

A marketing summary of

Comparative life cycle assessment of plant-based meats and conventional animal meats

Priera Panescu Scott, PhD

Lead Scientist, Plant-Based Specialist,
The Good Food Institute

This summary is intended for marketing purposes and features key insights from the Good Food Institute’s ISO-certified comparative life cycle assessment (LCA) of plant-based and animal-based meat (Bonales et al. 2024), the most comprehensive open-access assessment of the life cycle impacts of plant-based meat published to date.

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Overview

Over the past decade, the global plant-based meat market has grown considerably, driven by mainstream consumers desiring products that mimic the taste, texture, and functionality of conventional animal products. Investors and consumers are also increasingly interested in the environmental effects of their decisions. By including plant-based meat in product portfolios, companies can diversify their business strategies while reaching carbon reduction goals and other sustainability targets.

When explaining the sustainability benefits of plant-based meat, the results from this ISO-certified LCA are a trusted reference that evaluates 18 environmental impact categories,

and compares beef, pork, chicken, and plant-based meat production using real-world, commercial-scale data. Baseline figures for animal-based meat represent highly optimized production systems.

The three plant-based meats represented in this LCA are: one with soy protein and two with pea protein (made with different enrichment techniques) as the primary ingredients—each protein base was then mixed with wheat gluten, coconut oil, canola oil, potato starch, spices, and water. These recipes are indicative of the most common ingredients and processes used to make commercially available plant-based meats in the United States.



Photo courtesy of Beyond Meat

Key insights

Across all 18 environmental categories, plant-based meat has, on average, 91% lower impacts than beef, 88% lower impacts than pork, and 71% lower impacts than chicken.

Plant-based meat uses fewer resources than animal meat.



Plant-based meat production requires significantly less land, water, fossil fuels, pesticides, and fertilizers compared to animal meat.

On average, plant-based meat has 79% less land use, 95% less water consumption, and 81% less fossil resource use than animal meat. Diversifying the protein supply to include more plant proteins promotes an agricultural system that relies on fewer inputs and resources, improving economics and resilience.

Plant-based meat causes far less air and water pollution than animal meat.



Plant-based meat production emits far fewer greenhouse gases and less air and water pollution compared to animal meat.

On average, plant-based meat production generates 89% fewer GHG emissions, 89% less fine particulate matter, and 93% less water pollution (marine eutrophication) compared to animal meat production. Including plant-based meat in their portfolios can help businesses reach carbon- and pollution-reduction commitments while providing more options for consumers.

Plant-based meat delivers environmental benefits, no matter how it's made.



Plant-based meat is a sustainable choice, regardless of the crop geography, energy source, and ingredient choices.

Plant-based meat production is highly resource-efficient, making it inherently more sustainable than animal meat production, which requires far more crops, land, water, and other resources to produce the same amount of meat. Creating food directly from crops, such as soy, pea, and wheat, reduces the environmental pressures of agriculture and food systems—facilitating more resilient and secure food supply chains.

Summary of LCA results demonstrate the significant environmental benefits of plant-based meats compared to animal meats.¹

Average reduction for plant-based meat² compared to...

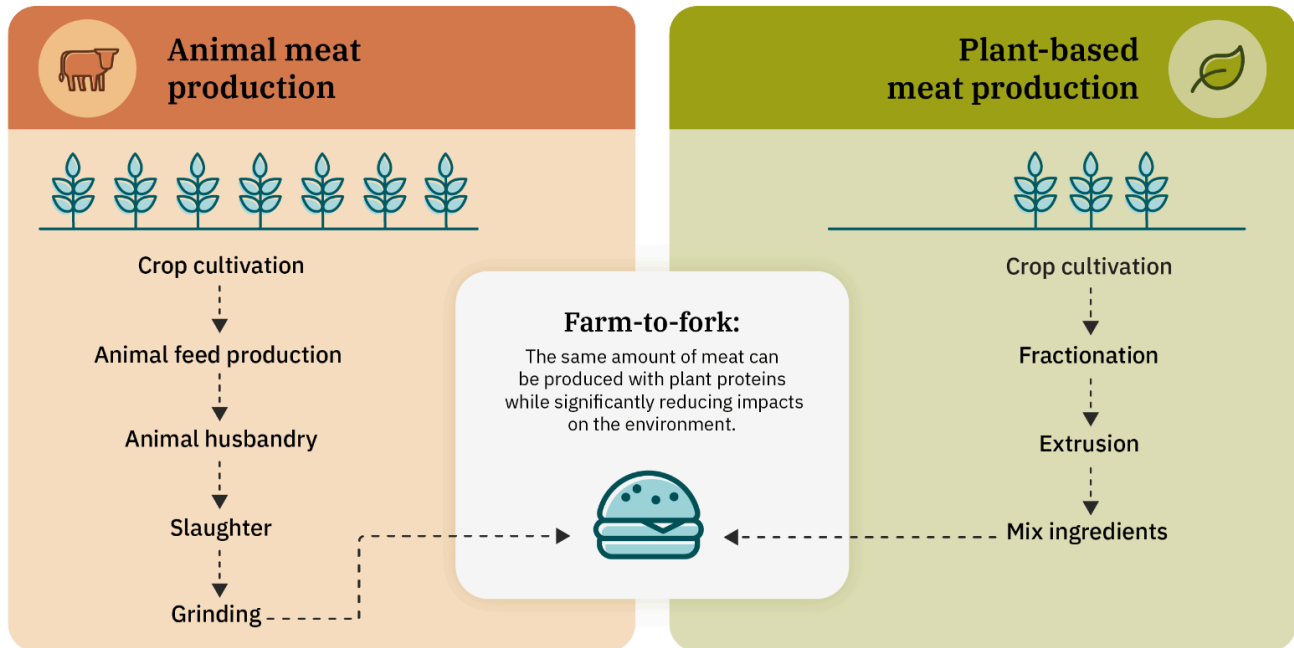
Environmental Impact	 Beef	 Pork	 Chicken
GHG emissions	94%	88%	67%
Land use	91%	60%	10%
Water use (Water consumption)	93%	96%	94%
Air pollution (Fine particulate matter formation)	91%	91%	83%
Water pollution (Marine eutrophication)	96%	90%	84%
Fossil resource use (Fossil resource scarcity)	81%	86%	69%
Avg of 18 impact categories	91%	88%	71%

