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From Awareness to Action: Exploring How Shifting Diets Can Help Mitigate Climate Change

Reducing ruminant consumption with individual and societal dietary change can lower methane emissions, contributing to a short-term slowdown in global warming.

Background

- Greenhouse gases (GHGs) consist of various gases, with Carbon Dioxide (CO2) responsible for over 70% of emissions, followed by Methane at approximately 20% (Jones et al., 2024).
- Methane is emitted through wetlands, human activities (agriculture, fossil fuel extraction) and waste management.
- Methane traps heat 27 to 30 times more effectively than CO2 over a 100-year period (US EPA, 2025).
- Despite its potency, methane has a shorter atmospheric lifespan of about 12 years (International Agency Agency, 2022).
- Understanding and mitigating methane emissions are crucial for effective climate action strategies.

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Problem

The study investigates the awareness of how individual dietary choices relate to climate change and get examples of how diets that are better for the planet are emerging in different areas of the globe as a path forward.

Objective

With growing awareness of the impact of methane emissions on the climate, there is a potential to promote individual change in diets and in food production to contribute to reducing emissions. Diets are closely related to cultural behaviour - individual, family and community behaviour, and also to economic status. Understanding these dynamics and how to influence behaviour is a key aspect to promote change in emissions. This work aims at a systemic analysis of:

- Causal diagram, on methane emissions
  - Reinforcing loops that run counter to the adoption of a planet-aware diet
  - Balancing loops that contribute to dietary change
- Describe the adoption curve for a planet-aware diet.
- Explore how different areas in the world are responding to a possible dietary change.
- Explore some early signs of change and propose ways of moving forward.

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Relevance

With a shorter atmospheric lifespan and much stronger warming effect than carbon dioxide, even small reductions of methane emissions can have a relatively quick impact on slowing climate change.

One of the most immediate and effective ways to achieve this is by shifting dietary habits, particularly by reducing beef consumption. However, meat consumption is deeply embedded in cultural and economic traditions, making dietary shifts a complex challenge.

Technological solutions and policy interventions take time to develop and implement, requiring coordination among multiple stakeholders. On an individual level, however, dietary choices are made daily, allowing for rapid adoption of change. This study examines trends, motivations, and challenges in dietary shifts while recognizing that individual choices can quickly influence methane reduction in the atmosphere.

Donella Meadows' work on systems and the Iceberg Model highlight that the most effective leverage point for transformation is at the level of mindsets and paradigms.

Addressing the issues of meat consumption and climate change requires more than just awareness of environmental consequences—it necessitates a deeper cultural shift in how societies and individuals view food choices.

Therefore, this study focuses on the emerging awareness of the impacts of beef consumption and how this is fostering behavioral change.

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Scope

This study focuses on the reduction of methane emissions in agriculture through individual and collective behavioral changes in choices people make in their diets. It examines how shifts in food consumption patterns—such as reduced reliance on ruminant livestock products—can contribute to lowering methane output from agricultural sources.

The analysis takes into consideration exclusively the methane emissions from meat production and consumption, with a focus on beef, and related agricultural activities. It excludes emissions from wetlands, rice production, energy sectors, waste management, and biomass burning.

Scope
Geography

As a work in progress, this study begins with a review of global data before focusing on Europe and North America, particularly the United States. Both regions have strong economies and contribute significantly to GHG emissions. Additionally, they offer widely available data, and their cultural and economic influence on other regions may play a role in driving dietary change.

As the study progressed, data indicated that Europe exhibits a stronger trend toward changes in dietary habits. Given that this shift is unique to the continent, it could influence other regions. In contrast, data from the United States reveal conflicting trends—some indicating a move toward change, while others suggest a stronger commitment to existing dietary habits.

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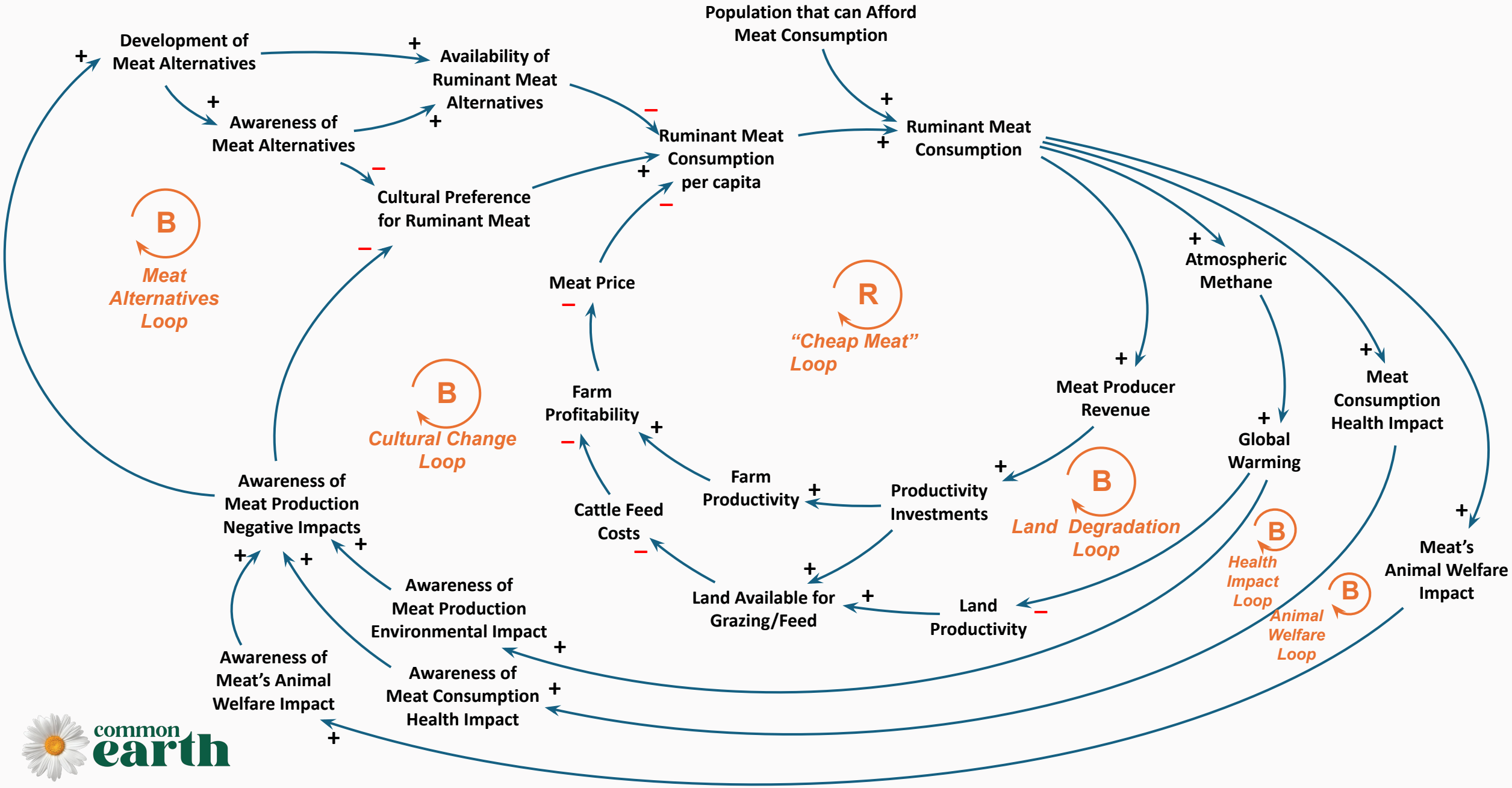
Dynamic Hypothesis:



