

A circular wreath of botanical illustrations surrounds a central white circle. The wreath includes various plants: a large green leaf with prominent veins, a red leaf, a fern frond, a cluster of small pink flowers, a large green leaf with a prominent vein, a cluster of orange flowers, a large red leaf, a cluster of purple flowers, a large green leaf with a prominent vein, and a fern frond.

Julie Sinistore, PhD

Resource, environmental and
social impacts of food choices

Agenda and Outcomes

Agenda

- Intro to me and LCA
- Environmental, social, health and equity implications of food choices
- When vegan alone falls short
- What can you do?
- Reflection and questions

Outcomes

- Understand the wholistic environmental and social impacts of food choices
- Enable yourself to make informed decisions about the foods you choose

Help a fellow Portland Vegan!

Are you **vegan**? Do you have thoughts on how **social change** happens?



Scan here to take this **survey** & for a chance to win a **\$25 gift card** to **Realm Refillery!**



Introduction



Who am I?



Education

- BS, Natural Resource Management, Cook College of Rutgers University
- MSc, Agroecology and PhD Biological Systems Engineering, UW-Madison
- Dissertation: Life cycle assessment of cellulosic ethanol



Virent

- Senior Life Cycle Analyst
- Communicate the business case for sustainability & LCA to C-Level Marketing/Sales

thinkstep

- Senior Consultant
- Learned electronics, building and construction
- Made connections with Fortune 500 companies working on LCA



UC-Berkeley

- Taught Life Cycle Thinking & Sustainable Product Design
- Mechanical engineering graduate program for 3 years

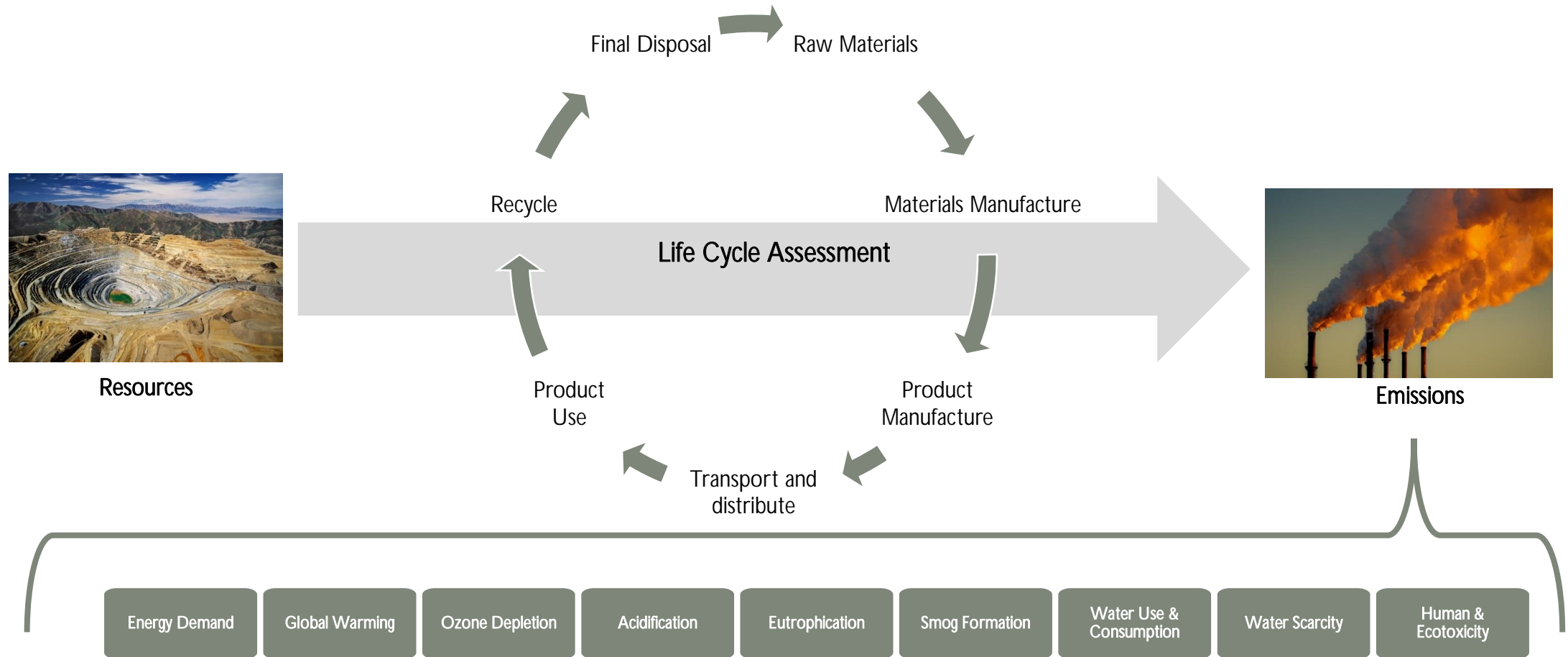


WSP

- Expanding my understanding of sustainability topics from LCA to GHG inventories, target setting and road mapping
- Treasurer of ACLCA and executive committee treasurer, member the
- ISO TAG 207 – governing ISO 14040 standards
- EPD verifier with the International EPD System

Life Cycle Assessment (LCA)

Summing all the resources entering and emissions leaving the system boundary to evaluate total environmental impacts from the production, usage and disposal of products

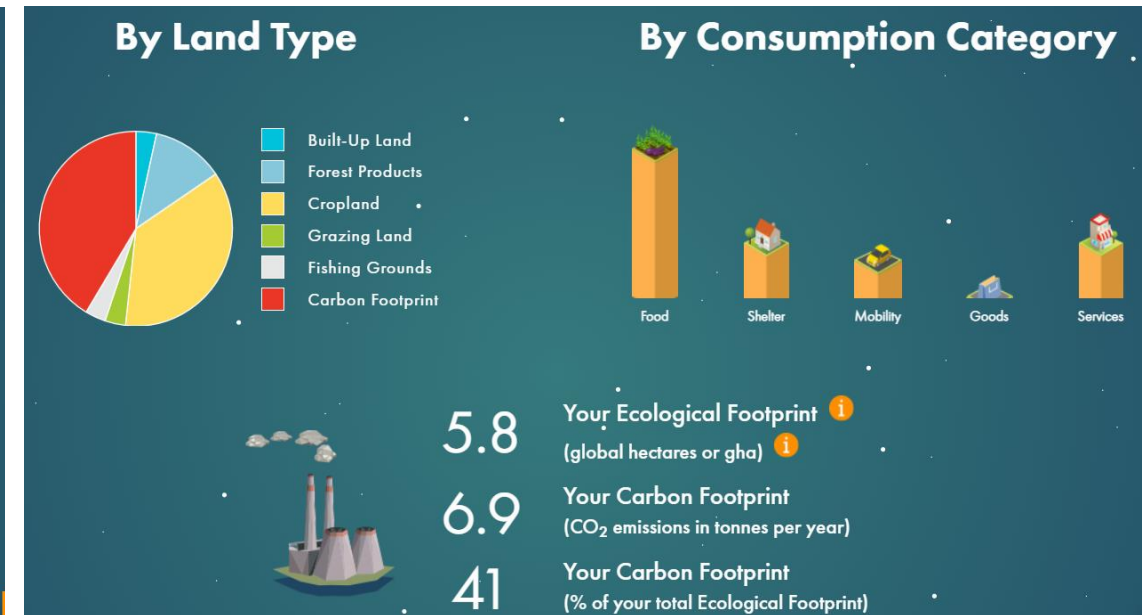
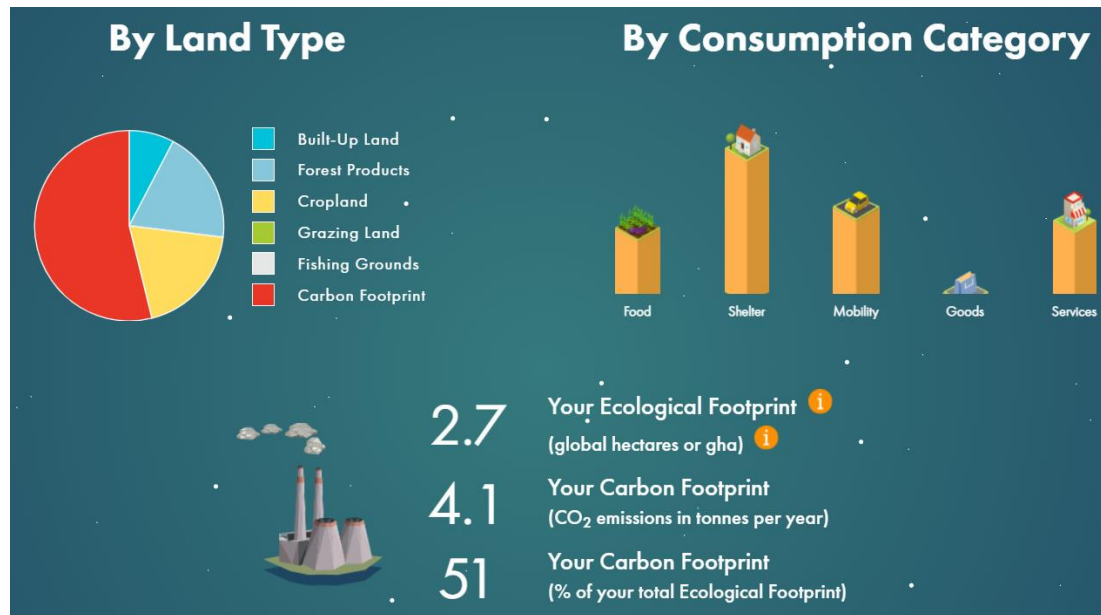




Environmental, social, health and equity



Why does food matter?



