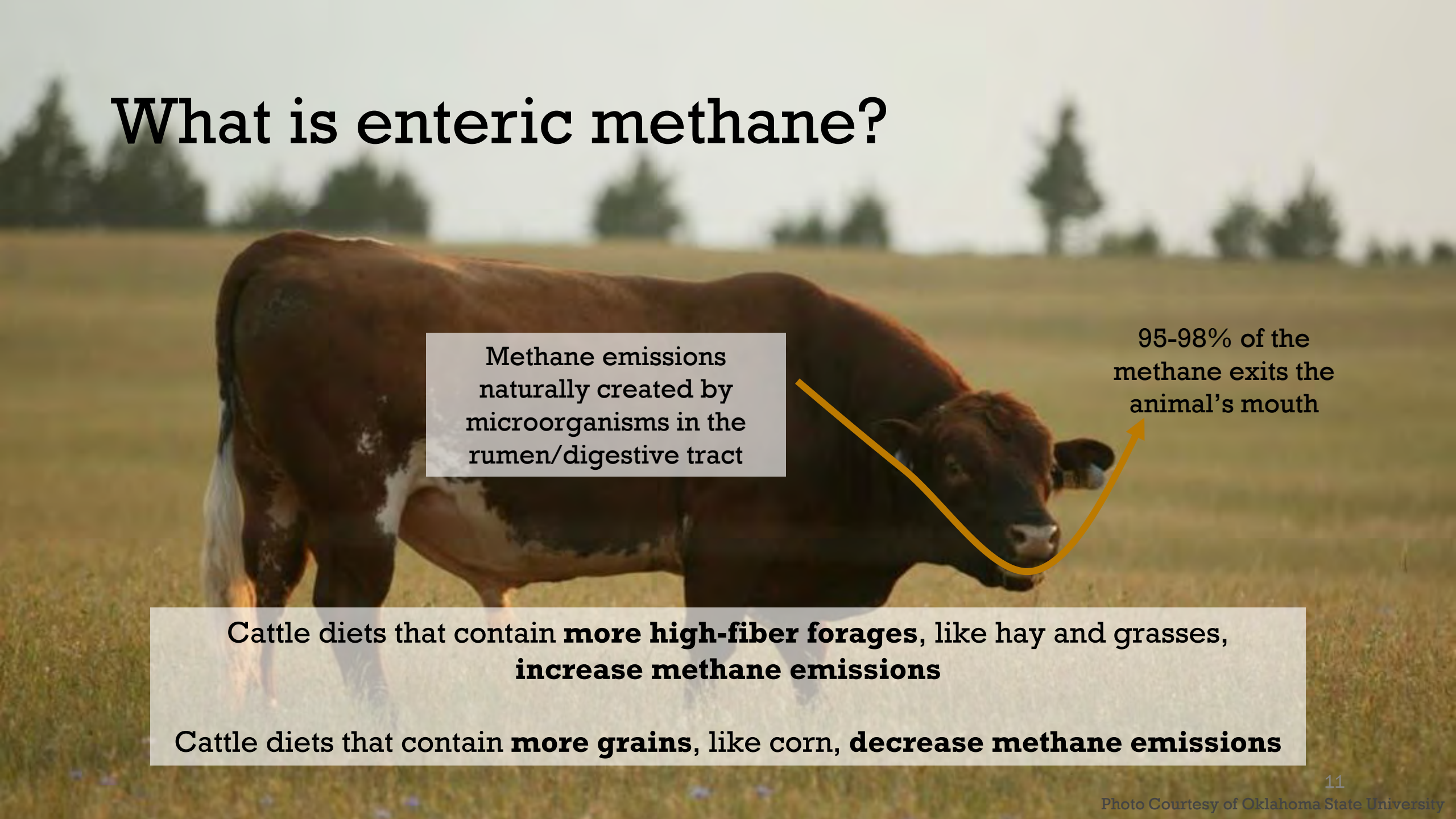


Figure 1. 2015 US Greenhouse Gas Emissions (GHG) Inventory in carbon dioxide equivalent emissions. Methane emissions from beef cattle represented 1.8% of all human-caused GHG emissions in the U.S. in 2015.[1]

According to the UN FAO STAT database, enteric methane emissions from U.S. beef cattle have declined by 34% since 1975.

Source: US EPA GHG Emissions Inventory, 2016

What is enteric methane?



Methane emissions naturally created by microorganisms in the rumen/digestive tract

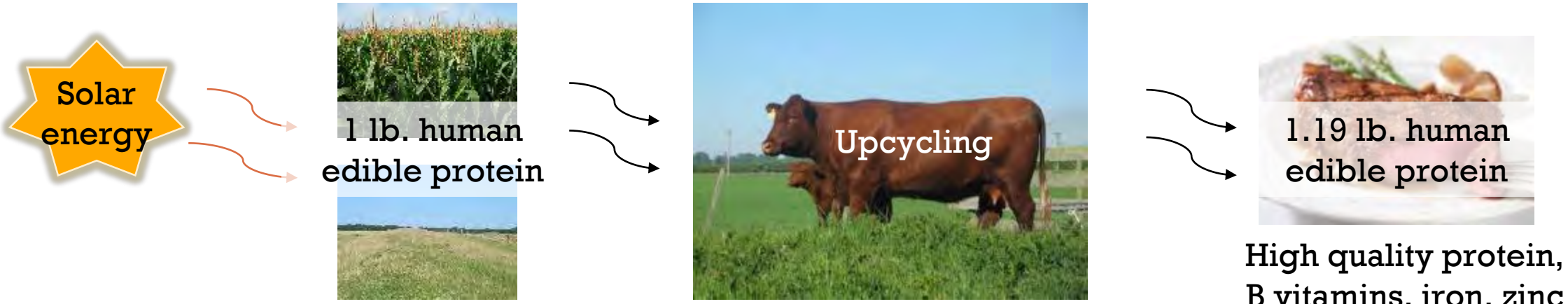
95-98% of the methane exits the animal's mouth

Cattle diets that contain **more high-fiber forages**, like hay and grasses, **increase methane emissions**

Cattle diets that contain **more grains**, like corn, **decrease methane emissions**

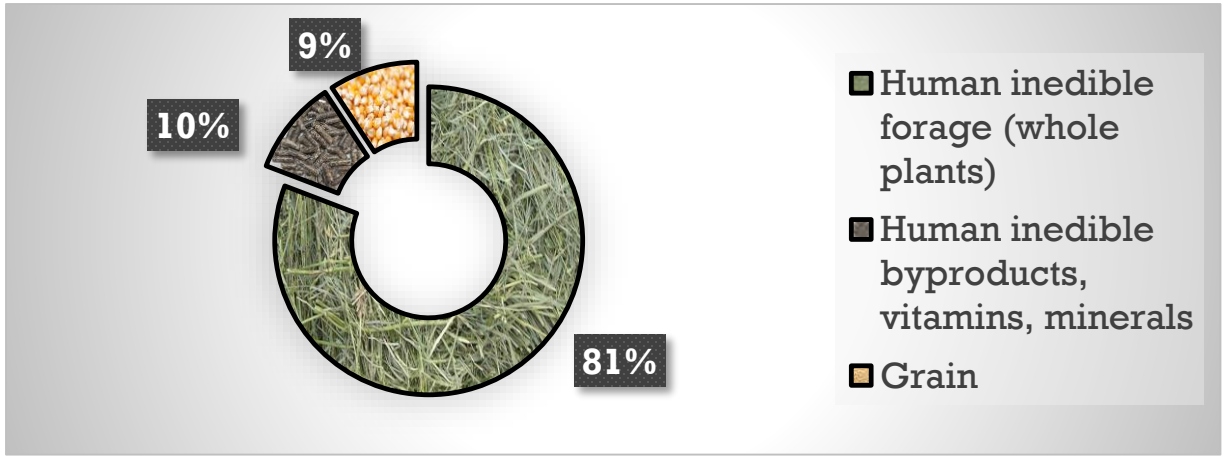
Photo Courtesy of Oklahoma State University