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Notes on Dynamic Hypothesis

- **“Cheap Meat” Loop:** As consumption rises, producers reinvest profits into productivity, lowering prices and increasing consumption.
- **“Cultural Change” Loop:** Meat consumption increases atmospheric methane, a powerful greenhouse gas. Over time, awareness of this impact increases, reducing some consumers’ preference for consuming ruminant meat.
- **“Land Degradation” Loop:** Global warming leads to climate destabilization, which impacts land productivity and use. This impacts cattle feed prices, and eventually meat prices, reducing consumption.
- **“Health Impact” Loop:** Meat consumption also has negative health effects, which have been documented for decades–Therefore, many consumers are already aware of them.
- **“Animal Welfare” Loop:** The impact of factory farming on animal welfare is becoming better known over time.
- **“Meat Alternatives” Loop:** As awareness of the environmental damage increases, consumers look for meat alternatives.

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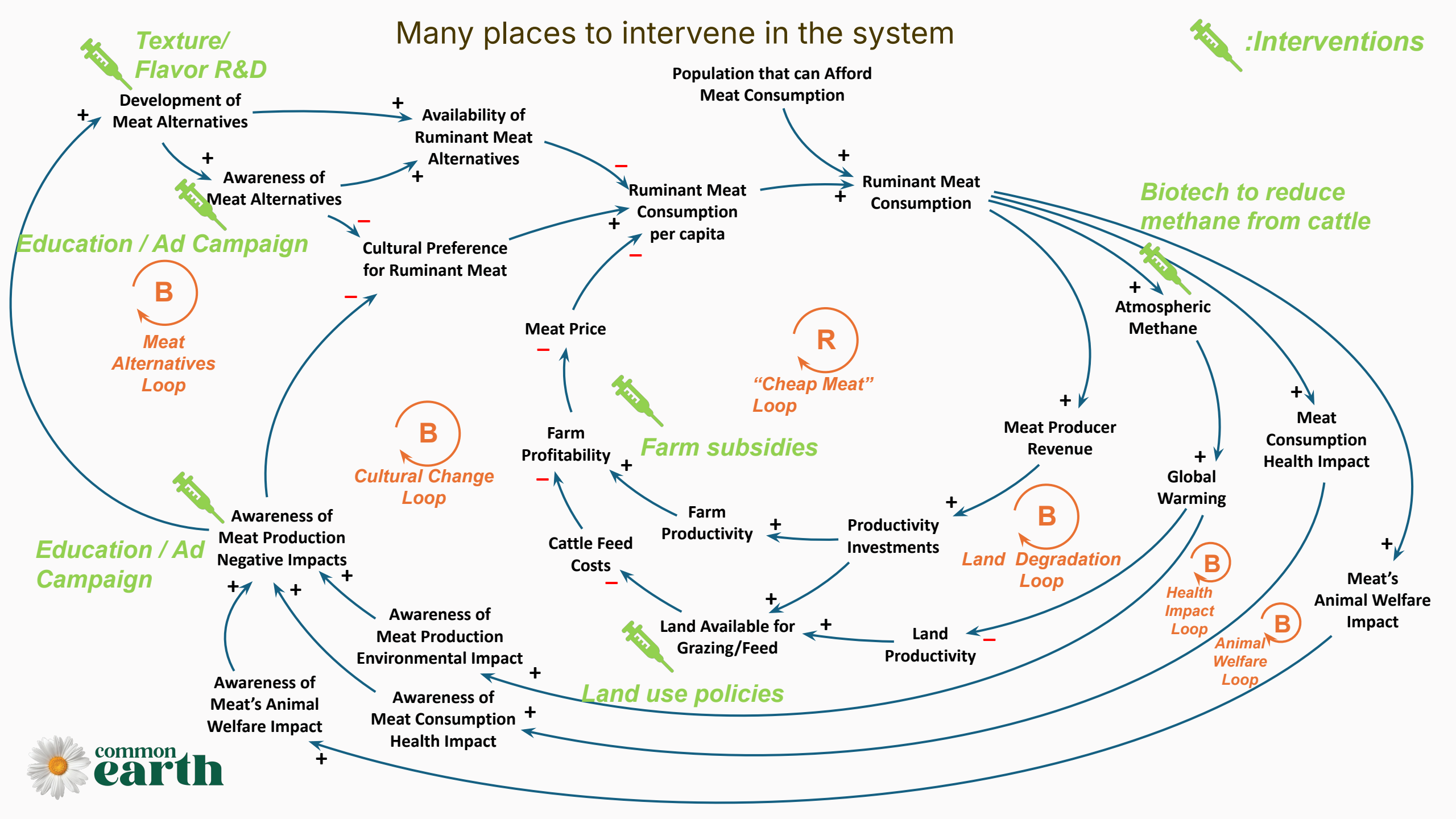
Many places to intervene in the system