→ Julie Vegan

→ Julie Standard Diet

Drawdown

NEW YORK TIMES BESTSELLER

DRAWDOWN

THE MOST COMPREHENSIVE
PLAN EVER PROPOSED TO
REVERSE GLOBAL WARMING
EDITED BY PAUL HAWKEN

REDUCE ANIMAL
PRODUCTS

#4 Plant-Rich Diet

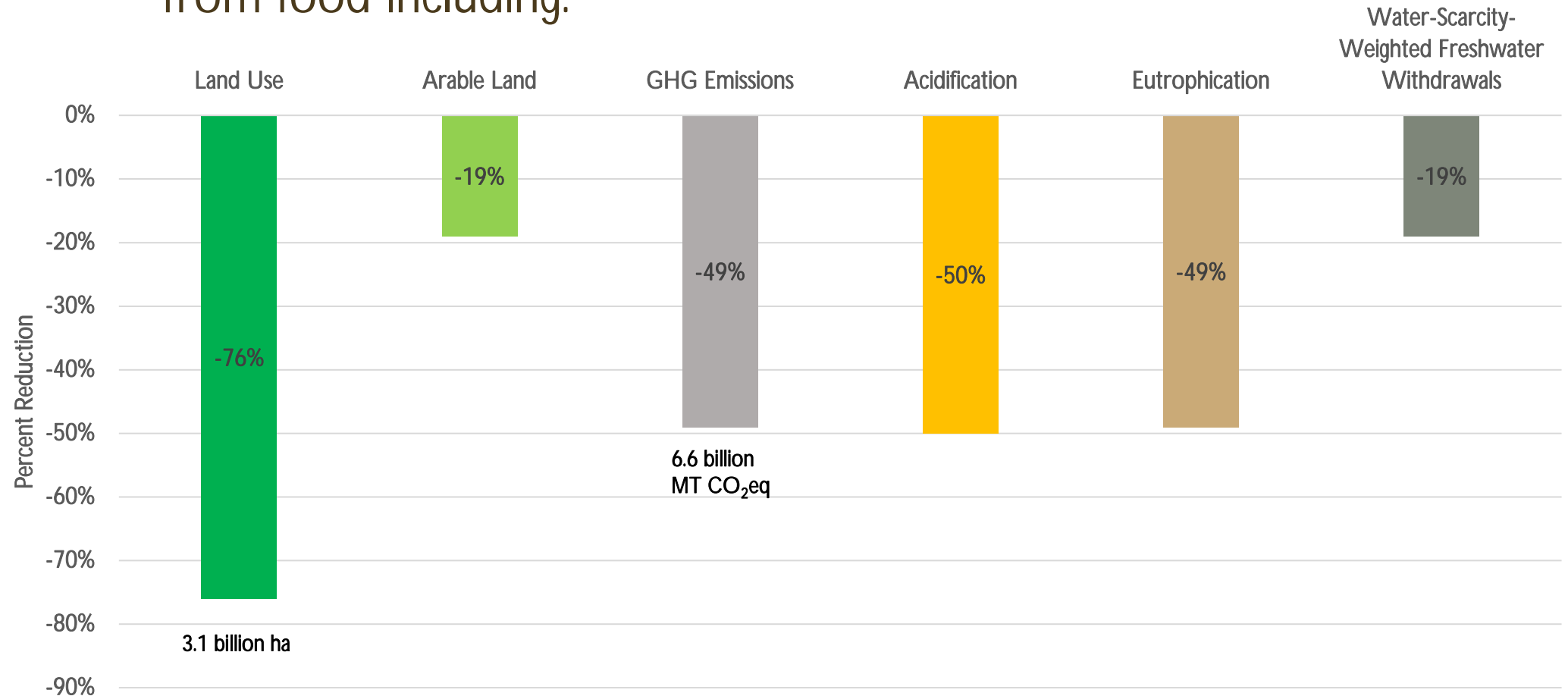
I will enjoy meatless or vegan
meal(s) each day of the
challenge.

LEARN MORE

- If cattle were a nation, they would have the 3rd highest GHG emissions of any country in the world.
- As Zen master Thich Nhat Hanh has said, making the transition to a plant-based diet may be the most effective way an individual can stop climate change.

Dietary LCA

Moving from current diets to a diet that excludes animal products has the potential to reduce impacts from food including:



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Greenhouse Gas Emissions

Per Capita Diet-Related GHG Footprints, United States—2

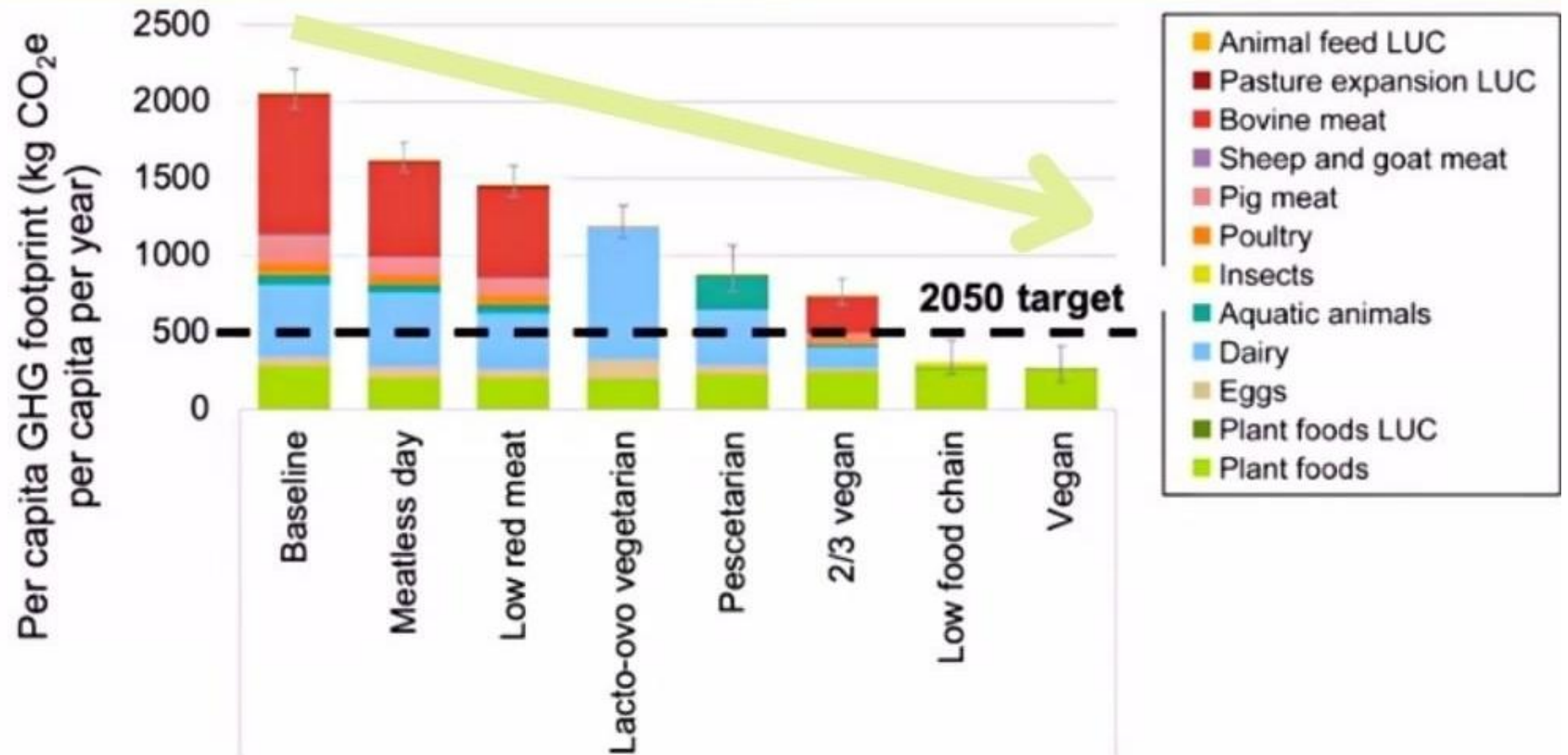
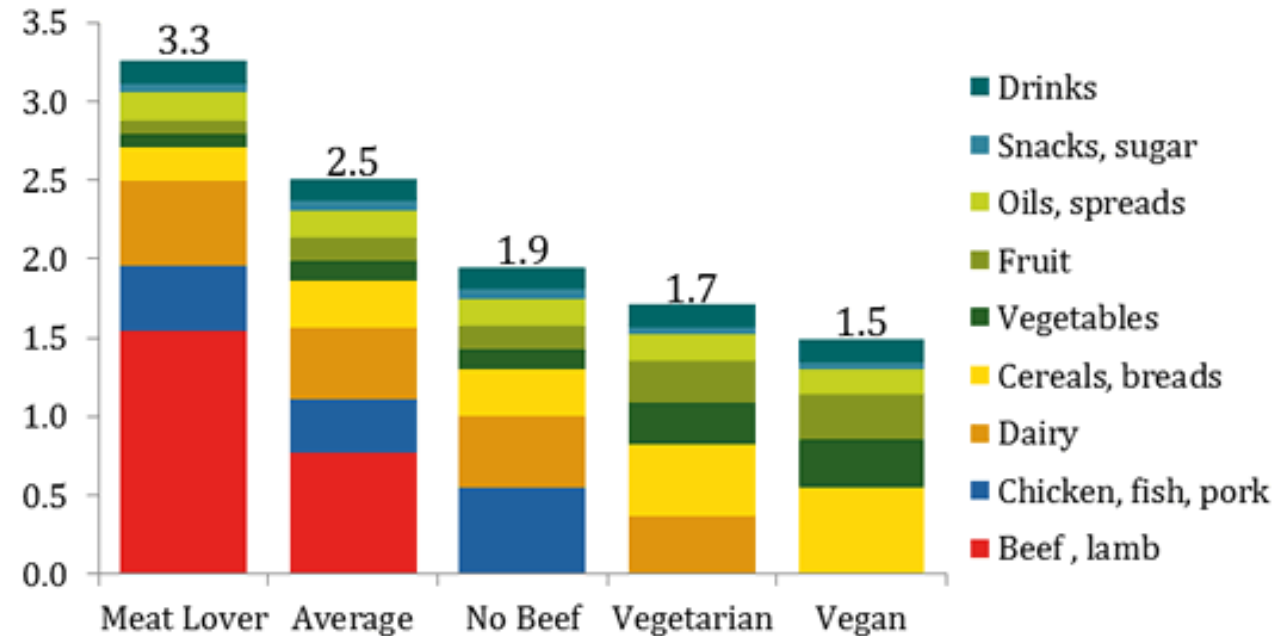


Image credit: Johns Hopkins Center for a Livable Future

Source: Kim, B. F., Santo, R. E., et al. (2019). Country-specific dietary shifts to mitigate climate and water crises. *Global Environmental Change*.

