Resource, environmental and social impacts of food choices

Julie Sinistore, PhD
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

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

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

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- 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?

If everyone lived like you, we would need

1.7 Earths

By Land Type

By Consumption Category

2.7
Your Ecological Footprint
(global hectares or gha)

4.1
Your Carbon Footprint
(CO₂ emissions in tonnes per year)

51
Your Carbon Footprint
(% of your total Ecological Footprint)

Julie Vegan

http://www.footprintcalculator.org

If everyone lived like you, we would need

3.5 Earths

By Land Type

By Consumption Category

5.8
Your Ecological Footprint
(global hectares or gha)

6.9
Your Carbon Footprint
(CO₂ emissions in tonnes per year)

41
Your Carbon Footprint
(% of your total Ecological Footprint)

Julie Standard Diet
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:

- Land Use: 3.1 billion ha
- Arable Land: -19%
- GHG Emissions: 6.6 billion MT CO$_2$eq
- Acidification: -50%
- Eutrophication: -49%
- Water Scarcity: -19%

Greenhouse Gas Emissions

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

- Animal feed LUC
- Pasture expansion LUC
- Bovine meat
- Sheep and goat meat
- Pig meat
- Poultry
- Insects
- Aquatic animals
- Dairy
- Eggs
- Plant foods LUC
- Plant foods

Per capita GHG footprint (kg CO₂-e per capita per year)

Baseline, Meatless day, Low red meat, Lacto-ovo vegetarian, Pescatarian, 2/3 vegan, Low food chain, Vegan

2050 target

Image credit: Johns Hopkins Center for a Livable Future
Greenhouse Gas Emissions

Foodprints by Diet Type: t CO₂e/person

- 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

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

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.

Carbon equivalents from EPA: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator
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.

What about bugs?

100 kg of cricket protein $\approx= 4.35$ kg CO$_2$e, roughly between peas and beans

Considerations:

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

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.

http://www.watercalculator.org
Almonds $\sim$ Asparagus

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.
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.

Clark, et al. 2019. Multiple health and environmental impacts of foods. PNAS. https://doi.org/10.1073/pnas.1906908116
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, gonorrhea, 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%.

2. World Health Organization: [https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance](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).

“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.

“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.”

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1440786
https://www.pnas.org/content/118/20/e2013637118
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 dolphins
- Microplastics are accumulating in mollusks and fish
- Reducing use of plastics and ensuring recycling will help save animals

Palm Oil

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

http://veganvine.blogspot.com/2013/03/can-plant-ever-be-non-vegan.html
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?
A gave

- 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.

http://www.ipsnews.net/2009/08/mexico-tequila-leaves-environmental-hangover/
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

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**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:

- **Vegan News Article**
  
  Are Your Sweeteners as Vegan and Ethical as You Are?
  
  By Julie Siniavko, PhD | January 4, 2018

- **Our Hen House Podcast #411**
  
  Available online and on Apple Podcasts, Android, Google Play, Stitcher and RSS
Thank you

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Appendix
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.

Shepon, A., Eshel, G., Noor, E., & Milo, R. The opportunity cost of animal based diets exceeds all food losses. 2018. PNAS. https://doi.org/10.1073/pnas.1713820115
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 (COI), 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

Health and environmental analysis of dietary change for the year 2050

- 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 $\Delta C(\text{fruit&veg})$ & red meat $\Delta C(\text{red meat})$, combined changes in overweight & obesity $\Delta \text{weight}$, & all factors combined (Total).

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 time more potent a greenhouse gas than carbon dioxide**.
- Soil carbon gained from “regenerative” grazing is temporary and does not continue to accumulate at a high rate over time.

**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.**

<table>
<thead>
<tr>
<th></th>
<th>Cow-calf (MMT)</th>
<th>Population finishing (MMT)</th>
<th>Total (MMT)</th>
<th>Enteric fermentation methane (CH₄)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional*</td>
<td>63,493.000</td>
<td>13,328.000</td>
<td>76,821.000</td>
<td>4.76</td>
</tr>
<tr>
<td>Grass-fed</td>
<td>78,946.000</td>
<td>20,876.000</td>
<td>99,822.000</td>
<td>6.79</td>
</tr>
</tbody>
</table>

Fishing Impacts

- Fishing nets make up 46% of all ocean plastic waste\(^1\)
- 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

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

http://www.n-print.org/
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.
Animal waste mismanagement drives biodiversity loss and accelerates climate risk.