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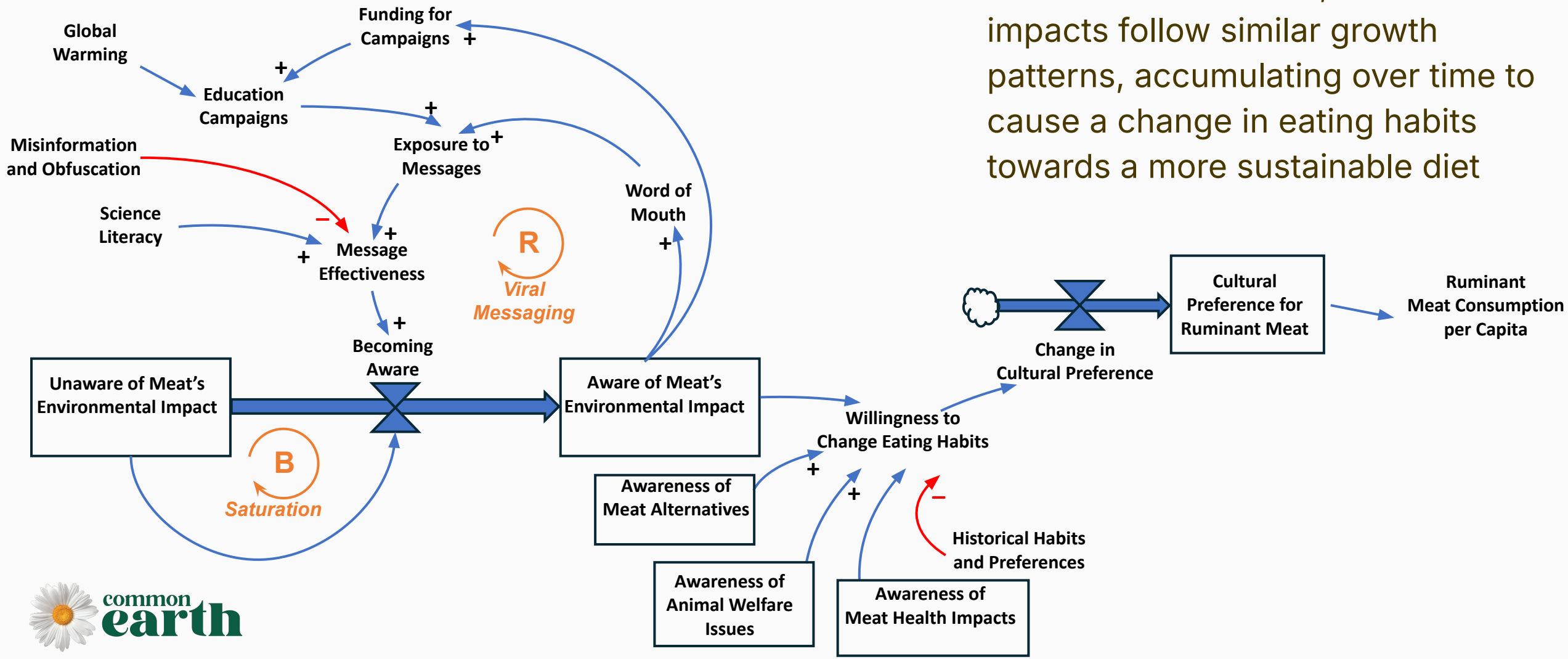
Awareness of Meat's Environmental impact increases following S-shaped growth, driven by education campaigns and word of mouth

Awareness of meat alternatives, animal welfare issues, and health impacts follow similar growth patterns, accumulating over time to cause a change in eating habits towards a more sustainable diet



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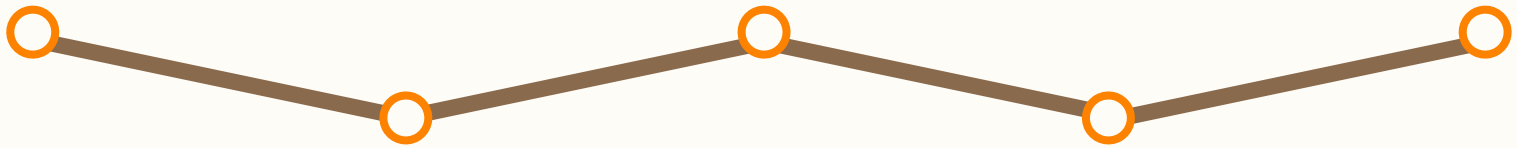
The Dynamic Model of Moralized Social Change (Judge et al., 2024) reflects the dynamic structure of growing awareness and cultural change.

Moral recognition
At this stage, moral concerns (e.g., health, ethics, environment) emerge within subgroups but are not yet widespread.

Approaching tipping points
A critical mass of people changes their behavior, making plant-based diets more normalized.

Norm abandonment
Meat consumption is socially discouraged and becomes a marginal behavior. Ethical, environmental, and health concerns make plant-based diets the mainstream norm.



Moral Amplification
Here, moral arguments gain traction, often through activism, media, and scientific discourse.

Institutionalization
At this stage, moralized beliefs become part of official policies, corporate practices, and broader social norms.