¹In addition to these six categories, twelve other impact categories were evaluated in the LCA and plant-based meat provided similar environmental benefits across these categories: freshwater ecotoxicity, freshwater eutrophication, human carcinogenic toxicity, human non-carcinogenic toxicity, ionizing radiation, marine ecotoxicity, mineral resource scarcity, ozone formation—human health and terrestrial health, stratospheric ozone depletion, terrestrial acidification, and terrestrial ecotoxicity. The six impact categories summarized above were chosen to holistically encapsulate cornerstone environmental focus areas: climate, resource consumption, and pollution. To view relative impact calculations for all 18 categories, reference Table 5-1 in the full LCA report (Bonales et al. 2024). Production processes are modeled using a mix of primary data gathered specifically for this study from plant-based meat and ingredient producers and secondary data from commercially available datasets. Plant-based meat production processes are largely based on primary data.

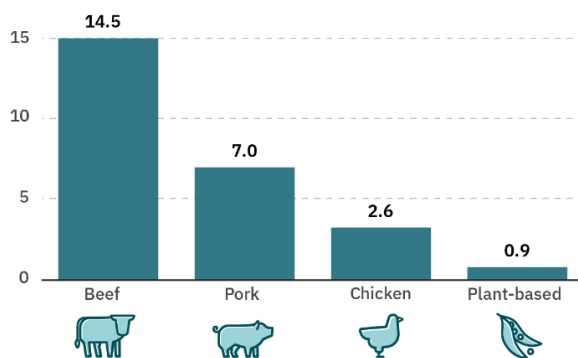
²The average impacts of three plant-based meats: two with pea protein and one with soy protein as the primary ingredients.

Plant-based meat offers many environmental benefits.

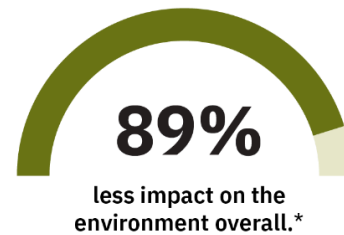
Comparing Life Cycles of Animal and Plant-based meat production



GHG emissions (kg CO₂e)



Producing 1-kg of plant-based meat instead of animal meat has



Compared to animal meat, plant-based meat production results in...



89%
lower GHG emissions



79%
less land use



95%
less water use



89%
less air pollution



92%
less water pollution**

*Averaged across 18 environmental impact categories, comparing three types of plant-based meats (two with pea protein bases and one with a soy protein base) to three types of animal meats (beef, pork, and chicken). To view relative impact calculations for all 18 categories, reference Table 5-1 in the full LCA report (Bonales et al. 2024).

**Averaged across two impact categories (freshwater eutrophication and marine eutrophication).



About GFI

The Good Food Institute is a nonprofit think tank working to make the global food system better for the planet, people, and animals. Alongside scientists, businesses, and policymakers, GFI's teams focus on making plant-based and cultivated meat delicious, affordable, and accessible. Powered by philanthropy, GFI is an international network of organizations advancing alternative proteins as an essential solution needed to meet the world's climate, global health, food security, and biodiversity goals. All of GFI's open-access insights and data are made possible by gifts and grants from our global community of donors. If you are interested in learning more about giving to GFI, please visit [here](#) or contact philanthropy@gfi.org.

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