FOOD AND SUSTAINABILITY: What we can learn from Earth’s ‘planetary boundaries’

Isaac Emery, PhD
Founder, Informed Sustainability Consulting
HEN VISION
Optimize the nation’s health by promoting access to nutritious food and clean water from a secure and sustainable food system.

HEN MISSION
Empower members to be leaders in sustainable and accessible food and water systems.

SUSTAINABILITY
HEN defines sustainability as: "A sustainable and resilient food system [that] conserves and renews natural resources, advances social justice and animal welfare, builds community wealth, and fulfills the food and nutrition needs of all eaters now and in the future."

(Harmon A. & Tagtow A., 2008)
VN VISION
Promote global health and well being by developing influential policy, comprehensive education, and supporting cutting edge research.

VN MISSION
Serve as the leading authority on evidence-based vegetarian nutrition for health professionals and the public.

SUSTAINABILITY
VN defines sustainability based on The Food and Agriculture Organization of the United Nations:
Sustainable Diets are those diets with low environmental impacts that contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources.

According to AND’s Veg Position Paper: “Plant-based diets are more environmentally sustainable than diets rich in animal products because they use fewer natural resources and are associated with much less environmental damage.”
LEARNING OBJECTIVES

At the end of this webinar, attendees will be able to describe:

1. What are the “planetary boundaries” and how can we use them to define ‘sustainability’ and sustainable diets?
2. How does our food system contribute to the planetary boundaries?
3. What are the biggest differences between food groups from an environmental perspective?
Food and Sustainability

What we can learn from Earth’s ‘planetary boundaries’?

ISAAC EMERY

HEN + VN WEBINAR SERIES

10/29/2020
Metrics-based sustainability

- Environmental footprint of products
- Identify opportunities to reduce impact
- Accurately communicate benefits
Topics

- What are Earth’s *planetary boundaries*?
- What are the environmental impacts of foods?
- From food to diet: how can we eat sustainably?
On Sustainability

“Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs.”

- Our Common Future (Brundtland Commission, 1987)

• Whose needs? Which needs? And how do we prioritize them?
• How are we limited by the environment? By the state of technology?
Environmental Boundaries: Earth’s Limits
Planetary Boundaries

Credit: J. Lokrantz/Azote based on Steffen et al. 2015
https://www.stockholmresilience.org/research/planetary-boundaries.html
Food’s Environmental Impact
Planetary Boundaries

Credit: J. Lokrantz/Azote based on Steffen et al. 2015
https://www.stockholmresilience.org/research/planetary-boundaries.html
Planetary Boundaries

Credit: J. Lokrantz/Azote based on Steffen et al. 2015
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“About 21–37% of total greenhouse gas (GHG) emissions are attributable to the food system. These are from agriculture and land use, storage, transport, packaging, processing, retail, and consumption...”

- IPCC Special Report on Climate Change and Land
Greenhouse gas emissions per 1000 kilocalories

Greenhouse gas emissions are measured in kilograms of carbon dioxide equivalents (kgCO₂-eq) per 1000 kilocalories. This means non-CO₂ greenhouse gases are included and weighted by their relative warming impact.

Land = Habitat

Agriculture & aquaculture threaten 24,000 of 28,000 ‘red list’ species

https://www.bloomberg.com/graphics/2018-us-land-use/
Land use of foods per 1000 kilocalories

Land use is measured in meters squared (m²) required to produce 1000 kilocalories of a given food product.

- Beef (beef herd): 119.49 m²
- Lamb & Mutton: 116.66 m²
- Cheese: 22.68 m²
- Beef (dairy herd): 15.84 m²
- Milk: 14.92 m²
- Pig Meat: 7.26 m²
- Poultry Meat: 6.61 m²
- Fish (farmed): 4.7 m²
- Eggs: 4.35 m²
- Tomatoes: 4.21 m²
- Bananas: 3.22 m²
- Oatmeal: 2.9 m²
- Prawns (farmed): 2.88 m²
- Citrus Fruit: 2.69 m²
- Peas: 2.16 m²
- Nuts: 2.11 m²
- Cassava: 1.86 m²
- Groundnuts: 1.57 m²
- Wheat & Rye: 1.44 m²
- Apples: 1.31 m²
- Tofu (soybeans): 1.3 m²
- Potatoes: 1.2 m²
- Root Vegetables: 0.89 m²
- Rice: 0.76 m²
- Maize: 0.65 m²

Note: Data represents the global average land use of food products based on a large meta-analysis of food production covering 38,700 commercially viable farms in 119 countries.

OurWorldInData.org/environmental-impacts-of-food • CC BY
Water = Habitat

Nutrient pollution affects ~90% of U.S. waterways

Dodds et al. 2008, https://doi.org/10.1021/es801217q
The livestock sector alone meets the planetary boundary for nitrogen.