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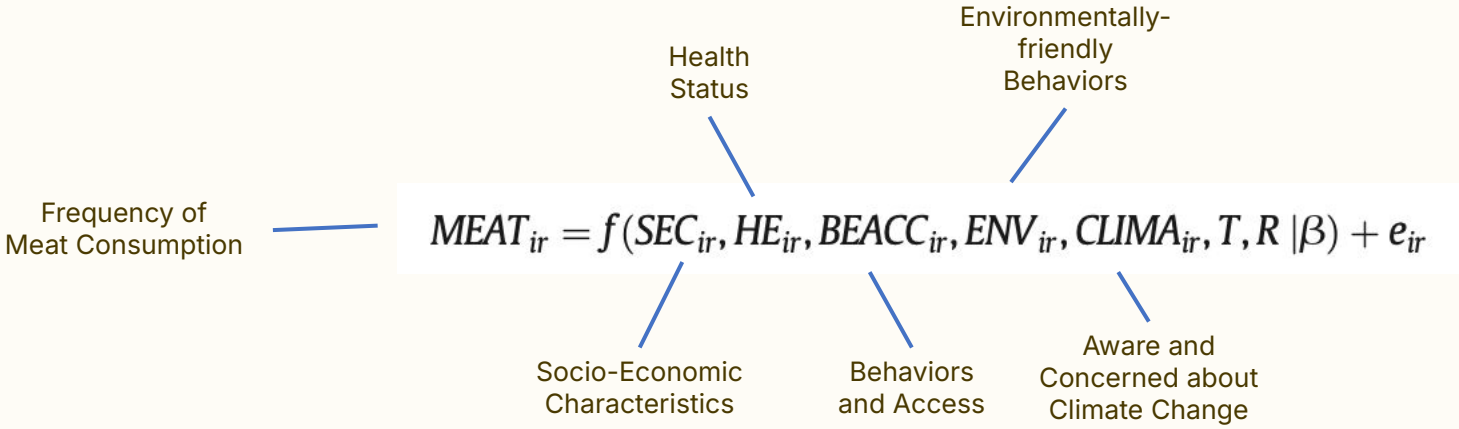
Source: Judge et al., 2024: Accelerating social tipping points in sustainable behaviors: Insights from a dynamic model of moralized social change

We're investigating what drives the Cultural Preference for Meat

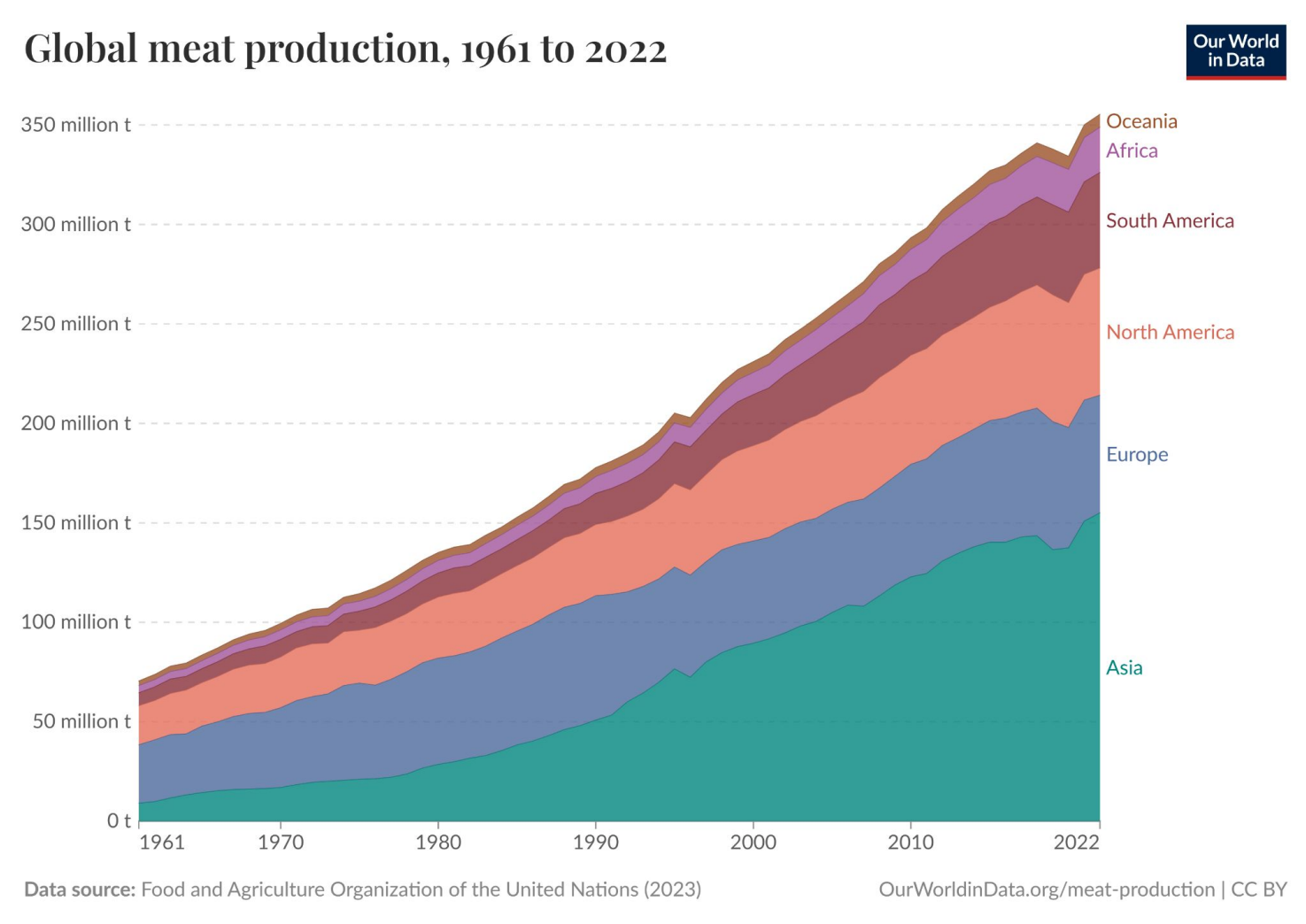


OTHER FACTORS:

- Policies
- Traditions
- Taste, texture, visual aspects

Bimbo F. 2023. Climate change-aware individuals and their meat consumption: Evidence from Italy. Sustainable Production and Consumption. 36:246–256. doi:10.1016/j.spc.2023.01.009.

