Going Vegan Reduces Your Environmental Impact

by Jack Norris, Registered Dietitian, Executive Director of Vegan Outreach

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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.

–Joseph Poore, Environmental Science Researcher, University of Oxford

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Introduction

Animal agriculture is one of the largest contributors to human-made greenhouse gas emissions, deforestation, water pollution, and air pollution. With so many alternatives available, making choices that help the environment is easier than ever.

Take, for example, the vegan Beyond Meat Burger. A quarter-pound Beyond Burger is nearly identical nutritionally to a quarter-pound beef burger but generates 90% less greenhouse gas emissions, requires 46% less energy and 99.5% less water, and uses 93% less land compared to the production, packaging, and distribution of U.S. beef (Heller and Keoleian, University of Michigan, 2018).

Vegans have the least environmental impact compared to lacto-ovo vegetarians, fish-eaters, low meat-eaters, medium meat-eaters, and high meat-eaters. Vegans produce only 25% of the greenhouse gas emissions and use 25% of the land and 46% of the water of high meat-eaters (Scarborough et al., *Nature Food*, 2023, Rabes et al., *Sustainable Production and Consumption*, 2020; Kim et al., *Global Environmental Change*, 2020; Jennings et al., *Nutrients*, 2023).

Air Pollution

The air pollution caused by animal agriculture significantly contributes to greenhouse gases. It also leads to premature deaths and environmental racism.

Greenhouse Gases

Limiting global warming to 1.5°C or 2°C will likely require extensive and unprecedented changes to the global food system, including incorporating more plant-based diets (Clark, et al. *Science*, 2020).

Meat and dairy production creates 56-58% of agriculture's greenhouse gas emissions while providing only 18% of calories and 37% of protein (Poore and Nemecek, *Science*, 2018; Xu et al., *Nature Food*, 2021). Animal agriculture contributes a minimum of 16.5% of all greenhouse gas emissions (Twine R, *Sustainability*, 2021).

Fishing is also implicated in climate change. Commercial fishing that uses bottom trawling disturbs carbon stores in the ocean's floor and significantly contributes to greenhouse gas emissions and ocean acidification (Attwood et al., *Frontiers*, 2024).

Producing protein from beef emits 90 times the greenhouse gases as an equivalent amount from peas. Even when comparing emissions from the lowest-impact meat and dairy products to the highest-impact plants, plant-based protein sources consistently have a smaller carbon footprint (Ritchie H, *Our World in Data*, 2020).

Multiple reports have found that a vegan diet has the most potential for reducing greenhouse gas emissions:

- Vegan diets have the greatest potential for reducing greenhouse gas emissions by up to 35 to 50% (Eshel et al., *Scientific Reports*, 2019).
- Changing to a vegan diet could reduce global agricultural emissions by 84% to 86%. The reduction in air pollution would prevent approximately 236,000 premature deaths per year (Springmann et al., *Nature Communications*, 2023).
- If animal agriculture were phased out over the span of 15 years, greenhouse gas emissions could stabilize for 30 years and offset 68% of carbon dioxide emissions through the remainder of this century. The resulting greenhouse gas reductions would provide half of those necessary to limit global warming to 2°C (Eisen and Brown, *PLOS Climate*, 2022).
- Land displaced by producing animal foods has the potential to sequester 152.5 gigatons of carbon (GtC) in living plant biomass. Ruminant animal pastures for meat and dairy comprise 72% of the carbon, while cropland for animal feed makes up the other 28%. This amount of carbon represents the past decade of fossil fuel emissions. Researchers consider it comparable to the reductions necessary to limit global warming to 1.5°C (Hayek et al., *Nature Sustainability*, 2020).

Smaller shifts toward a plant-based diet can also have large impacts on the environment:

- The United Nations Intergovernmental Panel on Climate Change reports that a shift towards plant-based diets is a major opportunity to limit greenhouse gas emissions (Intergovernmental Panel on Climate Change, 2022).
- Globally, replacing 50% of animal-sourced foods with plant-based alternatives would reduce agricultural and land-based emissions by 31% by 2050, while also increasing food security (Kozicka et al., *Nature Communications*, 2023).
- A global shift towards a flexitarian diet by 2050 would make the goal of limiting global warming to 1.5°C feasible (Humpenöder et al., *Science Advances*, 2024).
- In the United States, replacing half of all animal-based foods with plant-based foods could result in a 35% decrease in diet-related emissions, reducing roughly 224 million metric tons of emissions annually by 2030, the same amount as 47.5 million passenger vehicles (Heller et al., Center for Sustainable Systems, University of Michigan, 2020).

In contrast, eating locally does little to change the impact of various diets.

