Sustainability and Innovation in the Livestock Industry

Kim Stackhouse-Lawson, PhD

Colorado Plateau Science and Management Forum & Colorado Section of the Society for Range Management 2021 Meeting

October 7, 2021

Colorado State University

AgNext

Sustainable Solutions for Animal Agriculture

Vision: Animal agriculture is a sustainable component of our global food system by providing economic, social and environmental benefits to Colorado, the Nation, and the world.

Mission: Identify and scale innovation that fosters the health of animals and ecosystems to promote profitable industries that support vibrant communities.

Phased Cluster Hires DRAFT

First Cluster Hire – Clinical Sciences and Animal Sciences already Committed - 2021

- Population Health (2 positions)
  - Disease Epidemiologist
- Systems Modeling
- Feedlot Specialist
- Dairy Specialist

Second/Third Cluster Hire – 2022 - 2023

- Rangeland Scientist
- Cow Calf Population Health Management Specialist
- Animal Agriculture Law and Policy Specialist
- Environmental Impact Scientist
- Emerging Agriculture Technology Scientist
- Grazing System Specialist
- Nutritional Epidemiologist
- Emerging Infectious Disease Specialist
- Livestock Economist

711 Ranch
James Henderson
CEO

Beatty Canyon Ranch
Steve Wooten
President, CEO

Beef Marketing Group
John Butler
CEO

Brackett Ranches
Kim Brackett
CEO

Five Rivers
Mike Thoren
President, CEO

Veterinary Research & Consulting, LLC
Tom Portillo
Partner

Harper Livestock
Mike Harper
President, CEO

JBS USA
Cameron Bruett
Head of Corporate Affairs and Chief Sustainability Officer

LeValley Ranches
Robbie LeValley
CFO

Kraft Family Dairies
Mary Kraft
CFO

Safeway/Albertsons
Cathy East
Vice President Procurement Meat/Seafood/Deli

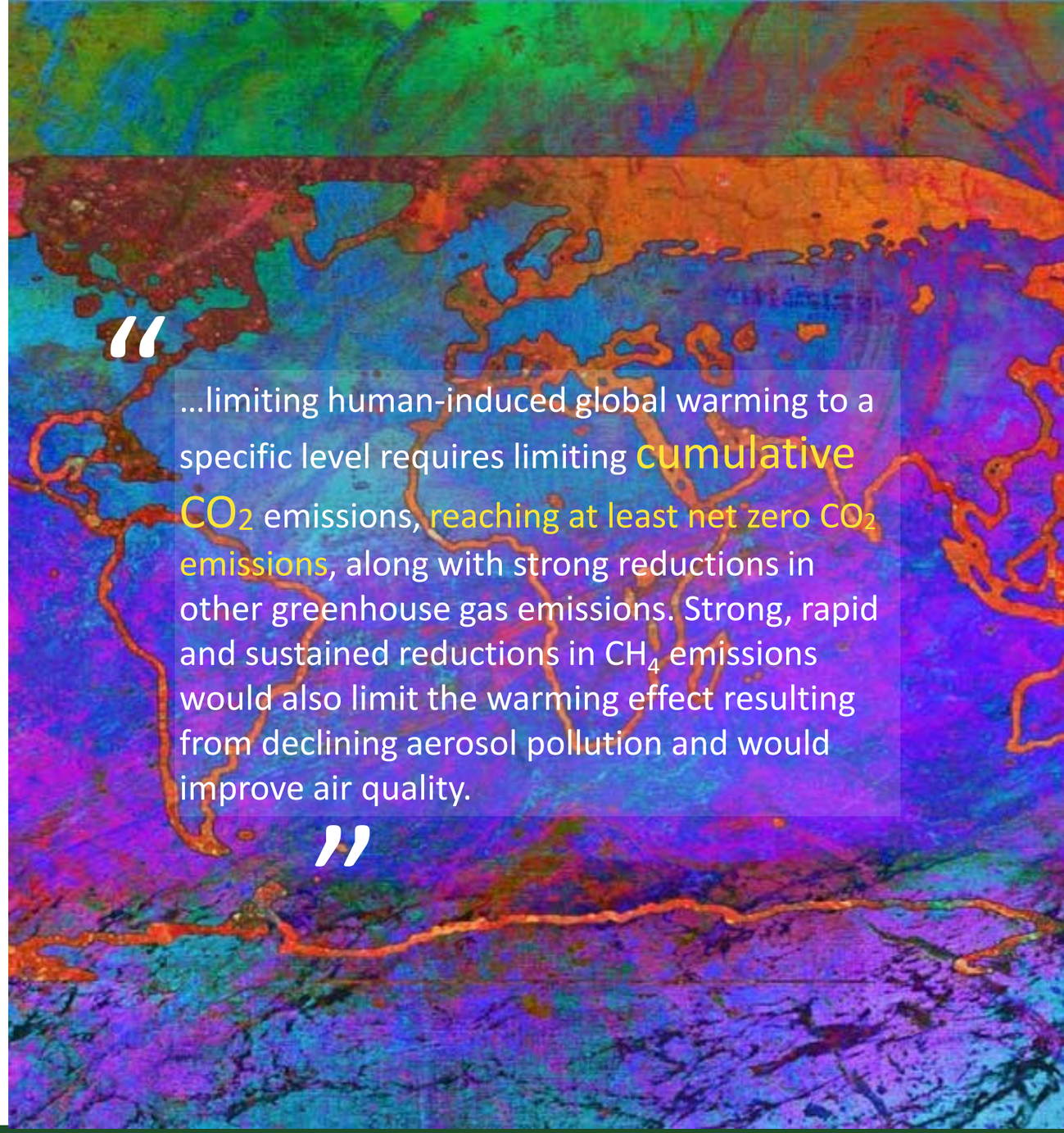
Veterinary Research & Consulting, LLC
Del Miles
Founder


LIVE
Science

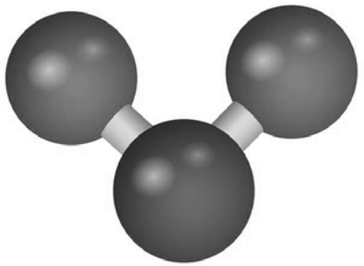

people
profit
survivability
adaptability
eco-friendly
efficiency
viability
long
regeneration
long-term
business
stewardship
resilience
people
sustainable
health
operational
enduring
nature
endurance
thinking
future
environmental
social
human
needs
strategic
common
competitiveness
responsibility
value
green
creation
renewal
inclusive
corporate
planet
life
profitability
development
economic
resources
correctness
impact
growth
ecological

The New IPCC AR6 Report

- Near term 1.5 to 2 °C warming unavoidable
- Many climate impacts also now irreversible
- “Net zero” goals cited by many misinterpret the IPCC
- “Cumulative CO_2” is a very specific term
- Methane reductions are seen more as a way of offsetting reduced cooling by sulfate aerosols (fossil fuel reductions coincide with reductions in sulfate aerosols)
- GWP* acknowledged as more accurate measurement of impact for methane

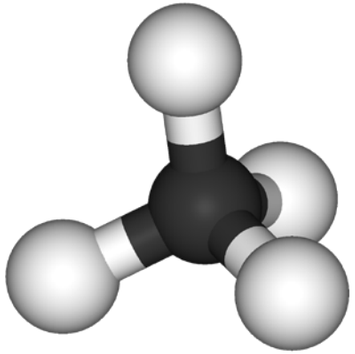


The Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO_2).



