

Avoiding meat and dairy is ‘single biggest way’ to reduce your impact on Earth

Biggest analysis to date reveals huge footprint of livestock - it provides just 18% of calories but takes up 83% of farmland

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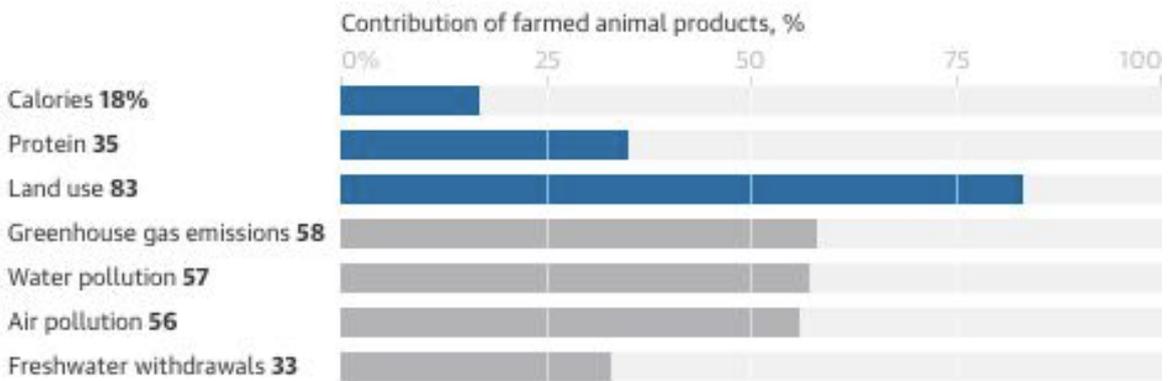
Cattle at an illegal settlement in the Jamanxim National Forest, state of Para, northern Brazil, November 29, 2009. With 1,3 million hectares, the Jamanxim National Forest is today a microcosm that replicates what happens in the Amazon, where thousands of hectares of land are prey of illegal woodcutters, stock breeders and gold miners. Photograph: Antonio Scorza/AFP/Getty Images

Avoiding meat and dairy products is the single biggest way to reduce your environmental impact on the planet, according to the scientists behind the most comprehensive analysis to date of the damage farming does to the planet.

The new research shows that without meat and dairy consumption, global farmland use could be reduced by more than 75% – an area equivalent to the US, China, European Union and Australia combined – and still feed the world. Loss of wild areas to agriculture is the leading cause of the current **mass extinction of wildlife**.

The new analysis shows that while meat and dairy provide just 18% of calories and 37% of protein, it uses the vast majority – 83% – of farmland and produces 60% of agriculture’s greenhouse gas emissions. Other recent research shows **86% of all land mammals are now livestock or humans**. The scientists also found that even the very lowest impact meat and dairy products still cause much more environmental harm than the least sustainable vegetable and cereal growing.

More than 80% of farmland is used for livestock but it produces just 18% of food calories and 35% of protein



Guardian Graphic | Source: Poore and Nemecek, Science

The study, **published in the journal Science**, created a huge dataset based on almost 40,000 farms in 119 countries and covering 40 food products that represent 90% of all that is eaten. It assessed the full impact of these foods, from farm to fork, on land use, climate change emissions, freshwater use and water pollution (eutrophication) and air pollution (acidification).