Greenhouse gas (GHG) emissions from transportation make up a very small amount of the emissions from food, and what you eat is far more important than where your food traveled from.

–Ritchie H, Our World in Data, 2018

Environmental Racism

Hog and dairy farms produce enormous waste. It's stored in lagoons and then sprayed onto fields, destroying the quality of life in local communities.

If waste is sprayed too often, it saturates the soil and leaks into the aquifer and nearby rivers and streams. The practice also aerosolizes fecal matter, creating toxic particulates that get blown onto nearby homes, accompanied by a terrible stench that drives residents indoors. A majority of those homes belong to African Americans, who have had their property drenched in hog waste for decades and their wells polluted, too. For 30 years, their complaints about the effect on their health and quality of life have mostly fallen on deaf ears at the [North Carolina] statehouse—making this a clear case of environmental racism with quantifiable human cost.

–Skolnick A, Sierra Club, 2017

The Sierra Club quotes residents living near hog waste lagoons:

> [Hog waste] comes over here just like it's raining. That's what we inhale if we're outside, and it comes inside the house because you can't keep that odor out. We don't have cookouts or family get-togethers like we used to, because we don't know when the odor is gonna come. When it's really hot, it burns your eyes.

Water

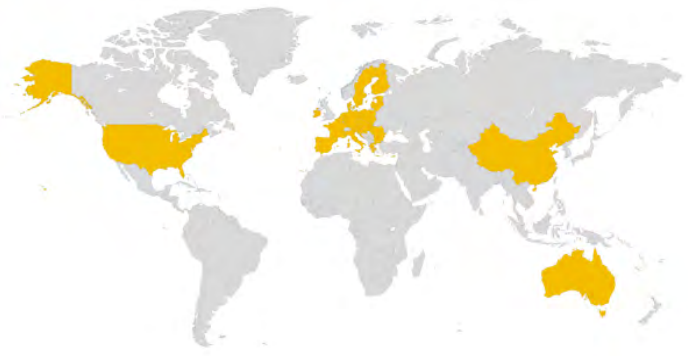
783 million people worldwide don't have access to clean drinking water while animal agriculture uses nearly 1/3 of available drinking water (Gerbens-Leenes et al., *Water Resources and Industry*, 2013). For example, the Colorado River is of critical importance for 40 million people but persistent overuse has depleted its reservoirs; of the Colorado River's direct water consumption, 46% goes to growing hay for cattle (Richter et al., *Communications Earth & Environment*, 2024).

In comparing a normal diet from a number of cities in the Mediterranean region with a healthy Mediterranean, pescatarian, or vegetarian diet, the healthy vegetarian diet had the lowest water footprint, 30-53% lower than a typical Mediterranean diet (Vanham et al., *Science of the Total Environment*, 2016).

In comparing a variety of common, sustainable diets to the standard Western diet, a vegan diet uses the least amount of water by up to 50% (Aleksandrowicz et al., *Public Library of Science*, 2016).

Land

Worldwide, meat and dairy production uses 83% of farmland but provides only 18% of calories and 37% of protein. Even "low-impact" beef uses 36 times more land than peas. If everybody stopped eating meat and dairy products, farmland use could be reduced by 75%, an area equivalent to the size of the U.S., China, Australia, and the European Union combined (Poore and Nemecek, *Science*, 2018).



Nearly two-thirds of all soybeans, corn, and barley crops, and about one-third of all grain crops, are used to feed animals (Willett et al., *Lancet*, 2019). If the entire U.S. population replaced beef with beans, 42% of U.S. cropland would be freed up (Harwatt et al., *Climatic Change*, 2017).

In comparing the land use of each animal-based food in the U.S. with that of a nutritionally comparable plant-based alternative, replacing all animal-based products could sustain 350 million additional people. An amount of land that can produce 100 grams of protein from plants can produce only 60 grams of protein from eggs, 50 grams from chickens, 25 grams from dairy, 10 grams from pigs, and 4 grams from beef (Shepon et al., *Proceedings of the National Academy of Sciences*, 2018).

We should point out that one study analyzed ten different diet scenarios and found that a lacto-vegetarian diet required the least amount of land, lower even than a vegan diet (Peters et al., *Elementa: Science of the Anthropocene*, 2016). It's not clear why. The main difference between the two diets was that they assigned 4 cups of dairy to lacto-vegetarians and 2.9 cups of soy milk to vegans suggesting their model must assign a larger amount of land for producing soy milk than dairy. That much soy milk would be a lot for most vegans. More importantly, Our World in Data compared the land use of soy milk to cow's milk with data from Poore and Nemecek (2018) and found that dairy requires 14 times as much land per volume of milk (Ritchie, 2022).

