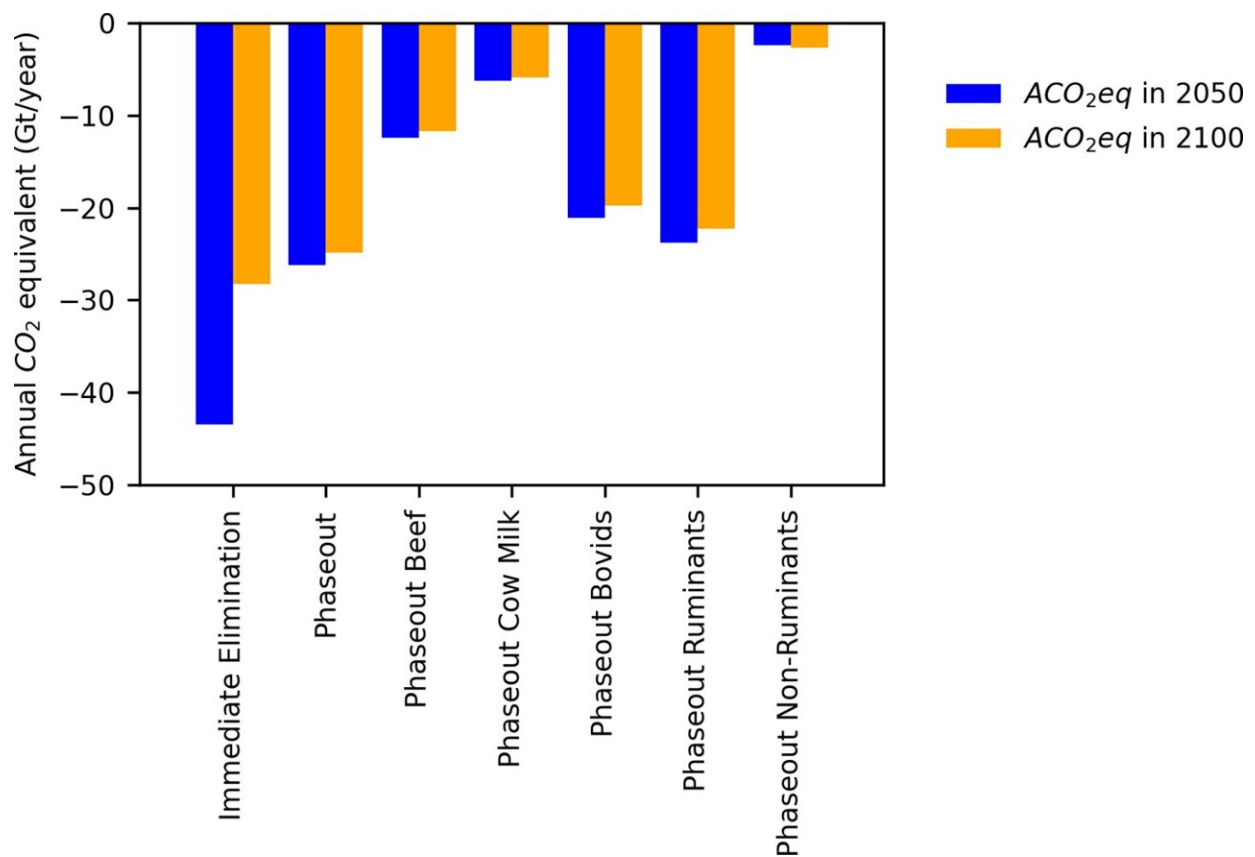


# Phasing out animal agriculture could potentially stabilize greenhouse gas levels for decades, according to new model

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Bars show sustained reduction in annual CO<sub>2</sub> emissions necessary to equal cumulative reduction in radiative forcing, a measure of the instantaneous warming potential of the atmosphere, of the given scenario in 2050 (blue) and 2100 (orange). Credit: Eisen and Brown, 2022, CC-BY 4.0 ([creativecommons.org/licenses/by/4.0/](https://creativecommons.org/licenses/by/4.0/))

The worldwide phase out of animal agriculture, combined with a global switch to a plant-based diet, would effectively halt the increase of atmospheric greenhouse gases for 30 years and give humanity more time to end its reliance on fossil fuels, according to a new study by scientists from Stanford University and the University of California, Berkeley.

"We wanted to answer a very simple question: What would be the impact of a global phase-out of animal agriculture on atmospheric greenhouse gases and their global-heating impact?" said Patrick Brown, a professor emeritus in the department of biochemistry at Stanford University. Brown co-authored the paper with Michael Eisen, a professor of genetics and development at UC Berkeley.