Cattle are upcyclers: more than simply recycling they are upgrading plant proteins (incl. plant leftovers) into higher quality protein for people



Human edible and inedible plants

High quality protein, B vitamins, iron, zinc



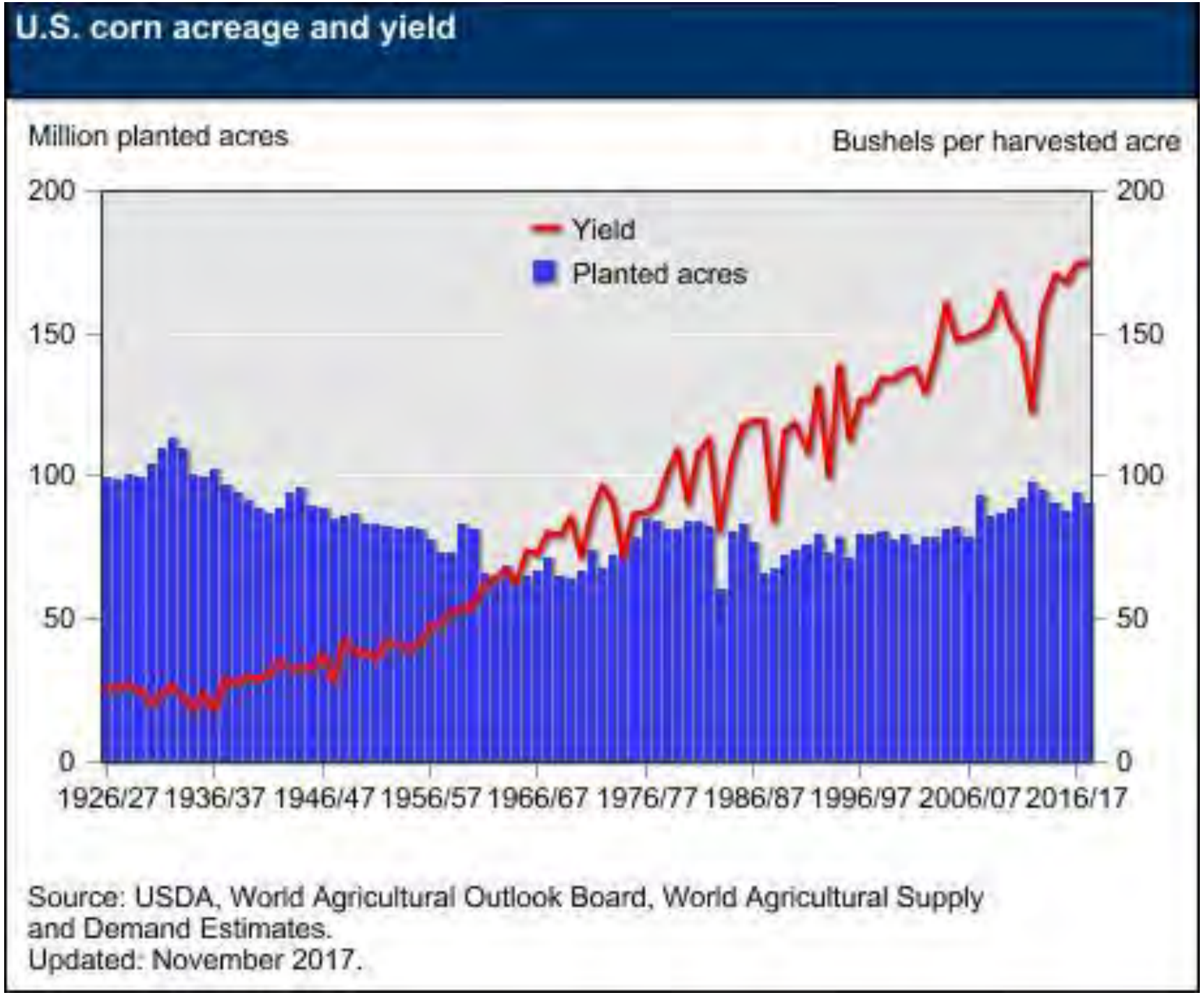
Greater than 90% of what grain finished beef cattle eat is not in competition with the human food supply – upcycling is the fundamental value beef brings to a sustainable food system!

Source: CAST, 1999 and NASEM, 2016

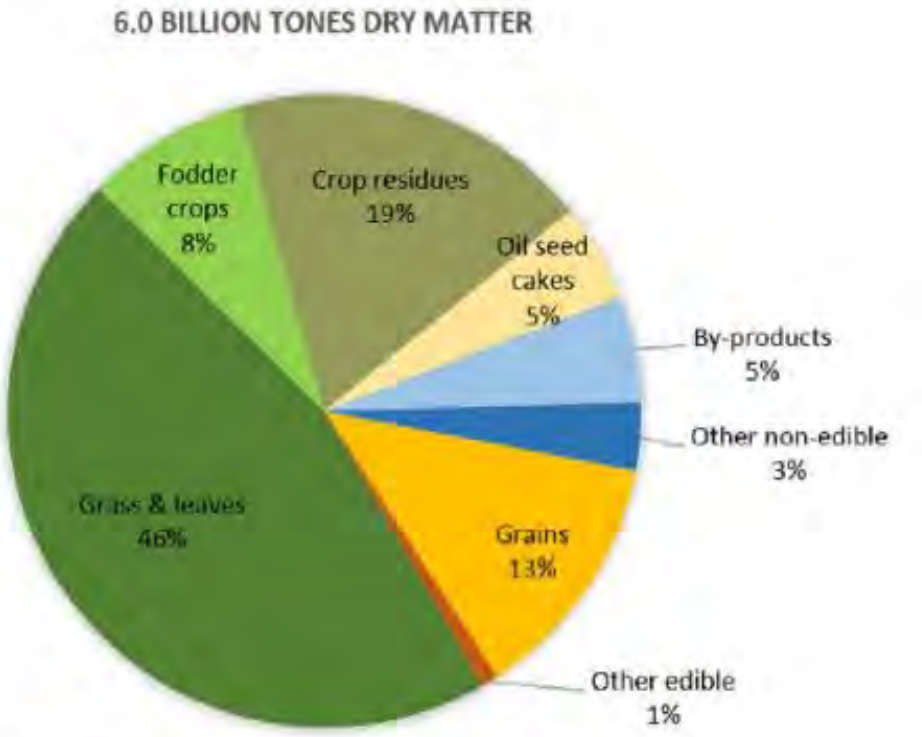
Why feed cattle corn? Because they upgrade the protein

Essential amino acid	Corn grain, g/kg	Beef, g/kg of choice grade carcass weight	% more essential AA in kg of beef compared to kg of corn
Tryptophan	0.67	2.01	300%
Threonine	3.54	7.46	211%
Isoleucine	3.37	7.67	228%
Leucine	11.55	13.76	119%
Lysine	2.65	14.43	545%
Methionine	1.97	4.3	218%
Phenylalanine	4.63	6.7	145%
Valine	4.77	8.42	177%
Histidine	2.87	5.79	202%
Arginine	4.7	11.2	235%

Source: National Nutrient Database for Standard Reference Release 28


U.S. corn acreage and yield
Million planted acres
Bushels per harvested acre
Yield
Planted acres
200
150
100
50
0
1926/27
1936/37
1946/47
1956/57
1966/67
1976/77
1986/87
1996/97
2006/07
2016/17
Source: USDA, World Agricultural Outlook Board, World Agricultural Supply and Demand Estimates.
Updated: November 2017.

