Nourishing the Future: Sustainable Food Systems for Nutrition and Dietetic Students

JOHNS HOPKINS
CENTER *for* A LIVABLE FUTURE

FOOD + PLANET

Presented by:
Johns Hopkins Center for a Livable Future
Food + Planet

Food and Our Climate

Module 3

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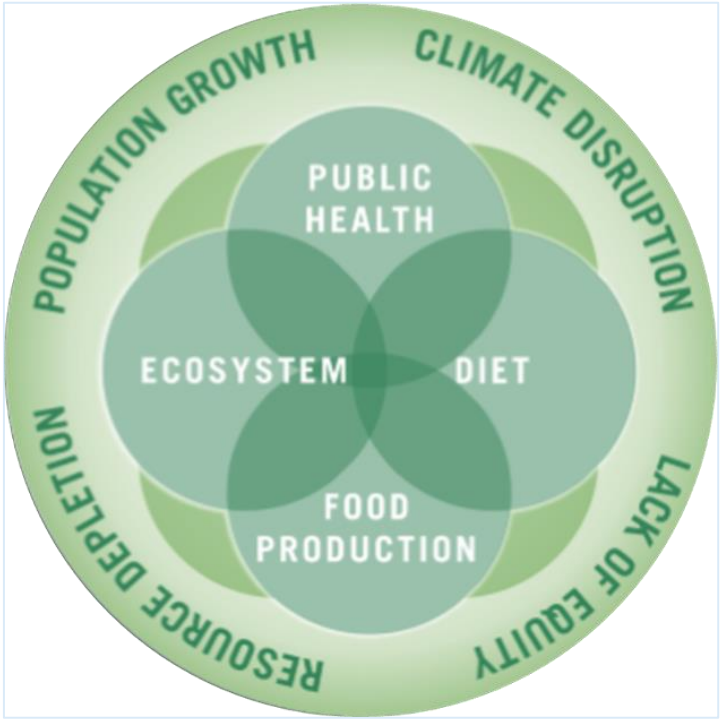
Four Modules

Module 1	Module 2	**Module 3**	Module 4
Introduction to Sustainable Food Systems	**Food Systems for All**	**Food and our Climate**	Aquatic Foods, Nutrition, and Sustainability

The Johns Hopkins Center for a Livable Future



- Interdisciplinary academic center at the Johns Hopkins Bloomberg School of Public Health
- Education, research, policy, and practice
- Vision: a healthier, sustainable and resilient food system for all

Image source: Johns Hopkins Center for a Livable Future.

Food + Planet

- *A collective, visionary 501c3 founded by four registered dietitians with varied experience in the food system*
- *Aim: empower health care professionals to be leaders in sustainable food systems*

Vision: a science and practice of nutrition that honors nature as the foundation of health through the four dimensions of sustainability

Image source: Vogliano, C., Geagan, K., Chou, S., Palmer, S. (2021). *Figure 1. The 4 dimensions of sustainable diets*. [Infographic]. Empowering nutrition professionals to advance sustainable food systems [White Paper]. *Food and Planet*. Retrieved September 14, 2025, from https://7157e75ac0509b6a8f5c-5b19c577d01b9ccfe75d2f9e4b17ab55.ssl.cf1.rackcdn.com/GVISUTJI-PDF-1-675987-4519061561.pdf

Learning Objectives

- Summarize the relationship between food systems and climate change
- Explain risks to our food systems from a changing climate
- Evaluate dietary shifts to reduce the greenhouse gas contributions from food systems
- Describe the role of RDNs as leaders in food system change

Section A: Primer on Climate Change

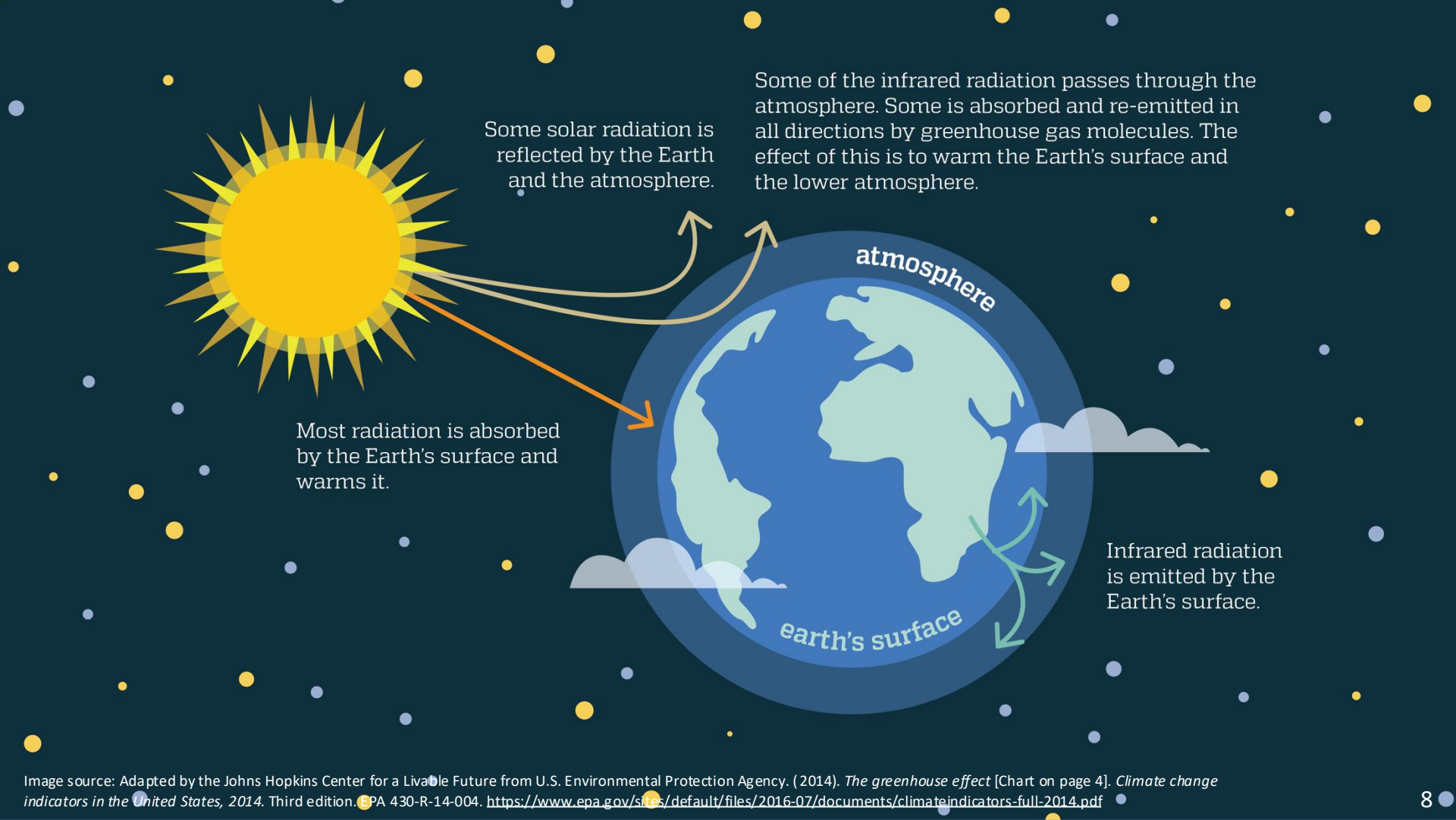
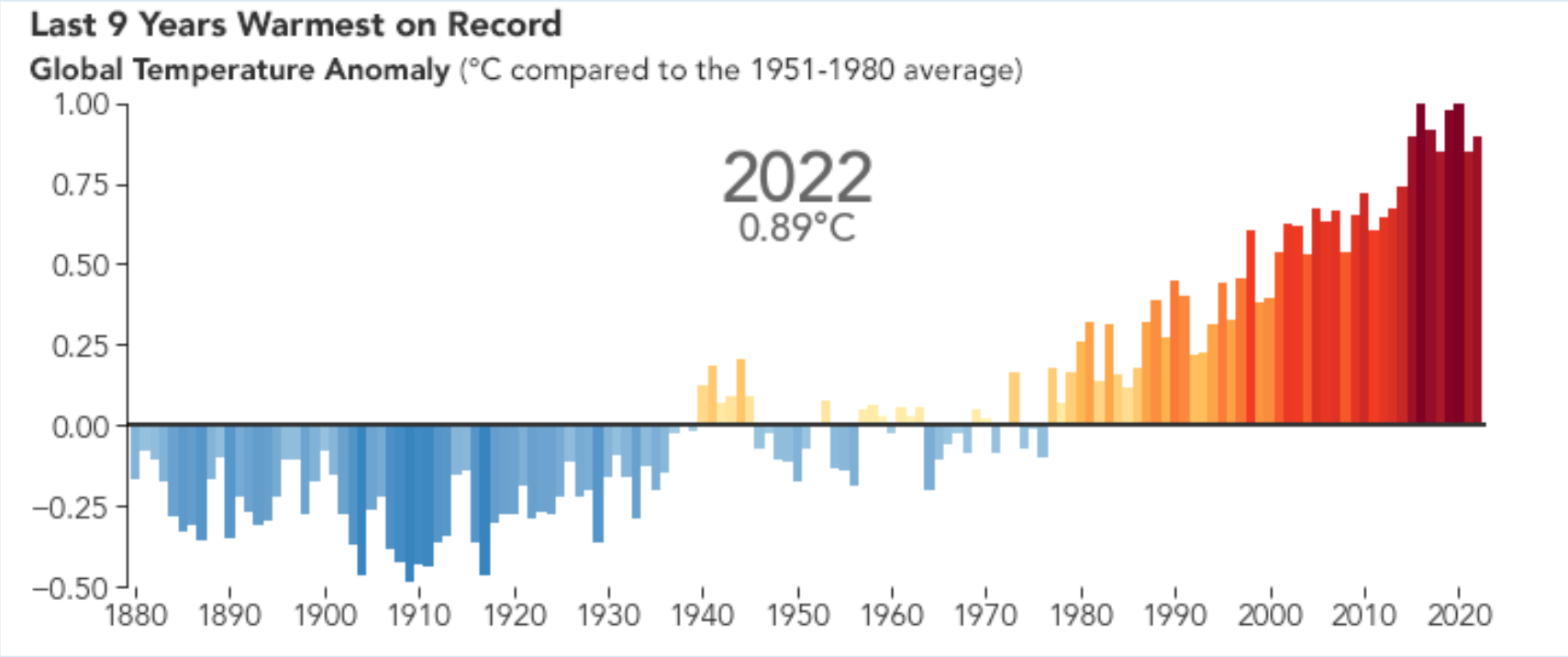


Image source: Adapted by the Johns Hopkins Center for a Livable Future from U.S. Environmental Protection Agency. (2014). *The greenhouse effect* [Chart on page 4]. *Climate change indicators in the United States, 2014.* Third edition. EPA 430-R-14-004. https://www.epa.gov/sites/default/files/2016-07/documents/climateindicators-full-2014.pdf

Average Global Temperature Increases



Sources: NOAA Climate. (2023). Global average surface temperature in 2022 compared to the 1991–2020 average. Climate.gov. https://www.climate.gov/media/15007;
Image is from NASA. (2020). Last 9 years warmest on record [Chart]. World of change: global temperatures. *NASA Earth Observatory*. https://earthobservatory.nasa.gov/world-of-change/global-temperatures

Trends in Global Temperature Changes

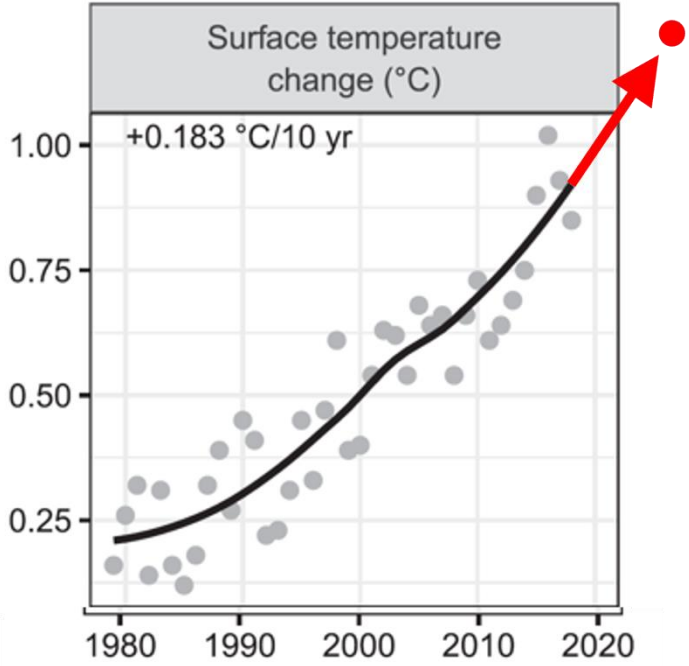
- In 2024, Earth was 2.6 degrees Fahrenheit (1.47 degrees Celsius) warmer than the 1800s prior to the Industrial Revolution
- The warmest years have all occurred in the recent past: 2014–2024
- If humans do nothing to reduce greenhouse gas emissions, temperatures are predicted to rise another 2.5–10 degrees Fahrenheit over the next century

Sources: UN. (n.d.). Climate action fast facts. *United Nations Climate Action.* Retrieved July 31, 2025, from https://www.un.org/en/climatechange/science/key-findings; NOAA. (2023). It's official: 2022 was the world's 6th-warmest year on record. Climate.gov. https://www.climate.gov/media/15007; Bardan, R. (2025). Temperatures rising: NASA confirms 2024 warmest year on record. NASA.https://www.nasa.gov/news-release/temperatures-rising-nasa-confirms-2024-warmest-year-on-record/

Climate Mitigation Targets

- Average global temperature rise:
  - < 1.5 degrees Celsius (2.7 degrees Fahrenheit)
  - < 2 degrees Celsius (3.6 degrees Fahrenheit)
    - Less ambitious
    - More feasible
    - More dangerous

- How are we doing?
  - 2024 averages: ~1.4 degrees Celsius



Sources: UNFCCC. (2022). Nationally determined contributions under the Paris Agreement: Synthesis report by the secretariat (No. GE.22-17490(E)). *United Nations Framework Convention on Climate Change*. https://unfccc.int/documents/619180 Climate Central. (2023). The hottest 12-month stretch in recorded history: How carbon pollution affected countries and major cities worldwide from November 2022 to October 2023. *Climate Central*. https://www.climatecentral.org/report/the-hottest-12-month-stretch-in-recorded-history-2023; Graph is adapted by the Center for a Liveable Future from Ripple, W. J., Wolf, C., Newsome, T. M., Barnard, P., & Moomaw, W. R. (2020). *Figure 2. Climatic response time series from 1979 to the present* (Graph). World scientists' warning of a climate emergency. *BioScience*, 70(1), 8–12. Scopus. https://doi.org/10.1093/biosci/biz088

Greenhouse Gasses

Carbon dioxide
CO_2

- Burning fossil fuels, industrial activity, and deforestation
- Atmospheric lifetime: 200+ years (or more)

Methane
CH_4

- Livestock, landfills, oil/gas extraction, rice paddies
- Atmospheric lifetime: ~12 years
- 84x more potent than CO_2

Nitrous oxide
N_2O

- Fertilizers, livestock, industrial activity, burning fossil fuels
- Atmospheric lifetime: ~120 years
- 284x more potent than CO_2

Greenhouse gas (GHG) equivalents

Total US emissions in 2022 = 6,343 million metric tons of CO_2 equivalent (excludes land sector). Percentages may not add up to 100% due to independent rounding. Land use, land-use change, and forestry in the United States is a net sink and offsets 13% of these greenhouse gas emissions. This net sink is not shown in the above diagram. All emission estimates are sourced from the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022.