Based on the model, published in the open-access journal *PLoS Climate*, phasing out animal agriculture over the next 15 years would have the same effect as a 68 percent reduction of carbon dioxide (CO<sub>2</sub>) emissions through the year 2100. This would provide 52 percent of the net emission reductions necessary to limit global warming to 2 degrees Celsius above preindustrial levels, which scientists say is the minimum threshold required to avert disastrous climate change.

The changes would stem, the authors say, from the spontaneous decay of the potent greenhouse gases methane and nitrous oxide, and the recovery of biomass in natural ecosystems on the more than 80 percent of humanity's land footprint currently devoted to livestock.

"Reducing or eliminating animal agriculture should be at the top of the list of potential climate solutions," Brown said. "I'm hoping that others, including entrepreneurs, scientists and global policymakers, will recognize that this is our best and most immediate chance to reverse the trajectory of climate change, and seize the opportunity."

Brown is also the founder and CEO of Impossible Foods, a company

developing alternatives to animals in food production. Eisen is an advisor to the company. Both Brown and Eisen stand to benefit financially from the reduction of animal agriculture.

## Unlocking negative emissions

Brown and Eisen are not the first to point out that ongoing emissions from animal agriculture are contributing to global warming. But what has not been recognized before, they say, is the much more impactful "climate opportunity cost"—the potential to unlock *negative* emissions by eliminating livestock.

"As the methane and nitrous oxide emissions from livestock diminish, atmospheric levels of those potent greenhouse gases will actually drop dramatically within decades," Brown said. "And the CO<sub>2</sub> that was released into the atmosphere when forests and wild prairies were replaced by feed crops and grazing lands can be converted back into biomass as livestock are phased out and the forests and prairies recover."

Brown and Eisen used publicly available data on livestock production, livestock-linked emissions and biomass recovery potential on land currently used to support livestock to predict how the phaseout of all or parts of global animal agriculture production would alter net anthropogenic, or human-caused, emissions from 2019 levels. They then used a simple climate model to project how these changes would impact the evolution of atmospheric greenhouse gas levels and warming for the rest of the century.

They examined four dietary scenarios: an immediate replacement of all animal agriculture with a plant-only diet; a more gradual and, the authors say, more realistic, 15-year transition to a global plant-only diet; and versions of each where only beef was replaced with plant-only products.

For each hypothetical scenario, the scientists assumed that non-agricultural emissions would remain constant and that the land formerly used for livestock production would be converted to grasslands, prairies, forests and the like that will absorb atmospheric CO<sub>2</sub>.

"The combined effect is both astoundingly large, and—equally important—fast, with much of the benefit realized by 2050," Brown said. "If animal agriculture were phased out over 15 years and all other greenhouse-gas emissions were to continue unabated, the phase-out would create a 30-year pause in net greenhouse gas emissions and offset almost 70 percent of the heating effect of those emissions through the end of the century."

While the complete phase out of animal-based agriculture was projected to have the largest impact, 90 percent of the emission reductions could be achieved by only replacing ruminants such as cattle and sheep, according to the model.

While their paper does not explore the particulars of what a global phaseout of animal agriculture would entail, the authors acknowledge that "the economic and social impacts of a global transition to a plant-based diet would be acute in many regions and locales ..." and that "it is likely that substantial global investment will be required to ensure that people who currently making a living from animal agriculture do not suffer when it is reduced or replaced."

But, they write, "in both cases, these investments must be compared to the economic and humanitarian disruptions of significant global warming."

## **Changing attitudes**

Many will scoff at the idea that billions of people can be convinced to

switch to a plant-only diet within 15 years. To these skeptics, Eisen points out that other revolutions have happened in less time. "We went from having no cellphones to cellphones being ubiquitous in less time than that. Electricity, cars, solar panels—all became common in a relatively short period of time," Eisen said.

Moreover, Brown added, societal attitudes toward food are far from fixed. "Five hundred years ago, nobody in Italy had ever seen a tomato. Sixty years ago, nobody in China had ever drunk a Coke. Mutton was once the most popular meat in America," he said. "People around the world readily adopt new foods, especially if they are delicious, nutritious, convenient and affordable."

The scientists have made all of the raw data they used, as well as their calculations and the computer code used to carry out the calculations, publicly available so that others can make up their own mind.

"The great thing about science is that, in the end, it all comes down to whether the conclusions are supported by the evidence," Brown said. "And in this case, they are."

**More information:** Eisen MB, Brown PO (2022) Rapid global phaseout of animal agriculture has the potential to stabilize greenhouse gas levels for 30 years and offset 68 percent of CO<sub>2</sub> emissions this century. *PLOS Clim* 1(2): e0000010.  
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