Greenhouse Gas Emissions

Foodprints by Diet Type: t CO₂e/person



Note: All estimates based on average food production emissions for the US. Footprints include emissions from supply chain losses, consumer waste and consumption. Each of the four example diets is based on 2,600 kcal of food consumed per day, which in the US equates to around 3,900 kcal of supplied food.

Sources: ERS/USDA, various LCA and EIO-LCA data



- Meat Lover diet for 80 years = **646,000 miles** driven in a average car
- Vegan diet for 80 years = **294,000 miles** driven in an average car
- Vegan = less than half the emissions than meat lover

Protein

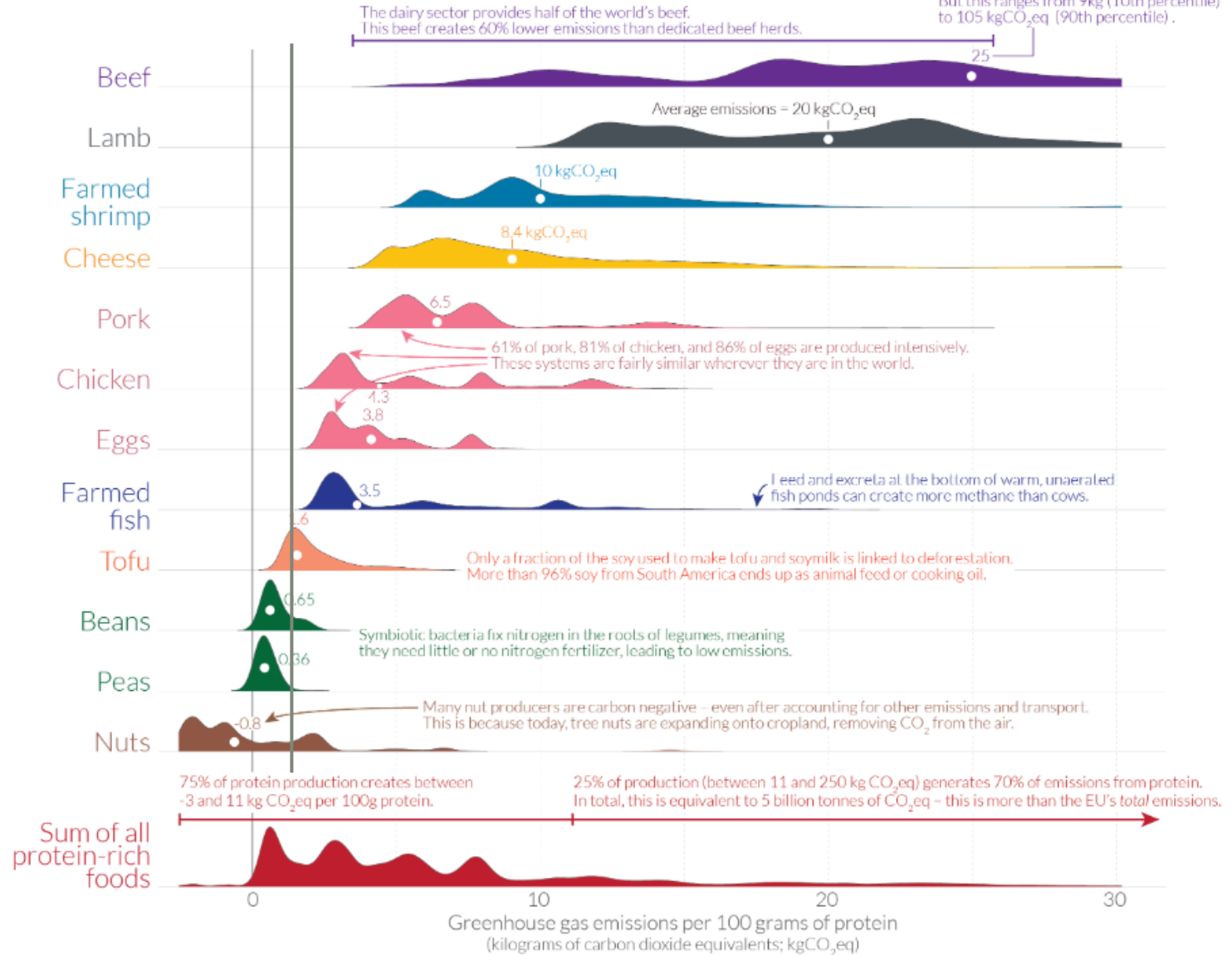
- Even the most sustainably-produced animal proteins have **higher** GHG emissions per 100 grams of protein compared to the least sustainably-produced plant-based proteins.
- Animal-based agricultural emissions account for 57% of total global agricultural emissions, while only 29% is from plant-based food.

How does the carbon footprint of protein-rich foods compare?

Greenhouse gas emissions from protein-rich foods are shown per 100 grams of protein across a global sample of 38,700 commercially viable farms in 119 countries.

The height of the curve represents the amount of production globally with that specific footprint. The white dot marks the median greenhouse gas emissions for each food product.

Producing 100 grams of protein from beef emits 25 kilograms of CO₂eq, on average. But this ranges from 9kg (10th percentile) to 105 kgCO₂eq (90th percentile).

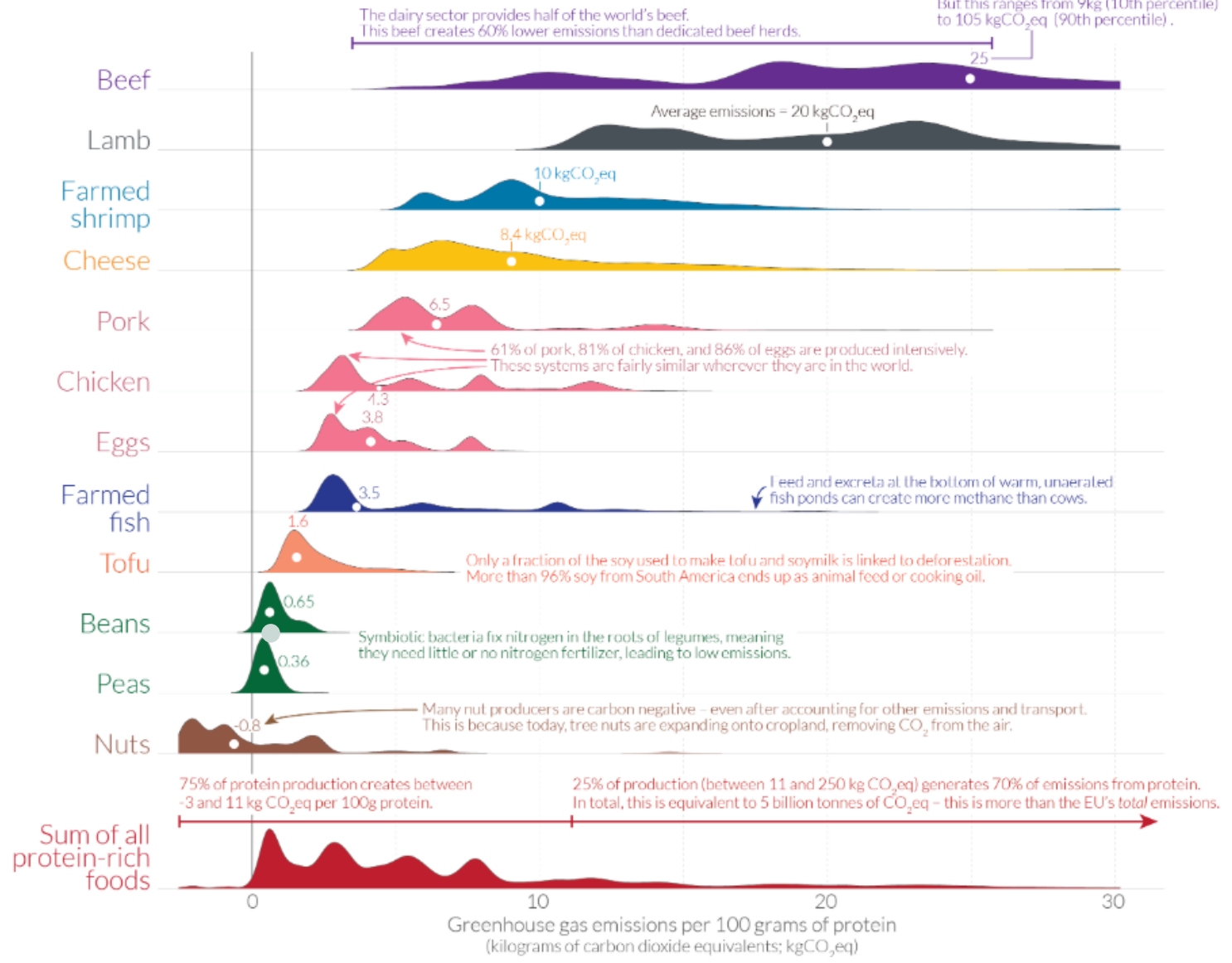


Xu, et. al., 2021. Global GHG emissions from animal-based foods are twice those of plant-based foods. Nature Food.