- Uwizeye et al., Nature Food, 2020

Basins with a WPL above one received more phosphorus than they could assimilate. Credit: Mekonnen et al./WRR/AGU.
Eutrophying emissions represent runoff of excess nutrients into the surrounding environment and waterways, which affect and pollute ecosystems. They are measured in grams of phosphate equivalents (PO₄eq).

<table>
<thead>
<tr>
<th>Food Product</th>
<th>Eutrophying Emissions (PO₄eq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prawns (farmed)</td>
<td>220.6 g</td>
</tr>
<tr>
<td>Beef (dairy herd)</td>
<td>197.4 g</td>
</tr>
<tr>
<td>Fish (farmed)</td>
<td>133.8 g</td>
</tr>
<tr>
<td>Beef (beef herd)</td>
<td>131.4 g</td>
</tr>
<tr>
<td>Pig Meat</td>
<td>110.4 g</td>
</tr>
<tr>
<td>Lamb &amp; Mutton</td>
<td>32 g</td>
</tr>
<tr>
<td>Poultry Meat</td>
<td>26.3 g</td>
</tr>
<tr>
<td>Cheese</td>
<td>25.4 g</td>
</tr>
<tr>
<td>Milk</td>
<td>17.8 g</td>
</tr>
<tr>
<td>Dark Chocolate</td>
<td>16.0 g</td>
</tr>
<tr>
<td>Eggs</td>
<td>15.1 g</td>
</tr>
<tr>
<td>Rice</td>
<td>9.5 g</td>
</tr>
<tr>
<td>Citrus Fruit</td>
<td>7 g</td>
</tr>
<tr>
<td>Bananas</td>
<td>5.5 g</td>
</tr>
<tr>
<td>Potatoes</td>
<td>4.8 g</td>
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<tr>
<td>Nuts</td>
<td>3.1 g</td>
</tr>
<tr>
<td>Apples</td>
<td>3 g</td>
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<tr>
<td>Wheat &amp; Rye</td>
<td>2.7 g</td>
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<td>2.2 g</td>
</tr>
<tr>
<td>Maize</td>
<td>0.9 g</td>
</tr>
</tbody>
</table>

Note: Data represents the global average eutrophying emissions from food products based on a large meta-analysis of food production covering 38,700 commercially viable farms in 119 countries.

OurWorldInData.org/environmental-impacts-of-food • CC BY
Meat consumption is responsible for the top 2 drivers of zoonotic disease.

- UN Environment Program, 2020

“In the US, for example, of the antibiotics defined as medically important for humans by the FDA, over 70 percent... are sold for use in animals.”


“Without effective antibiotics, even minor surgery and routine operations could become high risk procedures...”

- UK Government
Food → Diet

How can we eat sustainably?
HOW YOUR SANDWICH CHANGED THE WORLD
From Food to Diet

- Footprint (carbon, water, land, nutrient…) of a meal?
  - Add all the ingredients (Bread + lettuce + tomato + mayo + bacon)

- Footprint of one person’s diet?
  - That’s a lot of ingredients…

- Footprint of a community’s diet?
  - TOO MUCH MATH
  - TOO MANY QUESTIONS
From Food to Diet

- Footprint (carbon, water, land, nutrient…) of a meal?
  - Add all the ingredients (Bread + lettuce + tomato + mayo + bacon)

- Footprint of a community’s diet?
  - What do people eat ON AVERAGE?
    - NHANES survey data
    - National consumption estimates
  - What are the eco-impacts of those FOOD TYPES?
    - “Vegetables” “Nuts & seeds” “Dairy products” etc.
83% of food production emissions are from meat, eggs, and dairy.
Country-specific dietary shifts to mitigate climate and water crises

Brent F. Kim et al.

Global Environmental Change

https://doi.org/10.1016/j.gloenvcha.2019.05.010
Carrying capacity of U.S. agricultural land: Ten diet scenarios

Christian J. Peters et al.

Elementa

https://doi.org/10.12952/journal.elementa.000116
The healthiness and sustainability of national and global food based dietary guidelines: modelling study
Marco Springmann et al. BMJ
Questions

Please type your questions into the chat box
Carbon footprint of self-selected US diets: nutritional, demographic, and behavioral correlates

Donald Rose, Martin C Heller, Amelia M Willits-Smith, Robert J Meyer

The American Journal of Clinical Nutrition

https://doi.org/10.1093/ajcn/nqy327
THANK YOU

Slides, recording, and CEU certificate will be sent after the webinar

Please take a minute to complete the webinar evaluation form, linked in the chat box

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