Livestock: On our plates or eating at the table?



Fodder crops: grain and legume silage, fodder beets
Crop residues: straws and stover, sugar cane tops, banana stems
By-products: brans, corn gluten meal and feed, molasses, beetroot pulp and spent breweries, distilleries, biofuel grains
Other non-edible: second grade cereals, swill, fish meal, synthetic amino acids, lime
Other edible: cassava pellets, beans and soy beans, rapeseed and soy oil

- 86% of what livestock eat globally isn't in competition with human food
- Contrary to commonly cited figures, 1 kg of meat requires 2.8 kg of human-edible feed for ruminants and 3.2 for monogastrics (e.g., pigs, chickens)
- **For every 0.6 kg of human edible protein cattle eat, they return 1 kg of human edible protein in the form of beef**

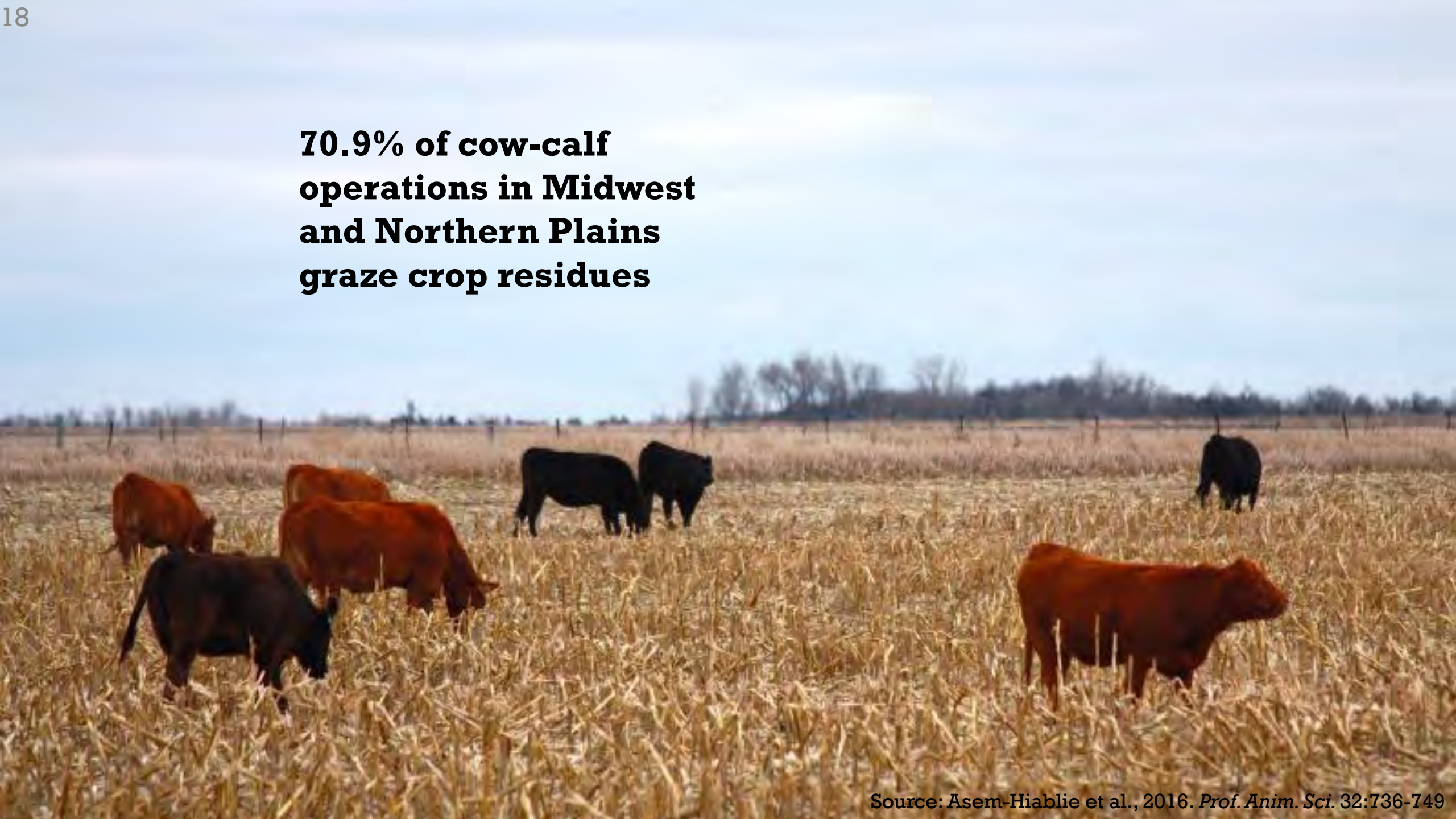
Mottet et al., 2017. Global Food Security. 14: 1-8

Beef’s role in a sustainable food system

Beef cattle allow us to produce food on land unsuitable for cultivation, while enhancing ecosystems


770 million acres of rangeland unsuitable for growing crops in the United States
Source: USDA-ERS

70.9% of cow-calf operations in Midwest and Northern Plains graze crop residues



Source: Asem-Hiablie et al., 2016. *Prof. Anim. Sci.* 32:736-749


~1.9 million cattle
graze small grains
in KS, OK, and TX
Source: USDA-NASS

The United States has the most environmentally-efficient beef production system in the world