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What about bugs?

100 kg of cricket protein ≈ 4.35 kg CO₂e, roughly between peas and beans

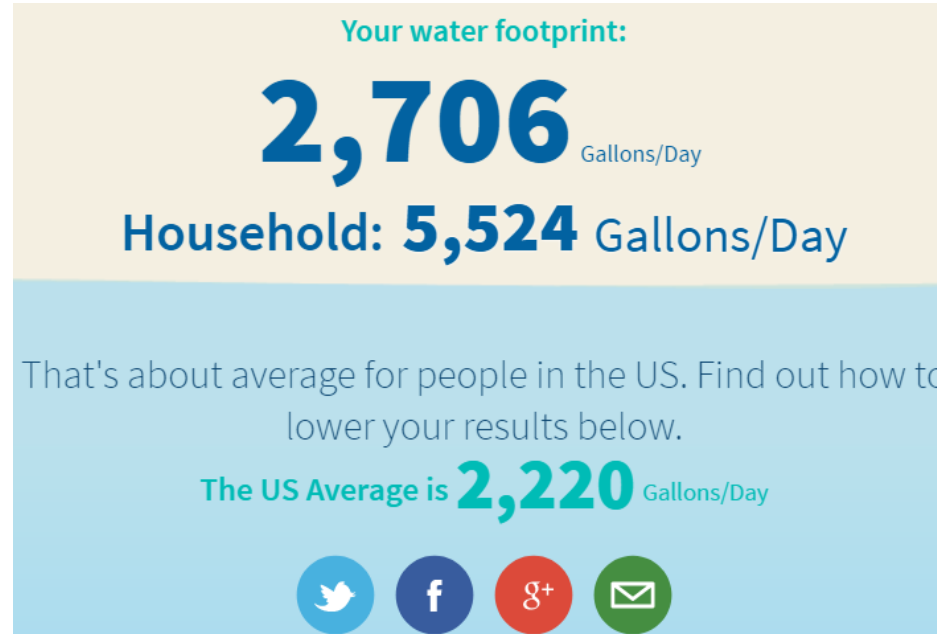
Considerations:

- Allergies – people allergic to shrimp and lobster may be allergic to crickets
- Chitin may inhibit protein absorption

Water



Vegan me

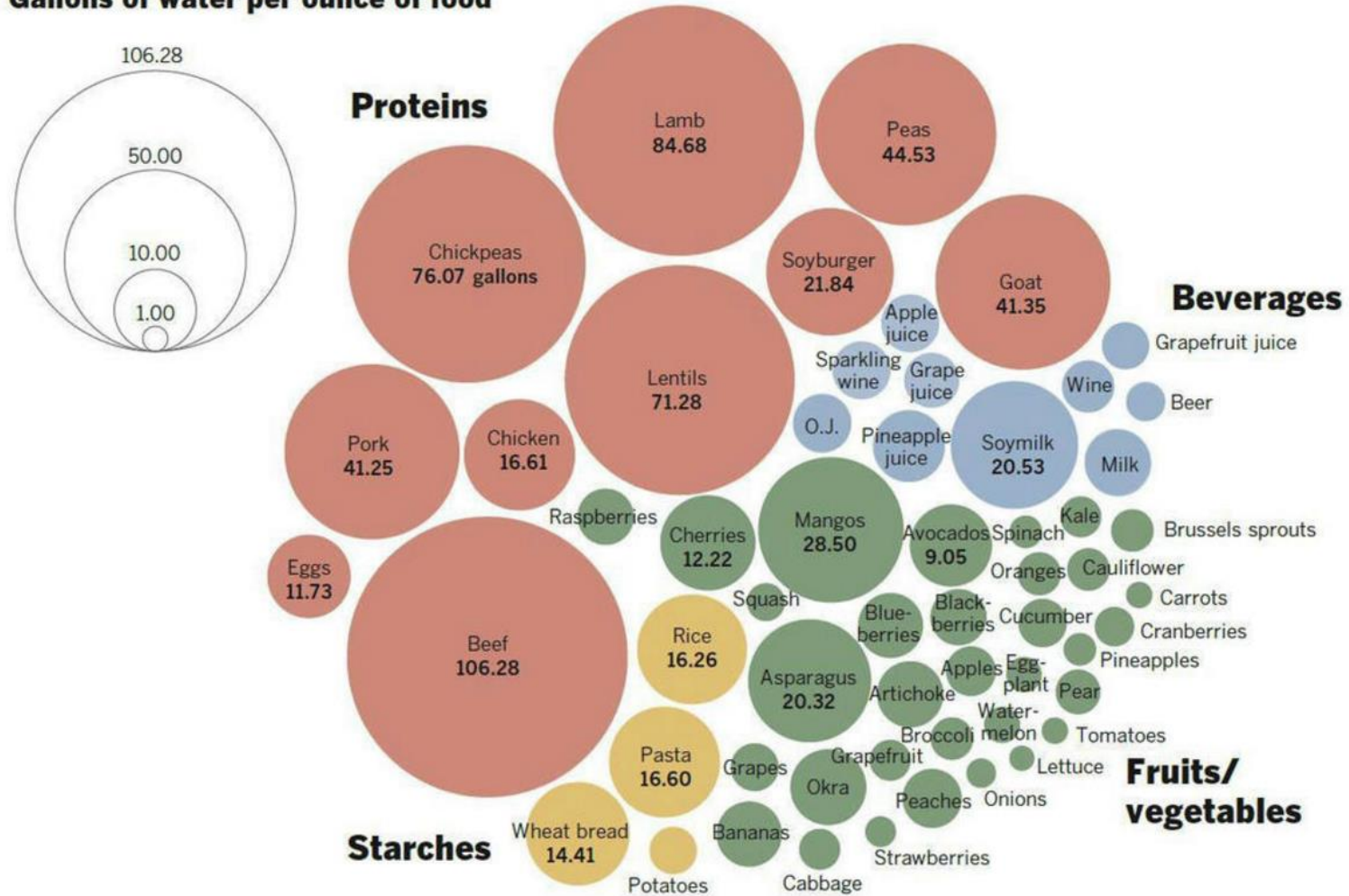


Me if I ate animal products

- Vegan me uses half an Olympic swimming pool of water per year.
- If I ate meat, I would use 1.5 Olympic swimming pools per year.