Grass-Fed Beef and Climate Change

Most beef cattle in the United States live the last portion of their lives on feedlots where they're fed grains. Such cattle require less land and emit less greenhouse gases than cattle who graze for their entire lives. As shown above, feedlot-finished beef requires significantly more land and emits significantly more greenhouse gases than do plant foods.

But some people argue that, contrary to the idea that beef harms the environment, grazing cattle can actually be a *solution* to climate change. This idea gained momentum with a 2013 TED talk by biologist Allan Savory, How to green the world's deserts and reverse climate change.

Savory says that land being turned into deserts is one of the greatest promoters of climate change and that the idea that grazing livestock is the leading cause of desertification is misleading. He argues that the only way to combat desertification is to use livestock to mimic the historic herds of wild ruminant animals living and migrating on grasslands.

Savory developed a method for how cattle ranchers could mimic these historical herds and started a movement among ranchers to implement his methods.

In his TED talk, he showed images of impressive changes to a number of land plots that had previously been desertified and said that applying these methods to half the world's grasslands offers the most hope for solving climate change.

At the end of his talk, Savory receives a standing ovation for the hope he inspires for reversing climate change.

Is Savory correct?

If grazing livestock is going to combat climate change, it must result in a negative amount of CO2-equivalent greenhouse gases released into the atmosphere. It's difficult to see how this could be the case given that grazing animals release large amounts of methane (CH4), a form of carbon that is many times more potent than CO2, and the reason why ruminant animals are normally considered to be such a driver of climate change.

Even if methane wasn't involved, it would be unlikely for grazing animals to remove carbon from the atmosphere. There's a cycle of carbon being incorporated into plants, then into the animals who eat the plants, then into the humans who eat the animals, and eventually back to plants. During that cycle, carbon leaks into the atmosphere in a variety of ways. The only variable that can overcome this carbon leaking in a grazing system is to permanently store extra carbon in the soil, known as *soil carbon sequestration*. This can happen by the soil trapping more decaying organic matter and feces than it previously had, by grasses growing deeper roots, and by plants that livestock don't consume being added to the grazing land. (There's also a nitrogen cycle that impacts climate change and follows a similar pattern as carbon with regard to grass-fed beef.)

How much carbon can be sequestered by the soil by changing the way we graze animals? Extensive research has examined this question and the answer is "not much."

The Food Climate Research Network of Oxford University published a thorough report on the subject, *Grazed and Confused* (2017). The report points out that "Ruminants in well-managed grazing systems can sequester carbon in grasslands, such that this sequestration partially or entirely compensates for the CO2, CH4 and N2O these systems generate (Table 1, p. 12)." But there is a significant limiting factor in that only soils that have been relatively depleted of carbon have the potential to sequester significant amounts and once they're saturated, there becomes little potential to sequester more at which point the grazing animals once again become net-positive carbon emitters.

Grazed and Confused concludes:

> This report concludes that grass-fed livestock are not a climate solution. Grazing livestock are net contributors to the climate problem, as are all livestock. Rising animal production and consumption, whatever the farming system and animal type, is causing damaging greenhouse gas release and contributing to changes in land use. Ultimately, if high consuming individuals and countries want to do something positive for the climate, maintaining their current consumption levels but simply switching to grass-fed beef is not a solution. Eating less meat, of all types, is.

Since 2017, much additional research has been published, though it doesn't change the conclusions of *Grazed and Confused*.

One study compiled 292 local comparisons of conventional and improved beef production systems across global regions (Cusack et al., *Global Change Biology*, 2021). They conclude:

> Overall, this meta-analysis suggests that substantial GHG emissions reductions are possible in beef production systems, both via increased efficiency and land-based C sequestration….Nonetheless, given the unlikelihood that these strategies will be applied globally to maximum effect, beef management changes for increased efficiency and C sequestration should be considered as complements to efforts to curtail the growing global demand for beef in order to achieve large-scale, sustainable reduction in food GHG emissions.

At current beef consumption levels, a nationwide shift to grass-fed beef in the United States would require 30% more cattle which would have significant environmental impacts. Only reductions in beef consumption can guarantee reductions in the environmental impact of the food system (Hayek and Garrett, *Environmental Research Letters*, 2018).

In conclusion, *under ideal conditions*, which usually don't exist, grass-fed beef can produce fewer emissions than feedlot beef. Under even more ideal conditions, grass-fed beef can sequester carbon for a period of time. But it's not realistic to think that grass-fed beef can be a solution for climate change, especially compared to being vegan.

Summary

Animal agriculture is not a sustainable system and your environmental footprint can be drastically reduced on a plant-based diet!

Please see veganoutreach.org/vegan to learn how you don't need animal foods to be healthy or to have high-protein, satisfying meals.

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