And the U.S. beef community continues to shrink it's environmental footprint

Source: US Beef Sustainability Assessment

Carbon footprint of US beef is lower than many parts of the world

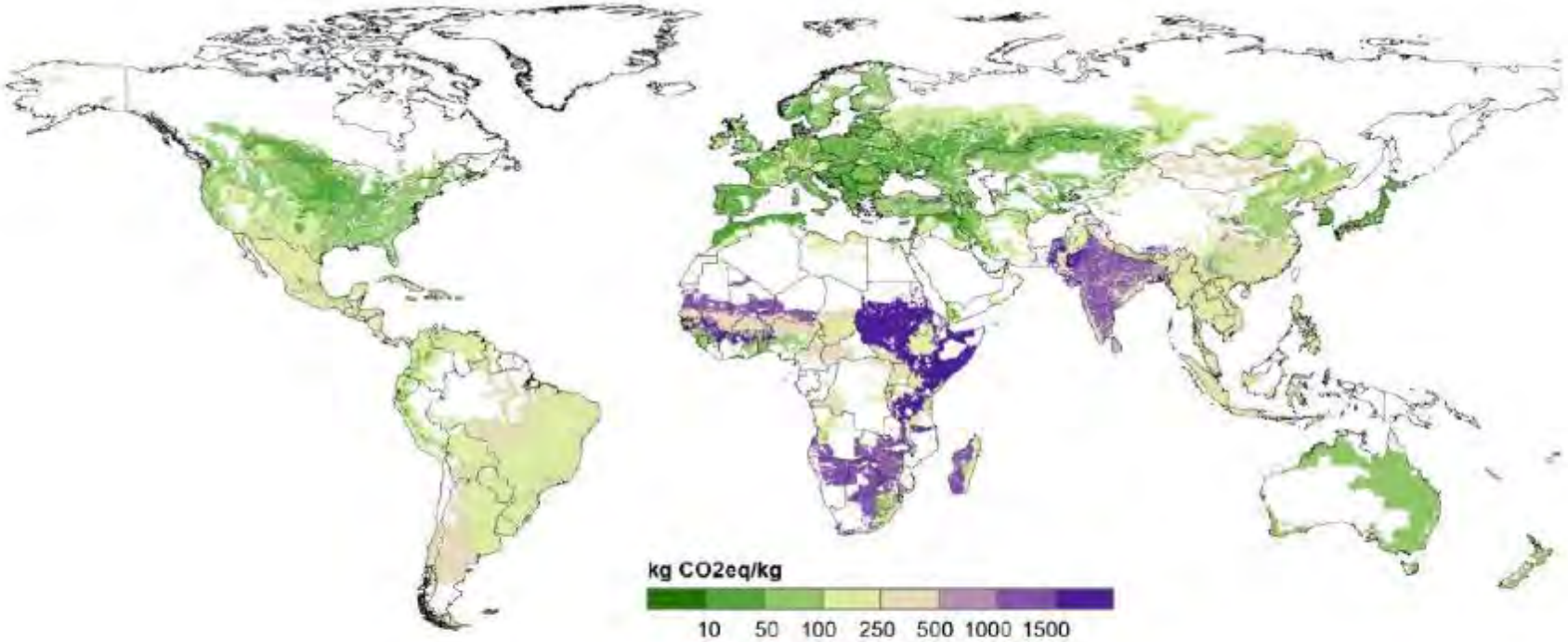
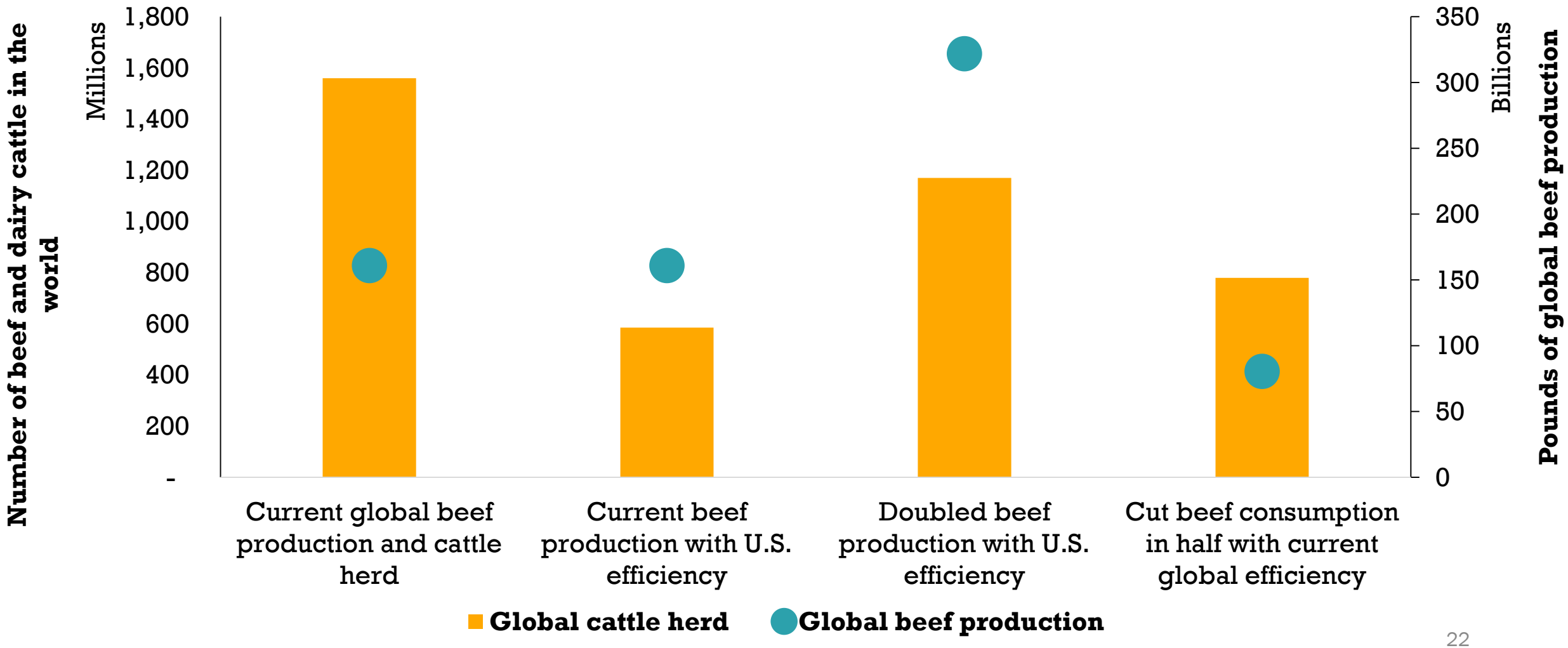


Figure S 47. GHG efficiency of bovine meat production (expressed in kg CO_2eq/g protein) in the year 2000

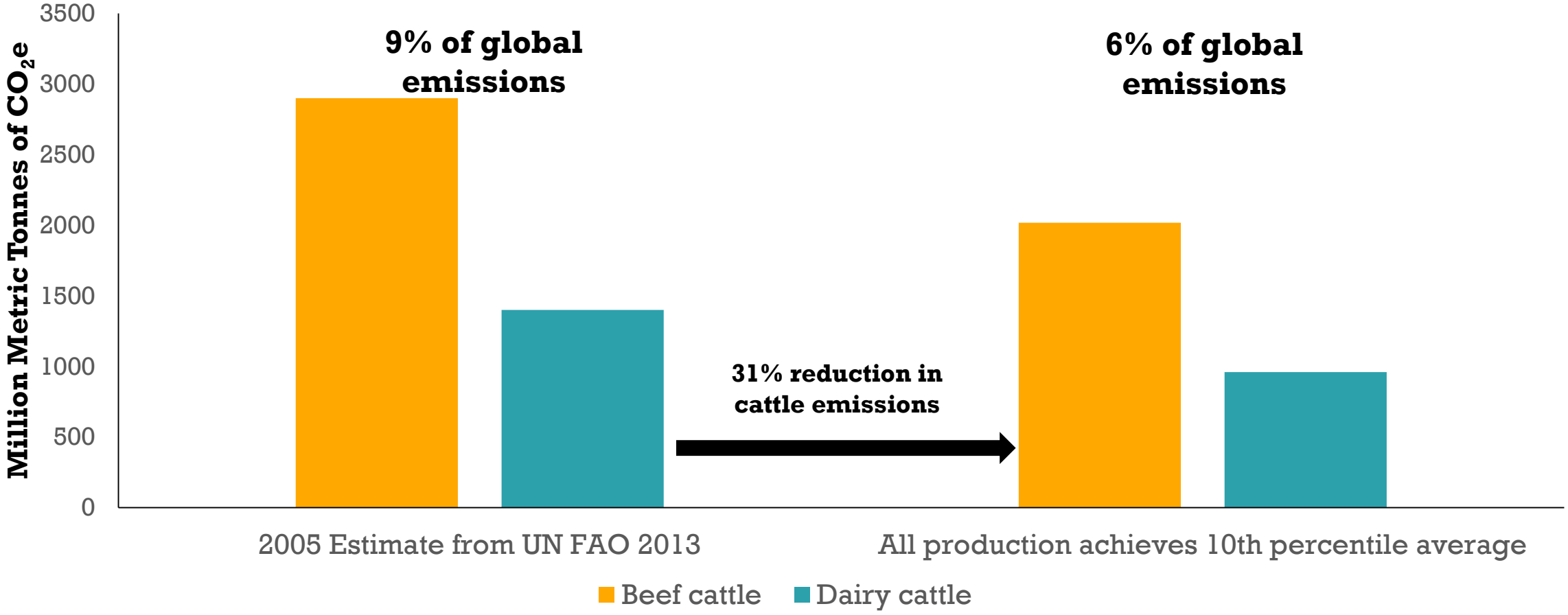
Source: Herrero et al., 2013. *Proc. Natl. Aca. Sci.* 110: 20888-20893