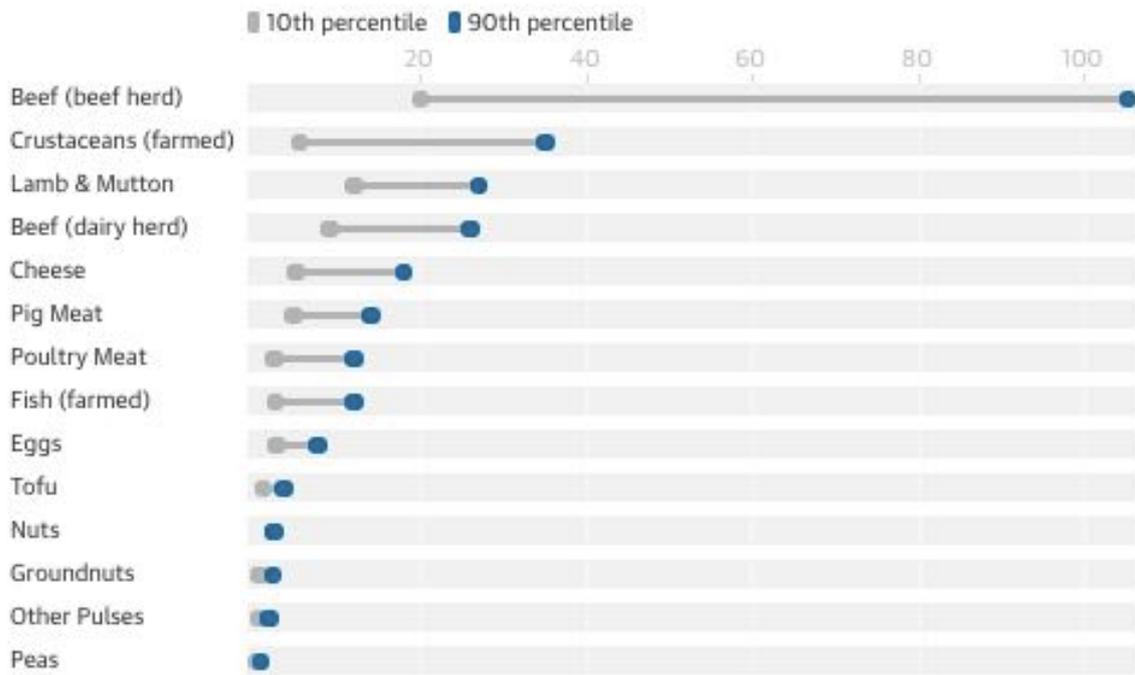
“A vegan diet is probably the single biggest way to reduce your impact on planet Earth, not just greenhouse gases, but global acidification, eutrophication, land use and water use,” said Joseph Poore, at the University of Oxford, UK, who led the research. “It is far bigger than cutting down on your flights or buying an electric car,” he said, as these only cut greenhouse gas emissions.

“Agriculture is a sector that spans all the multitude of environmental problems,” he said. “Really it is animal products that are responsible for so much of this. Avoiding consumption of animal products delivers far better environmental benefits than trying to purchase sustainable meat and dairy.”

The analysis also revealed a huge variability between different ways of

producing the same food. For example, beef cattle raised on deforested land result in 12 times more greenhouse gases and use 50 times more land than those grazing rich natural pasture. But the comparison of beef with plant protein such as peas is stark, with even the lowest impact beef responsible for six times more greenhouse gases and 36 times more land.

Beef results in up to 105kg of greenhouse gases per 100g of meat, while tofu produces less than 3.5kg



Guardian Graphic | Source: Poore and Nemecek, Science

The large variability in environmental impact from different farms does present an opportunity for reducing the harm, Poore said, without needing the global population to become vegan. If the most harmful half of meat and dairy production was replaced by plant-based food, this still delivers about two-thirds of the benefits of getting rid of all meat and dairy production.

Cutting the environmental impact of farming is not easy, Poore warned: “There are over 570m farms all of which need slightly different ways to reduce their impact. It is an [environmental] challenge like no other sector of the economy.” But he said at least \$500bn is spent every year on agricultural subsidies, and probably much more: “There is a lot of money there to do something really good with.”

Labels that reveal the impact of products would be a good start, so consumers could choose the least damaging options, he said, but subsidies for sustainable

and healthy foods and **taxes on meat and dairy** will probably also be necessary.

One surprise from the work was the large impact of freshwater fish farming, which provides two-thirds of such fish in Asia and 96% in Europe, and was thought to be relatively environmentally friendly. “You get all these fish depositing excreta and unconsumed feed down to the bottom of the pond, where there is barely any oxygen, making it the perfect environment for methane production,” a potent greenhouse gas, Poore said.

The research also found grass-fed beef, thought to be relatively low impact, was still responsible for much higher impacts than plant-based food. “Converting grass into [meat] is like converting coal to energy. It comes with an immense cost in emissions,” Poore said.

The new research has received strong praise from other food experts. Prof Gidon Eshel, at Bard College, US, said: “I was awestruck. It is really important, sound, ambitious, revealing and beautifully done.”

He said previous work on quantifying farming’s impacts, **including his own**, had taken a top-down approach using national level data, but the new work used a bottom-up approach, with farm-by-farm data. “It is very reassuring to see they yield essentially the same results. But the new work has very many important details that are profoundly revealing.”

Prof Tim Benton, at the University of Leeds, UK, said: “This is an immensely useful study. It brings together a huge amount of data and that makes its conclusions much more robust. The way we produce food, consume and waste food is unsustainable from a planetary perspective. Given the global obesity crisis, changing diets – eating less livestock produce and more vegetables and fruit – has the potential to make both us and the planet healthier.”