Global meat production more than quadrupled since 1961 with Asia increasing 15 fold and becoming the largest meat producer



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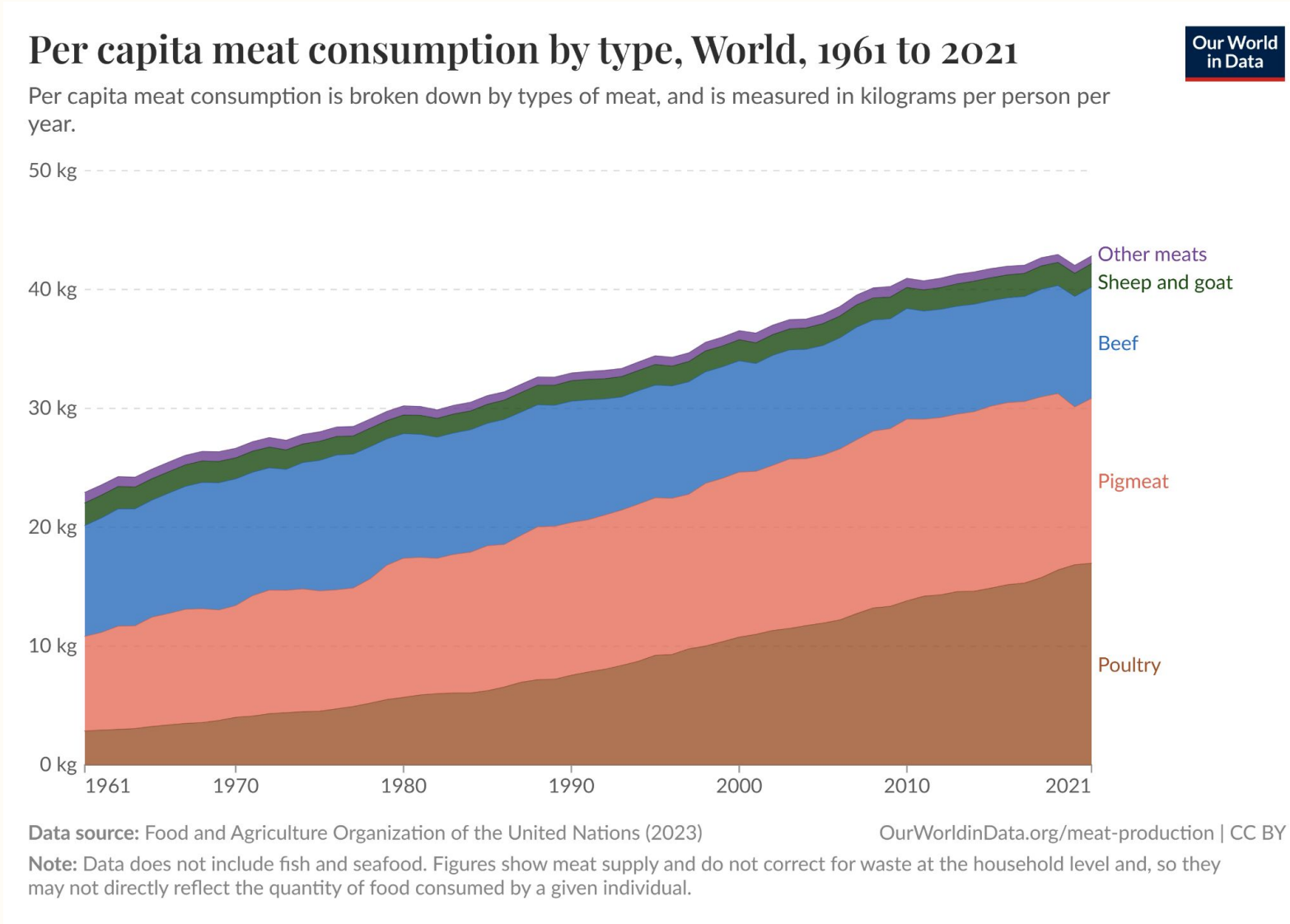
Meat consumption per capita has increased 87% since 1961 driven primarily by poultry



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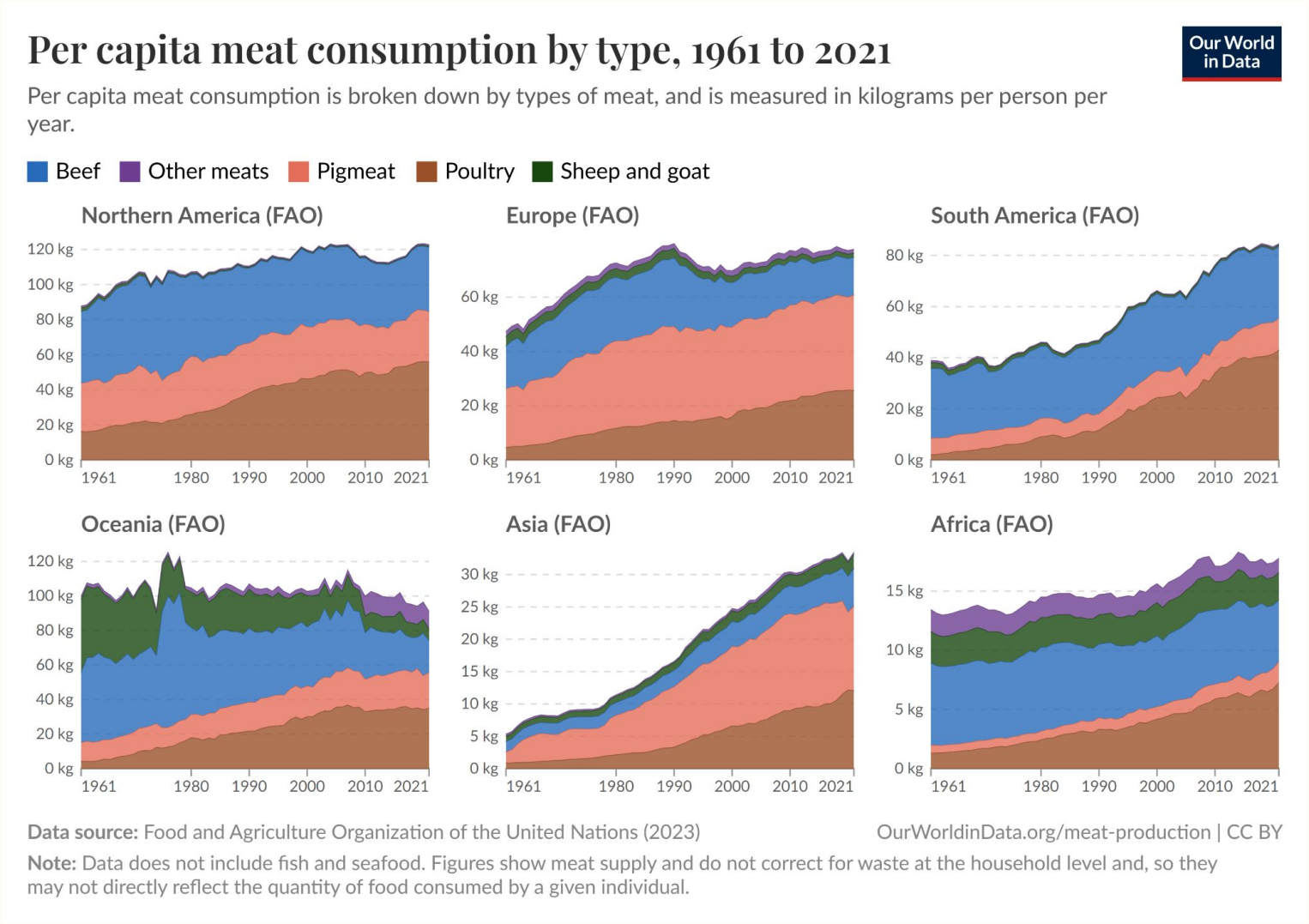
All regions increased their meat consumption with Asia and South America growing most significantly due to increase in wealth.