Achieving U.S.-level productivity around the world would improve sustainability



Source: UN Food and Agriculture Organization FAOSTAT database

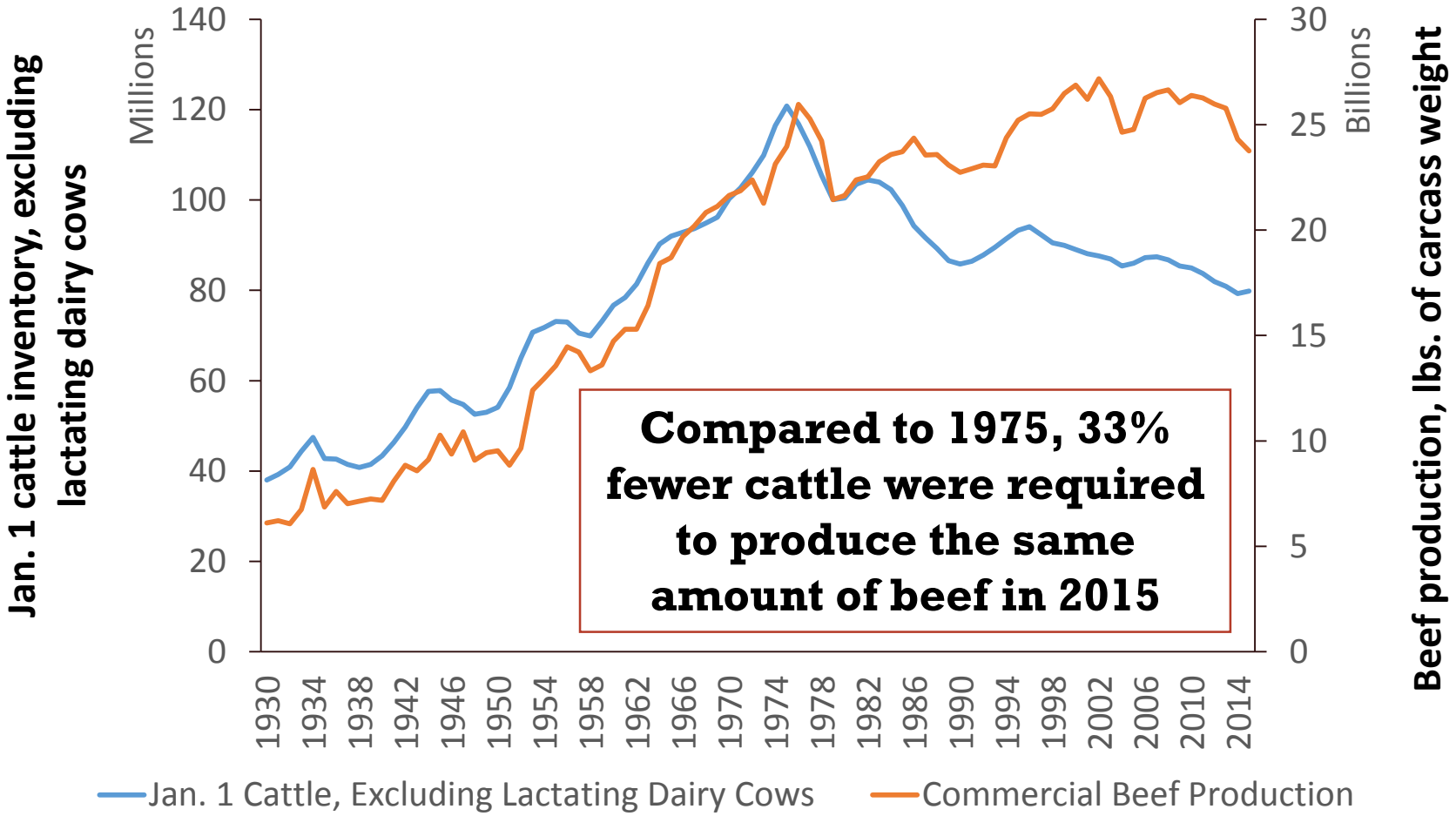
Achieving the average emission intensity of the 10th percentile for beef and dairy production would lower global GHG emissions 3%



With no change in beef and dairy product output!

Source: UN FAO, 2013. *Tackling Climate Change through Livestock*

US cattle inventory and beef production trends (1930 – 2015)



Source: USDA-NASS

The Beef Checkoff Program launched a comprehensive lifecycle assessment to quantify and benchmark environmental, social and economic aspects of beef industry sustainability from 2005 - 2011. Improvements included:

- **10%** Emissions to water
- **7%** Emissions to soil
- **2%** Greenhouse gas emissions
- **32%** Occupational illnesses and accidents
- **2%** Energy use
- **2%** Resource consumption
- **3%** Water use

Increased use of precision farming techniques

Improvements in crop yields

Improved genetics, health and nutrition for cattle

Increased use of biogas capture and conversion

Improved implementation of right-sized packaging

How was sustainability improved?

Future opportunities to further increase sustainability:

- Continue to increase waste water recovery and biogas capture
- Explore additional packing alternatives to reduce inputs
- Reduce food waste
- Continue to optimize nutrient application to soil and crop yields
- Further adoption of water efficient irrigation systems

Source: Beef Industry Sustainability Lifecycle Assessment, funded by the beef checkoff

Committed to a journey of continuous improvement

BEEF

Funded by the Beef Checkoff.

How much water does it take to produce beef?

Range of water use estimates in the literature: **317 – 23,965 gallons per lb. of boneless beef**

Blue water = surface and groundwater

Green water = evapotranspiration water (precipitation)

