The Elephant in the Room: Drill Baby Drill

Rethinking carbon, methane and the ruminant–plant relationship

Alvaro Garcia DVM PhD
Global Farming Digest

Abstract

Discussions of cattle, methane and climate change often focus on the greenhouse gas (GHG) emitted by the animal while paying less attention to the origin and movement of the carbon involved. Ruminants operate largely within a biological carbon cycle in which atmospheric carbon dioxide is captured by plants through photosynthesis, consumed by animals, and subsequently returned through respiration, methane, manure and decomposition. Fossil fuels represent a fundamentally different pathway because their extraction and combustion transfer carbon stored underground for millions of years into the active carbon cycle. Recognizing this distinction does not diminish the importance of enteric methane. Rather, it provides a more complete framework for evaluating livestock emissions and mitigation strategies.

Ruminants also perform a unique biological function by converting grasses, crop residues and other fibrous materials that humans cannot digest into nutrient-dense foods. Their environmental performance should therefore consider not only emissions per animal but also productive efficiency and emissions per unit of food produced. Improvements in forage quality, nutrition, reproduction, health and longevity can reduce methane intensity while improving the use of land and feed resources. Effective climate strategies should address avoidable methane emissions from both agriculture and fossil-energy systems while recognizing their different carbon pathways. Sustainable livestock production ultimately requires understanding of the complete ruminant-plant-soil system rather than evaluating the cow in isolation.

Introduction

A cow does not manufacture carbon. The ruminant eats plants that obtained their carbon from atmospheric CO_2 through photosynthesis. Rumen microorganisms ferment this material, converting cellulose and other carbohydrates humans cannot digest into milk, meat and other products. Carbon then follows several pathways: some returns to the atmosphere as CO_2 or methane, some becomes animal tissue and food, and some returns to the soil through manure and plant residues. This movement among plants, animals, soils and the atmosphere is part of the biological carbon cycle, a relationship that predates agriculture by millions of years. There is another very different carbon pathway that begins somewhere else. When coal, oil and natural gas are extracted and burned, carbon that had been stored underground for millions of years is transferred into the active carbon cycle. Unlike the carbon in grass consumed by the cow, this represents the introduction of geological carbon into a system where it was previously isolated. That distinction does not make methane from cattle irrelevant. Methane is a powerful GHG, livestock are an important source of anthropogenic methane, and reducing avoidable enteric emissions should remain an objective of efficient livestock production. But methane and carbon dioxide should not be treated as interchangeable simply because both affect climate.

Methane remains in the atmosphere for roughly a decade before being removed through chemical processes, while a portion of added carbon dioxide persists for centuries or longer. Consequently, sustained emissions of the two gases behave differently over time. Continued fossil carbon emissions progressively add carbon to the atmosphere-ocean-land system. Sustained biogenic methane emissions maintain an elevated contribution to warming, while increases or decreases in those emissions alter that contribution. These differences matter when evaluating agriculture because the relevant question is not simply whether an animal emits a greenhouse gas. We need to understand the carbon pathway, the duration of the gas in the atmosphere and the function of the production system from which it originates.