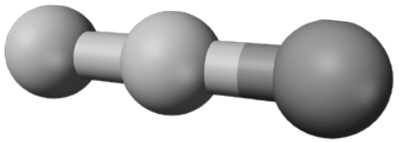
Carbon dioxide (CO_2)

CO_2, by definition, has **a GWP of 1** regardless of the time period used, because it is the gas being used as the reference. CO_2 remains in the climate system for a very long time: CO_2 emissions cause increases in atmospheric concentrations of CO_2 that will last thousands of years.



Methane (CH_4)

Methane (CH_4) is estimated to have a **GWP of 28–36** over 100 years. CH_4 emitted today lasts about a decade on average. CH_4 absorbs more energy than CO_2. The net effect of the shorter lifetime and higher energy absorption is reflected in the GWP. The CH_4 GWP also accounts for some indirect effects, such as the fact that CH_4 is a precursor to ozone, and ozone is itself a GHG.

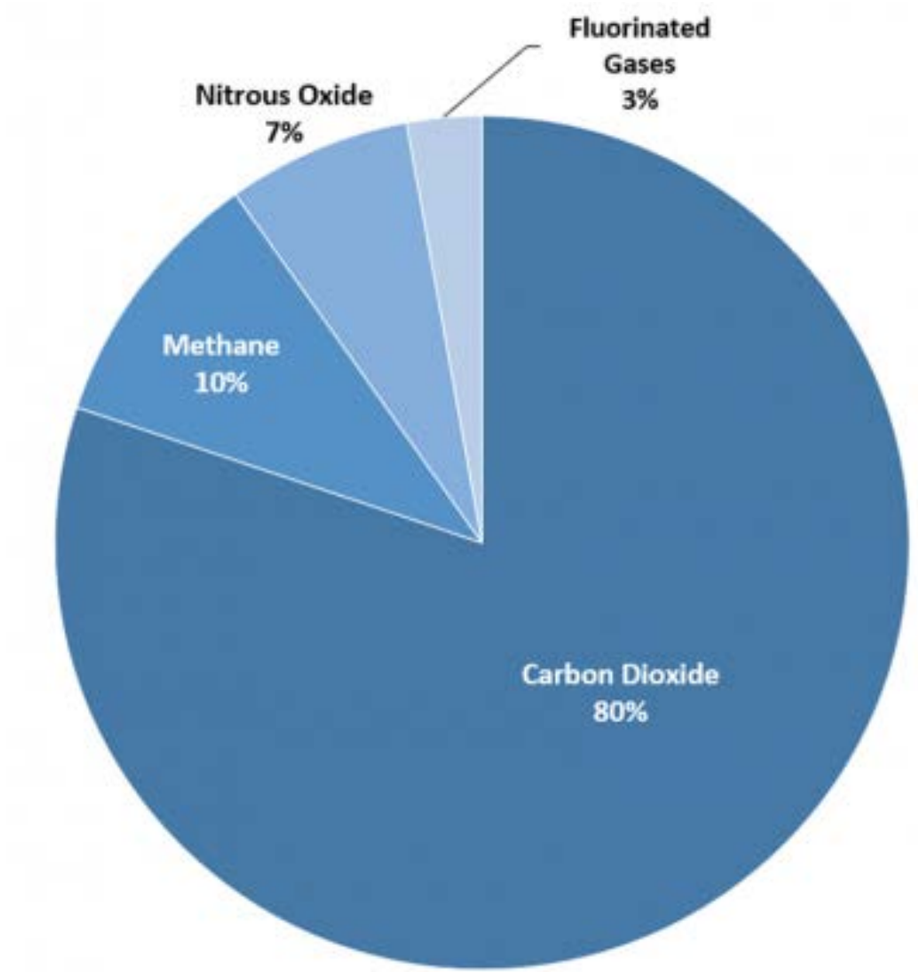


Nitrous Oxide (N_2O)

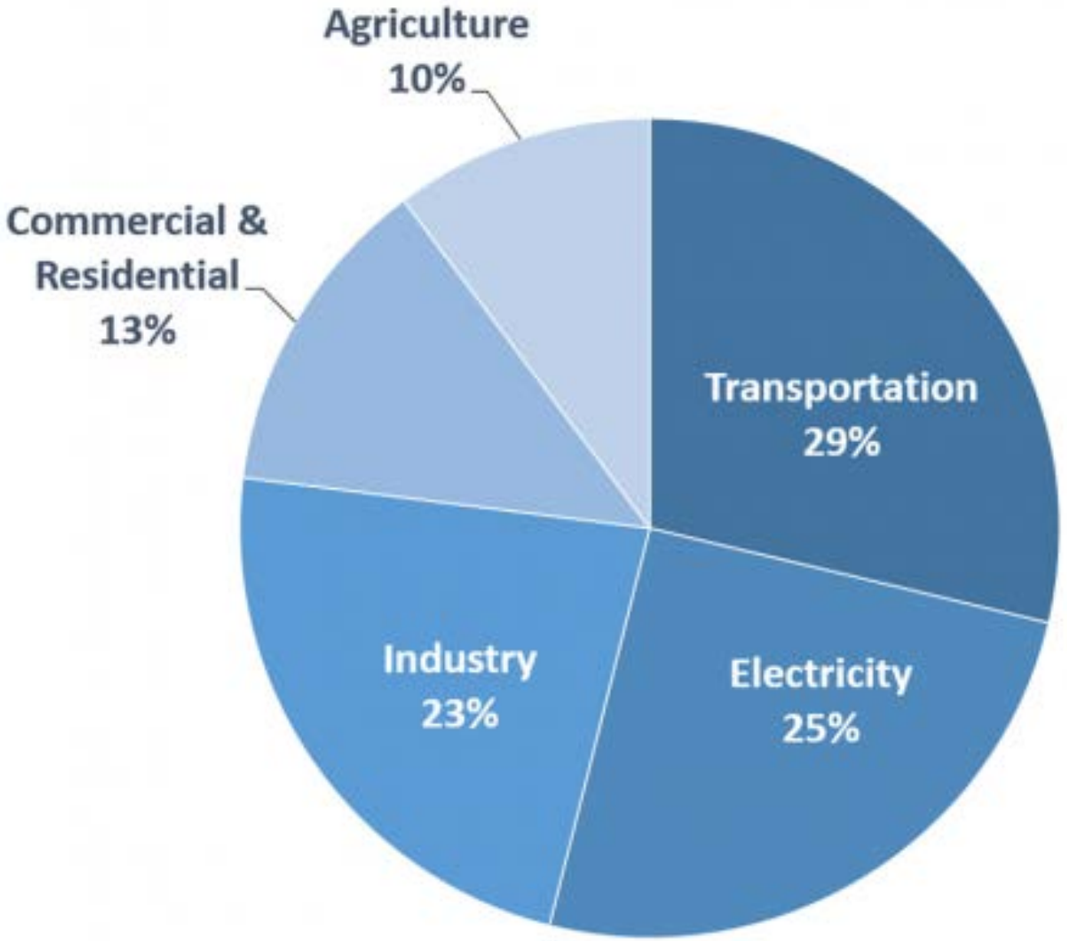
Nitrous Oxide (N_2O) has a **GWP 265–298** times that of CO_2 for a 100-year timescale. N_2O emitted today remains in the atmosphere for more than 100 years, on average.