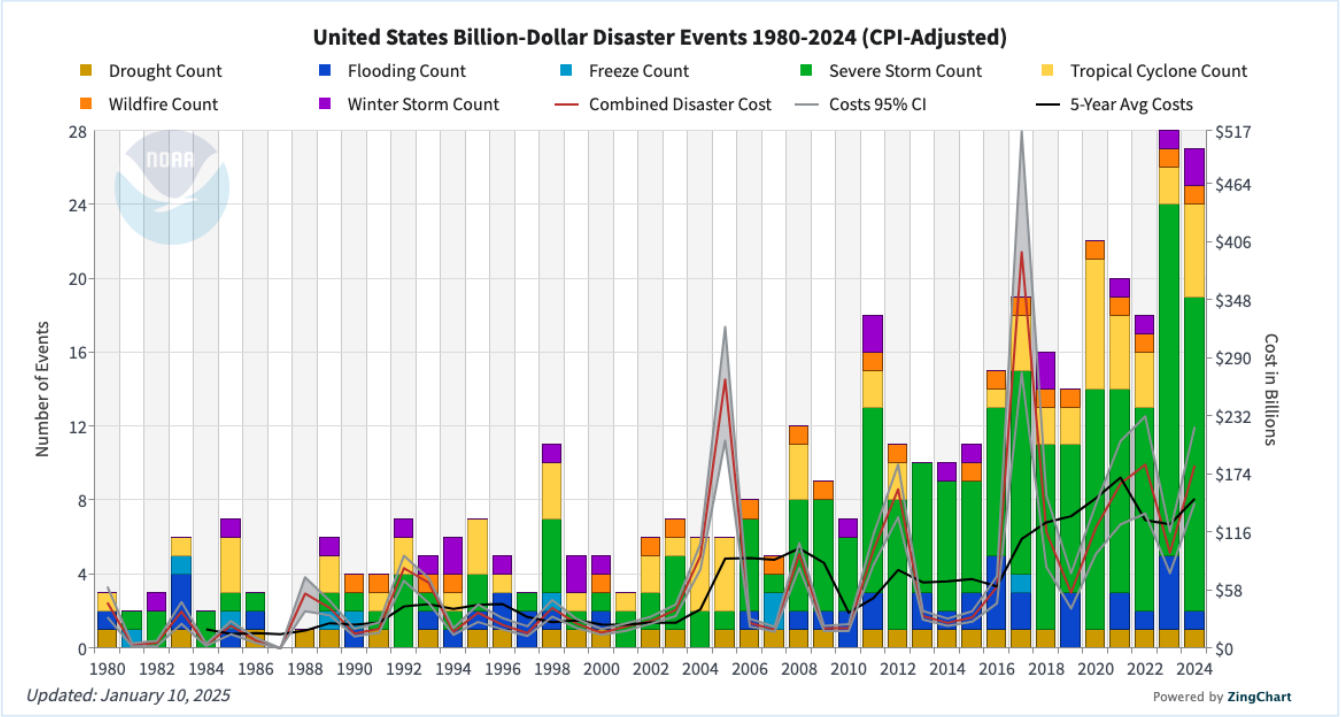
Source: US EPA. (2025). *Inventory of U.S. greenhouse gas emissions and sinks*. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

Greenhouse Gases and Climate Change

- Destabilization of climate and weather systems
- Sea level rise
- More extreme weather events
  - Heat waves
  - Precipitation/flooding
  - Drought

Image source: Microsoft Stock Images.

Weather-Related Events Are Costly



Source: NOAA National Centers for Environmental Information. (2025). *U.S. billion-dollar weather and climate disasters* (2025). https://www.ncei.noaa.gov/access/billions/time-series/US/cost; Full report is available at https://www.ncei.noaa.gov/access/billions/

Section B: Food System Contributions to Climate Change

Global Greenhouse Gas Emissions from Food Production

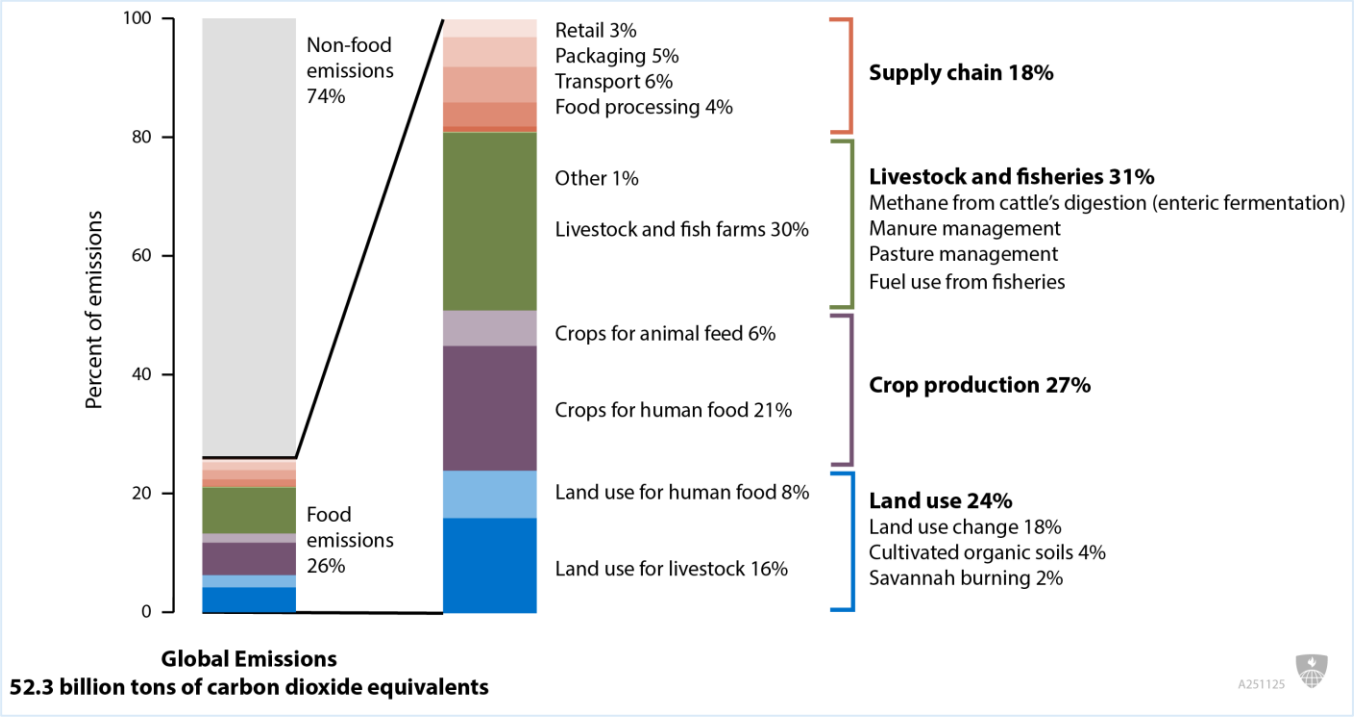


Image source: Adapted by the Johns Hopkins Bloomberg School of Public Health from Ritchie, H. (2019). Food production is responsible for one-quarter of the world's greenhouse gas emissions. *Our World in Data*. https://ourworldindata.org/food-ghg-emissions and based on data from Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, 360(6392), 987–992. https://doi.org/10.1126/science.aaq0216

Global Food System Emissions

What aspects of global livestock production contribute the most to greenhouse gas emissions?

Image source: photo is from Microsoft Stock Images.

Enteric Fermentation

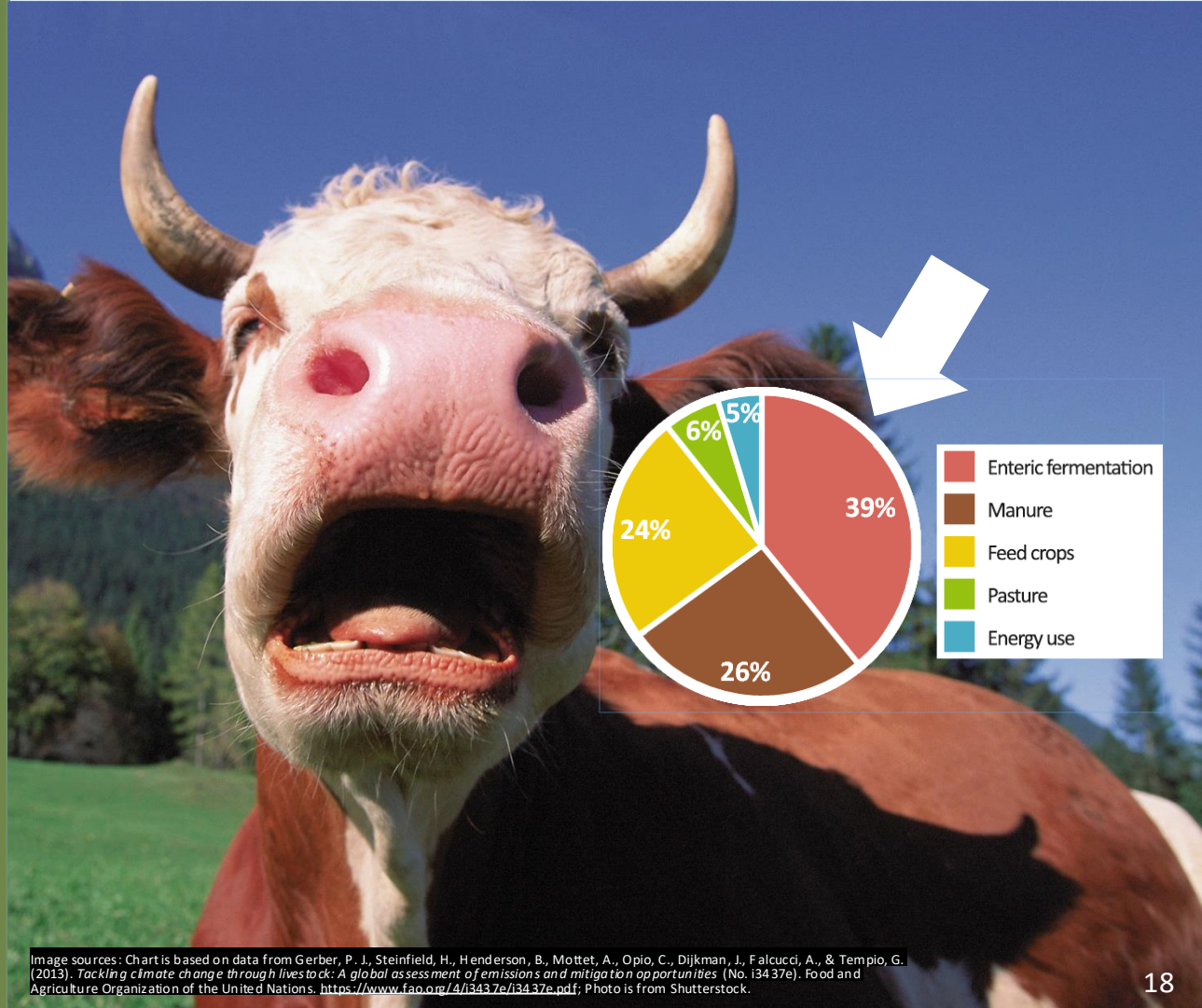


Image sources: Chart is based on data from Gerber, P. J., Steinfield, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A., & Tempio, G. (2013). *Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities* (No. i3437e). Food and Agriculture Organization of the United Nations. https://www.fao.org/4/i3437e/i3437e.pdf; Photo is from Shutterstock.

Manure

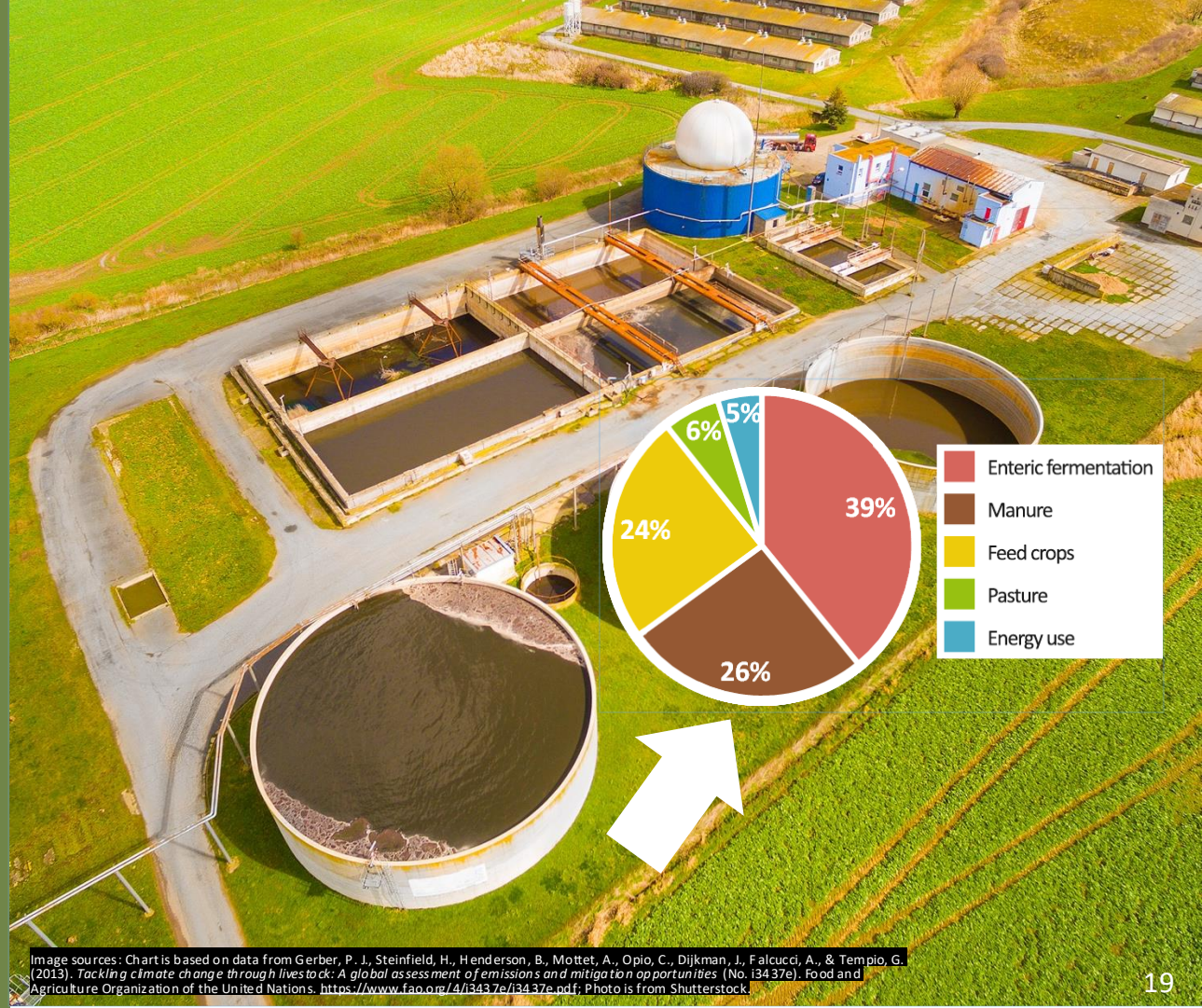


Image sources: Chart is based on data from Gerber, P. J., Steinfield, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A., & Tempio, G. (2013). *Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities* (No. i3437e). Food and Agriculture Organization of the United Nations. https://www.fao.org/4/i3437e/i3437e.pdf; Photo is from Shutterstock.

Feed Crop Production

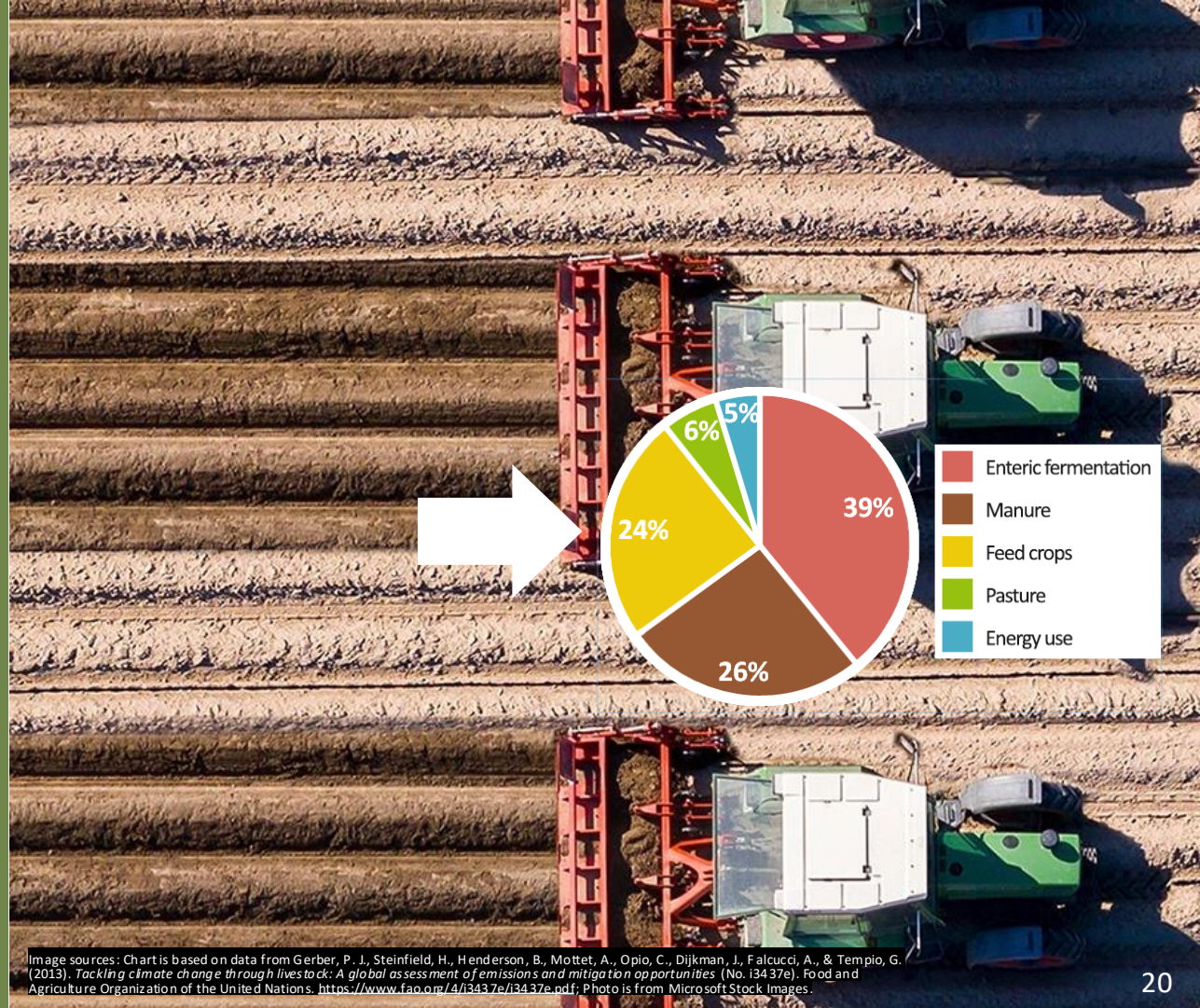


Image sources: Chart is based on data from Gerber, P. J., Steinfield, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A., & Tempio, G. (2013). *Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities* (No. i3437e). Food and Agriculture Organization of the United Nations. https://www.fao.org/4/i3437e/i3437e.pdf; Photo is from Microsoft Stock Images.