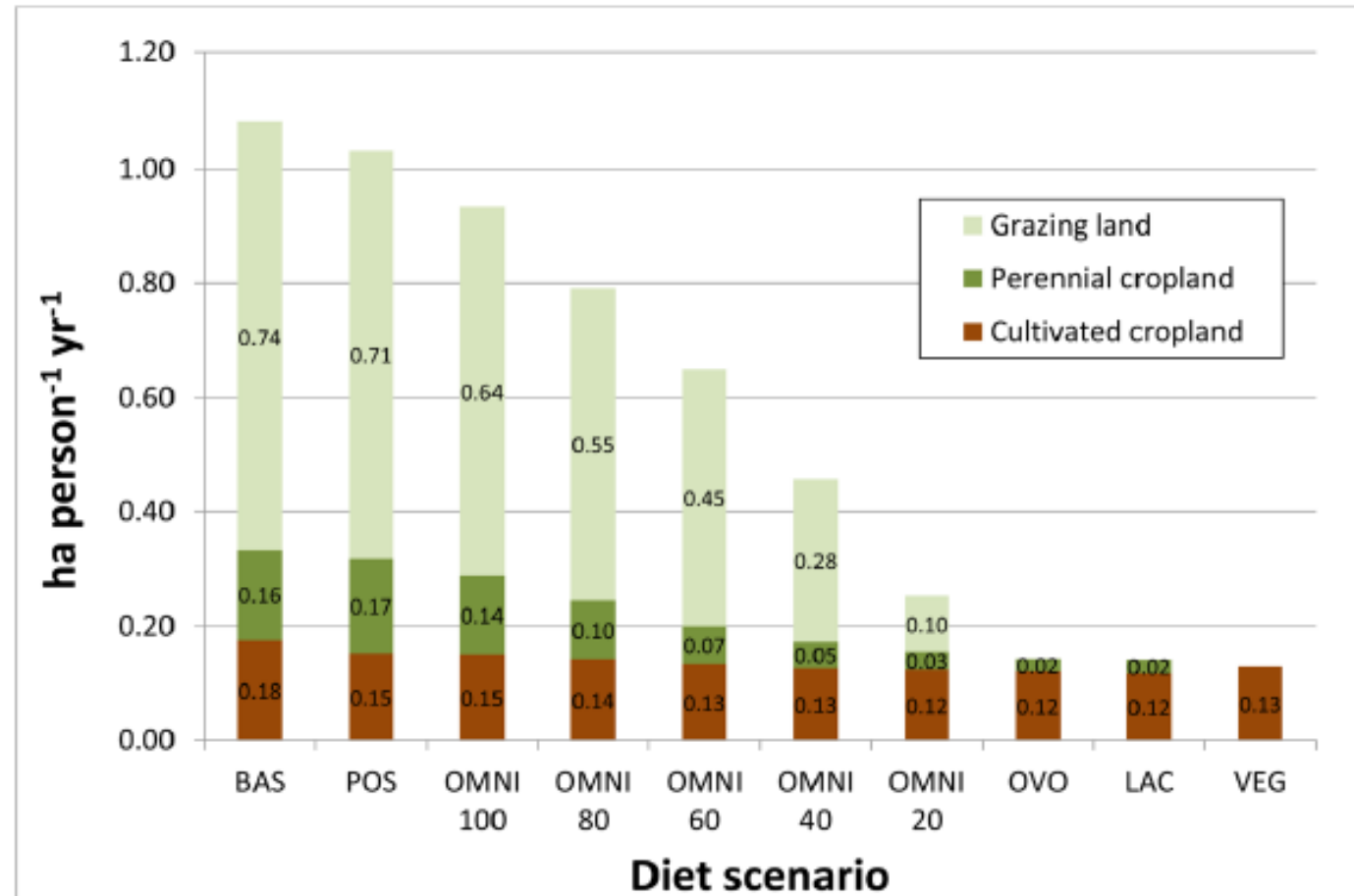
Water

Gallons of water per ounce of food



Almonds ~ = Asparagus

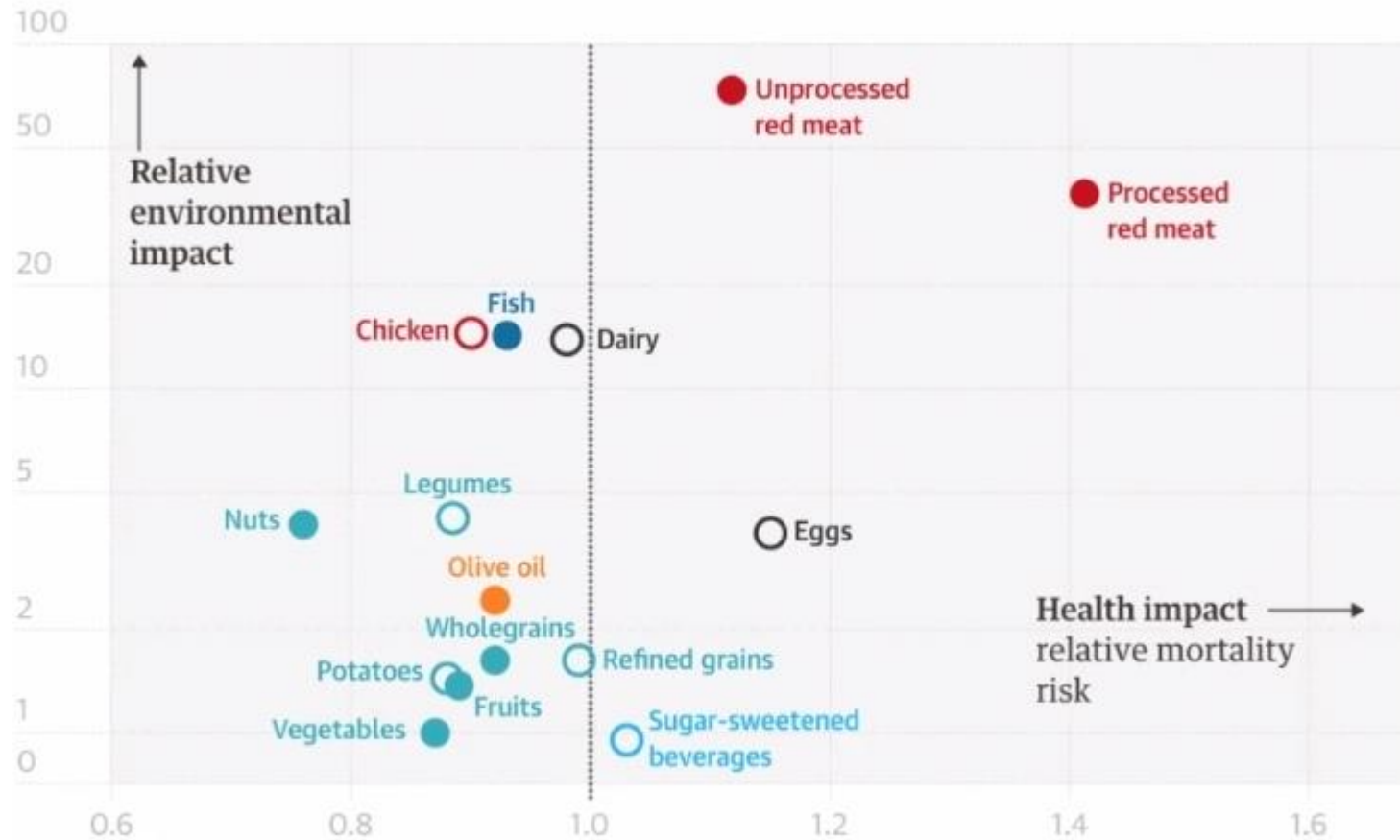
Land



High animal consumption to low animal consumption

A vegan would use **19** football fields in 80 years, while a baseline diet with average meat would use **111** football fields in 80 years

Health and environmental impacts



Guardian graphic. Source: Clark et al, PNAS, 2019. Note: Foods linked to a statistically significant change in mortality risk are denoted by solid circles. Those not linked are denoted by open circles

The WHO classifies processed meat as a **known human carcinogen** and unprocessed red meat as a **potential carcinogen**
Environmental burdens of foods correlate positively with negative health outcomes with animal products

Antibiotic resistance

- In livestock, antibiotics are primarily used to increase growth, more so than to prevent or cure illness.¹
- A growing list of infections – such as pneumonia, tuberculosis, blood poisoning, gonorrhoea, and foodborne diseases – are becoming harder, and sometimes impossible, to treat as antibiotics become less effective.²
- A systematic review published in The Lancet Planetary Health found that interventions that restrict antibiotic use in food-producing animals reduced antibiotic-resistant bacteria in these animals by up to 39%.

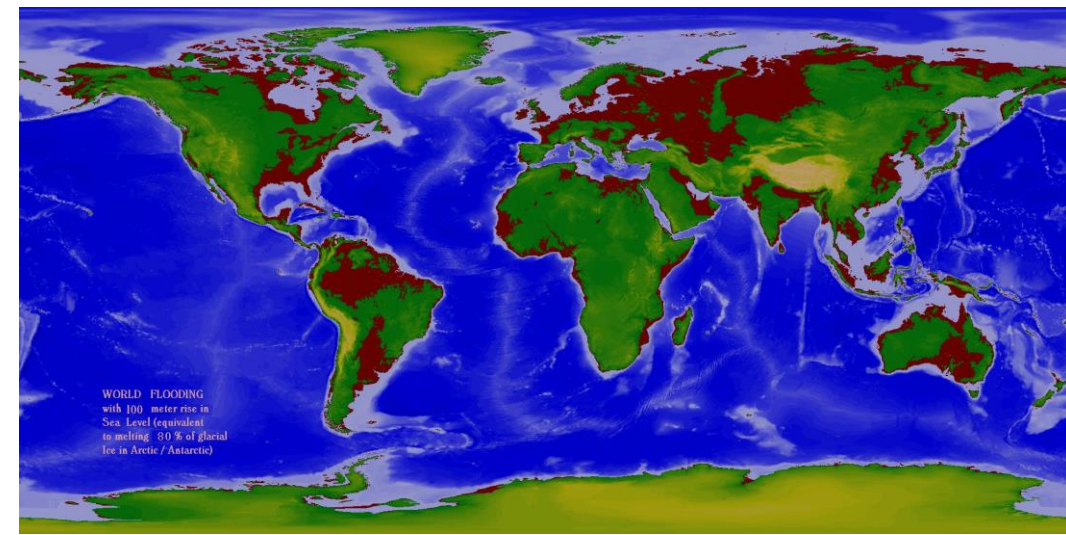
1. Mann, et. al., 2021. Antibiotic resistance in agriculture: Perspectives on upcoming strategies to overcome upsurge in resistance. *Curr Res Microb Sci.* [10.1016/j.crmicr.2021.100030](https://doi.org/10.1016/j.crmicr.2021.100030)

2. World Health Organization: <https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance>

Environmental Racism

- Environmental impacts from **climate change** (e.g., rising sea level and drought) will disproportionately affect Black, Brown and Indigenous people
- **Slaughterhouse** workers are predominantly of the global majority and endure **dangerous conditions**, long hours, repetitive physical stress and mental stress.
- **Factory farms** contribute to **poor air quality and water pollution** and are more likely to be located in low-income communities
- According to a 2021 study by the National Academy of Sciences released, US agricultural production results in ~17,900 **air quality-related deaths** per year, "Of those, 80% are attributable to animal-based foods, both directly from animal production and indirectly from growing animal feed." Emissions from these animal enterprises kill more people in the U.S. each year than particle pollution from coal plants (about 13,000).

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"The worst thing, worse than the physical danger, is the emotional toll. . . . Pigs down on the kill floor have come up and nuzzled me like a puppy. Two minutes later I had to kill them-beat them to death with a pipe. I can't care."

"Swine CAFOs are disproportionately located in black and brown communities and regions of poverty . . ." say Maria C. Mirabelli, Steve Wing, Stephen W. Marshall, and Timothy C. Wilcosky of the School of Public Health at the University of North Carolina-Chapel Hill.