Source: US EPA

Overview of U.S. Greenhouse Gas Emissions in 2019

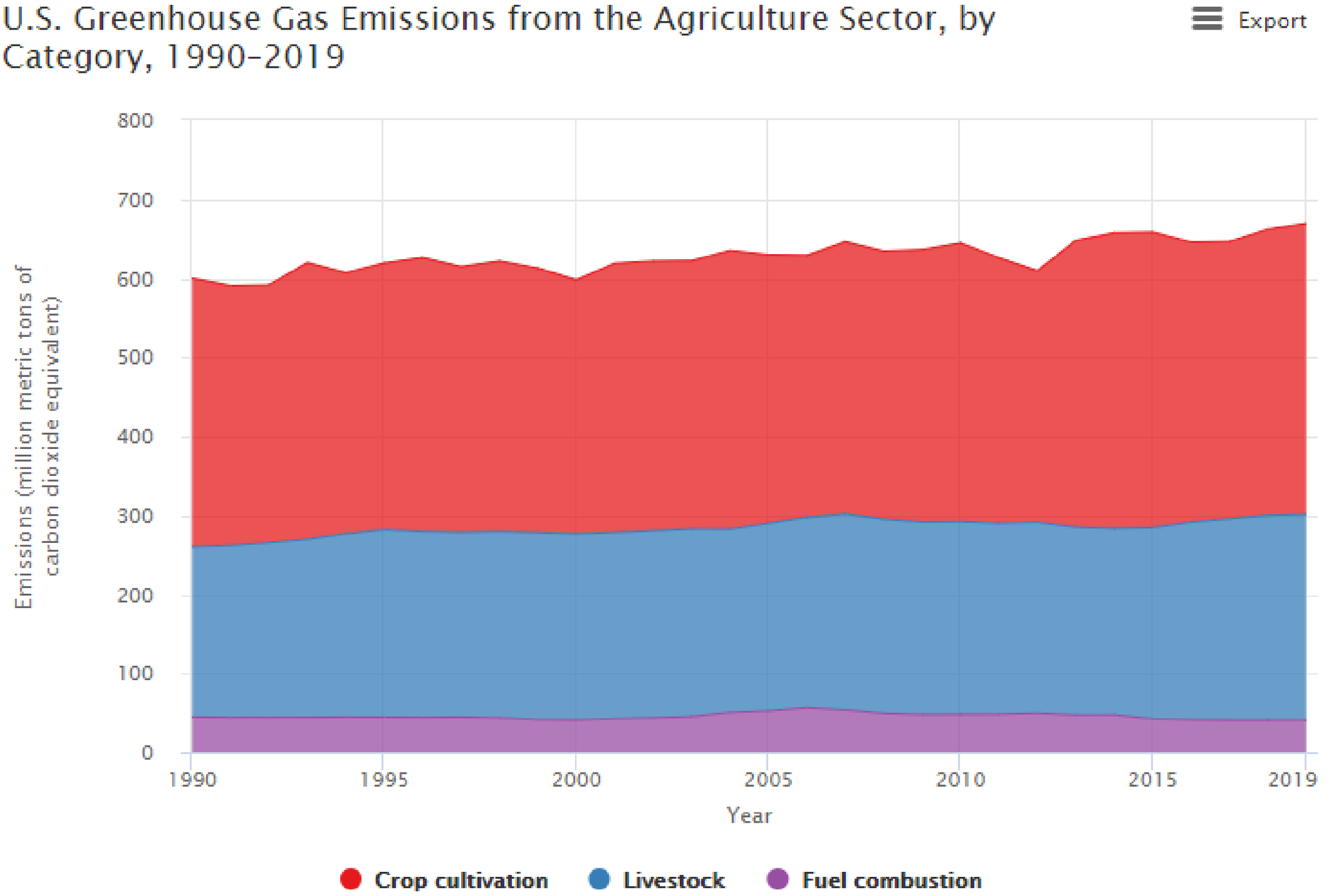


Sources of U.S. Greenhouse Gas Emissions in 2019



Source: US EPA (2021). Inventory of U.S. GHG emissions and sinks: 1990-2019

U.S. Greenhouse Gas Emissions from the Agriculture Sector, by Category, 1990–2019



Percent change:

1990–2019

Crop cultivation:

▲ 8.4%

Livestock:

▲ 20.7%

Fuel combustion:

▼ 8.9%

Total: ▲ 11.5%

Livestock is responsible for 3.8% of U.S. GHG emissions

Source: U.S. EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2019.
https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