Gray water = water required to dilute out pollutants

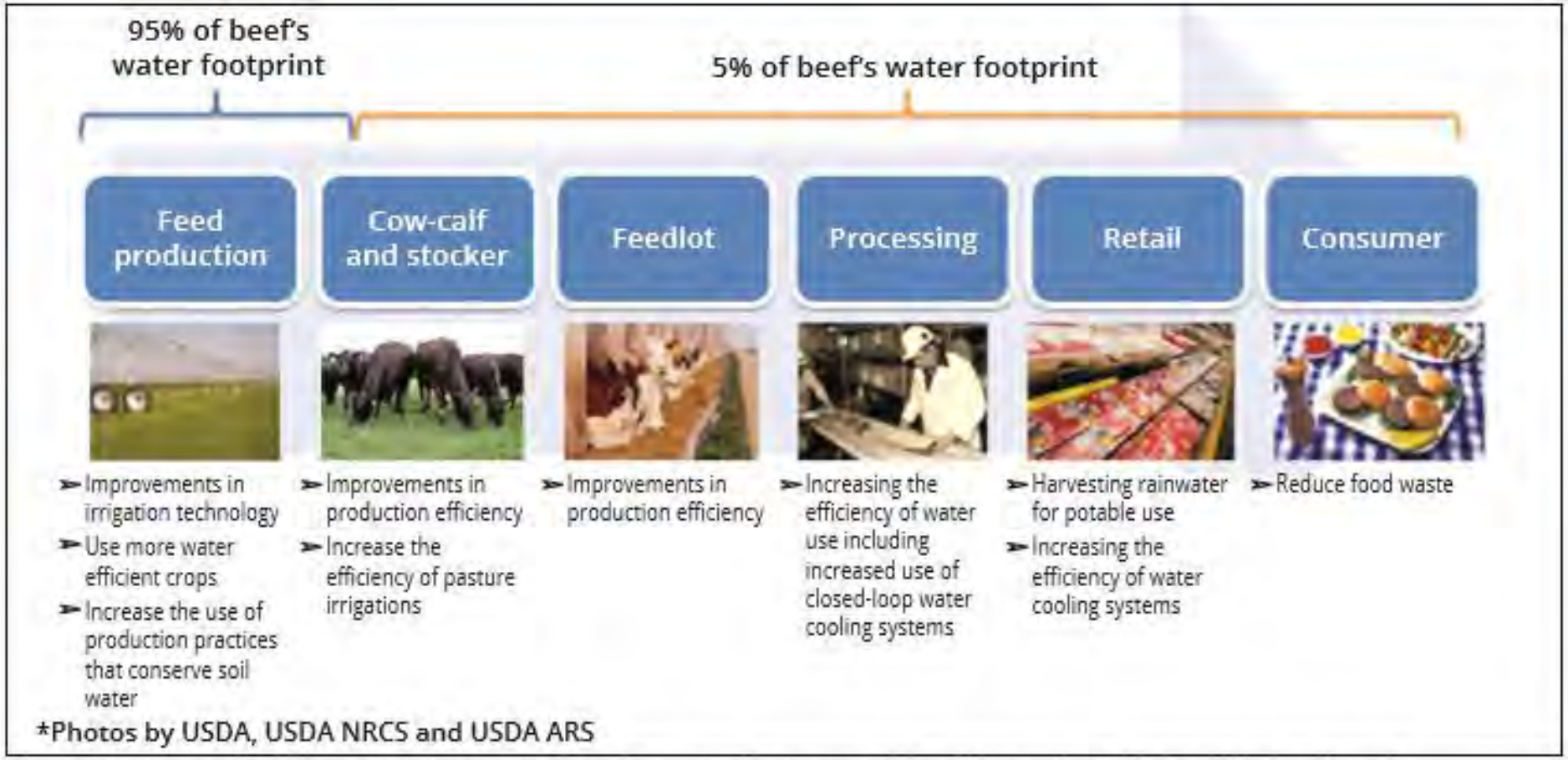
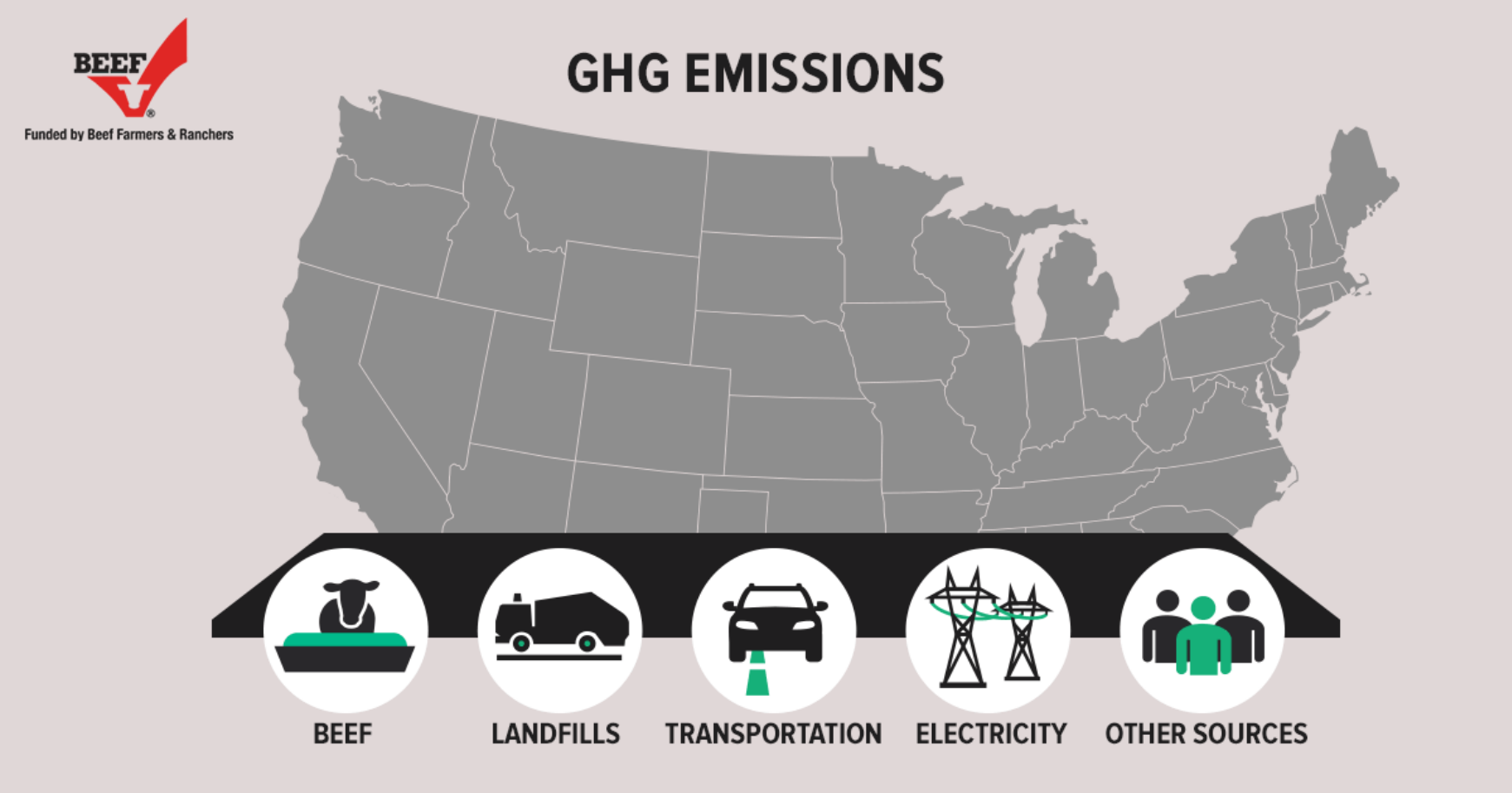


Figure 1. Examples of opportunities to reduce the water footprint of beef throughout the beef value chain.*

Source: http://www.beefresearch.org/CMDocs/BeefResearch/Sustainability_FactSheet_TopicBriefs/ToughQuestions2-Water.pdf

Beef production is responsible for about 2% of U.S. greenhouse gas emissions



Source: U.S. EPA GHG Inventory, 2016

Food for thought

Continuing to reduce the environmental footprint of beef, and all foods, is important

But, are we missing other important "food system" sustainability issues, by focusing only on environmental footprints of individual foods?