Land Use Change (Deforestation)

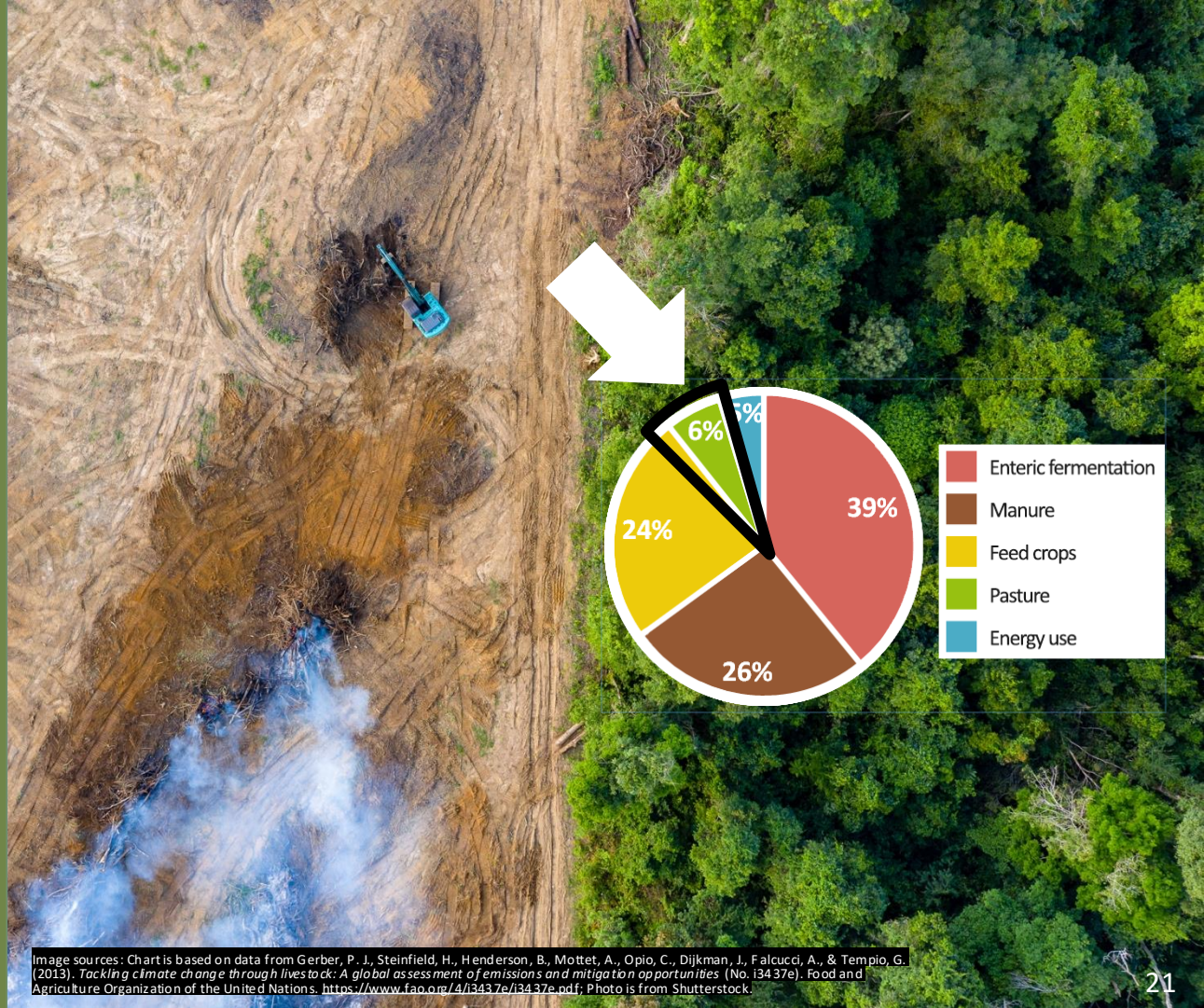


Image sources: Chart is based on data from Gerber, P. J., Steinfield, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A., & Tempio, G. (2013). *Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities* (No. i3437e). Food and Agriculture Organization of the United Nations. https://www.fao.org/4/i3437e/i3437e.pdf; Photo is from Shutterstock.

GHG Footprints of Food—1

Per serving GHG footprints

- *> 3,800 unique observations*
- *> 150 countries*

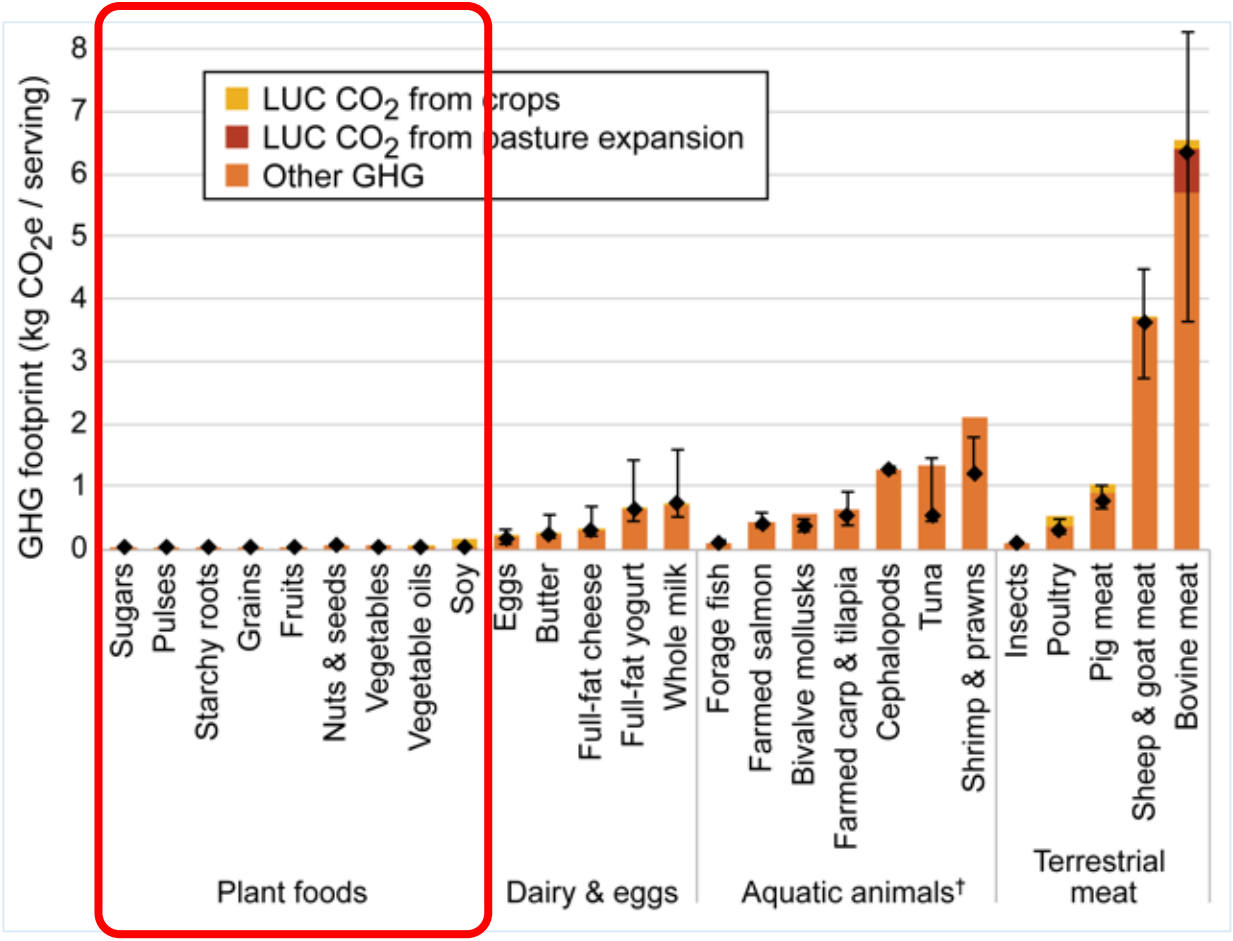


Image source: Kim, B. F., Santo, R. E., Scatterday, A. P., Fry, J. P., Synk, C. M., Cebron, S. R., Mekonnen, M. M., Hoekstra, A. Y., de Pee, S., Bloem, M. W., Neff, R. A., & Nachman, K. E. (2020). *Figure 2. Average per serving GHG* [Chart]. Country-specific dietary shifts to mitigate climate and water crises. *Global Environmental Change*, *62*. https://doi.org/10.1016/j.gloenvcha.2019.05.010

GHG Footprints of Food—2

Per serving GHG footprints

- *> 3,800 unique observations*
- *> 150 countries*

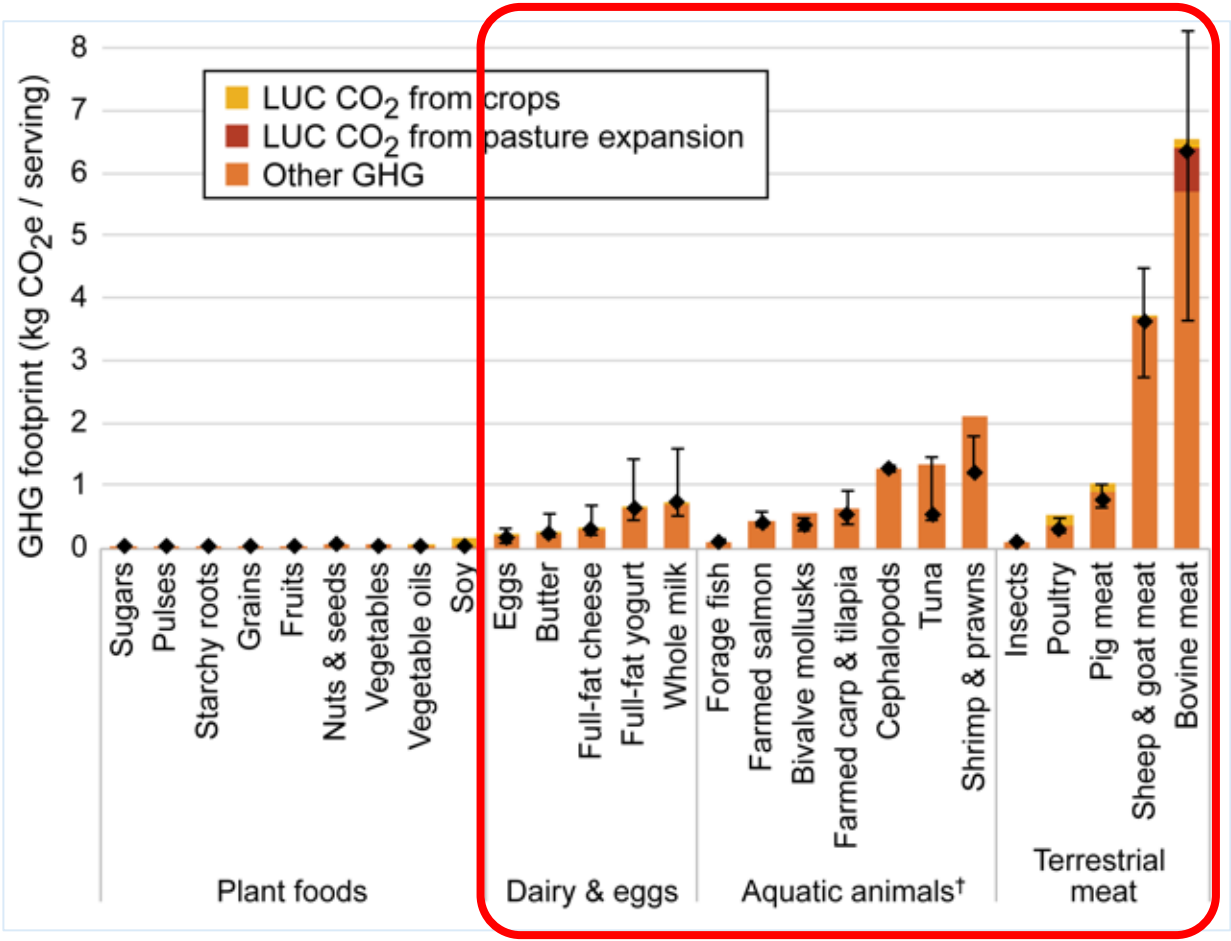
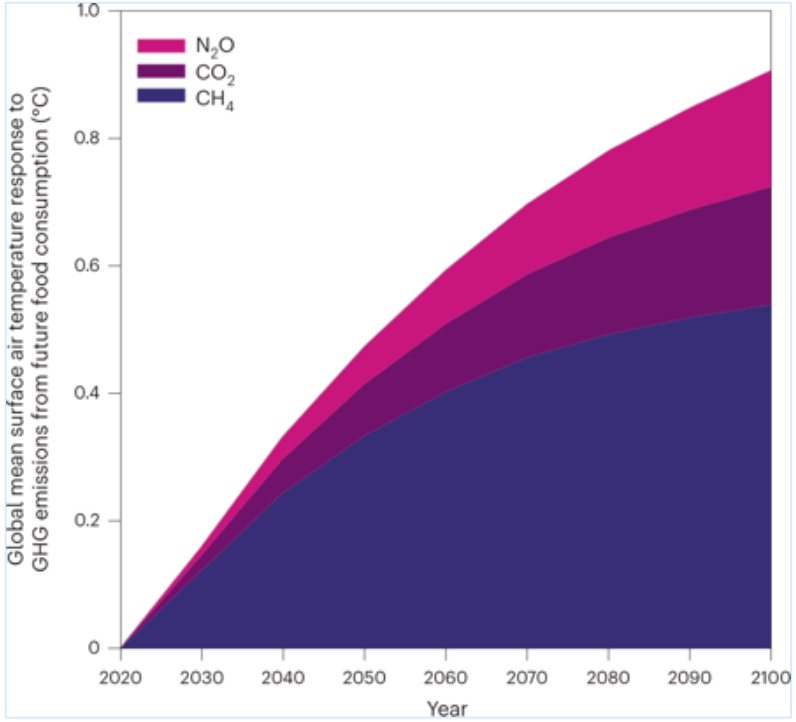


Image source: Kim, B. F., Santo, R. E., Scatterday, A. P., Fry, J. P., Synk, C. M., Cebron, S. R., Mekonnen, M. M., Hoekstra, A. Y., de Pee, S., Bloem, M. W., Neff, R. A., & Nachman, K. E. (2020). *Figure 2. Average per serving GHG* [Chart]. Country-specific dietary shifts to mitigate climate and water crises. *Global Environmental Change*, *62*. https://doi.org/10.1016/j.gloenvcha.2019.05.010

Global Temperature Rise from Food Demand Is Driven by Meat and Dairy



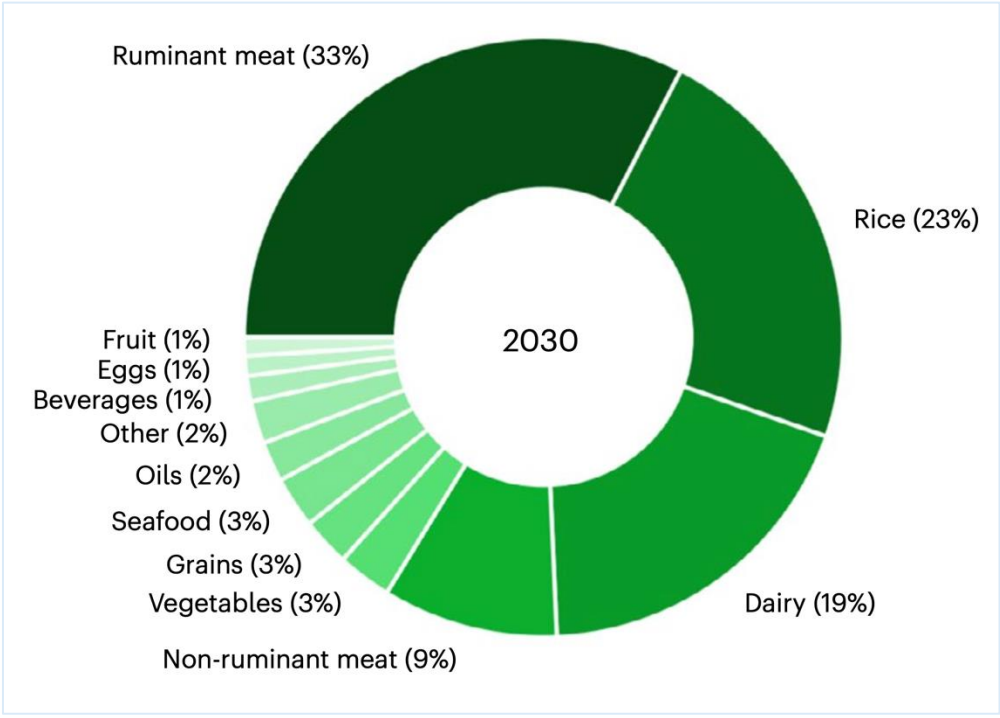


Image sources: Ivanovich, C., Sun, T., Gordon, D., & Ocko, I. (2023). *Figure 2. Global mean surface air temperature responses attributed to individual GHG emissions (methane, carbon dioxide and nitrous oxide) from future food consumption under a high-population projection* [Chart] and *Figure 3. Relative contribution of food groups to global mean surface air* [Chart]. Future warming from global food consumption. *Nature Climate Change*, *13*, 297–302. https://doi.org/10.1038/s41558-023-01605-8