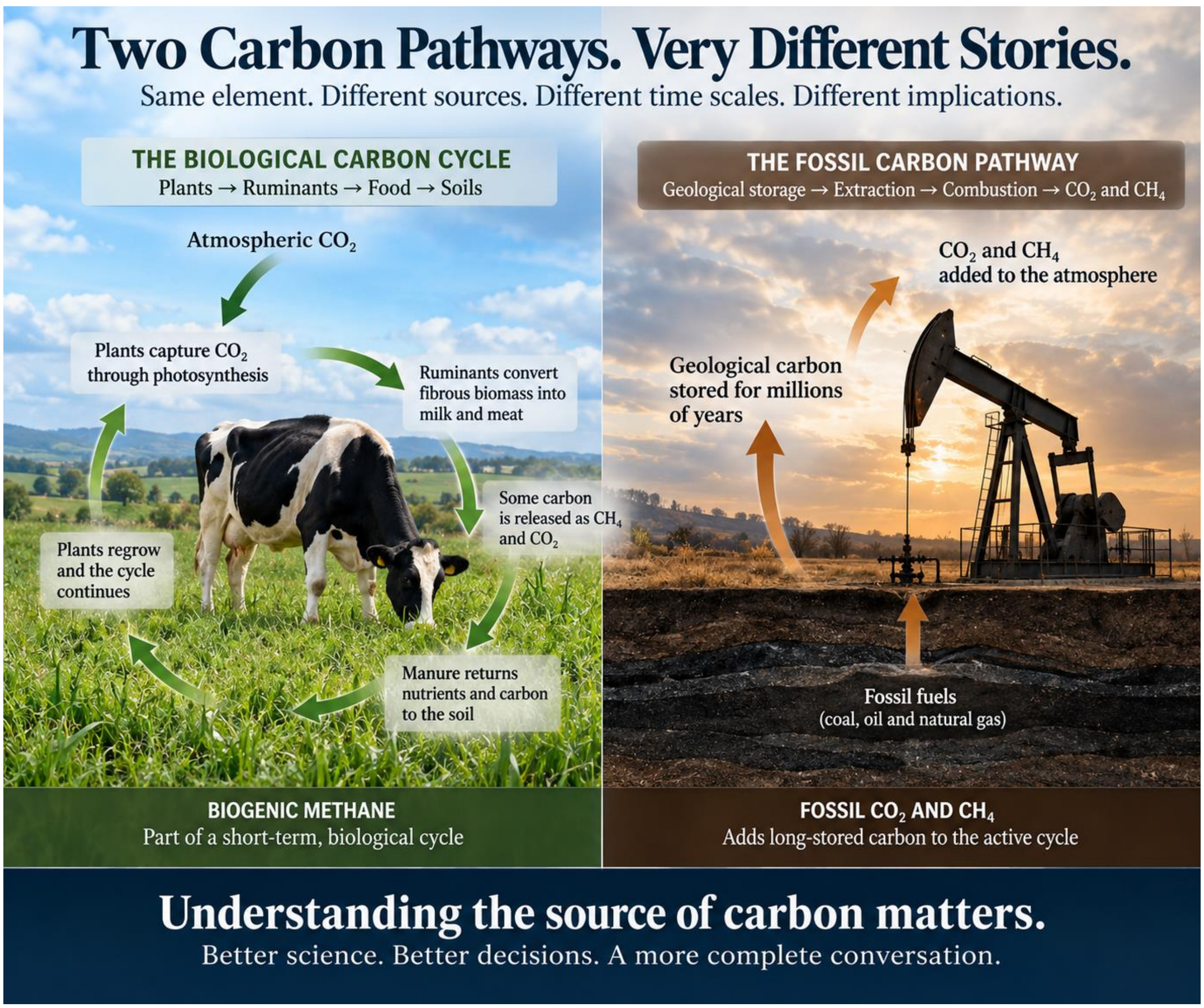

Figure 1. Two carbon pathways. Carbon associated with ruminant production originates largely from recently captured atmospheric CO_2 and cycles among plants, animals, soils and the atmosphere. Fossil-fuel extraction introduces geological carbon that had been stored outside the active carbon cycle for millions of years.

The cow in the carbon cycle

Consider a grazing animal. Grass captures atmospheric CO_2 and converts solar energy into plant biomass. The cow consumes biomass, much of which has no direct food value to humans, and rumen microbes transform it into nutrients the animal can use. Milk or meat leaves the farm as food, manure returns nutrients and organic material to the soil, plants grow again, and the cycle continues. This does not create a closed system with zero climate impact, nor does it excuse poor management. It does, however, describe something fundamentally different from extracting fossil carbon and adding it to the active carbon pool.

The distinction becomes particularly important on grasslands and rangelands where cultivation may be undesirable, uneconomical or environmentally inappropriate. Humans cannot eat grass, but ruminants can use it. They can also utilize crop residues, fibrous by-products and other materials with limited direct value as human food. The animal is therefore more than an emitter. It is a biological converter capable of transforming resources humans cannot digest into nutrient-dense food while returning nutrients and organic matter to agricultural soils.

Methane still matters

Recognizing this biological cycle should not become an argument for ignoring methane. That would be as simplistic as arguing that cattle are inherently unsustainable because they emit it. The useful question is how much food and economic value a livestock system produces with the resources it consumes and the emissions it generates.