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1016401

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1440786/>

<https://www.pnas.org/content/118/20/e2013637118>

https://www.catf.us/wp-content/uploads/2010/09/CATF_Pub_TheTollFromCoal.pdf

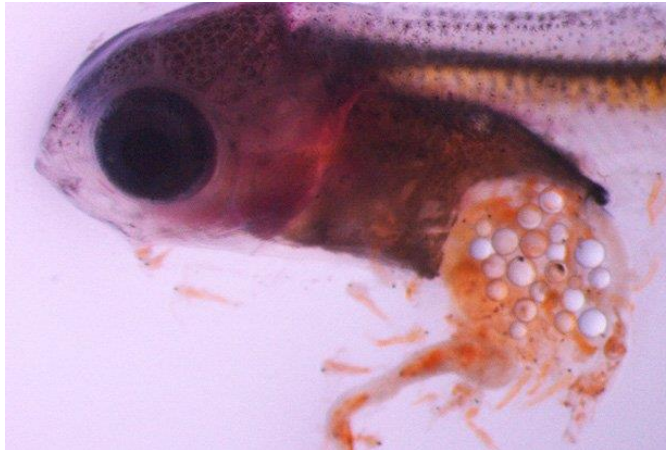


When veganism is not enough



Plastic Kills

- Plastic impacts 700 species of marine animals
- Plastic isn't inherently non-vegan, but it kills animals world-wide especially: sea turtles, seals and sea lions, sea birds, fish, whales and dolphins¹
- Microplastics are accumulating in mollusks and fish²
- Reducing use of plastics and ensuring recycling will help



1. <http://www.onegreenplanet.org/animalsandnature/marine-animals-are-dying-because-of-our-plastic-trash/>

2. <https://www.sciencedaily.com/releases/2014/07/140710141630.htm>

Palm Oil

- It's plant-based, but not good for animals
- Orangutan habitat destruction affects food and shelter availability
- Vehicle strikes and intentional killing



Sugar – not as sweet as we think



- Environmental damage from burning sugarcane for hand harvesting
 - Soil structural damage
 - Particulate matter and toxic gas emissions: formaldehyde and acenaphthylene, both linked to cancer
- If it damages the environment, it harms habitat for human and non-human animals, is that vegan?

Agave



Liquid waste at agave plantation. Credit: Courtesy of José Hernández

- Grown in Mexico and South Africa – need irrigation
- Mismanagement of Mexican agave plantations and contracts = rollercoaster of prices causing agave shortages,
- Small producers to go out of business, consolidation of production to large plantations which are monocultures that rely heavily on synthetic fertilizers and pesticides.
- Look for organic and fair-trade.

Does that leave us with sweet nothing?

- Maple syrup – expensive
- Sugar alternatives – artificial? Stevia?
- Honey? – not vegan
 - If honey isn't vegan then why are food products that require bee pollination vegan?
 - Nut, citrus, stone fruit and pome trees
 - Cucurbits, Solans, berries... and so much more





Challenge



Are you ready to be challenged?

→ Plastic Pledge

- Pledge to avoid plastic for a week for Earth Day
- Try to buy in bulk
- Collect all the plastic that you do use that week and see how much there is
- Consider signing up for Ridwell – get a free trial
- Visit a bulk buying store like Realm Refillery



Package Free Grocery

2310 NE Broadway Portland, OR 97232



Reflection and questions



Reflection

- Yes, many studies and Life Cycle Assessments and other studies show that a plant-based lifestyle has many environmental, social, health and economic benefits
- Important questions:
 - If you are dedicated to reducing your personal impacts on the environment, are you walking that talk 3 times a day at mealtime?
 - If a food or plastic product harms the environment in its production and that harms human and non-human animals, is that sustainable?
- I don't claim to have all the answers, but I hope I have given you something to think about 😊

Thank you! Questions and more information:

- [VegNews Article](#)

Are Your Sweeteners as Vegan and Ethical as You Are?

By Julie Sinistore, PhD | January 4, 2018

- [Our Hen House Podcast #411](#)