Carbon Sequestration

- Can reduce net CO_2, but enough to offset CH_4, N_2O?
- Diminishing returns
- Under specific conditions
- Also land-use constraints

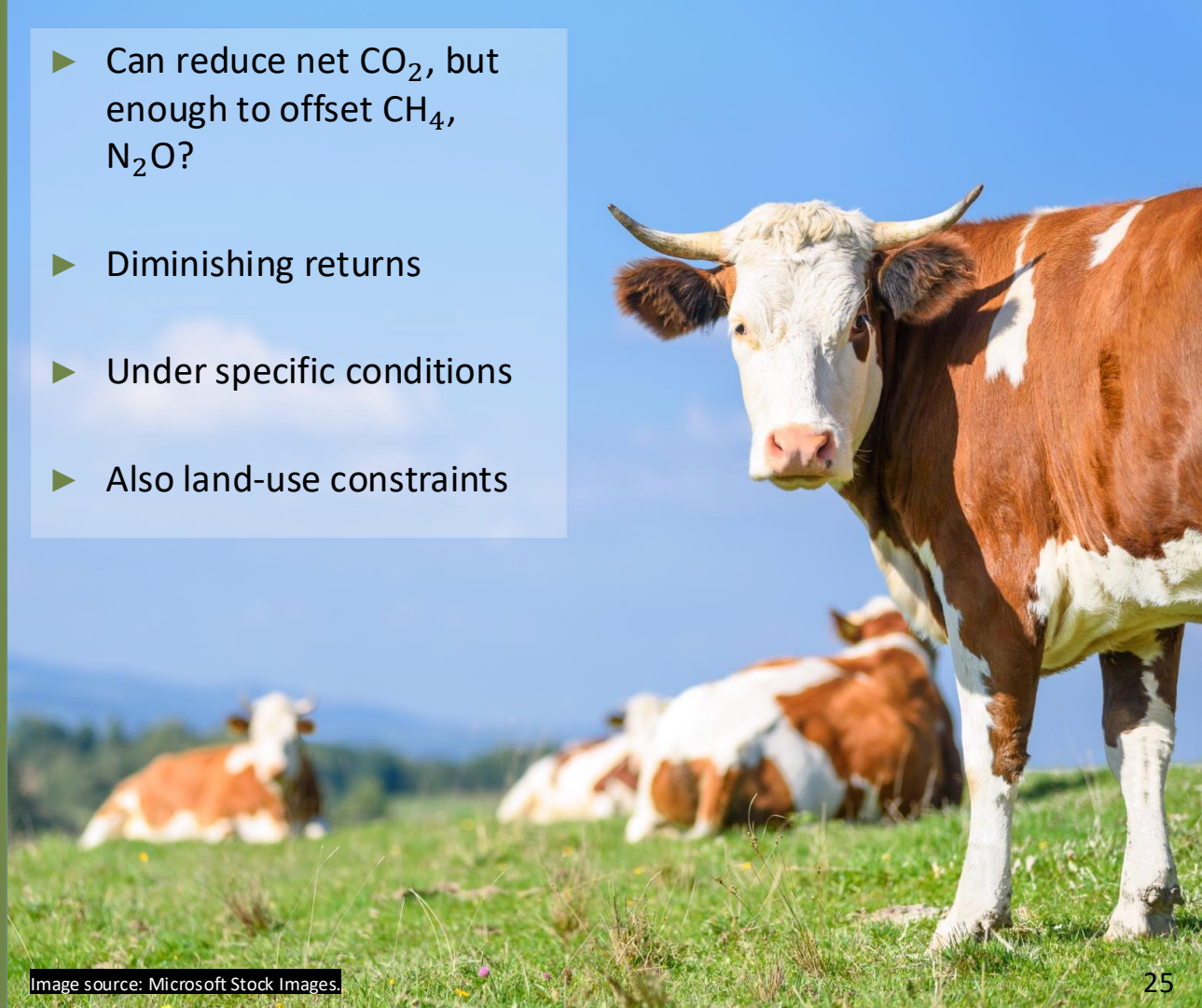


Image source: Microsoft Stock Images.

Section C: Climate Change Impacts on Food Systems

Effects of Climate Change on Food Systems

- Reduced yields and economic losses
- Extreme events such as droughts, floods, heat waves
- Shifts in climate means shifts in:
  - Biological cycles and growing seasons
  - Habitats for pests and pollinators
- Changes in nutritional content of crops
  - Atmospheric conditions (higher CO_2 has impact on nutrients, growth)
- Risks to food safety and food security (prices, access, availability)
- Occupational exposures and health

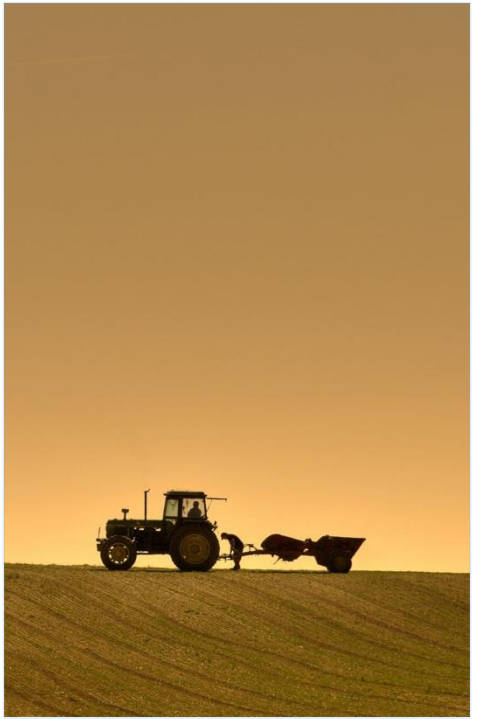


Image source: Microsoft Stock Images.

Climate Change and Agricultural Productivity

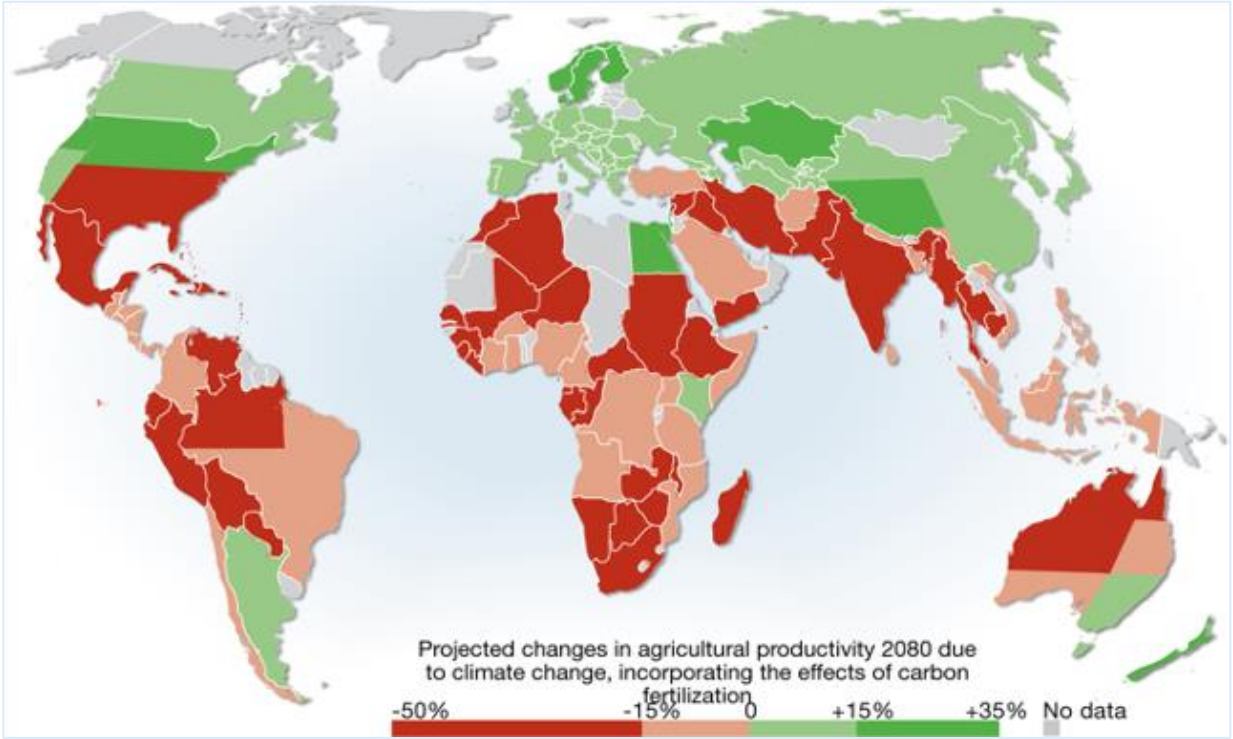


Image source: Cline, W. R. (2007). *Global warming and agriculture: impact estimates by country*. Center for Global Development.

Projected Changes to Crop Yields Due to Climate Change

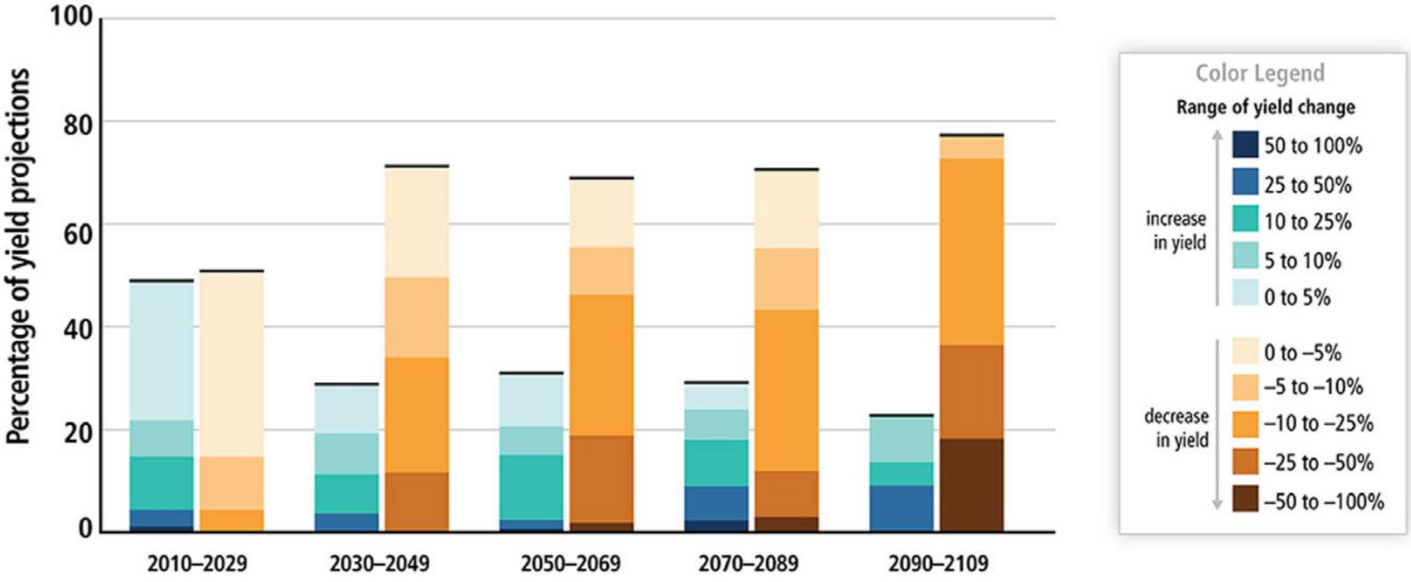


Fig. 1.1 Product yield estimates in IPCC Research (IPCC, 2014c)

Image source: Jovović, Z., Velimirović, A., & Yaman, N. (2024). *Figure 1.1. Product yield estimates in IPCC Research* [Chart]. Climate and crop production crisis. In Ö. Çetin (Ed.), *Agriculture and Water Management Under Climate Change* (pp. 1–28). Springer, Cham. https://doi.org/10.1007/978-3-031-74307-8_1

Higher CO_2 Alters Nutrient Levels in Crops

Carbohydrates

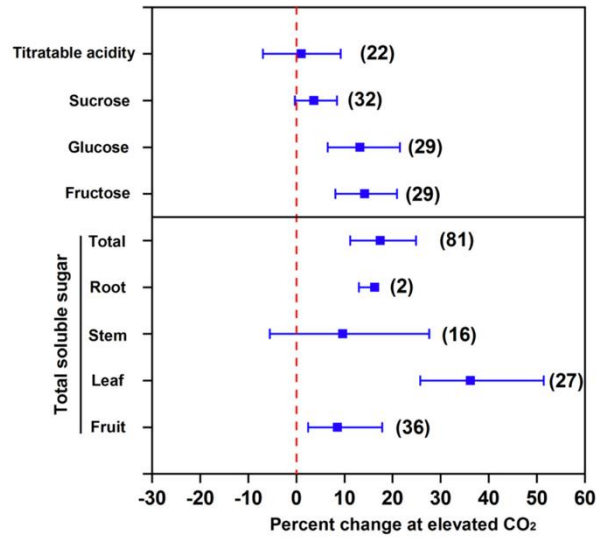


FIGURE 1 | Effect of elevated CO_2 on the concentrations of soluble sugar and acidity in vegetables. Data are means of percent change with 95% confidence intervals (indicated with error bars) under elevated CO_2 compared to ambient CO_2. The number of observations is in parentheses.

Micronutrients

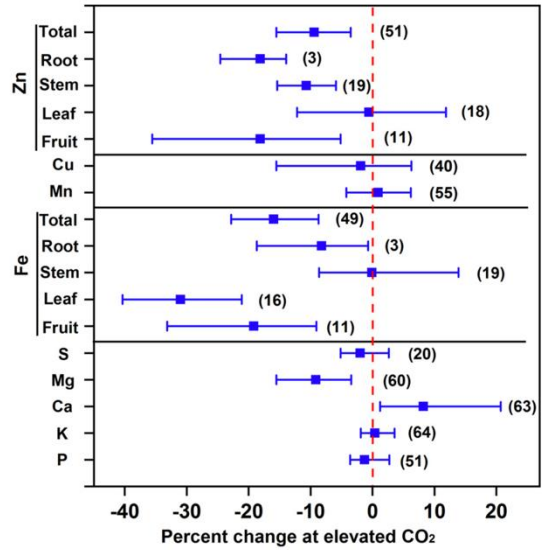


FIGURE 4 | Effect of elevated CO_2 on the concentrations of minerals in vegetables. Data are means of percent change with 95% confidence intervals (indicated with error bars) under elevated CO_2 compared to ambient CO_2. The number of observations is in parentheses.

Image source: Dong, J., Gruda, N., Lam, S. K., Li, X., & Duan, Z. (2018). *Figure 1. Effect of elevated CO_2 on the concentrations of soluble sugar and acidity in vegetables* [Chart] and *Figure 4. Effect of elevated CO_2 on the concentrations of minerals in vegetables* [Chart]. Effects of elevated CO2 on nutritional quality of vegetables: A review. *Frontiers in Plant Science*, *9*. https://doi.org/10.3389/fpls.2018.00924

Pests and Pollinators

- Pollinator-dependent crops contribute one-third of global crop production
- 1,500 crops require pollination

Image source: Microsoft Stock Images.