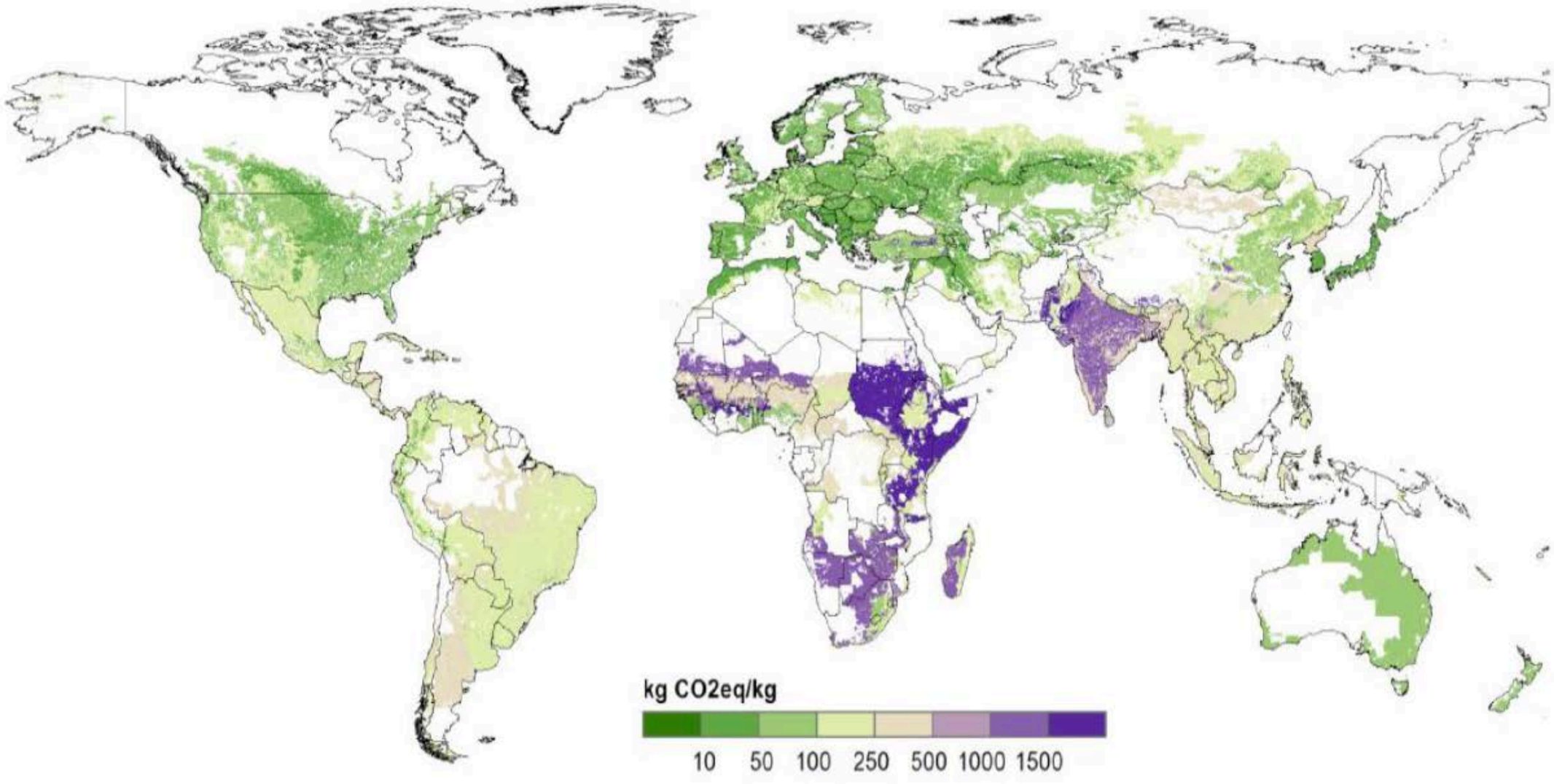
Image: agri-footprint.com

Total emissions are not the same as footprints

LCA methodology provides a much more comprehensive and complete picture of impact

Allows us to understand unintended consequences

Global beef production footprints



Source: UN FAO

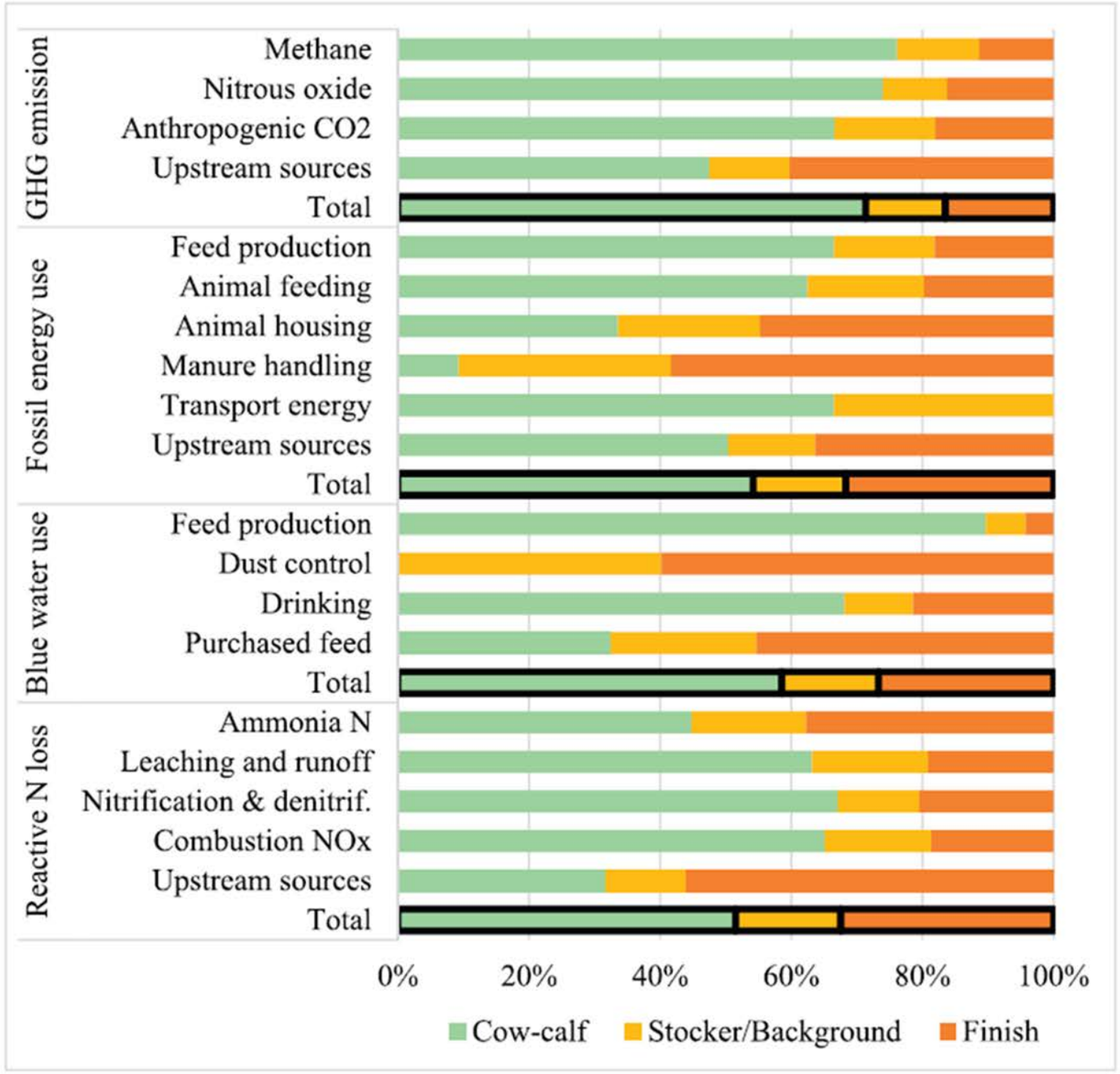


Fig. 2. Distribution of the sources of each environmental impact across the three major phases in the life cycle of beef cattle production.

