Environmental benefits of alternative proteins

Global demand for meat is expected to rise by at least 50 percent by 2050.[1] Meeting this demand with conventional meat alone would accelerate pollution and deplete scarce natural resources. Alternative proteins—meat and seafood made from plants, fermentation, or cultivated from animal cells—use a fraction of the land and water required by conventional meat, generate fewer greenhouse gases (GHGs), and reduce the flow of pollutants into communities and ecosystems. To safeguard our natural resources, policymakers should support alternative proteins by making public investments in research, development, and commercialisation.

Alternative proteins are land-efficient.

Alternative proteins use resources directly, without cycling them through animals, and thus require significantly less land. Plants provide nearly two-thirds of the global protein supply on only one-fourth of all agricultural land.[2] A shift to alternative proteins could free up twice as much land as China and India combined.[3] With reforestation and carbon sequestration, the freed-up land would further mitigate climate change–potentially removing 26 gigatons of carbon dioxide equivalent per year, about half of current global emissions.[4] Moreover, by mitigating deforestation and habitat loss, alternative proteins can serve as a key strategy to preserve biodiversity.

Alternative proteins generate fewer GHGs.

Alternative proteins have significantly smaller GHG footprints, as they do not require raising methane-emitting livestock and growing crops for feed. They provide a crucial tool to decarbonise food systems—which account for over a third of global GHG emissions—and meet Paris Agreement goals.[5] If alternative proteins rise to half the global protein market, including dairy, they would mitigate 5 gigatons of carbon dioxide equivalent annually, and agriculture and land-use GHG emissions would decline by 31 percent by 2050 instead of increasing.[6] By capturing just 11 percent of the protein market by 2035, alternative proteins can slash GHGs on a scale roughly equal to decarbonising the entire aviation industry.[7]

Comparative Life Cycle Assessments*

Producing this alternative protein	instead of this conventional meat	reduces this environmental impact category by this much		
		GHG EMISSIONS	LAND USE	AIR POLLUTION (PM)
Impossible Burger[I]	Beef burger patty	89%	96%	–
Beyond Burger[II]	Beef burger patty	89%	92%	–
Quorn Fillet[III]	Chicken breast	75%	78%	–
Morningstar Original Chik Patties[IV]	Chicken sausage patty	46%	84%	69%
Plant-based burger (soy protein)[V]	Beef burger patty	98%	87%	99%
	Chicken burger patty	90%	82%	90%
	Pork burger patty	90%	85%	90%
Plant-based burger (soy)[VI]	Beef burger patties	82%	84%	95%
Plant-based burger (pea)[VI]		84%	64%	91%
Fermentation-based burger (mycoprotein)[VI]		82%	69%	91%
Cultivated beef[VII]	Conventional beef	92%	90%	94%
Cultivated chicken[VII]	Conventional chicken	+3%	64%	20%
Cultivated pork[VII]	Conventional pork	44%	67%	42%

Sources: I. Khan, et al. (2019); II. Heller, et al. (2018); III. Kazer, et al. (2021); IV. Dettling, et al. (2016); V. Saerens, et al. (2021); VI. Smetana, et al. (2021); VII. Sinke, et al. (2023).**

Alternative proteins are water-efficient and can address water scarcity.

Only 0.003 percent of Earth's water is available freshwater, and over two billion people currently live in countries with inadequate water supply.[8] Water scarcity is projected to worsen in the coming decades, especially in drought-susceptible areas like the American West, including the Colorado River—for which more than three-quarters of water withdrawals are related to agriculture.[9] In fact, agriculture is the largest user of freshwater, accounting for 70 percent of withdrawals globally.[10] Plant-based meat can reduce water use by up to 99 percent and cultivated meat 66 percent (compared to conventional beef).[11] As water becomes a limited resource, alternative proteins offer a water scarcity solution.[12]

Alternative proteins cause significantly less air and water pollution.

By using plants, fermentation, or cell cultivation instead of livestock, the production of alternative proteins does not emit the same toxic air pollutants—including ammonia, particulate matter, and hydrogen sulfide—as conventional meat production.[13] Similarly, because there is no animal waste to discharge and fewer crops and fertilisers are needed, alternative proteins reduce the discharge of nitrogen and phosphorus, which stimulate the growth of algal blooms that impair water quality.[14] A shift towards alternative proteins can keep our air and water clean, improving the health of communities and ecosystems, while meeting increasing protein demand.

Policymakers should invest in alternative proteins for a secure, sustainable food supply.

Supporting alternative protein innovation and commercialisation will increase food security. Beyond their significant environmental benefits, alternative proteins expand consumer choice and promote national security by increasing supply chain resilience.[15] In addition, transitioning to alternative proteins could support 83 million jobs and generate US$700 billion in economic value by 2050 globally.[16]

Like renewable energy, technologies enabling alternative proteins are key environmental solutions made possible by scientific breakthroughs. To unlock alternative proteins' full potential, the world's governments should collectively invest **US$10.1 billion annually** in research, development, and commercialisation.[17] With sufficient public investment, alternative proteins can deliver a secure food supply for a growing population while protecting the environment and global stability.

**Table represents the results of several life cycle assessment studies that compare alternative protein products with conventional meat products. A more comprehensive compilation of studies is available at the listed URL. A plus (+) sign in front of a percentage indicates an increase in impact within the environmental category. A dash (—) sign indicates data is unavailable. **For Sinke, et al. (2023), the 2030 scenarios are based on conservative (higher resource use) assumptions of future cultivated meat commercial-scale production coupled with ambitious, low carbon footprint benchmarks for conventional meat production. The cultivated meat products evaluated were produced with renewable energy.*

About GFI APAC

Headquartered in Singapore, the Good Food Institute APAC is Asia's leading alternative protein think tank, accelerating a shift towards a more secure, sustainable, and just food system through open-access food science R&D, corporate engagement, and public policy. GFI APAC is funded entirely by philanthropic support.

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