Changes to Oceans and Aquatic Ecosystems

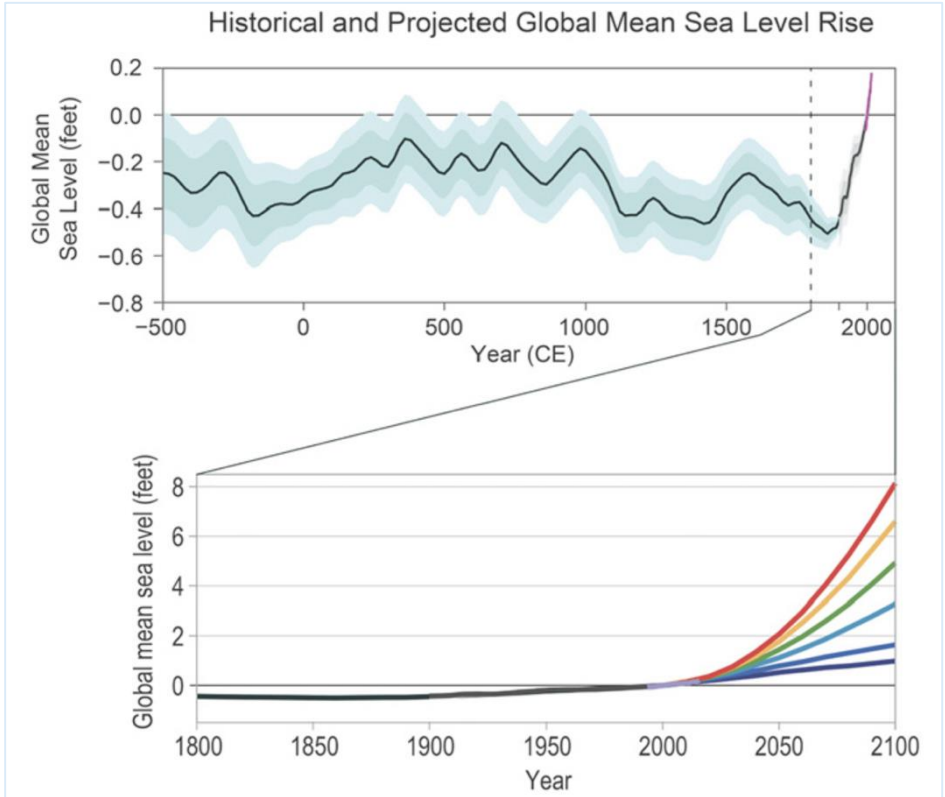


Fig. 2. Past and projected changes in global mean sea level rise under different emissions scenarios. From Wuebbles et al. (2017).

Image source: Culligan, P. J. (2019). *Figure 2. Past and projected changes in global mean sea level rise under different emissions scenarios* [Chart]. From Wuebbles et al. (2017). Green infrastructure and urban sustainability: A discussion of recent advances and future challenges based on multiyear observations in New York City. *Science and Technology for the Built Environment*, *25*(9), 1113–1120. https://doi.org/10.1080/23744731.2019.1629243

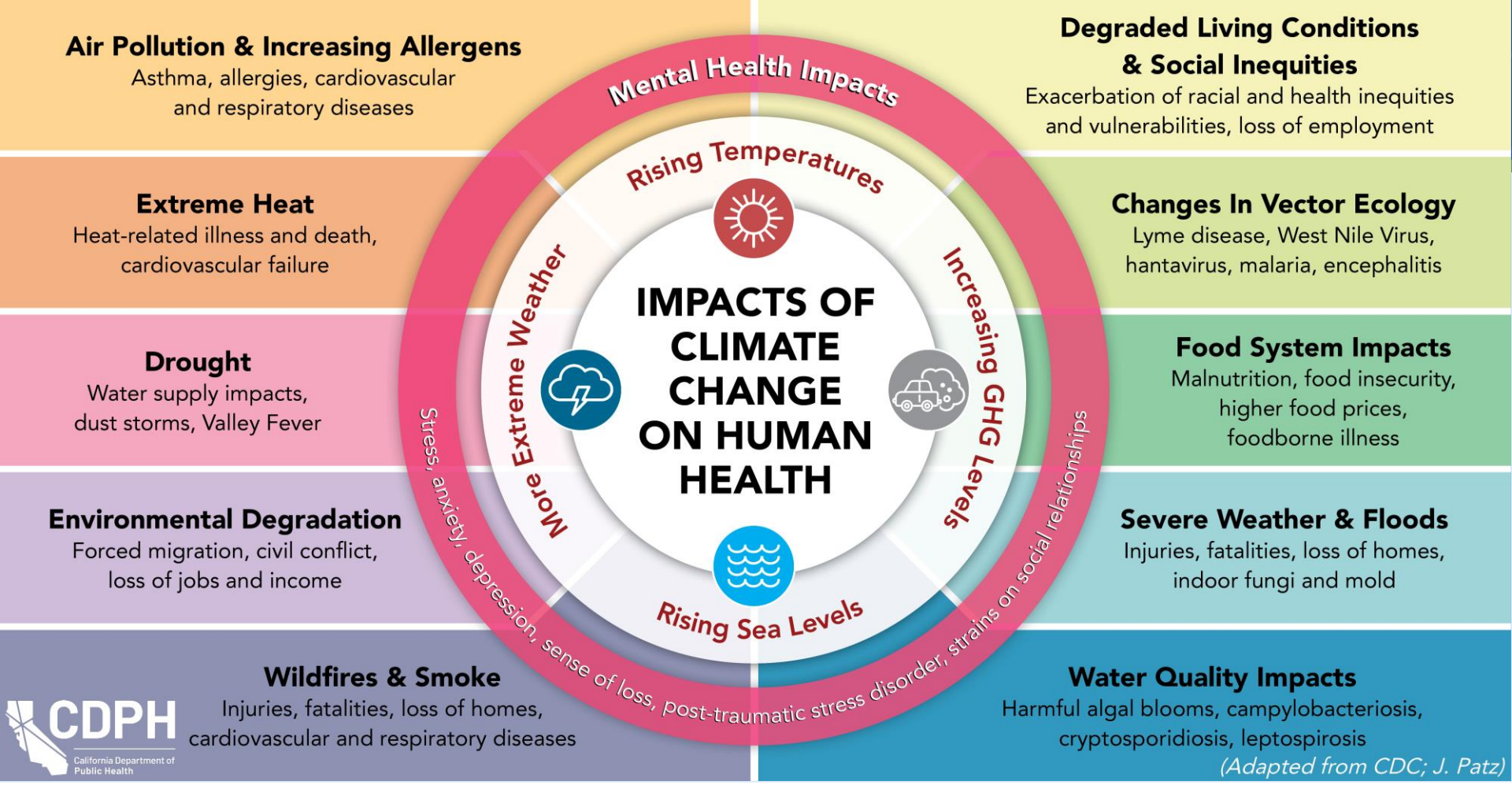


Image source: California Department of Public Health. (2025). *Impacts of Climate Change on Human Health*.
https://www.cdph.ca.gov/Programs/OHE/PublishingImages/Climate-Health-Equity/CDPH-Climate-Health-Impacts-Diagram.png

Climate Impacts and Health Outcomes

Top three:

1. *Infectious diseases*
2. *Overall mortality*
3. *Respiratory, cardiovascular, or neurological outcomes*

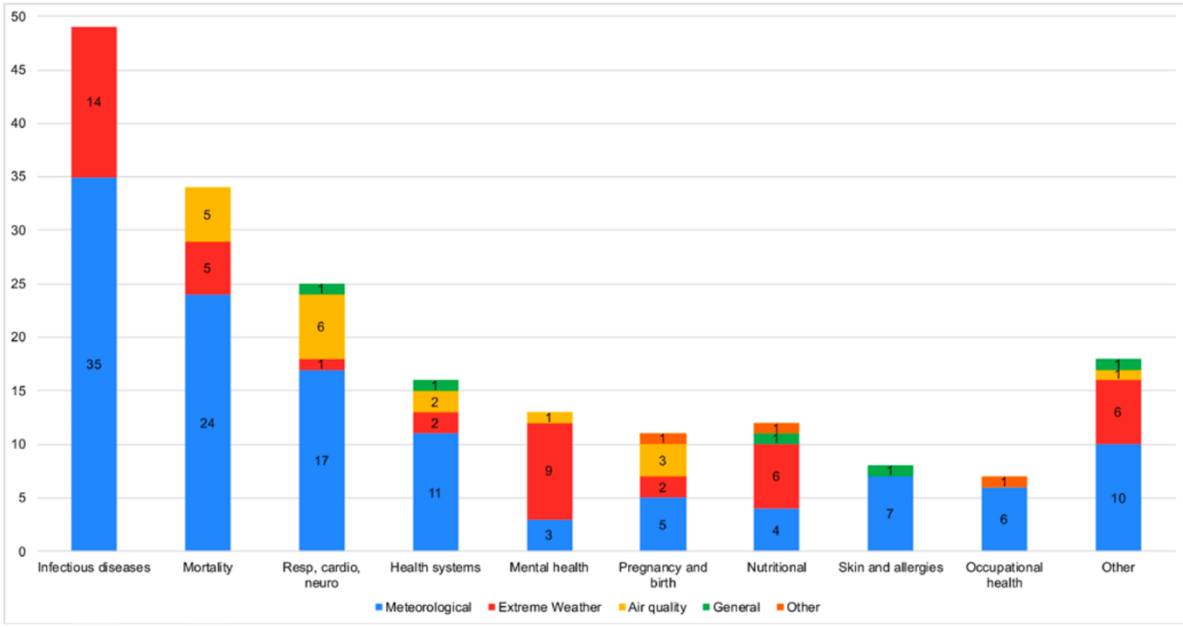


Figure 4 Summary of the combination of climate impact and health outcome (frequencies).

Image source: Rocque, R. J., Beaudoin, C., Ndjaboue, R., Cameron, L., Poirier-Bergeron, L., Poulin-Rheault, R.-A., Fallon, C., Tricco, A. C., & Witteman, H. O. (2021). *Figure 4. Summary of the combination of climate impact and health outcome (frequencies)* [Chart]. Health effects of climate change: An overview of systematic reviews. *BMJ Open*, *11*(6). https://doi.org/10.1136/bmjopen-2020-046333

Climate Impacts and People

- 40% world labor force in food system
- Agriculture accounts for 4% world gross domestic product (GDP)
- Greater exposure to occupational hazards

Sources: FAO. (2024). *Employment indicators 2000–2022 (October 2024 update)* (No. FAOSTAT Analytical Brief 92). Food and Agriculture Organization of the United Nation. https://www.fao.org/statistics/highlights-archive/highlights-detail/employment-indicators-2000-2022-(september-2024-update)/en; World Bank. (2024). *Agriculture, forestry, and fishing, value added (% of GDP)*. https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS; Photo is from Microsoft Stock Images.

Discussion 1: Climate Change and Nutrition

- How do you think the changing nutrient content of crops will impact the clients you will work with? Will it differ by type of diet? Location? Community?
- Should these changes influence nutrient databases and nutrition labeling?
- How can nutritional professionals guide consumers toward nutrient-dense food choices given the inconsistencies in nutrient quality of foods?
- What are some additional ways that nutrition professionals can support consumers in this topic?

Section D: Reducing the Climate Footprint of Food Systems

Food, Agriculture, and Land Use

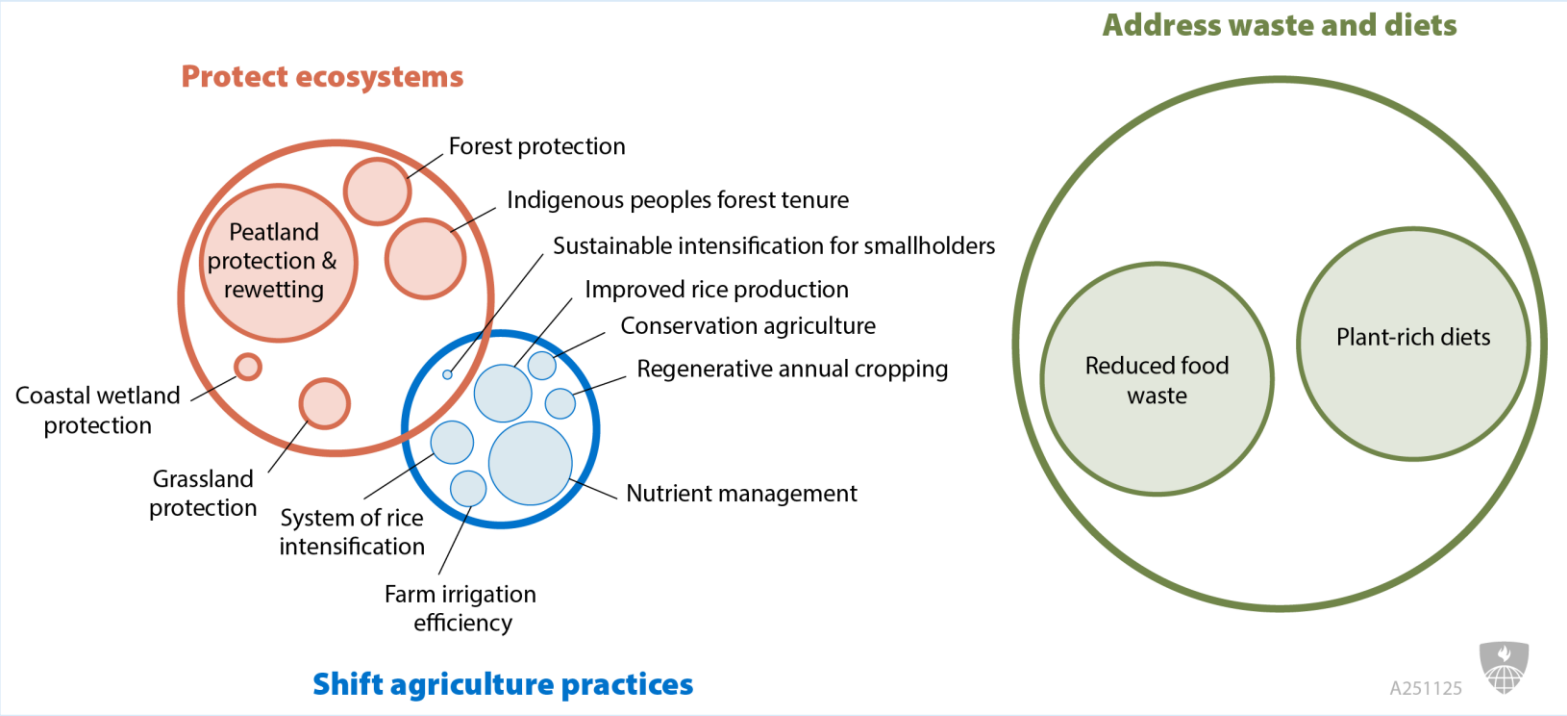


Image source: Adapted by the Johns Hopkins Bloomberg School of Public Health from Mehra, M. (2021). *Resilient & sustainable land management practices. Project Drawdown*.[Presentation Slides]. https://unfccc.int/sites/default/files/resource/2%20PD_NBS_Mamta%20Mehra_Oct2021.pdf#:~:text=How%20can%20we%20reduce%20the%20pressures%20on,worldwide%20along%20with%20addressing%20the%20issue%20of

Solutions: Reducing the Food System Contribution to Climate Change through Less Meat, Less Waste

"A diet that includes more plant-based foods and fewer animal source foods is healthy, sustainable, and good for both people and planet. It is not a question of all or nothing, but rather small changes for a large and positive impact."

—EAT Lancet Planetary Health

Source: The EAT-Lancet Commission on Food, Planet, Health. (n.d.). *Figure 3, Planetary Health Plate* [Graphic]. *The Planetary Health Diet*. EAT Forum. https://eatforum.org/wp-content/uploads/2025/09/EAT-Lancet_Commission_Summary_Report.pdf

Strategies for a Healthy Climate

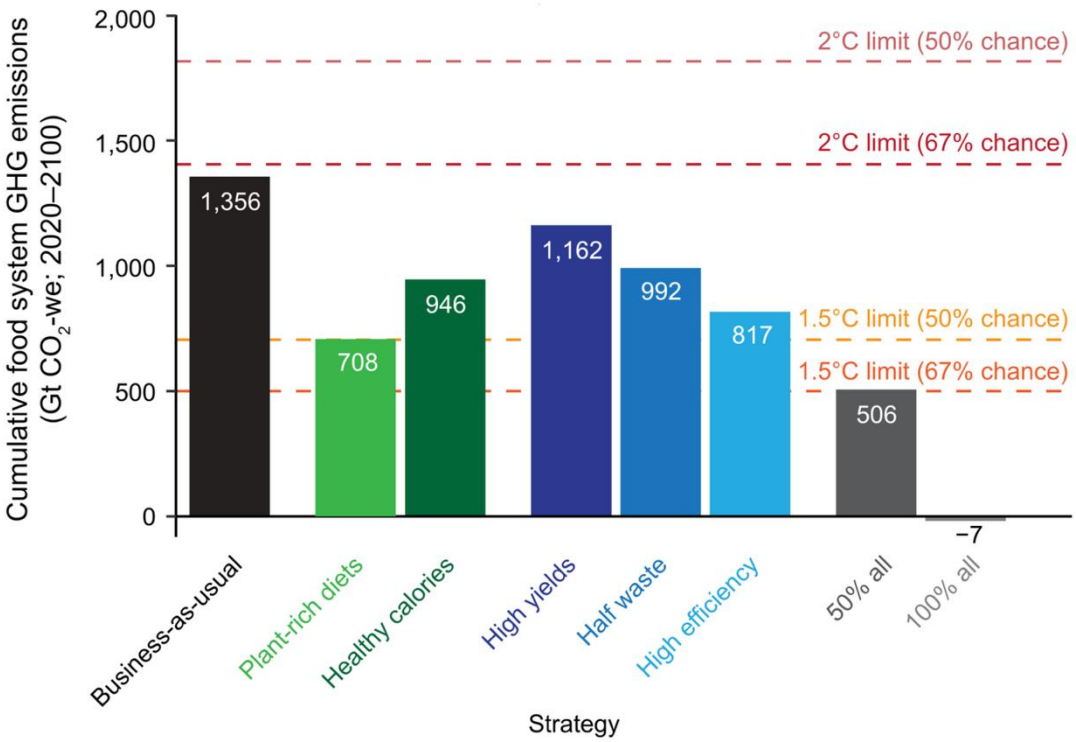


Fig. 1. Projected cumulative 2020 to 2100 GHG emissions solely from the global food system for business-as-usual emissions and for various food system changes that lead to emission reductions.