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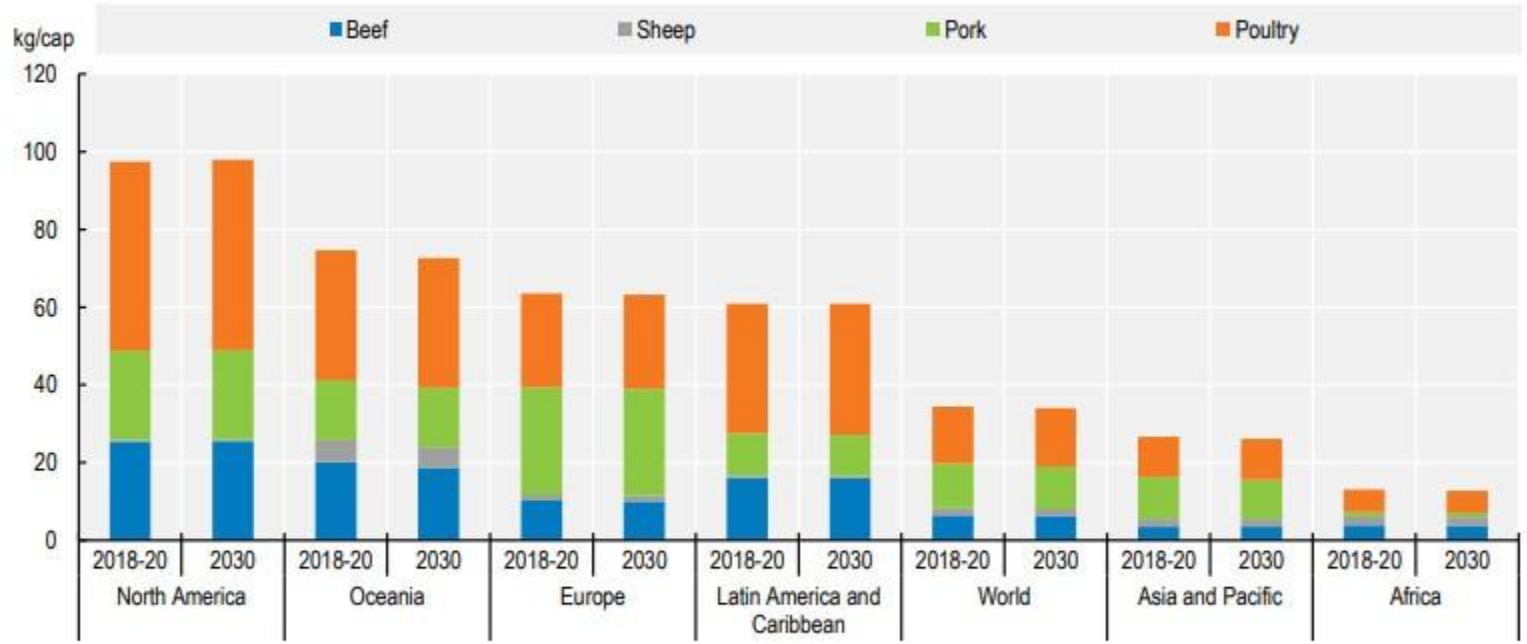
Global meat consumption projected to increase by 14% by 2030 compared to the base period average of 2018-2020

Figure 6.8. Meat consumption per capita: Continued rise of poultry and fall of beef



Note: Per capita consumption is expressed in retail weight.
Source: OECD/FAO (2021), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://dx.doi.org/10.1787/agr-outl-data-en.

Source: OECD-FAO Agricultural Outlook 2021-2030

Increase largely driven by income and population growth in developing countries. Saturation reached in developed countries.

"Meat demand continues to increase as income continues to grow in developing countries, where per capita consumption is projected to increase further and per capita growth rates to be equivalent to those in developed countries, when compared to the base period. In developed countries, changes in meat consumption reflect a decline in the influence of factors such as income and price, and, as noted above, many of these countries have reached saturation in their meat consumption levels (...). Other factors include religious beliefs, cultural norms, urbanisation, and environmental, ethical, and health concerns."

Only Asia projected to increase per capita beef consumption as other regions opt for cheaper meats due to economic hardship

"...beef consumption in the developing world is expected to continue to remain lower, at about one-third in volume terms, relative to developed countries. Asia is the only region where it is projected to increase its per capita beef consumption over the projection period, albeit from a low base. Several countries that have high beef per capita consumption will see their level of beef consumption decline in favour of cheaper pigmeat and poultry meat."