Environmental footprints of beef cattle production in the U.S.

Surveys and visits of farms, ranches and feedlots were conducted throughout ***seven regions*** *(Northeast, Southeast, Midwest, Northern Plains, Southern Plains, Northwest and Southwest) to determine common practices and characteristics of cattle production. These data along with other information sources were used to create about* ***150 representative production systems throughout the country****, which were simulated with the* ***Integrated Farm System Model using local soil and climate data.*** *The simulations* ***quantified the performance and environmental impacts of beef cattle*** *production systems for each region. A* ***farmgate life cycle assessment was used to quantify resource use and emissions for all production systems*** *including traditional beef breeds and cull animals from the dairy industry.*

Source: Rotz et.al, 2019. Agricultural Systems 1369:1-13.

Greenhouse Gases from Beef Systems

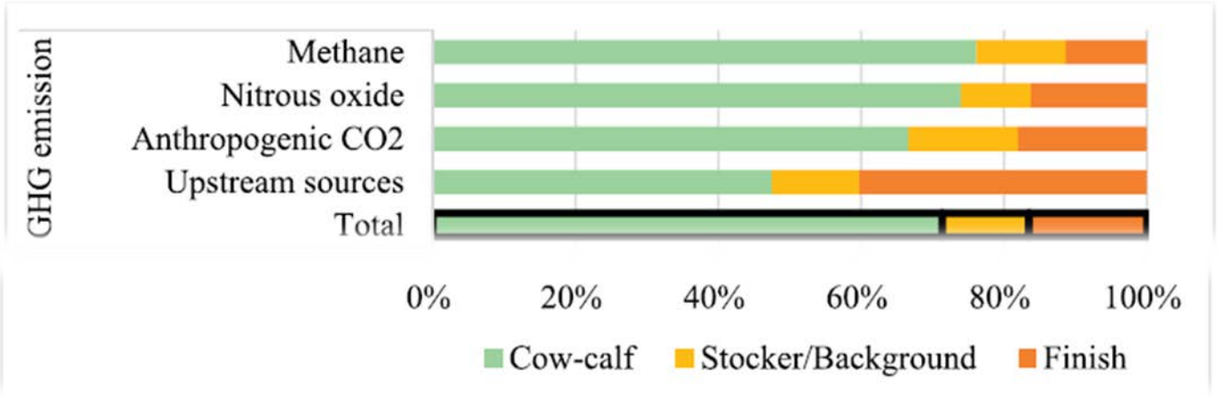


Fig 2 (abrev). Distribution of sources of each environmental impact across the three major phases in the life cycle of bee production.

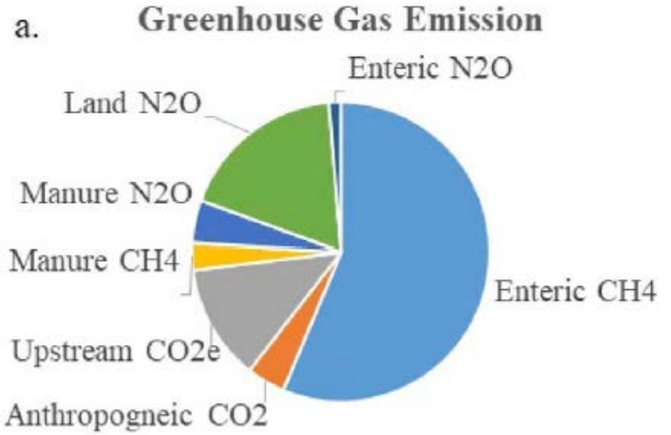


Fig 3 (abrev). Distribution of each environmental footprint among sources

GHG emission intensity, expressed per kg of carcass weight produced was: 21.3 ± 2.3 kg CO_2e

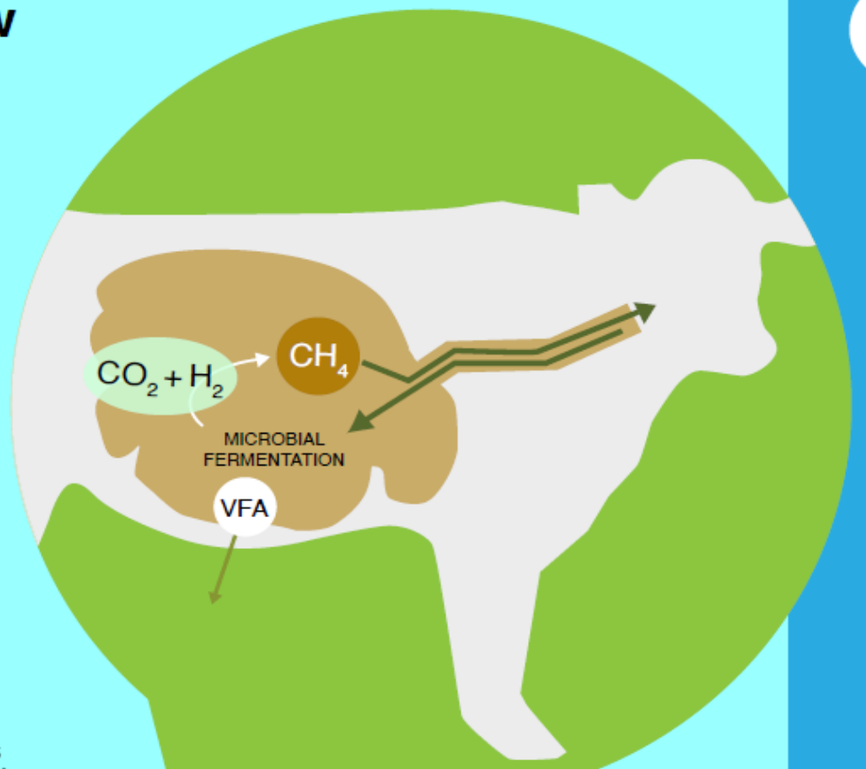
Source: Rotz et.al, 2019. Agricultural Systems 1369:1-13.