Image source: Clark, M. A., Domingo, N. G. G., Colgan, K., Thakrar, S. K., Tilman, D., Lynch, J., Azevedo, I. L., & Hill, J. D. (2020). *Figure 1. Projected cumulative 2020 to 2100 GHG emissions solely from the global food system for business-as-usual emissions and for various food system changes that lead to emission reductions* [Chart]. Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets. *Science*, *370*(6517), 705–708. https://doi.org/10.1126/science.aba7357

Equity: Per Capita Meat Supply, by Country

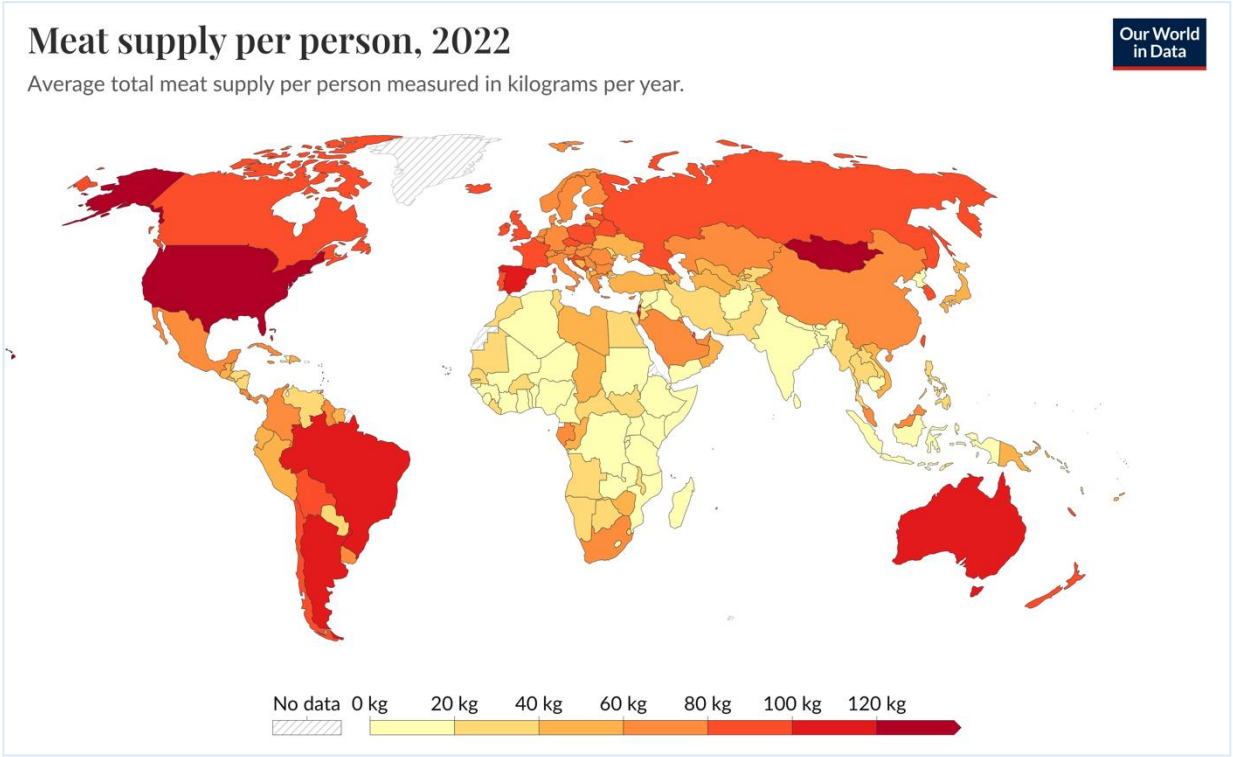


Image source: Our World in Data. (2025). *Yearly per capita supply of all meat: Meat supply per person*. Our World in Data. https://ourworldindata.org/grapher/meat-supply-per-person?time=2022

What Can High-Income Countries Do to Make Diets More Sustainable and Aligned With the Planetary Health Diet?—1

1

Eat less meat and dairy (for most)

2

Consume more whole grains, vegetables, legumes, and nuts

1. Eat Less Meat and Dairy (for Most)

- Replace animal proteins with healthy plant proteins
  - Beans
  - Lentils
  - Nuts
- Emphasize sustainably and regeneratively produced animal foods
  - Including aquatic foods
- Moderate portions of dairy

Image stock: Microsoft Stock Images.

What if We Choose Only Grass-Fed Beef?

Image stock: Microsoft Stock Images.

Global Agricultural Land Use

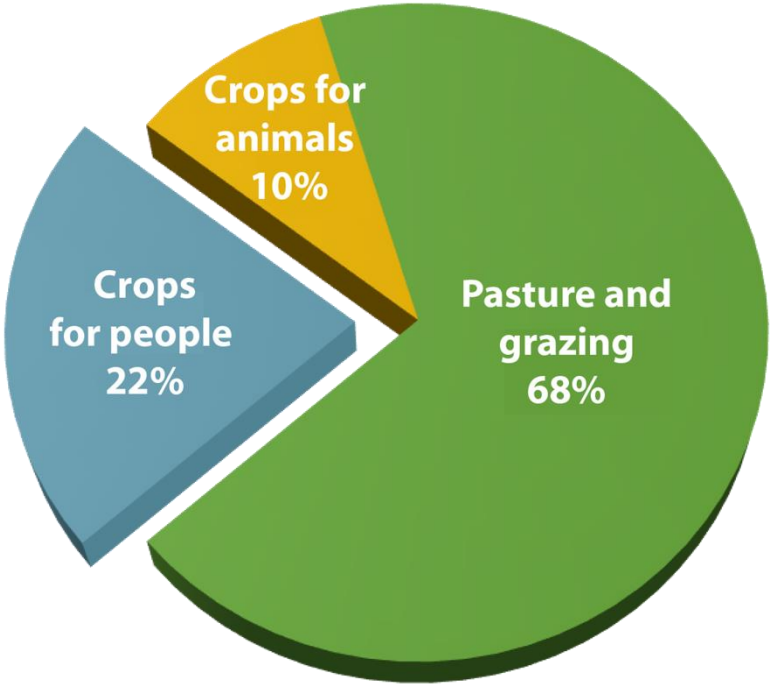


Image sources: Photo is from Microsoft Stock Images; Pie chart was created by the Center for a Livable Future based on data from FAO and Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, *360*(6392), 987–992. https://doi.org/10.1126/science.aaq0216

Dairy: The Complexities

Nutrition

- Source of affordable micronutrients
  - Calcium, magnesium, phosphorus, iodine, zinc
- Associated with growth and cognition for children
- Favorable evidence of protection against serious heart disease and all cause mortality
- Plant-based milks vary by source
- Form matters

Environment

- Generally, more greenhouse gas emissions (GHGe) per liter and water-intensive than dairy alternatives
- Products using large quantities of milk per serving have greater environmental impacts
- Most impact from animal feed production and farm activities, including solid waste disposal

Sources: Smedman, A., Månsson, H. L., Drewnowski, A., & Edman, A.-K. M. (2010). Nutrient density of beverages in relation to climate impact. *Food & Nutrition Research*, *54*(5170). https://doi.org/10.3402/fnr.v54i0.5170; Drewnowski, A., Rehm, C. D., Martin, A., Verger, E. O., Voinnesson, M., & Imbert, P. (2015). Energy and nutrient density of foods in relation to their carbon footprint. *The American Journal of Clinical Nutrition, 101*(1), 184–191. https://doi.org/10.3945/ajcn.114.092486; Johnson, A. J., Stevenson, J., Pettit, J., Jasthi, B., Byhre, T., & Harnack, L. (2025). Assessing the nutrient content of plant-based milk alternative products available in the United States. *Journal of the Academy of Nutrition and Dietetics*, *125*(4), 515–527. https://doi.org/10.1016/j.jand.2024.06.003

Greenhouse Gas Emissions Associated with Dairy and Plant-Based Milk

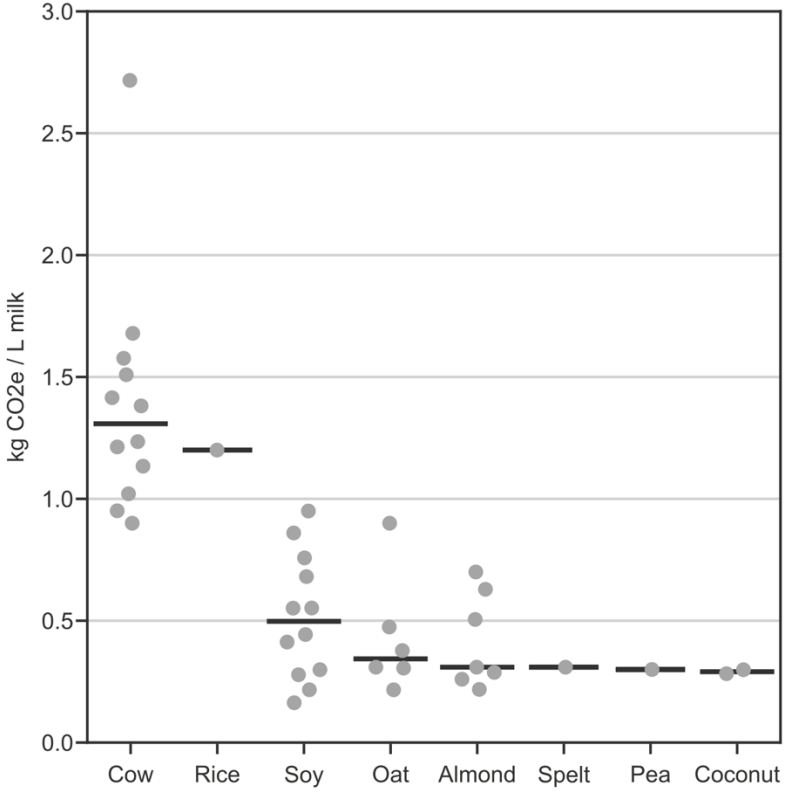
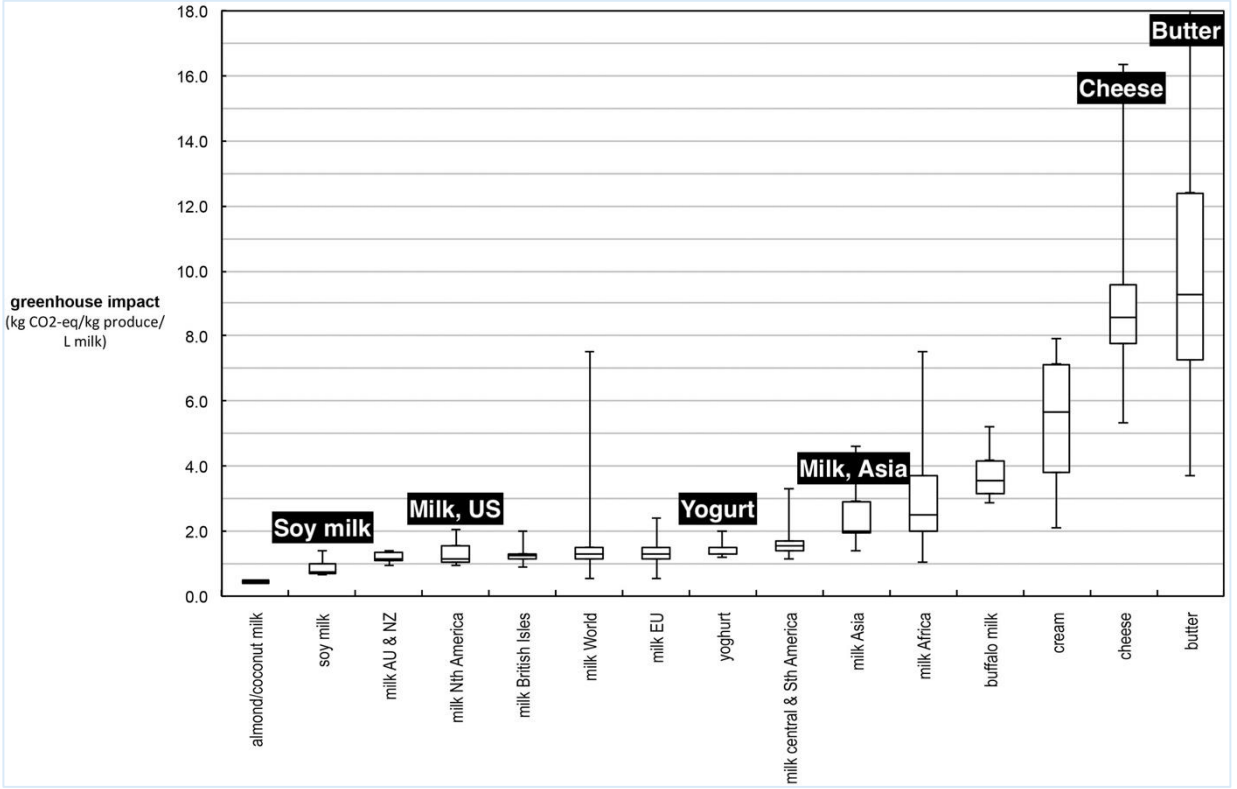


Fig. 3 Greenhouse gas emissions (kg CO_2e/L milk) associated with dairy and plant-based milks.

Source: Ramsing, R., Santo, R., Kim, B. F., Altema-Johnson, D., Wooden, A., Chang, K. B., Semba, R. D., & Love, D. C. (2023). *Figure 3. Greenhouse gas emissions (kg CO_2e/L milk) associated with dairy and plant-based milks* [Chart]. Dairy and plant-based milks: implications for nutrition and planetary health. *Current Environmental Health Reports*, *10*(3), 291–302. https://doi.org/10.1007/s40572-023-00400-z

Comparison of Global Warming Potential (GWP) Values for Dairy and Dairy Substitutes



Sources: Shalant, J. (2017). To shrink your carbon footprint, ease up on the dairy. National Resource Defense Council. https://www.nrdc.org/stories/shrink-your-carbon-footprint-ease-dairy; NRDC. (2017). Less beef, less carbon: Americans shrink their diet-related carbon footprint by 10 percent between 2005 and 2014 (Nos. 16-11-B; Issue Paper). National Resource Defense Council. https://www.nrdc.org/sites/default/files/less-beef-less-carbon-ip.pdf; Graph adapted by the Center for a Livable Future from *Figure 9. Comparisons of synthesized GWP values for dairy and dairy substitutes* [Chart]. Clune, S., Crossin, E., and Verghese, K. (2017). Systematic review of greenhouse gas emissions for different fresh food categories. Journal of Cleaner Production, 140, 2, 766–783. https://doi.org/10.1016/j.jclepro.2016.04.082

What Can High-Income Countries Do to Make Diets More Sustainable and Aligned With the Planetary Health Diet?—2

1

Eat less meat and dairy (for most)

2

Consume more whole grains, vegetables, legumes, and nuts

2. Consume More Whole Grains, Vegetables, Legumes ,and Nuts

- Choose healthy plant proteins
- Choose a variety of whole grains and reduce reliance on refined staples
- Purchase local produce in season
- Focus on diversity and variety

Image source: Shutterstock.