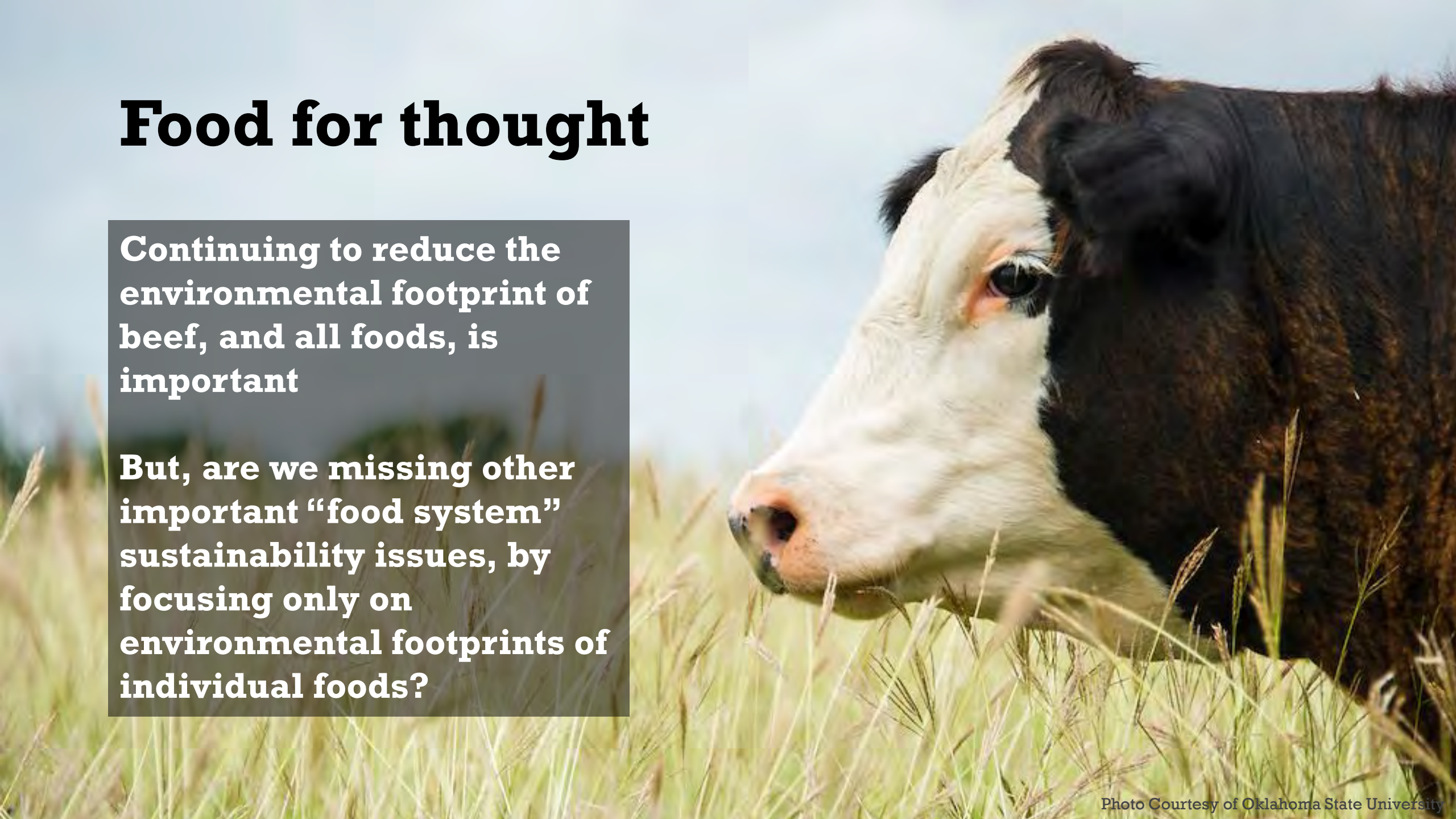


Photo Courtesy of Oklahoma State University

If every American went vegan, we'd reduce U.S. greenhouse gas emissions 2.6% (which is 0.36% of global emissions)*

- *This assumes all livestock in the U.S. would disappear

- "*Overall, the removal of animals resulted in diets that are nonviable in the long or short term to support the nutritional needs of the US population without nutrient supplementation.*"