Our Hen House

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Thank you

Julie Sinistore

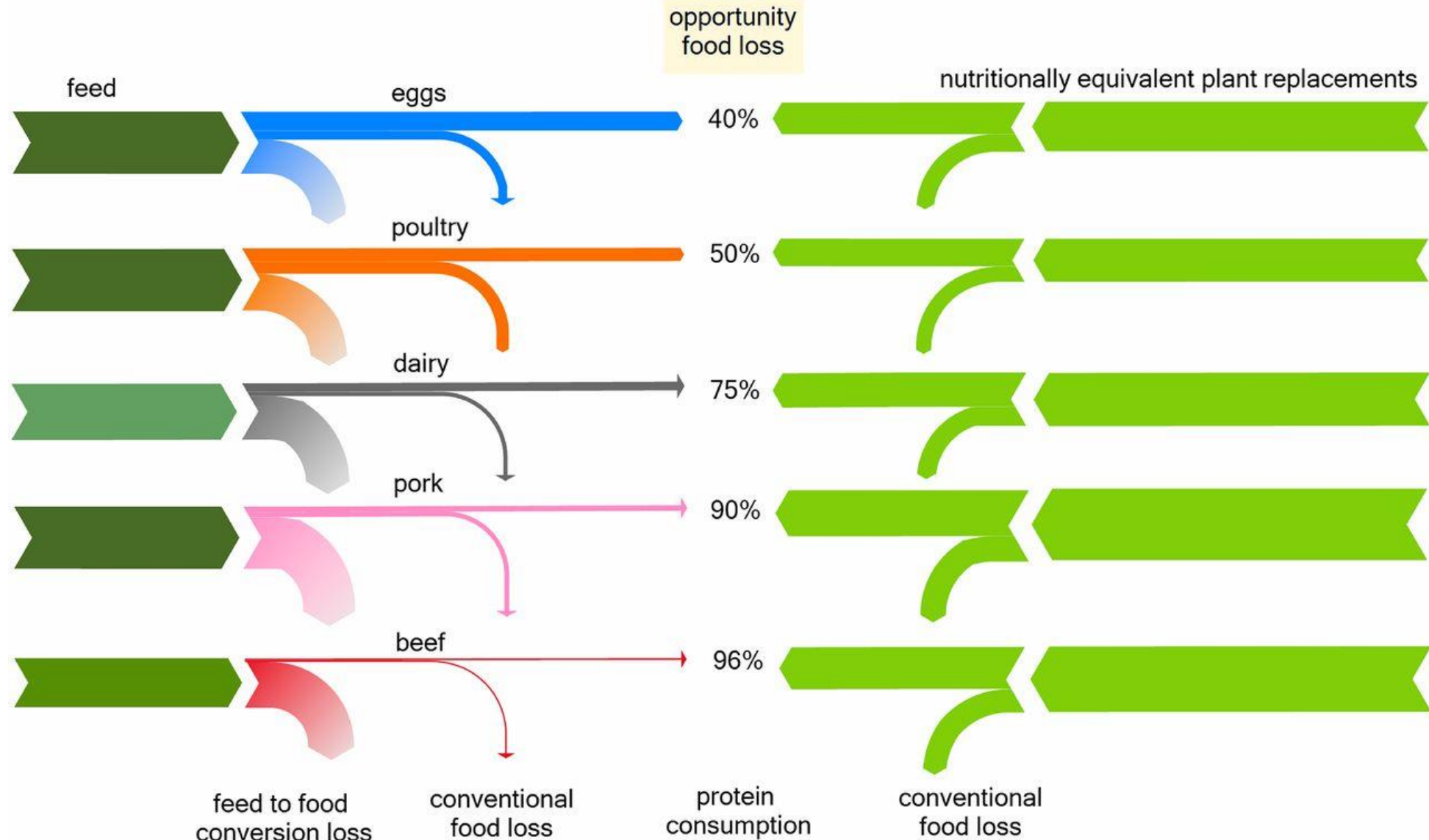
juliesinistore@gmail.com



Appendix



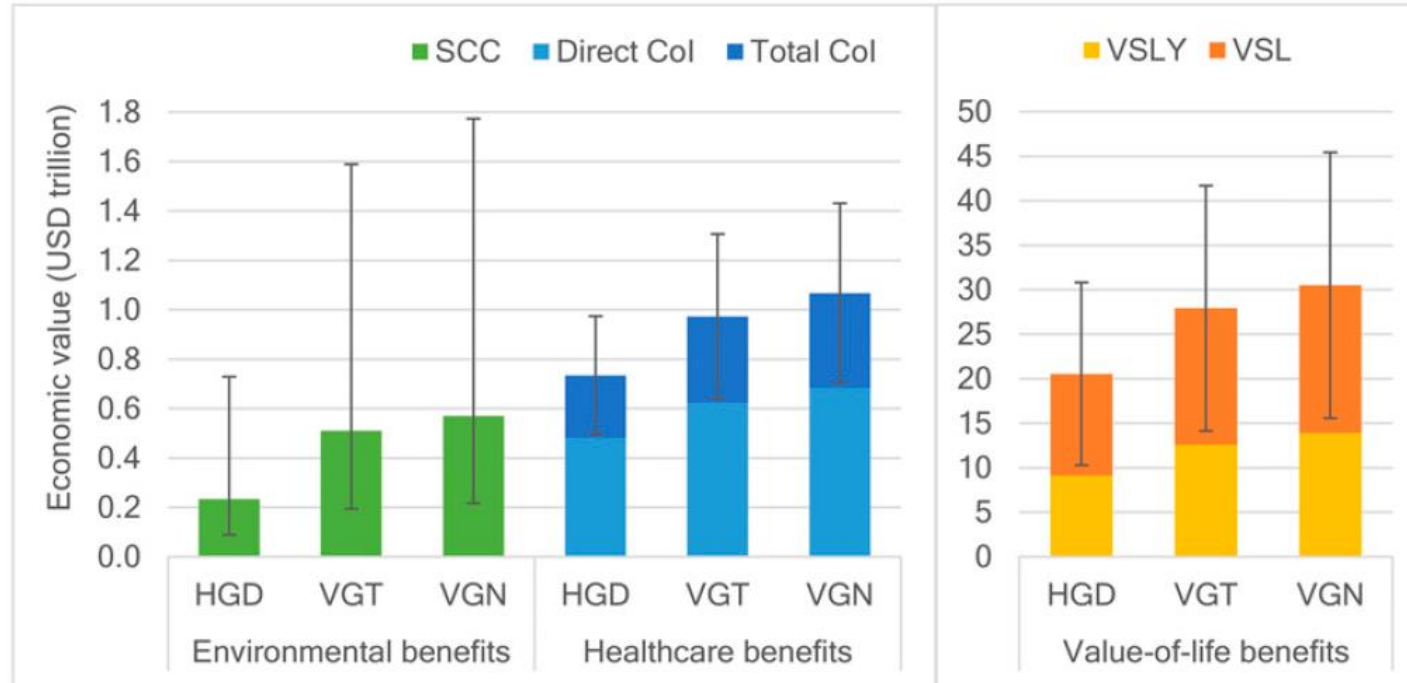
Economic Impacts



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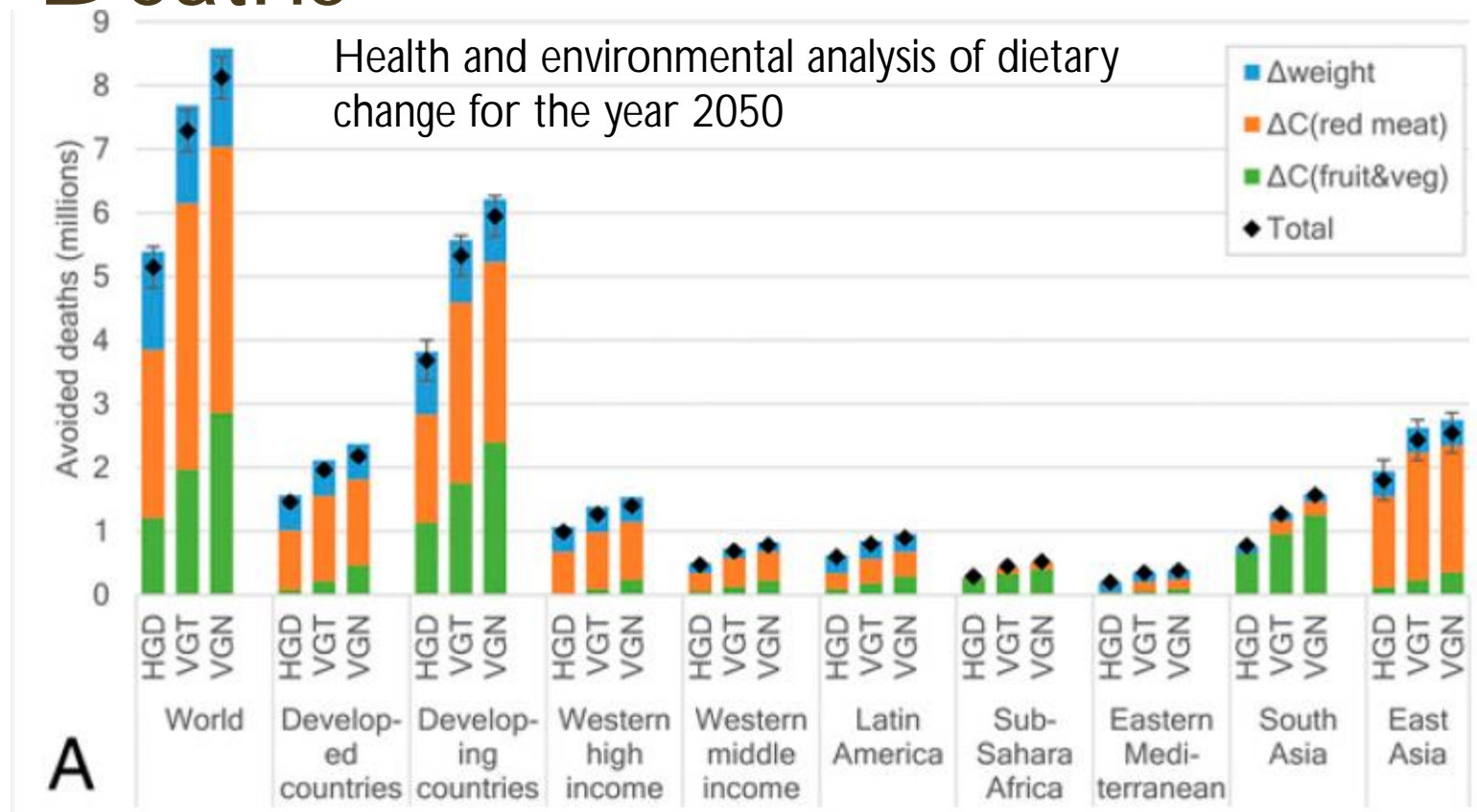
Animal protein has opportunity costs. E.g., 96% for Beef. That means you could produce almost twice as much protein from plants than from beef from the same land area and other inputs.

Social Costs of Carbon and Illness



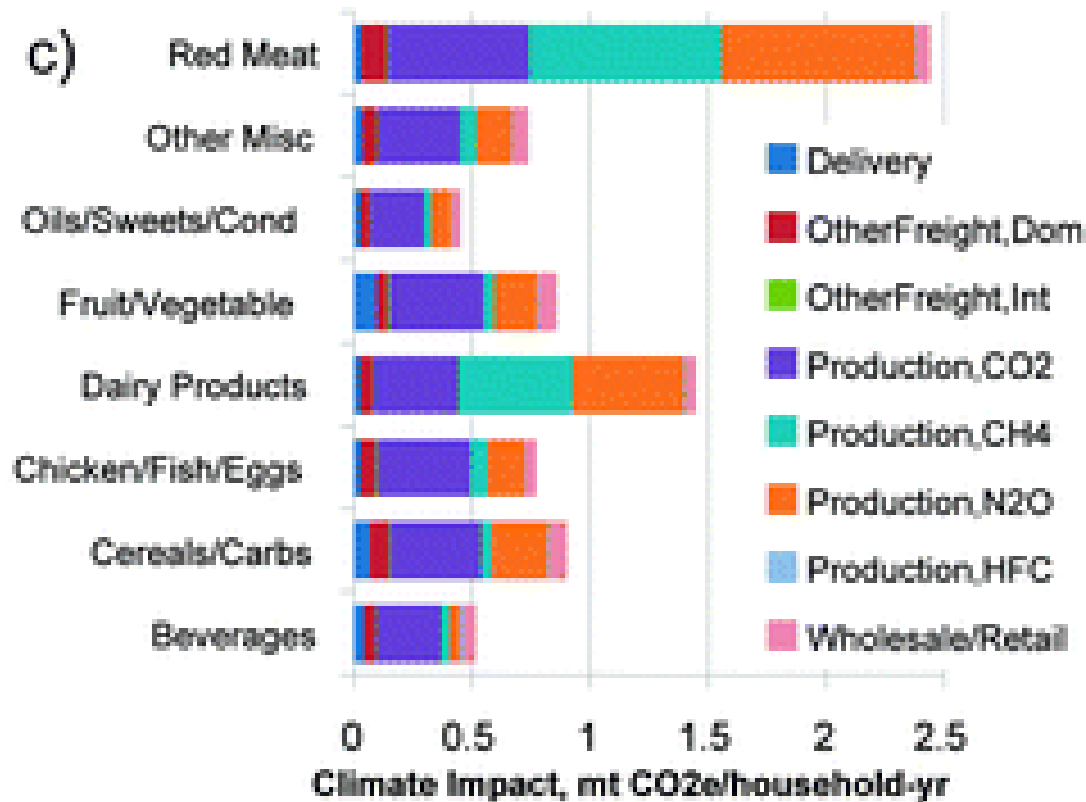
- 3 scenarios: healthy eating and energy intake (HGD), vegetarian & vegan dietary patterns (VGT and VGN)
- Left: The value of environmental benefits derived from estimates of the **social cost of carbon (SCC)** and the value of healthcare benefits based on estimates of the **costs of illness (Col)**, including direct healthcare costs and total costs, which also include indirect costs associated with unpaid informal care and productivity losses from lost labor time.
- Right: The value of health benefits associated with the willingness to pay for mortality reductions based on the **value of statistical life and life-year (VSL and VSLY)**.

Avoided Deaths



- Global guidelines on healthy eating and energy intake (HGD), vegetarian (VGT), vegan (VGN).
- Avoided deaths are relative to the reference scenario in 2050 by risk factor & region.
- Risk factors: changes in the consumption of fruits & vegetables Δ C(fruit&veg) & red meat Δ C(red meat), combined changes in overweight & obesity Δ weight, & all factors combined (Total).

Food Miles



- A “localized” diet reduces GHG emissions per household by about **1000 miles/yr**.
- Shifting totally away from red meat and dairy to a plant-based diet reduces GHG emissions equal to **8100 mi/yr**.
- Transport of animal products contributes significantly to their GHG emissions, less so for plant products.
- Food miles contribute **only ~11%** of household climate impacts.

What about grass-fed or “regenerative” grazing?

- Grass-fed increases GHG emissions per amount of meat.
- Why?
 - If all the beef consumption in the US switched from conventional to grass-fed, that would require a **30% increase in the number of cattle**.
 - Grass-fed cattle gain weight more slowly (and reach a lower slaughter weight) than grain-fed cattle = **longer to raise and produce less meat**.
 - Grass-fed cattle produce **3 times more methane** than cows fed grains and methane is **25 times more potent** a greenhouse gas than carbon dioxide.
- Soil carbon gained from “regenerative” grazing is temporary and does not

CO **Table 2.** Beef cattle population and enteric fermentation methane emissions (in millions of metric tons) of present-day conventional beef systems and future hypothetical exclusively grass-fed beef systems. *Source: US EPA.