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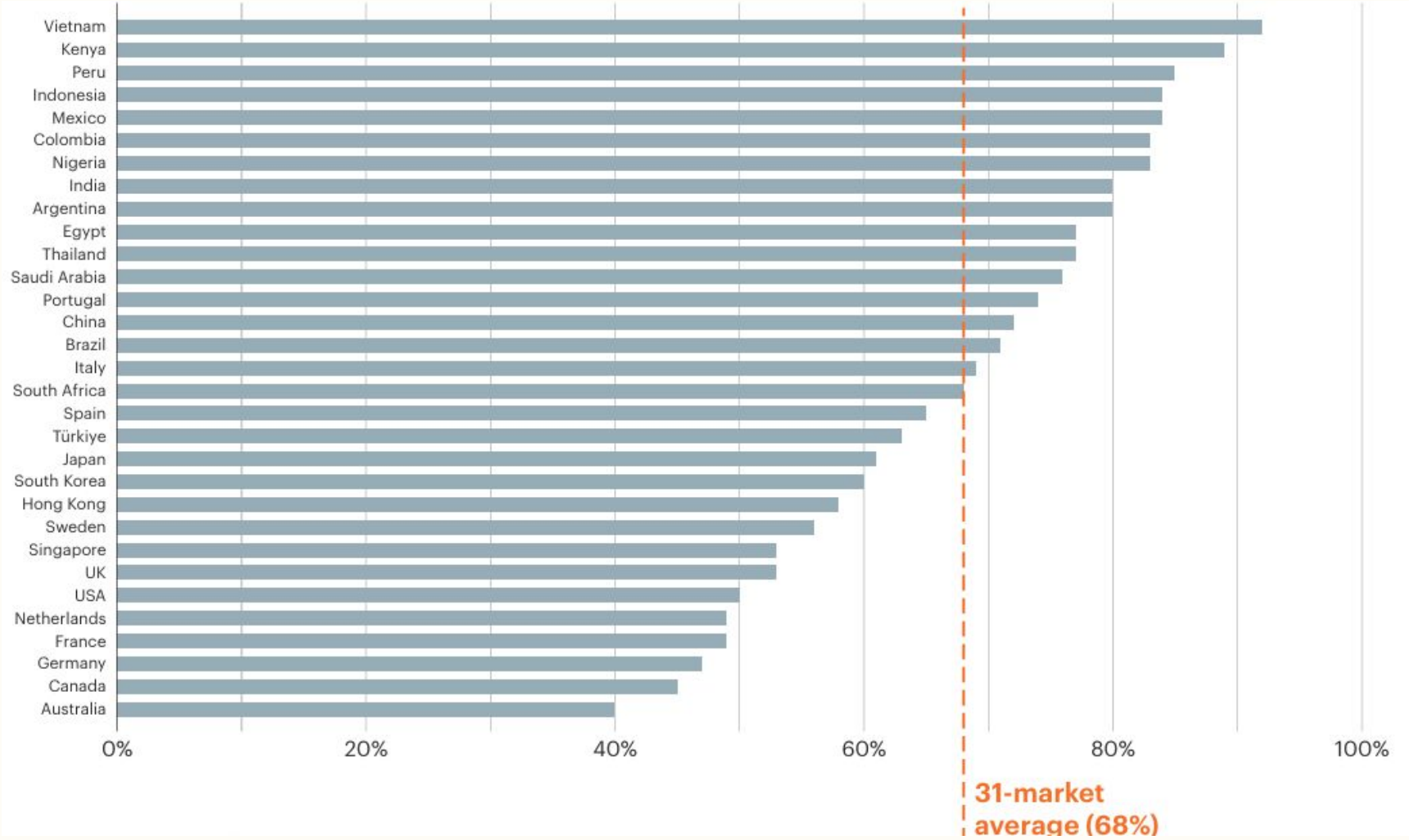
OECD/FAO (2020), *OECD-FAO Agricultural Outlook 2020-2029*, OECD Publishing, Paris/FAO, Rome, https://doi.org/10.1787/1112c23b-en.