Dr Peter Alexander, at the University of Edinburgh, UK, was also impressed but noted: “There may be environmental benefits, eg for biodiversity, from sustainably managed grazing and increasing animal product consumption may improve nutrition for some of the poorest globally. My personal opinion is we should interpret these results not as the need to become vegan overnight, but rather to moderate our [meat] consumption.”

Poore said: “The reason I started this project was to understand if there were sustainable animal producers out there. But I have stopped consuming animal products over the last four years of this project. These impacts are not

necessary to sustain our current way of life. The question is how much can we reduce them and the answer is a lot.”

Giving up beef will reduce carbon footprint more than cars, says expert

Study shows red meat dwarfs others for environmental impact, using 28 times more land and 11 times water for pork or chicken

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Beef production results in five more climate-warming emissions than chicken or pork. Photograph: Alamy

Beef’s environmental impact dwarfs that of other meat including chicken and pork, new research reveals, with one expert saying that eating less red meat would be a better way for people to cut carbon emissions than giving up their cars.

The heavy impact on the environment of meat production was known but the research shows a new scale and scope of damage, particularly for beef. The popular red meat requires 28 times more land to produce than pork or chicken, 11 times more water and results in five times more climate-warming emissions. When compared to staples like potatoes, wheat, and rice, the

impact of beef per calorie is even more extreme, requiring 160 times more land and producing 11 times more greenhouse gases.

Agriculture is a significant driver of global warming and causes 15% of all emissions, half of which are from livestock. Furthermore, the huge amounts of grain and water needed to raise cattle is a concern to experts worried about feeding an extra 2 billion people by 2050. But previous calls for **people to eat less meat** in order to help the environment, or preserve grain stocks, **have been highly controversial**.

“The big story is just how dramatically impactful beef is compared to all the others,” said Prof Gidon Eshel, at Bard College in New York state and who led the research on beef’s impact. He said cutting subsidies for meat production would be the least controversial way to reduce its consumption.

“I would strongly hope that governments stay out of people’s diet, but at the same time there are many government policies that favour of the current diet in which animals feature too prominently,” he said. “Remove the artificial support given to the livestock industry and rising prices will do the rest. In that way you are having less government intervention in people’s diet and not more.”

Eshel’s team analysed how much land, water and nitrogen fertiliser was needed to raise beef and compared this with poultry, pork, eggs and dairy produce. Beef had a far greater impact than all the others because as ruminants, cattle make far less efficient use of their feed. “Only a minute fraction of the food consumed by cattle goes into the bloodstream, so the bulk of the energy is lost,” said Eshel. Feeding cattle on grain rather than grass exacerbates this inefficiency, although Eshel noted that even grass-fed cattle still have greater environmental footprints than other animal produce. The footprint of lamb, relatively rarely eaten in the US, was not considered in the study **published in the journal Proceedings of the National Academy of Sciences**.

Prof Tim Benton, at the University of Leeds, said the new work is based on national US data, rather than farm-level studies, and provides a useful overview. “It captures the big picture,” he said, adding that livestock is the key to the sustainability of global agriculture.

“The biggest intervention people could make towards reducing their carbon footprints would not be to abandon cars, but to eat significantly less red meat,”

Benton said. “**Another recent study** implies the single biggest intervention to free up calories that could be used to feed people would be not to use grains for beef production in the US.” However, he said the subject was always controversial: “This opens a real can of worms.”

Prof Mark Sutton, at the UK’s Centre for Ecology and Hydrology, said: “Governments should consider these messages carefully if they want to improve overall production efficiency and reduce the environmental impacts. But the message for the consumer is even stronger. Avoiding excessive meat consumption, especially beef, is good for the environment.”

He said: “The US and Europe alike are using so much of their land in highly inefficient livestock farming systems, while so much good quality cropland is being used to grow animal feeds rather than human food.”

Separately, a second study of tens of thousands of British people’s daily eating habits shows that **meat lovers’ diets cause double the climate-warming emissions** of vegetarian diets.

The **study of British people’s diets** was conducted by University of Oxford scientists and found that meat-rich diets - defined as more than 100g per day - resulted in 7.2kg of carbon dioxide emissions. In contrast, both vegetarian and fish-eating diets caused about 3.8kg of CO₂ per day, while vegan diets produced only 2.9kg. The research analysed the food eaten by 30,000 meat eaters, 16,000 vegetarians, 8,000 fish eaters and 2,000 vegans.