This is where animal nutrition, health and management become part of environmental discussion. Better forage quality can improve digestibility and productivity while reducing methane intensity. Improved reproduction can reduce the number of nonproductive animals required to maintain a herd. Healthier cows that remain productive for additional lactations reduce replacement requirements. Better nutrition can increase milk or meat production without proportional increases in feed consumption. None of these practices make methane disappear, but they can reduce the resources and emissions required to produce a unit of food.

That distinction between absolute emissions and emissions intensity is particularly important. A high-producing dairy cow may emit more methane per day than a poorly producing cow while emitting considerably less methane per kilogram of milk or milk solids. The same principle applies to beef. An animal that grows efficiently and reaches market weight sooner may produce more methane on a particular day than a slow-growing animal, yet require fewer days, less maintenance feed and fewer resources to produce the same quantity of beef. Judging environmental performance solely by emissions per animal therefore rewards biological inefficiency.

> **"The relevant question is not simply whether an animal emits a greenhouse gas. We need to understand where the carbon came from."**

The objective should not be maximum production regardless of consequences. Neither should it be minimum methane per animal regardless of productivity. The more meaningful target is productive efficiency: healthy animals producing nutritious food efficiently from appropriate feed resources while minimizing unnecessary emissions and maintaining the land on which the production system depends.

The other methane source

The discussion becomes more interesting when fossil energy is included. Oil, natural gas and coal systems emit not only carbon dioxide when their products are burned but also methane during extraction, processing and distribution. Leaks, venting and other releases from fossil-fuel infrastructure represent an important anthropogenic methane source, and many of these emissions can be reduced using technologies that already exist.

This creates an important difference in how we should think about mitigation. Methane released from a leaking natural-gas system provides no milk, meat, nutrients or biological recycling in return. Enteric methane is an undesirable consequence of a fermentation process that allows ruminants to extract nutritional value from cellulose. That does not make enteric methane harmless, but it does mean that the two sources exist within very different systems and should not automatically be treated as equivalent simply because the molecule leaving each system is methane.

Agriculture should continue reducing methane where reductions are biologically practical and economically sustainable. Better diets, improved forage management, genetics, reproductive performance, animal health and effective methane-mitigation technologies all have roles to play. At the same time, the broader climate discussion cannot lose sight of the continuous transfer of geological carbon into the active carbon cycle through fossil-fuel extraction and combustion.

For farmers, this leads to a more useful definition of sustainability. Do not pursue production regardless of its biological cost, but do not pursue emission reductions that compromise animal health, productivity or economic viability either. Look instead for the intersection where productive animals, sound nutrition, good forage, healthy soils, appropriate stocking rates, nutrient recycling and profitable food production reinforce one another.

A cow grazing pasture and oil extraction are both connected to greenhouse gases. They are not the same carbon story. One operates primarily within a biological cycle in which atmospheric carbon is captured by plants, consumed by animals and returned through several pathways. The other retrieves carbon from geological storage and introduces it into the active carbon pool.

Both deserve attention, and livestock agriculture should continue improving its environmental performance. But if the discussion about cattle and climate focuses so intently on the methane coming from the cow that we lose sight of the carbon coming out of the ground, perhaps we have been looking at the wrong elephant.

Further reading.

Garcia, A. 2025. "Urbanization, Agriculture, and Carbon: Balancing Ecosystems for the Future." *Journal of Agriculture and Environmental Sciences* 14: 1–5. https://jaes.thebrpi.org/journals/jaes/Vol_14_2025/1.pdf

IPCC. 2021. *Climate Change 2021: The Physical Science Basis.* Cambridge University Press. https://www.ipcc.ch/report/ar6/wg1/

IPCC. 2022. *Climate Change 2022: Mitigation of Climate Change.* Cambridge University Press. https://www.ipcc.ch/report/ar6/wg3/

FAO. "Livestock and Enteric Methane." Food and Agriculture Organization of the United Nations. https://www.fao.org/in-action/enteric-methane/en/

Wilkinson, J. M. 2011. "Re-defining Efficiency of Feed Use by Livestock." *Animal* 5 (7): 1014–1022.
https://doi.org/10.1017/S175173111100005X

Wilkinson, J. M., and M. R. F. Lee. 2018. "Review: Use of Human-Edible Animal Feeds by Ruminant Livestock." *Animal* 12 (8): 1735–1743.
https://doi.org/10.1017/S175173111700218X