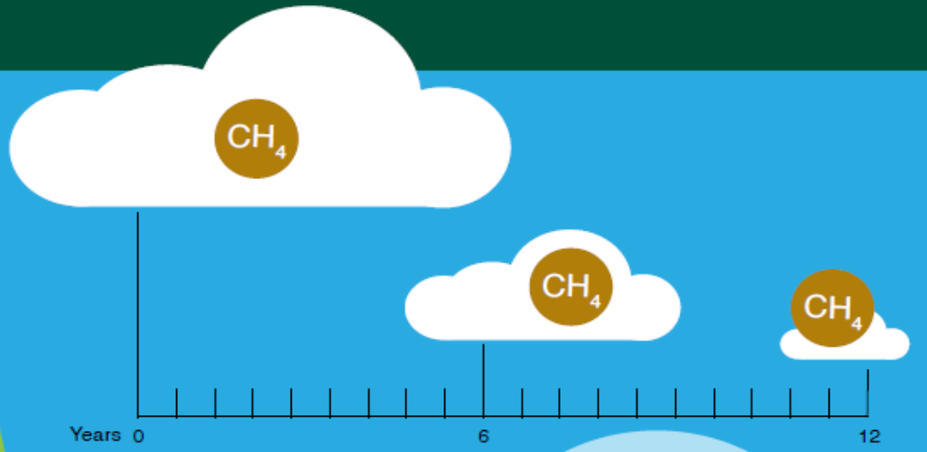
METHANE IN THE CARBON CYCLE

Carbon in cow

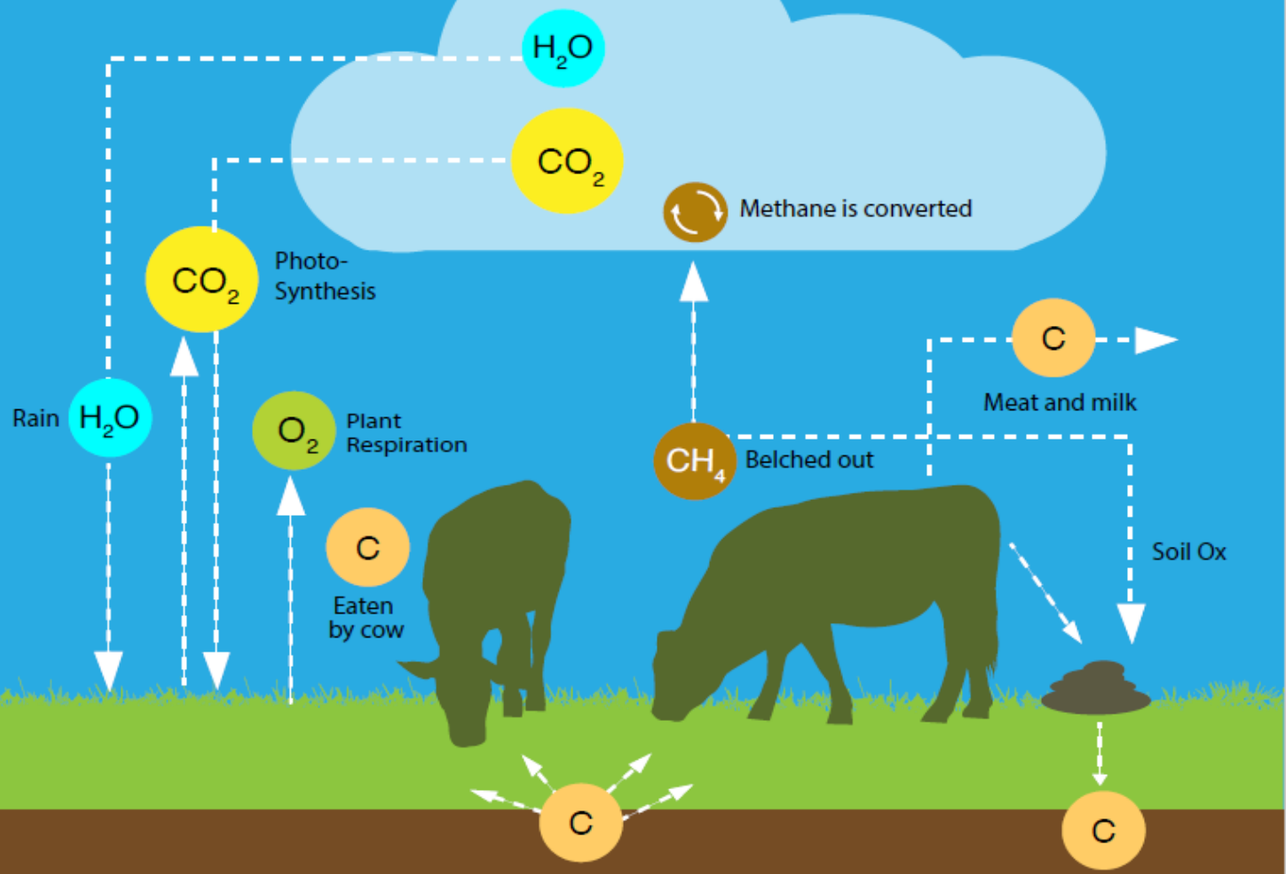
Enteric methane is a natural by-product of ruminal fermentation in reticulo-rumen and hindgut and is essential for normal rumen functioning. During the process of microbial fermentation, volatile fatty acids are produced and used to meet the metabolic needs of the animal. Carbon dioxide and H2 that are produced during this process are then converted into CH4 by rumen methanogens and eructated into the atmosphere.

College of Agriculture and Natural Resources
MICHIGAN STATE UNIVERSITY





Over 9-12 years, CH4 is broken down into CO2 and H2O by OH- radicals in the atmosphere. Current GWP metrics, however, treat this short-lived pollutant as a stock GHG, eg. CO2, and may be overstating the benefits of reducing emissions as any warming due to methane is dependent on the emissions of that decade and not cumulative emissions to that point (Allen et al., 2018).



Cow-calf and stocker ‘other’ GHG sources and sinks

- Incredible variability across the U.S.
- Nitrous oxide is primarily produced by nitrification and denitrification processes in soil:
  - following urine deposition
  - fertilizer application
  - stored manure
  - 74% of the contribution is from the cow-calf and stocker sector
  - Few successful mitigation strategies exist
- Anthropogenic CO_2
  - 0.7% of total U.S. consumption of fossil fuels
  - Fuel used for utility trucks and ATVs
  - Electricity to deliver water
- Upstream sources

Source: Rotz et.al, 2019. Agricultural Systems 1369:1-13.