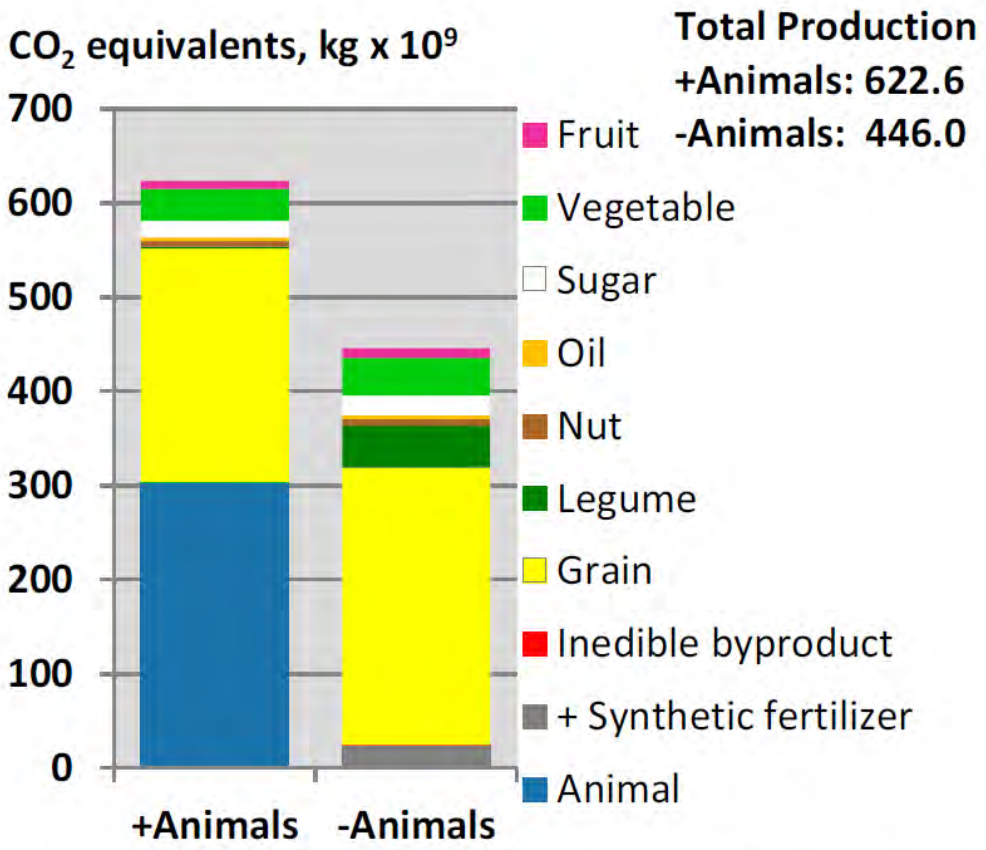


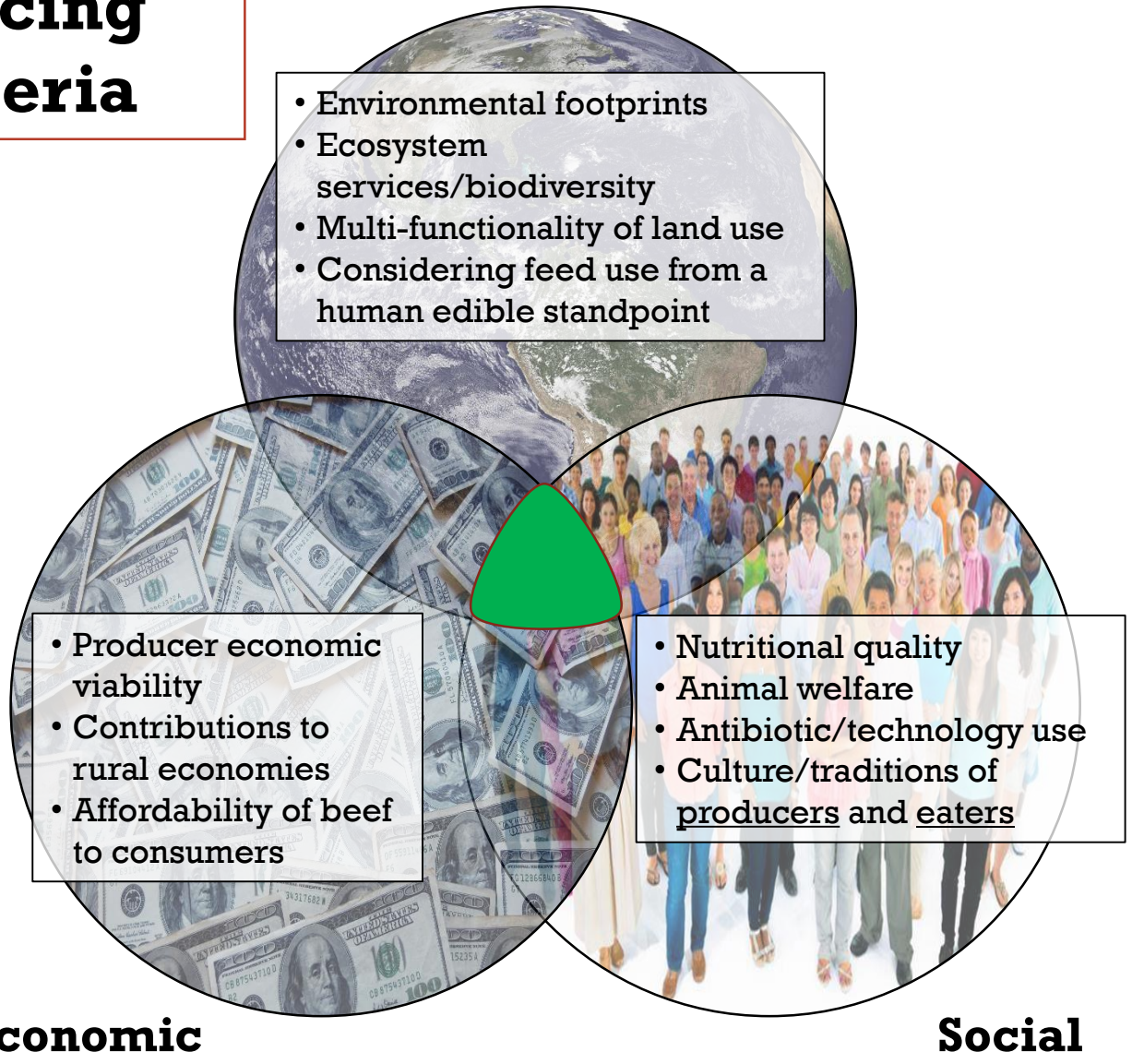
Fig. 5. GHG emissions associated with food production in a system representative of the current United States and a modeled system in which animal-derived food inputs are eliminated.

White and Hall, 2017. Proc. Natl. Acad. Sci. 114: E10301–E10308

The sustainability of our food systems requires balancing multiple important criteria

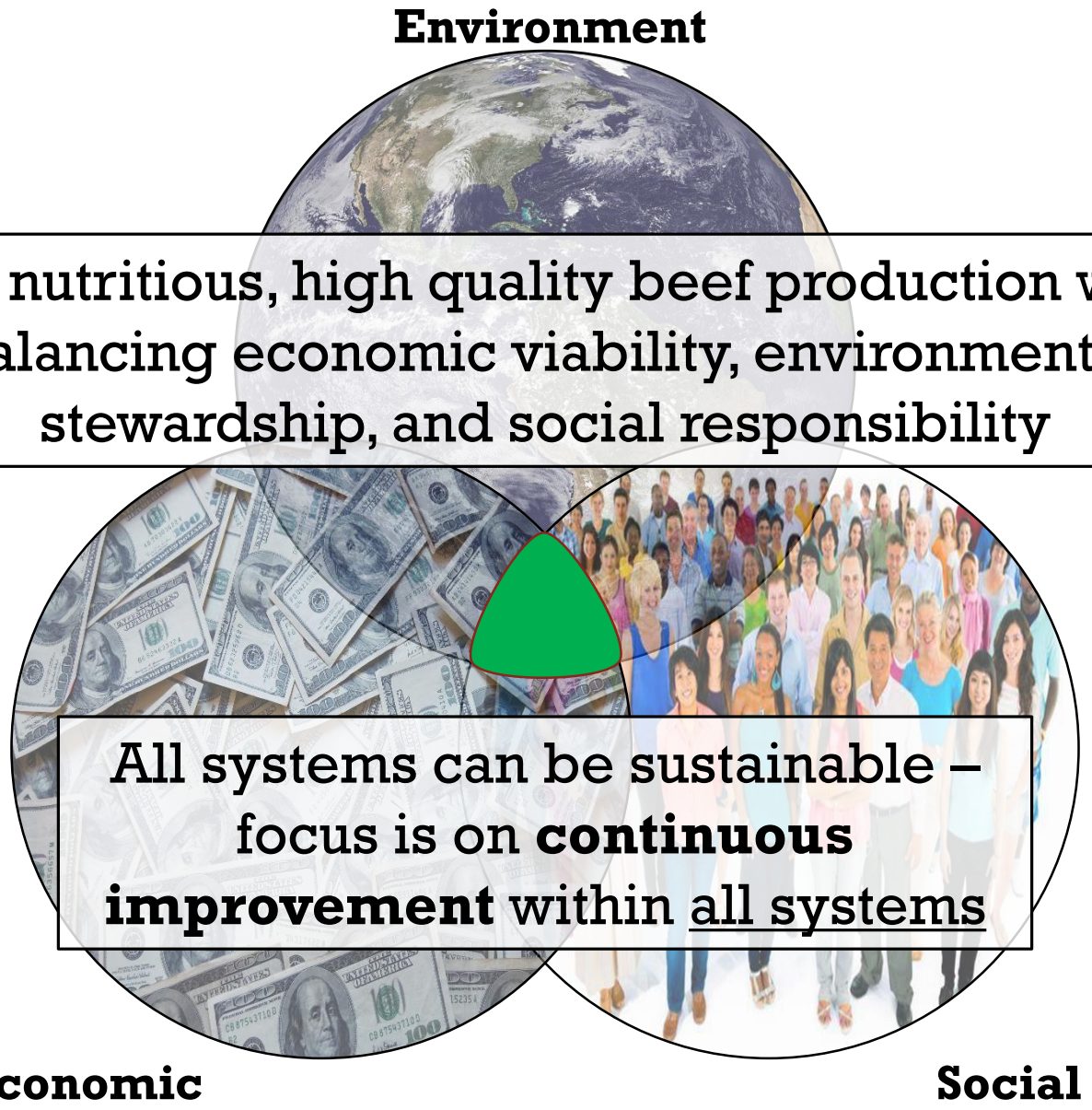
<u>Overarching needs</u>:

- Whole systems approaches
  - Focus on the nexus of different aspects of sustainability
  - Characterize and quantify interrelatedness of food, fiber, and fuel industries
- Recognize the role of value judgments and uncertainty



Bottom line:

- Beef production affects the environment **as does all food production and human activity**
- Environmental impacts per unit of beef have been **declining** over the past several decades
- U.S. beef production has one of the **lowest carbon footprints in the world**
- Higher "footprints" of beef (land, carbon, water) are driven by the unique biology of cattle that allows them to **upcycle protein** and **produce food on land unsuitable for cultivated agriculture**
  - Sustainability is about tradeoffs and nuance (e.g., land used for beef production is multifunctional)



Safe, nutritious, high quality beef production while balancing economic viability, environmental stewardship, and social responsibility

All systems can be sustainable – focus is on **continuous improvement** within <u>all systems</u>

THANK YOU

For more information, please visit:
http://beefresearch.org/beefsustainability.aspx

Funded by Beef Farmers & Ranchers