Plant-Based Proteins

- *Pulses (legumes, beans)*
- *Soy products*
- *Nuts and seeds*
- *"Alt" meats (processed products)*

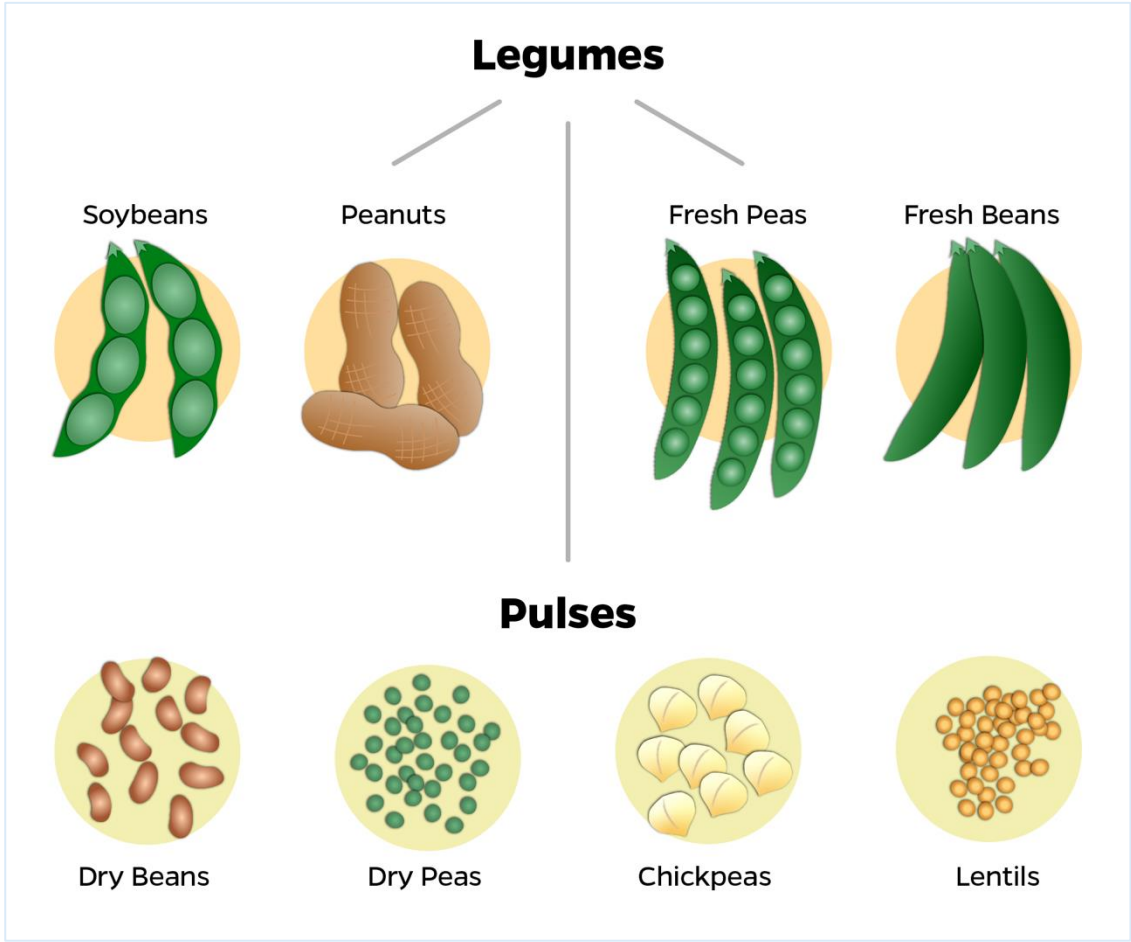


Image source: Johns Hopkins Center for a Livable Future.

Nuts and Seeds

Environment

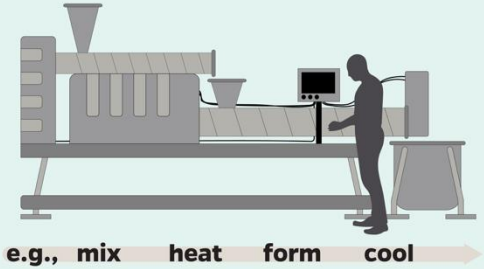
- Water needs
  - Tree versus plant
  - Water-scarce areas
- Yields
  - Trees = higher yields
- Soil health
  - Peanut = nitrogen fixing

Nutrition

- Protein and healthy fats
  - Omega-3, alpha-linolenic acid (ALA)
    - Flax, walnuts, and chia
  - Monounsaturated fatty acids (MUFAs)
  - Polyunsaturated fatty acids (PUFAs)
- Fiber
- Micronutrients
  - Vitamin E, calcium, magnesium, and other minerals

Image source: Shutterstock.

“Alt Meats” and Plant-Based Meat Substitutes

Inputs	Processing	Outputs
► Protein ingredients: soy, pea protein, wheat gluten, etc. ► Fats and vegetable oils ► Structural ingredients ► Binding agents ► Seasonings, coloring agents		► Coarse ground products (sausages and nuggets) ► Foods that mimic deli meat and hot dogs ► Crumbles that resemble ground meat

Source: Santo, R. E., Kim, B. F., Goldman, S. E., Dutkiewicz, J., Biehl, E. M. B., Bloem, M. W., Neff, R. A., & Nachman, K. E. (2020). Considering plant-based meat substitutes and cell-based meats: A public health and food systems perspective. *Frontiers in Sustainable Food Systems*, *4*. https://doi.org/10.3389/fsufs.2020.00134; Image is from the Johns Hopkins Center for a Livable Future.

Comparison of Greenhouse Gas Emissions of "Alt" Proteins

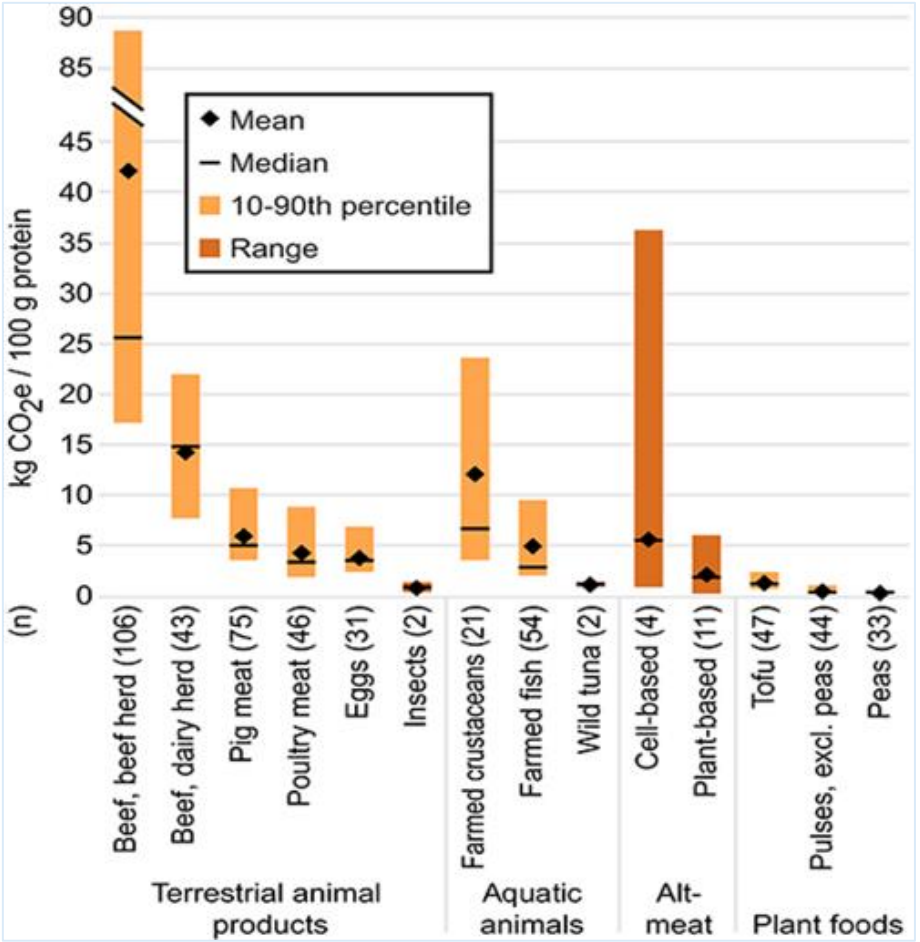


Image source: Santo, R. E., Kim, B. F., Goldman, S. E., Dutkiewicz, J., Biehl, E. M. B., Bloem, M. W., Neff, R. A., & Nachman, K. E. (2020). *Figure 3. Cradle-to-processing gate GHG footprints (wherever possible) per 100 g protein* [Chart]. Considering plant-based meat substitutes and cell-based meats: A public health and food systems perspective. *Frontiers in Sustainable Food Systems*, *4*. https://doi.org/10.3389/fsufs.2020.00134

Discussion 2: An Optimal Diet Pattern

- Given what was covered in the last section, how would you describe an ideal diet pattern?
- How would this differ by individual, income, community or location?
  - Urban versus rural
  - Coastal versus inland
  - Etc.
- What challenges do you anticipate in providing guidance to consumers and patients?
- What might be some barriers to implementation of plant forward menus in food service?

Section E: Connecting With Consumers to Shift Diets

Food Choice Is Complex! Not Logical nor Linear

Image source: Shutterstock.

Drivers of Meat Consumption

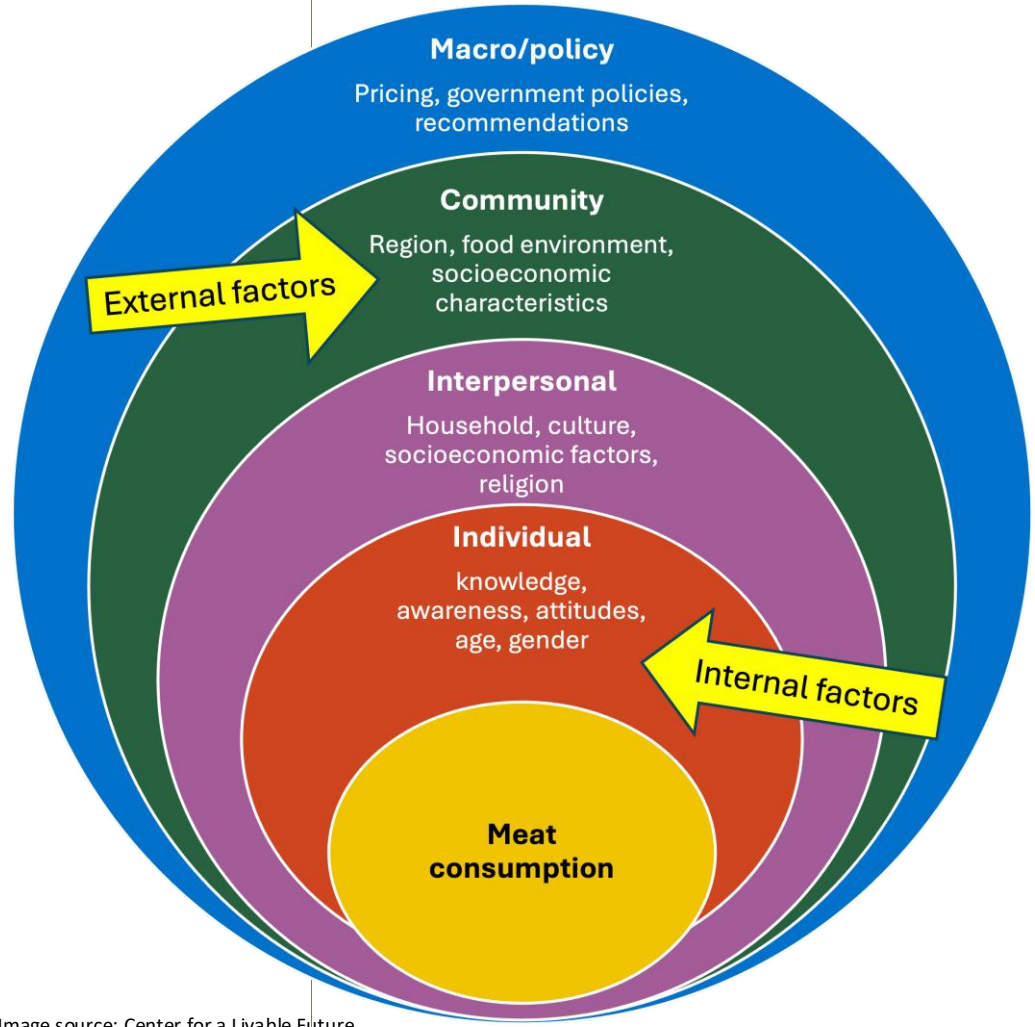


Image source: Center for a Livable Future.

Macro/policy: pricing and marketing of meat, government policies and recommendations

Community/institution: Geographic region, urban versus non-urban, food environment, school/workplace environment, socioeconomic characteristics, media, culinary trends, availability and attractiveness of alternative proteins

Interpersonal: Household dietary norms, culture, relationships, friends/family's dietary practices, socioeconomic factors, religion

Individual: knowledge, awareness, attitudes, values (moral disengagement, openness to change, altruism), age, gender, health, environment, and animal welfare concerns

Reasons People Reduce Meat Intake

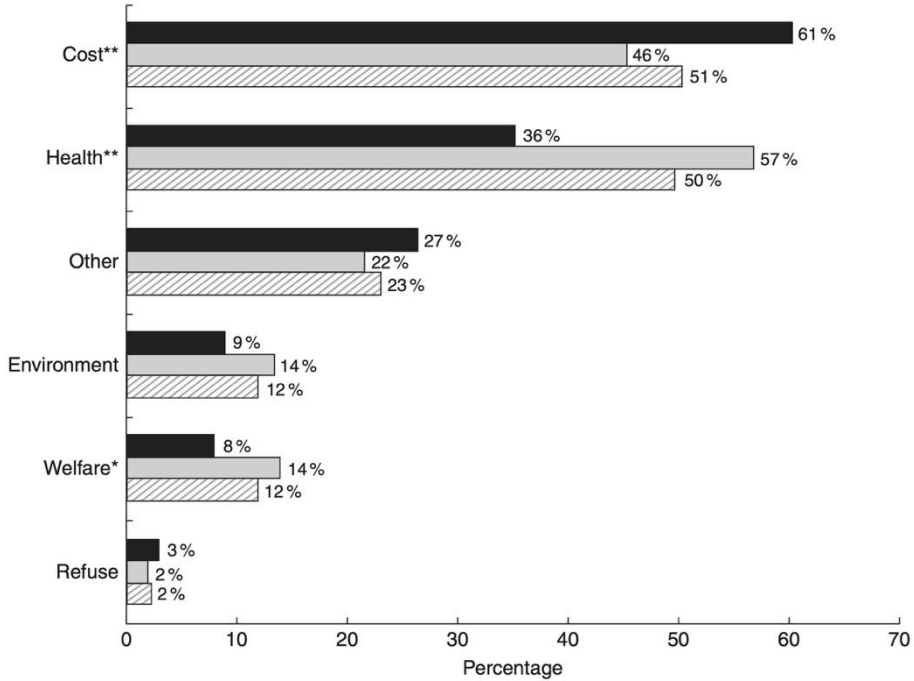


Fig. 1 Reasons for meat reduction by income (■, < $US 40 000; ▨, ≥ $US 40 000; ▨, overall) in a nationally representative adult sample: USA, 2015. Figure depicts the stratified results for percentage indicating each item was a reason for meat reduction, by income. *P* values reflect χ^2 for cross-tabulation: **P* < 0·05, ***P* < 0·01, ****P* < 0·001

Image source: Neff, R. A., Edwards, D., Palmer, A., Ramsing, R., Righter, A., & Wolfson, J. (2018). *Figure 1. Reasons for meat reduction by income in a nationally representative adult sample* [Chart]. Reducing meat consumption in the USA: A nationally representative survey of attitudes and behaviours. *Public Health Nutrition*, *21*(10), 1835–1844. https://doi.org/10.1017/S1368980017004190

Reasons People *Do Not* Reduce Meat Intake

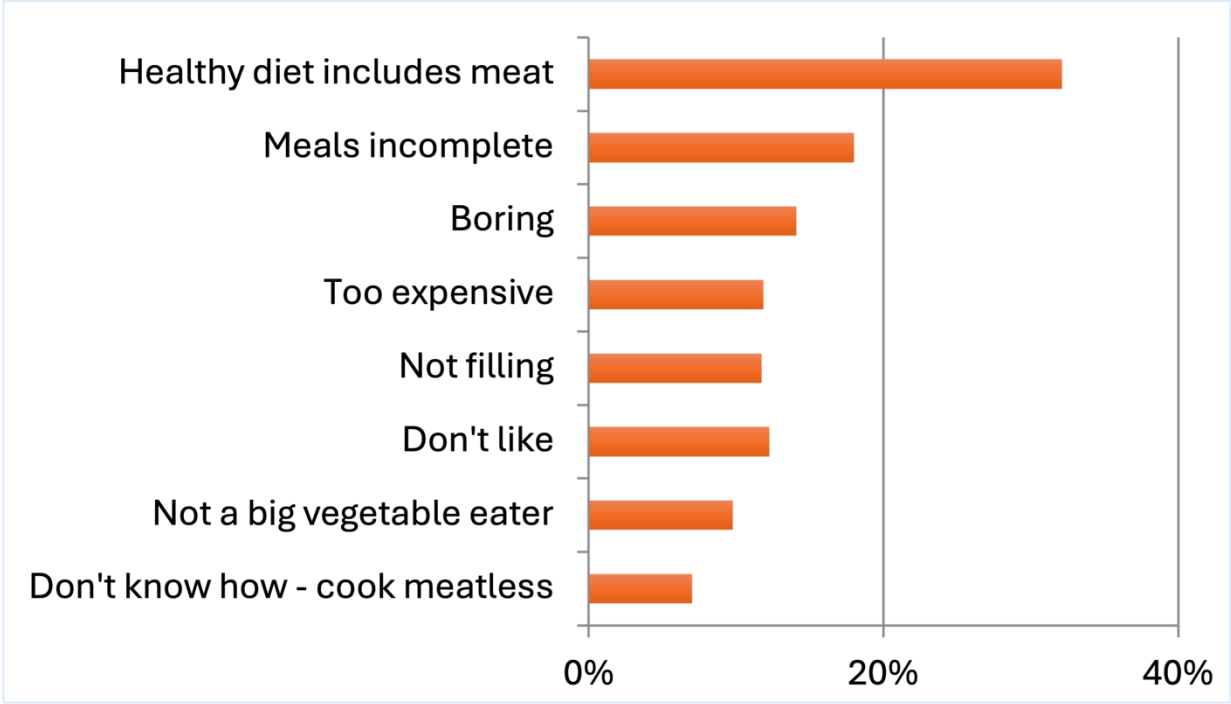


Image source: Adapted by the Center for a Livable Future from Neff, R. A., Edwards, D., Palmer, A., Ramsing, R., Righter, A., & Wolfson, J. (2018). *Figure 1. Reasons for meat reduction by income in a nationally representative adult sample* [Chart]. Reducing meat consumption in the USA: A nationally representative survey of attitudes and behaviours. *Public Health Nutrition*, *21*(10), 1835–1844. https://doi.org/10.1017/S1368980017004190