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

Rangeland’s store 20% of the globes soil organic carbon

The most important thing we can do for soil organic C in rangelands is to:

1. Preserve rangelands (avoid conversion)
2. Restore cultivated and degraded lands
3. Practice adaptive livestock management
    - This does not consider benefits of other ecosystems services (wildlife habitat, water storage capacity, etc.), rural community well-being and rural economies

Source: Sanderson et. al, 2020. Cattle, conservation and carbon in the western Great Plains. Journal of Soil and Water Conservation

How Beef Production Impacts Soil C

- Cycles nutrients back to the soil
- Proper grazing management can protect and restore C on degraded land
- Inclusion on highly productive forages (legumes often included) may help improve soil C
- Inclusion of deep-rooted plants within forage mixtures may help store C deeper into the soil profile

Regional and climatic variability

- Differences in climate and management practices among simulated farms, ranches and feedlots created variation in the environmental footprints of the simulated production systems within each region.
  - Individual beef cattle production systems, total carbon footprint ranged from 17 to 40 kg CO_2e/kg CW
- No size or type of production system was found to be most efficient
  - Indicating that many parameters can impact the efficiency and environmental impact of production
  - Soil type (primarily clay content), precipitation patterns and N fertilizer use were important factors influencing N_2O emissions
- Producers can have some influence on the environmental impacts of their operations through improved rate of gain and manure management practices; however, the major factors of soil type and climate are beyond their control.

Source: Rotz et.al, 2019. Agricultural Systems 1369:1-13.

Opportunities for improving sustainability

- Broad, general recommendations cannot be made at a national level for improving beef sustainability
- Improvements must be made on an individual operation basis considering the uncontrollable factors influencing the management of the operation
  - Time needed to produce finished cattle
  - Enteric emission reduction
  - Optimal use of fertilizer and lime (manure digestion)
  - Minimizing the use of trucks and all-terrain vehicles and
  - Increase use of solar and wind power
- Carbon sequestration/storage on grazing landscapes
  - Preserve rangelands (avoid conversion)
  - Restore cultivated and degraded lands
  - Practice adaptive livestock management

Source: Rotz et.al, 2019. Agricultural Systems 1369:1-13

Source: Sanderson et. al, 2020. Journal of Soil and Water Conservation

Industry approaches

CARBON NEUTRALITY

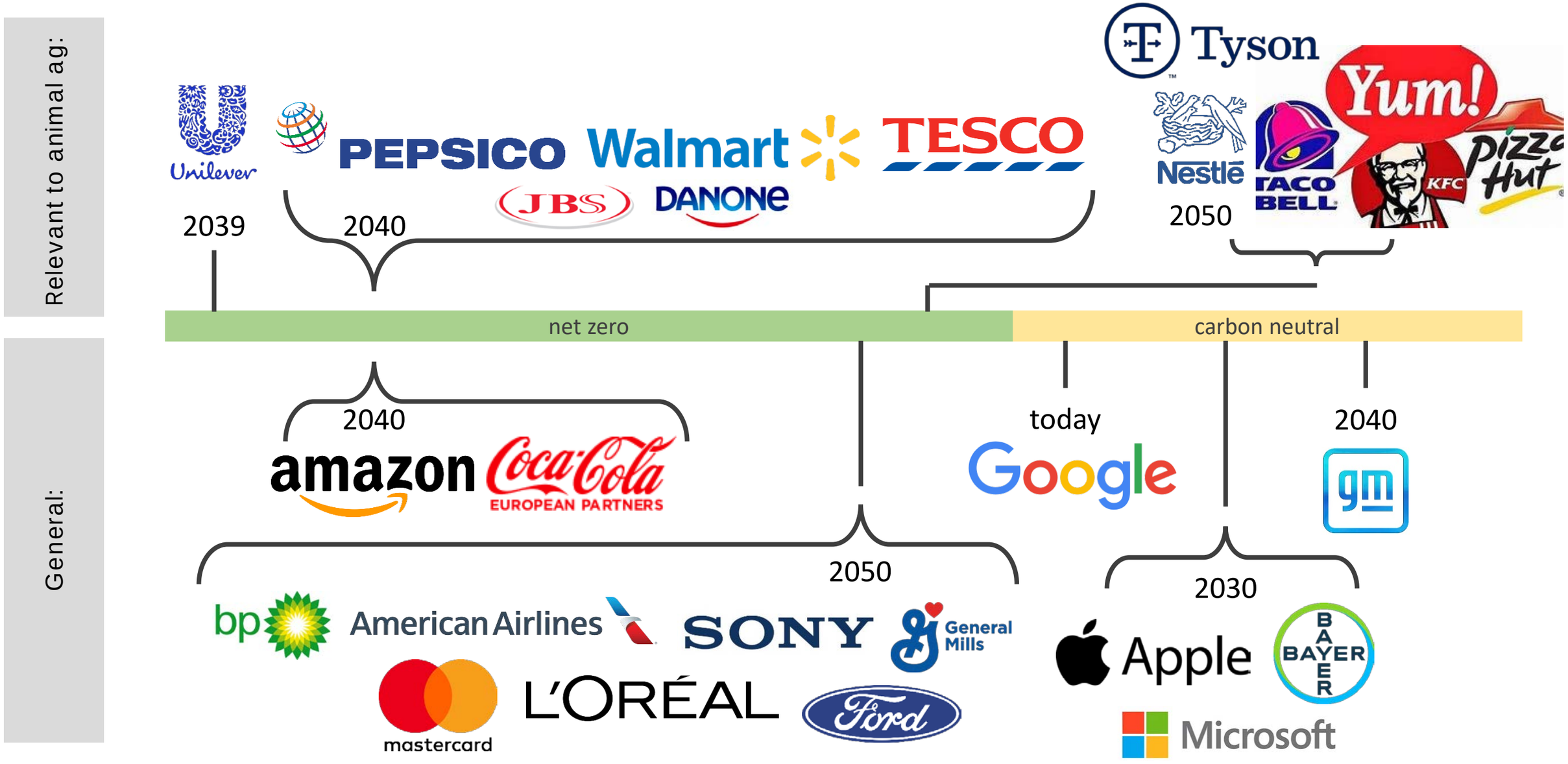
NCBA TARGETS

- Demonstrating Climate Neutrality of U.S. Cattle Production by 2040
- Increasing Producer Profitability and Economic Sustainability by 2025
- Enhance Trust Through Improved Animal Welfare, Handling & Training
- Continuously Improving Industry's Workforce Safety and Well-Being

Biden's Executive Action: *Biden-Harris Administration Commits on Climate Change – Creating Jobs, Building Infrastructure, and Delivering Environmental Justice*

- Issue of National Security
- NetZero economy by 2050
  - Carbon pollution-free power sector by 2035
  - 30 by 30 program, conserving 30% of lands and oceans by 2030
- At least 30% reduction of CH_4 by 2030 compared to 2020
- *"Examples of relevant financing could include assistance for dairy farmers seeking to reduce emissions from manure, support for development of biofuels (which produce about 30-40% of the greenhouse gas emissions produced by gasoline), or support for producers looking to quantify the greenhouse gas reduction benefits of organic farming"*
- *"This initiative that we are launching will place a high premium on accurate greenhouse gas accounting," Vilsack said. "It's absolutely vital if we're to establish consumer confidence in these emerging products and markets."– Tom Vilsack*

Current Company Commitments



Carbon neutral: refers to having a net-zero carbon footprint

Climate neutral: Climate neutral refers to the emission and mitigation of *all* greenhouse gases – not just carbon.

