

# Plant-based 'beef' reduces carbon dioxide but threatens agriculture jobs

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Plant-based alternatives to beef have the potential to help reduce carbon dioxide emissions, but their growth in popularity could disrupt the agricultural workforce, threatening more than 1.5 million industry jobs,

new economic models show.

This research, published Aug. 3 by Cornell, Johns Hopkins University and international partners in *The Lancet Planetary Health*, suggests that policymakers should be vigilant and ready to mitigate negative consequences of technological disruption.

By embracing meat protein alternatives, U.S. [food](#) production could reduce its agricultural carbon footprint by between 2.5% and 13.5%, mostly by decreasing the number of cows needed for [beef production](#) by two to 12 million, according to the paper.

"A reduced carbon footprint and increased food system resource-use efficiency are reasons alternative proteins could be in a portfolio of technologies and policies to promote more-sustainable food systems," said lead author Daniel Mason-D'Croz, senior research associate, Department of Global Development in the College of Agriculture and Life Sciences.

"Still, plant-based alternatives to beef are not silver bullets," he said, "with their impact on other environmental dimensions of the food system—such as total water use—ambiguous."

The researchers explored the potential disruption of plant-based beef alternatives by comparing the [economic consequences](#) under a range of scenarios, where plant-based beef alternatives replaced 10%, 30% or 60% of current U.S. beef demand.

"In the aggregate, food system changes would have a small, but potentially positive impacts on national gross domestic product," said Mason-D'Croz, who works with Mario Herrero, professor of [sustainable food systems](#) and [global change](#) in the Department of Global Development.

"But these changes would not be felt equally across the economy," Mason-D'Croz said, "with substantial disruptions observed across the food system, particularly in the beef-value chain, which could contract substantially by as much as 45% under the 60%-replacement scenario—challenging the livelihoods of the more than 1.5 million people employed in these sectors."

Acting to reduce [climate change](#) is important, the researchers said, but technological disruption can have many consequences—both positive and negative—across the economy, such as the issue of livelihoods, working conditions, human rights, fair wages and health equity.

"There are good reasons for regulators and policymakers to encourage these up-and-coming technologies," said senior author Herrero, a scholar at the Cornell Atkinson Center for Sustainability. "Politicians must remain aware to unintended negative consequences and commit to mitigating changes that are ethically concerning, including harms to disadvantaged workers and hard-hit local communities and small producers."

The adoption of plant-based beef alternatives could lead to other unintended consequences. For example, resources freed from contracting [beef](#) sectors—such as livestock feed—could allow the pork and poultry sectors to expand.

Models suggest that this could mean swapping two to 12 million cattle for 16 to 94 million more chickens or up to 1.4 million pigs, which raises animal welfare concerns, said Mason-D'Croz, a Cornell Atkinson faculty fellow.

The sheer numbers of animals affected could increase and the welfare conditions of many pigs and chicken in agricultural production are arguably worse than those of cattle, Mason-D'Croz said, given that the

pork and poultry sector frequently use confined feeding operations.

"Nevertheless, a range of plant-based alternatives to [animal products](#) are under development," Mason-D'Croz said. "If these are adopted widely, then increases in animal numbers would be less likely, even as economic disruption and negative impacts on the livelihoods of those employed in animal-sourced food value chains would be much larger."

**More information:** Daniel Mason-D'Croz et al, Ethical and economic implications of the adoption of novel plant-based beef substitutes in the USA: a general equilibrium modelling study, *The Lancet Planetary Health* (2022). [DOI: 10.1016/S2542-5196\(22\)00169-3](https://doi.org/10.1016/S2542-5196(22)00169-3)

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