Approaches to Shifting to Plant-Forward Diets Vary

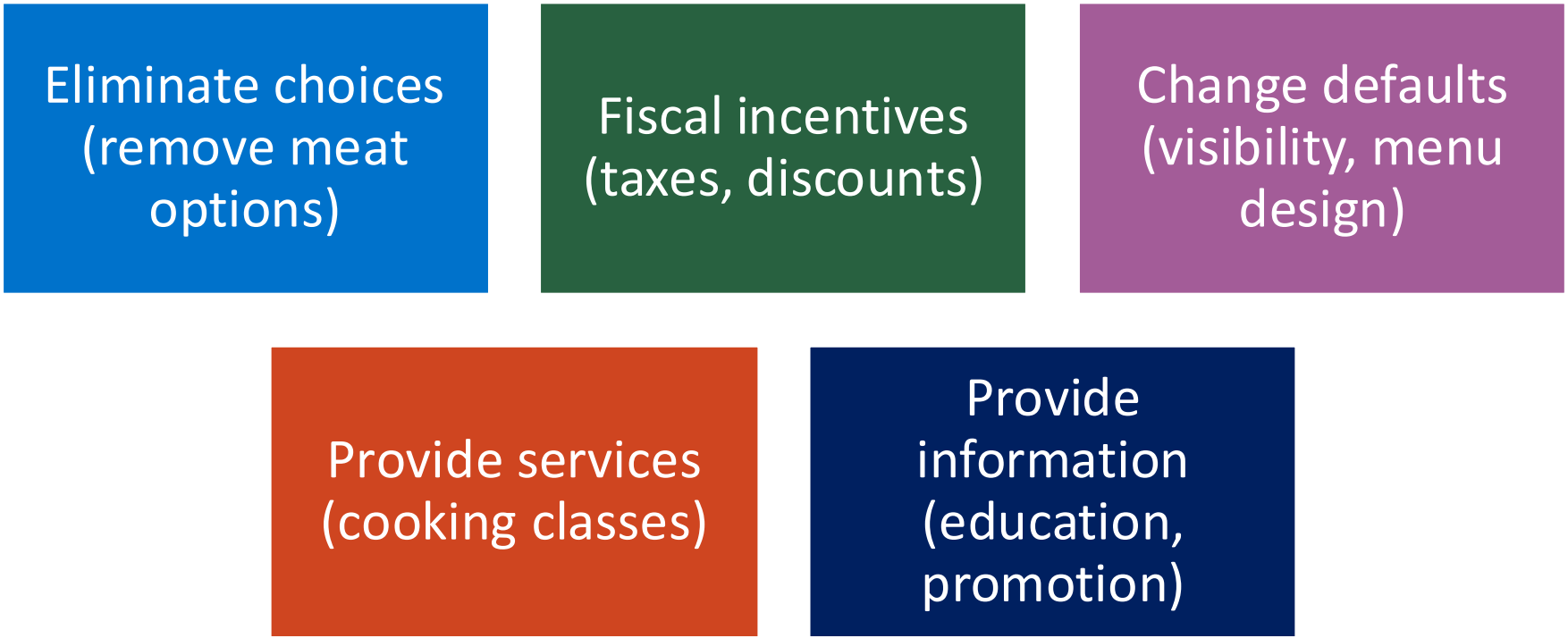


Image source: Adapted by the Center for a Livable Future from Rust, N. A., Ridding, L., Ward, C., Clark, B., Kehoe, L., Dora, M., Whittingham, M. J., McGowan, P., Chaudhary, A., Reynolds, C. J., Trivedy, C., & West, N. (2020). How to transition to reduced-meat diets that benefit people and the planet. *Science of the Total Environment*, *718*. https://doi.org/10.1016/j.scitotenv.2020.137208

Consumer Connections

- Combined approaches are most likely to be accepted and successful when they:
  - Raise awareness
  - Facilitate access and remove barriers

Source: Wellesley, L., & Froggatt, A. (2023). *Changing Climate, Changing Diets: Pathways to Lower Meat Consumption*. Chatham House. https://www.chathamhouse.org/2015/11/changing-climate-changing-diets-pathways-lower-meat-consumption; Images are from Shutterstock.

The Power of our Food Environment

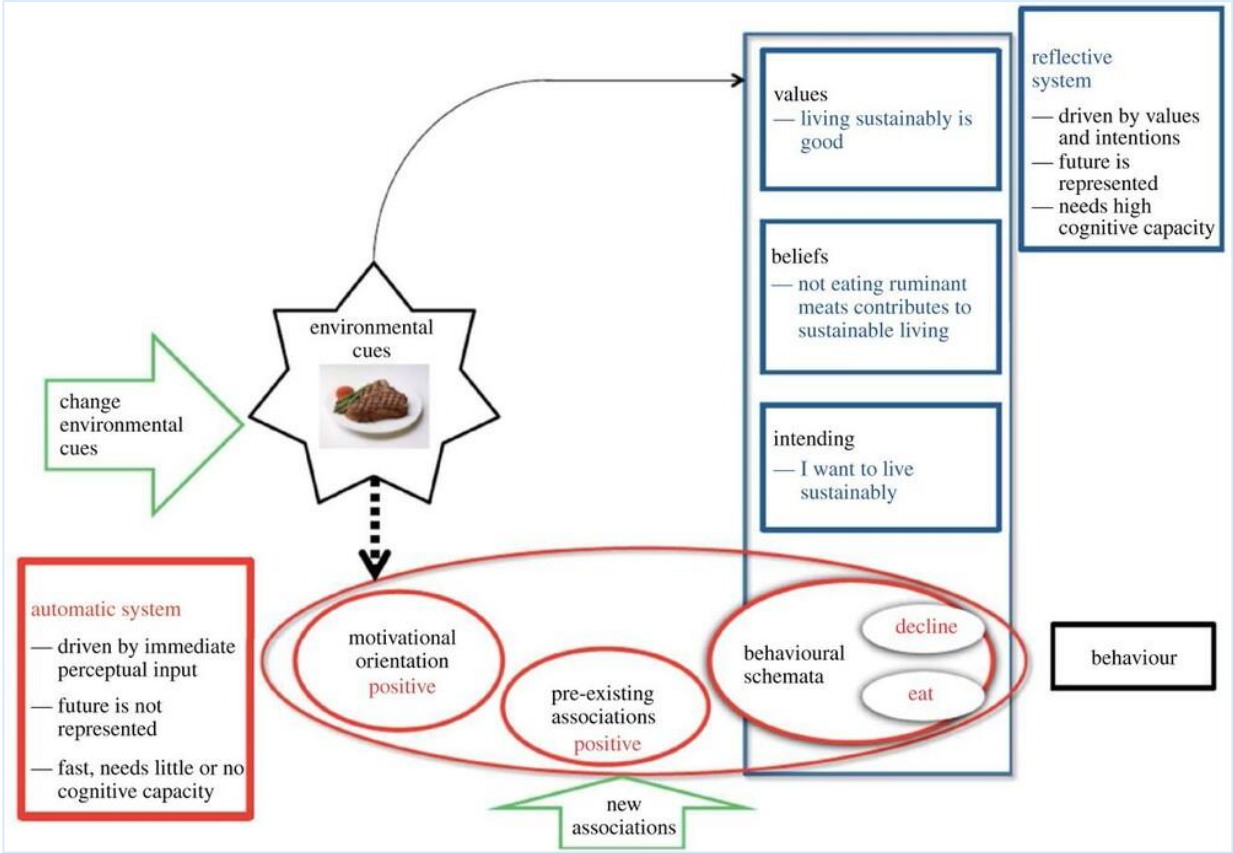


Image source: Marteau, T. M. (2017). *Figure 1. Automatic and reflective systems guiding behaviour, with potential points for intervention* [Chart]. Towards environmentally sustainable human behaviour: Targeting non-conscious and conscious processes for effective and acceptable policies. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *375*(2095). https://doi.org/10.1098/rsta.2016.0371

One Quick Slide on Policy as a Lever for Change!

- Challenges of moving from food trend to dietary transition:
  - Consumer intention-behavior gap
  - Bottom-up consumer pressure is valuable but limited
- Policy actions can support interventions that lead to triggering points
  - Impacts the broader external environment where the shift can happen

- Types of policy supporting consumer shifts
  - Mandates
  - Restrictions
  - Economic incentives
  - Marketing limits
  - Information provision
  - Environmental defaults

Sources: Gorski, M. T., & Roberto, C. A. (2015). Public health policies to encourage healthy eating habits: Recent perspectives. *Journal of Healthcare Leadership*, *7*, 81–90. https://doi.org/10.2147/JHL.S69188; Aschemann-Witzel, J., & Janssen, M. (2022). The role of policy actions to accelerate food consumer behaviour change. *Agricultural and Food Economics*, *10*(1), 22. https://doi.org/10.1186/s40100-022-00230-x

Gradual Change, Small Steps

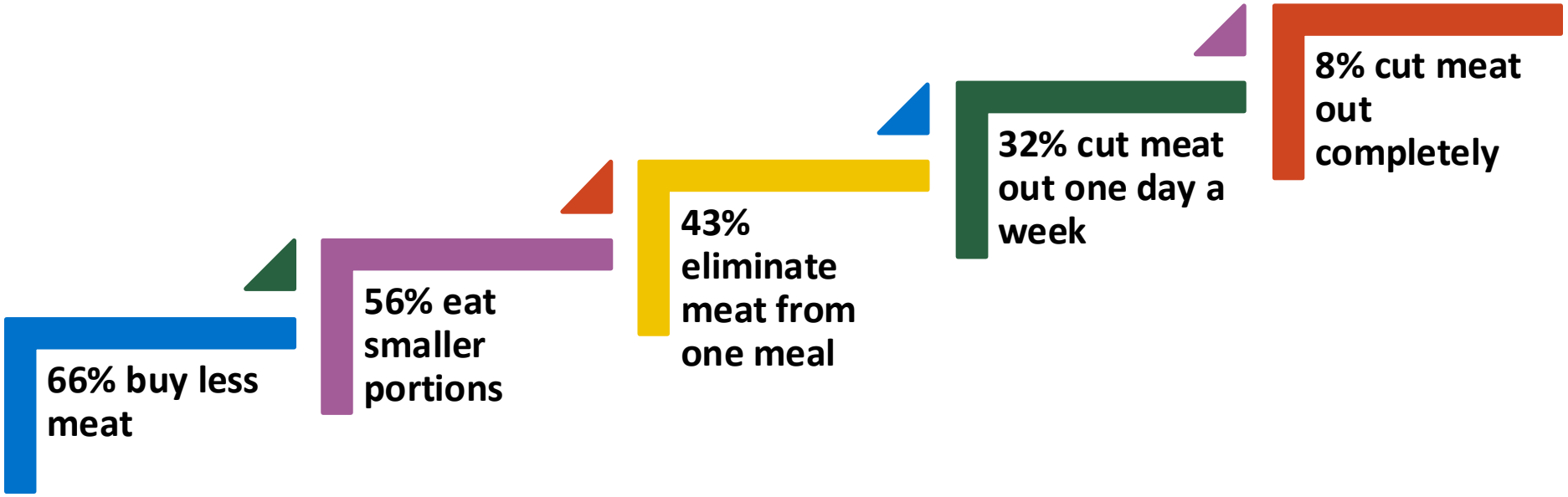
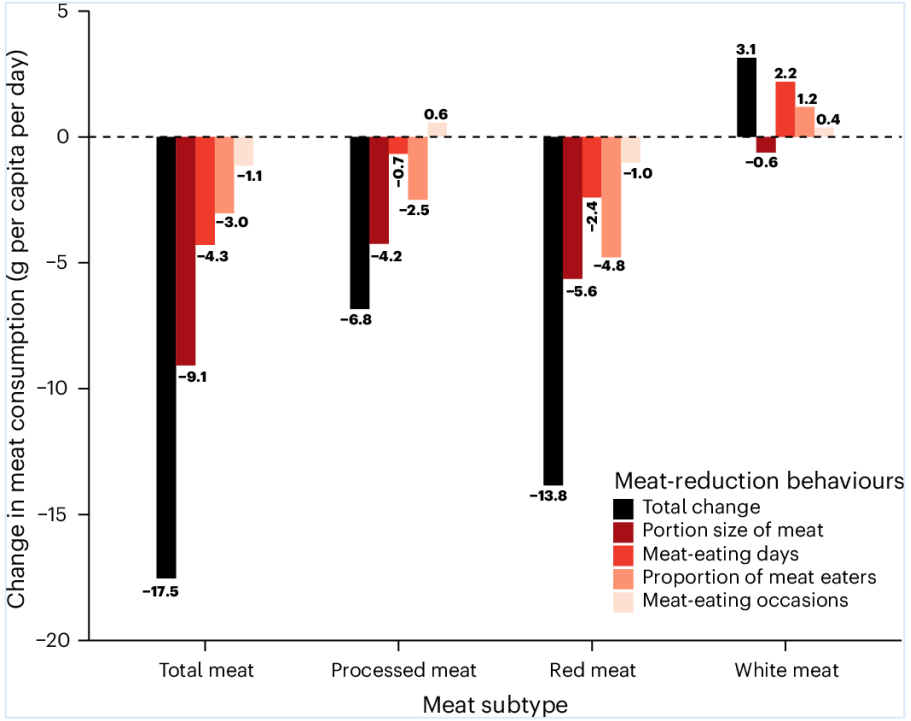


Image source: Adapted by the Center for a Livable Future from Neff, R. A., Edwards, D., Palmer, A., Ramsing, R., Righter, A., & Wolfson, J. (2018). Reducing meat consumption in the USA: A nationally representative survey of attitudes and behaviours. *Public Health Nutrition*, *21*(10), 1835–1844. https://doi.org/10.1017/S1368980017004190

Understanding Consumption Changes

The modest contribution of reducing meat-eating days indicates that we should not overestimate the impact of a weekly ‘Meatless Monday” or “Veggie Thursday.”



Sources: Reinders, M. J., & Dagevos, H. (2024). Meat reduction in small portions. *Nature Food*, *12*(5), 972–973. https://doi.org/10.1038/s43016-024-01084-w; graph is from Vonderschmidt, A., Jaacks, L. M., Alexander, P., Green, R., Bellows, A. L., & Stewart, C. (2024). *Figure 2: Decomposition analysis of meat-eating behaviours in the UK NDNS rolling programme years 1–11* **[Chart].** Smaller meat portions contribute the most to reducing meat consumption in the United Kingdom. *Nature Food*, *5*(12), 982–987. https://doi.org/10.1038/s43016-024-01070-2

Intervention Examples

MEATLESS MONDAY

GREENER BY DEFAULT

Image sources: Meatless Monday, Shutterstock, Greener by Default.

Study Overview

The impact of a weekly Meatless Monday email

- Those who practiced Meatless Monday were 15 times more likely to avoid meat on more than 1 day/week and 5 times more likely to have more meatless meals at home
- The longer people received the MM newsletter the more likely they were to reduce their meat intake overall and skip meat more than 1 day/week
- Those who received the e-newsletter > 3 years showed a trend toward increasing meatless meals at home

Source: Shakory, S., Altema-Johnson, D., Hendrickson, Z. M., & Ramsing, R. (2025). Dietary changes among people practicing Meatless Monday: A cross-sectional study. *Appetite*, *204*, 107760. https://doi.org/10.1016/j.appet.2024.107760 ; Image is a screenshot of *Eater's Digest* newsletter.

Case Study 1

Key Points: Food Systems and Climate

- Our food system is a key driver of climate change
- Climate change increasingly puts our food supply at risk
- There is consensus among climate, health, and environmental scientists about strategies to reduce the food system's contributions to climate
- Different strategies are needed in different places; responsibility for reducing meat and dairy falls mainly on countries with the highest intake
- Low consumer awareness is an opportunity for education

Thank You!

Image source: Microsoft Stock Images.

Practice and Resources Booklet

About This Presentation

Produced by the Center for Teaching and Learning at the Johns Hopkins Bloomberg School of Public Health.

JOHNS HOPKINS
BLOOMBERG SCHOOL
of PUBLIC HEALTH

Center for Teaching and Learning