When a company commits to Net Zero, it often includes its entire value chain and they rarely know how or have plans to achieve the goal.

UN SDG Commitments

Company	UN Sustainable Development Goal Commitments
Tyson	
Cargill	
JBS	

McDonalds, Target, The Nature Conservancy, Cargill

- 5-year, $8.5 million project to increase C sequestration across 100,000 acres of row crops and feed production across Nebraska
- Includes ecosystems services market consortium pilot program
- Additional $4.4 million to scale adoption of regenerative agriculture

The Nature Conservancy
Protecting nature. Preserving life.

Cargill™

target

Sustainability Program Established

JBS conducts a corporate materiality assessment and baseline emission assessment in 2015.

Tyson conducts a corporate materiality assessment and baseline emission assessment in 2016.

Cargill conducts a corporate materiality assessment and baseline emission assessment in 2017.

Tyson refocused climate goals based on SBTi initiatives in 2018.

Future Goals

2025 Goals: Cargill aims to reduce scope 1 and 2 emissions by 10% against 2017 levels. Cargill also hopes to implement water stewardship at all 81 facilities. JBS aims to eliminate all amazon deforestation in their supply chain.

2030 Goals: Tyson has a goal of reducing GHG emissions 30% by 2030. Cargill has a goal of reducing GHG emissions from their global supply chains by 30% per measured ton of product. Cargill also has a goal of restoring 600 billion liters of water in priority watersheds and reduce % million kg of water pollutants. JBS plans to reach 60% renewable energy usage and reduce scope 1 and 2 emissions by 30%. JBS also has goals of reducing water use intensity by 15%. JBS also has a goal of a 30% improvement in the Global Safety Index.

Beyond 2030: Tyson has committed to achieving net zero GHG emissions by 2050. Cargill hopes to have new R&D strategies and technology by 2040 or 2050 based on research grants and studies being conducted now. JBS has committed to achieving net zero GHG emissions by 2040.

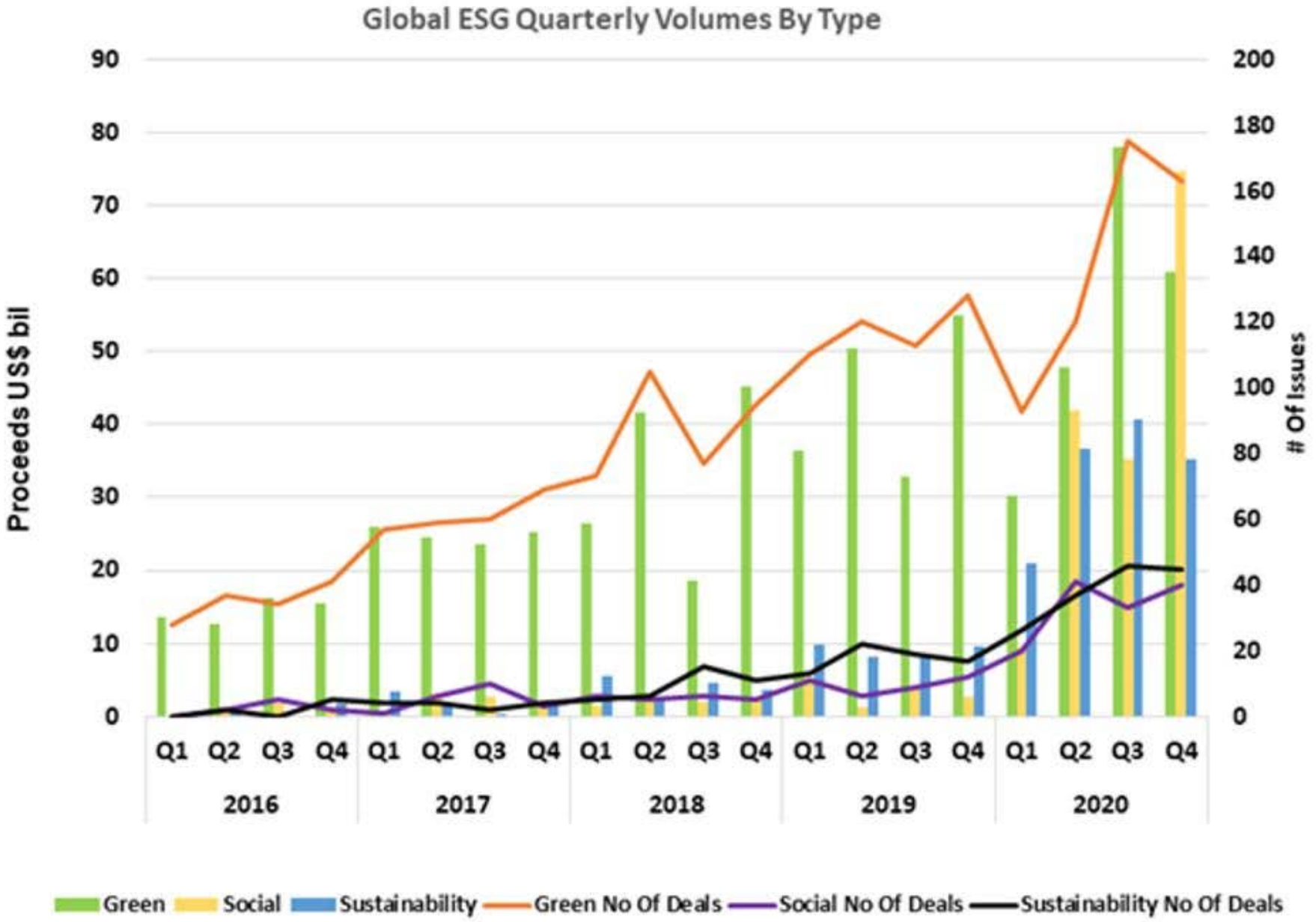
75%

Of millennials believe their investments can influence climate change

84%

Of millennials believe their investments can help lift people out of poverty

Source: Credit Suisse, Making an Impact: Earing Returns on Sustainable Terms



Source: Forbes

In Summary

- Climate will be the most important sustainability metric for the foreseeable future (social equity for corporations will be comparable)
  - Total methane emissions are increasing
  - GWP* has been acknowledged, but this will not change the importance of methane mitigation
- The impact of beef on climate is measured and reported differently and is complex
  - 4-5 different approaches and there is no alignment
- Behind in research, we don’t have a good “start here” for the supply chain
- Corporate programs (including retail and food service) have matured beyond the industry approach
  - Significant supply-chain expectations
- Sustainability (social, economic, environmental) will be an expectation moving into the future

Thank you

Kim.Stackhouse-lawson@colostate.edu

Colorado State University