	Cow-calf	Population finishing	Total	Enteric fermentation methane MMT CH ₄
Conventional*	63 493 000	13 328 000	76 821 000	4.76
Grass-fed	78 946 000	20 876 000	99 822 000	6.79

Fishing Impacts

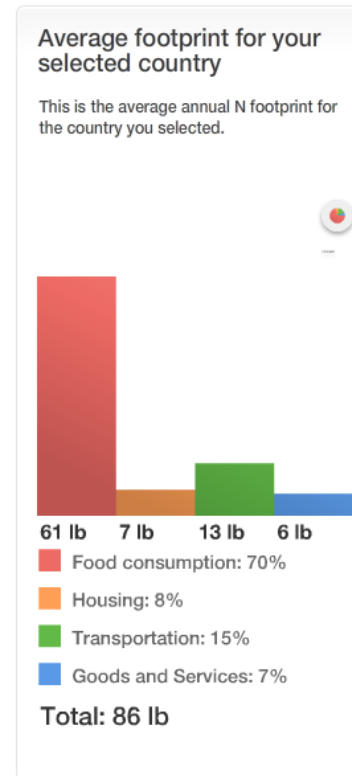
- Fishing nets make up 46% of all ocean plastic waste¹
- By catch and “ghost nets” kill whales, seals, turtles, birds, dolphins and other fish every year
- Between 2002 and 2010, 870 nets recovered from Washington State alone contained more than 32,000 marine animals.²
- Not to mention overfishing endangering dozens of fishes



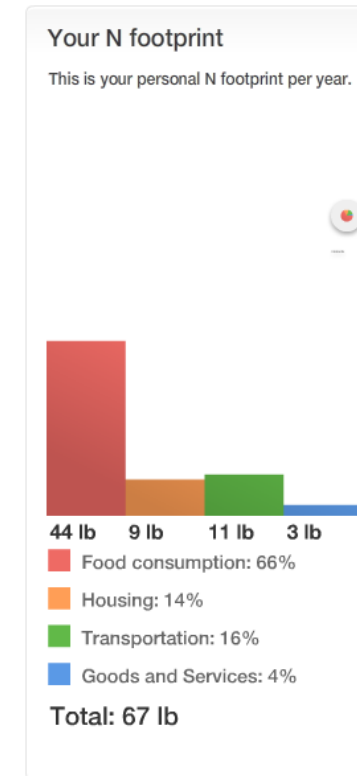
1. <https://news.nationalgeographic.com/2018/03/great-pacific-garbage-patch-plastics-environment/>, Lebreton et al. 2018 *Scientific Reports* 2. <https://www.ncbi.nlm.nih.gov/pubmed/19828155>

Lower N Footprint in US

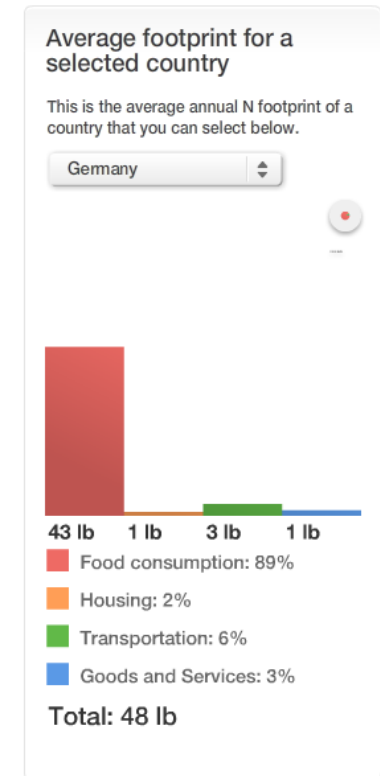
- Food-related N footprint is lower for a vegan in the US
- But about the same as the average German



Average US



Vegan US



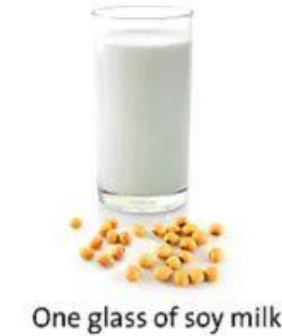
Average German

Water

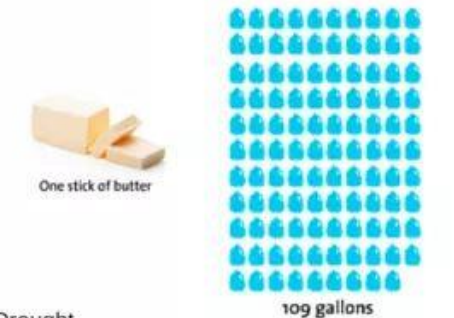
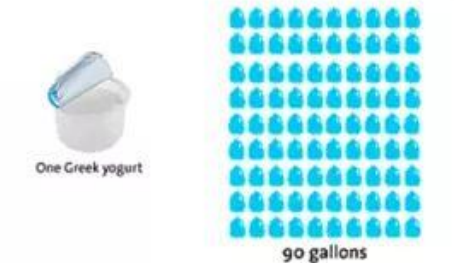
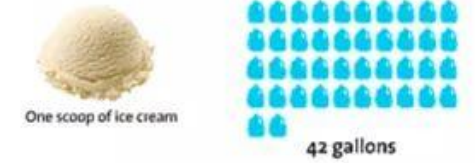
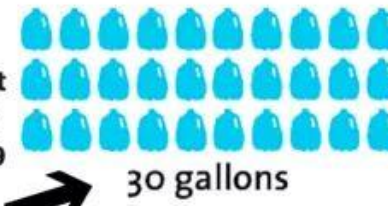
- It's not just meat, it's dairy.
- Almonds are not as water intensive to produce as cow's milk or other dairy products

How Thirsty Is Your Milk?

The water footprint, in gallons, of raw ingredients in our favorite creamy foods



Note:
Water Footprint Network says 54.9 gallons per cup



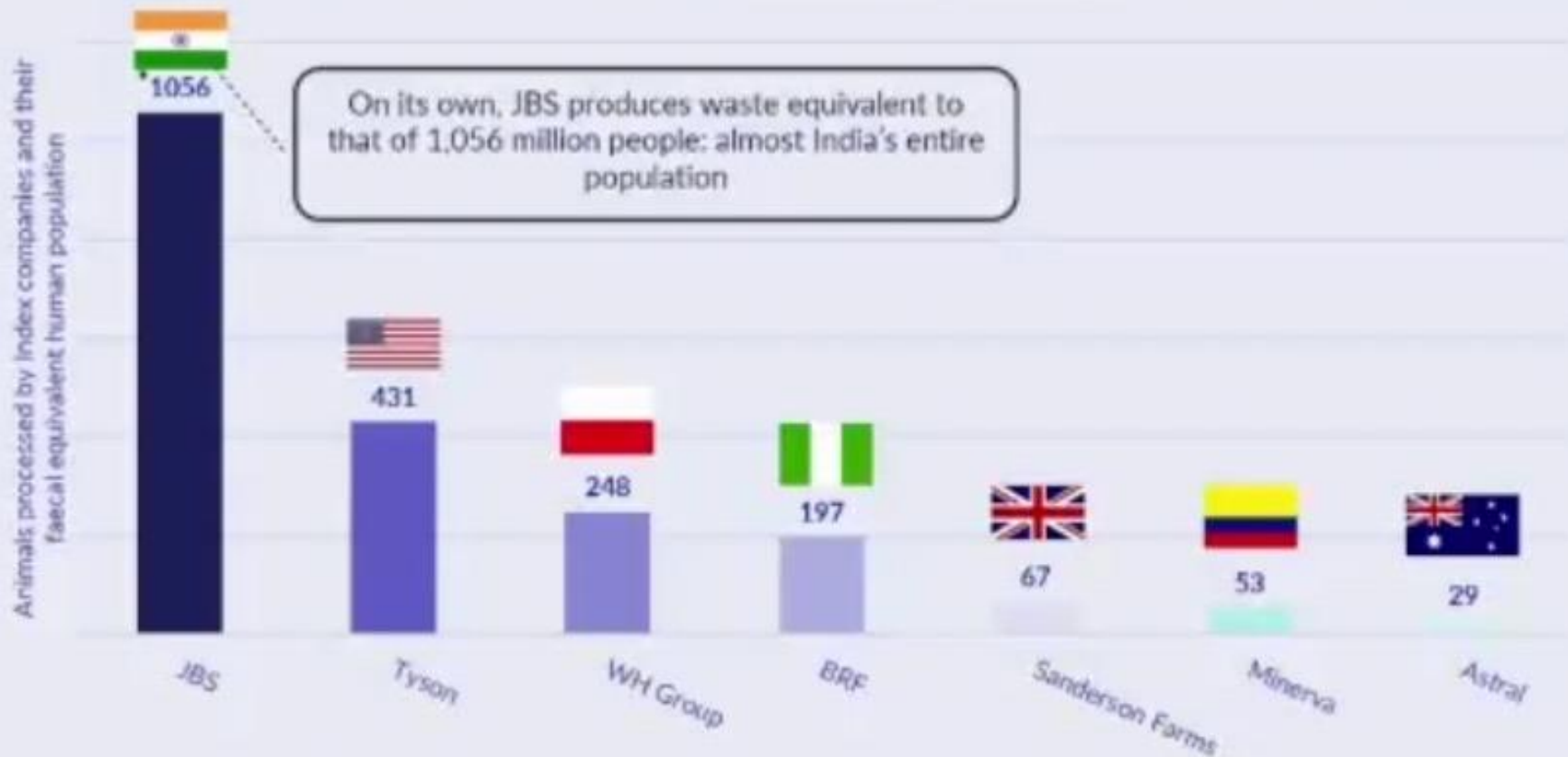
Mother Jones

article screenshots assembled independently by Truth or Drought

Source: motherjones.com/environment/2014/03/california-water-suck

Animal waste

The largest meat producers generate as much waste as entire countries



*The chart compares the quantity of waste produced by index companies and its equivalent in human faeces. (1) 10M population equivalent. Source: FAIRR, 2021

Animal waste mismanagement drives biodiversity loss and accelerates climate risk