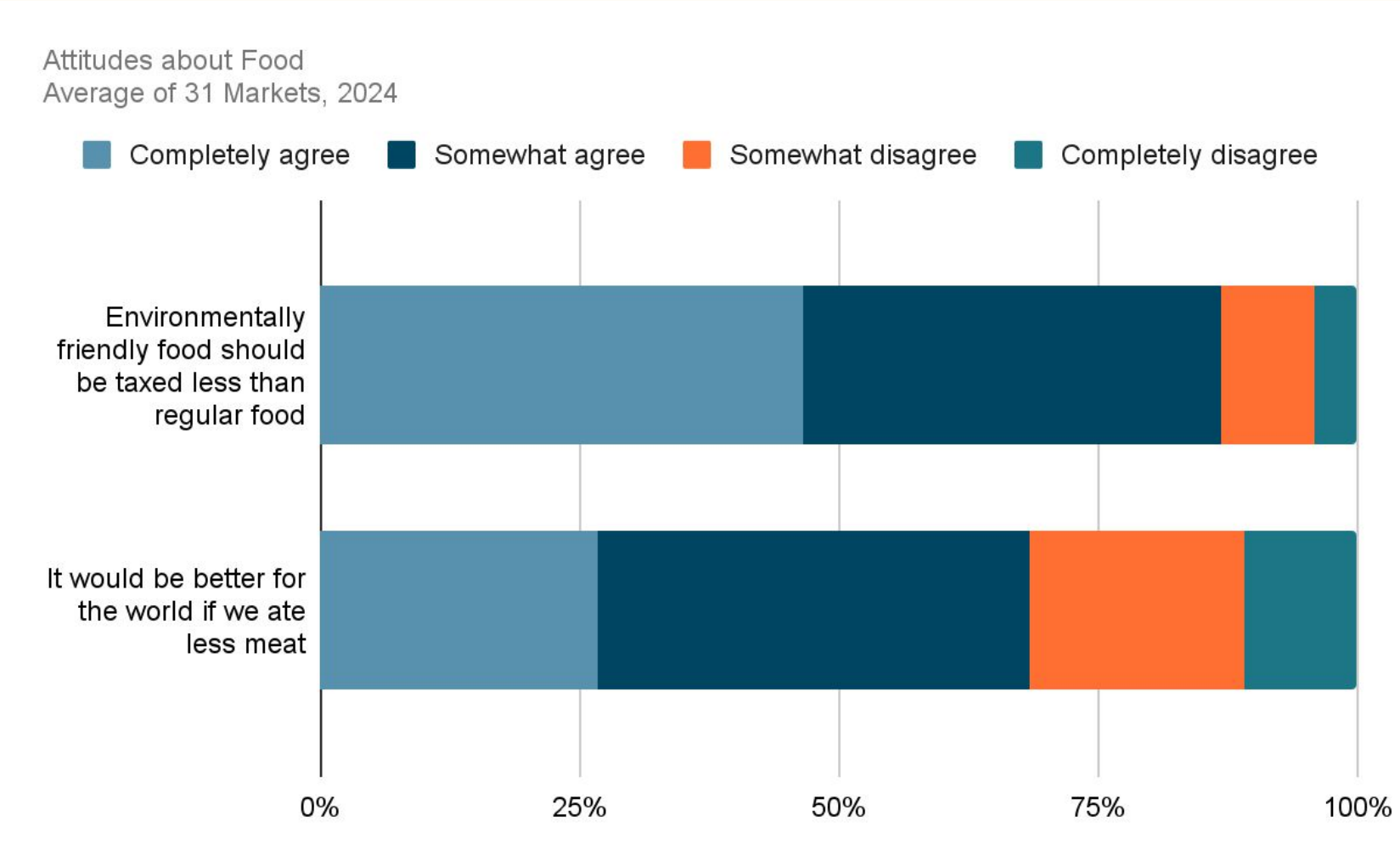
Yet more than two-thirds of people globally (68% average) indicate they would like to eat more plant-based foods...

Interest in Eating More Plant-based Foods "Yes," by Market, 2024



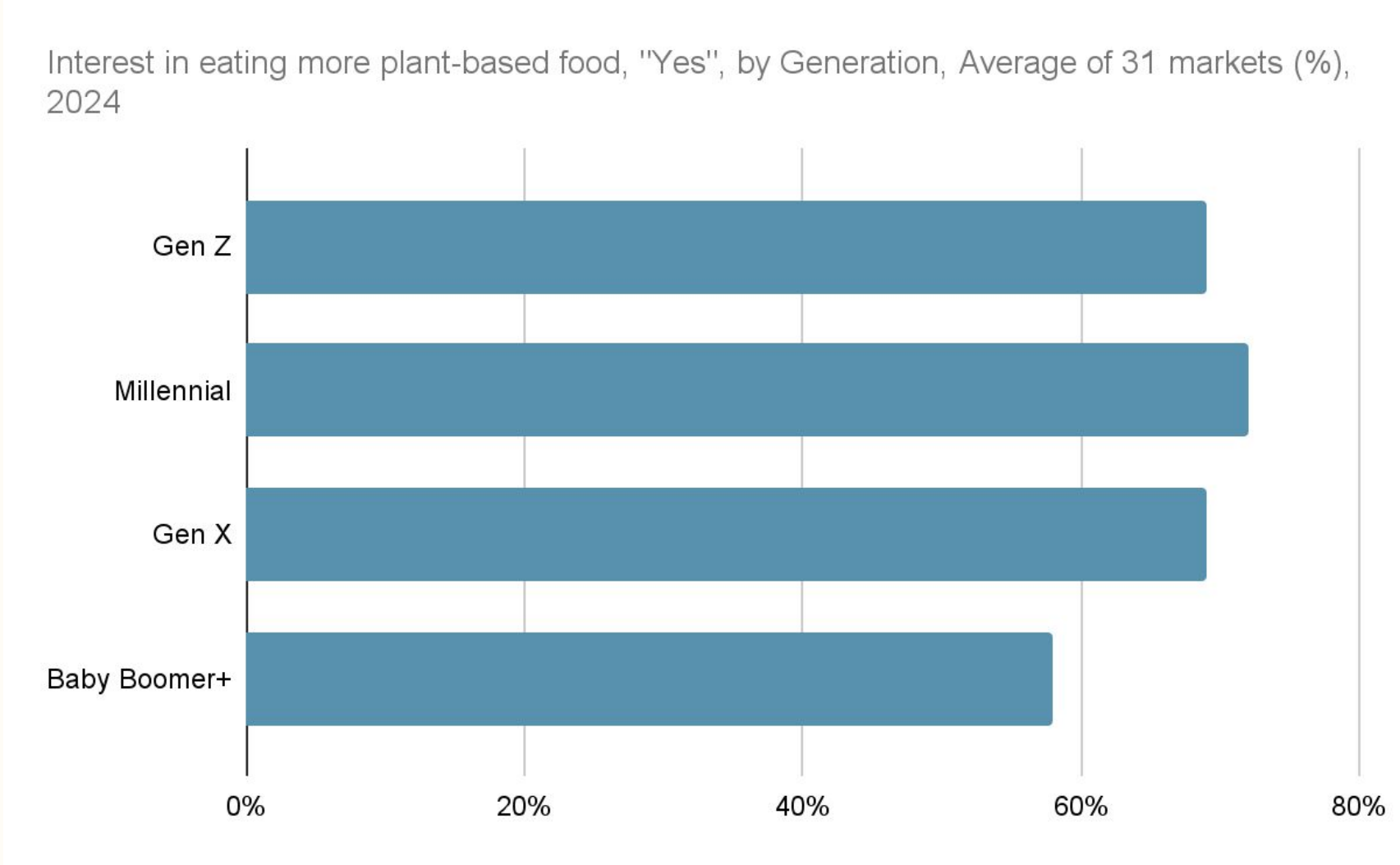
Source: GlobeScan-EAT Grains of Truth report (survey of 30,216 people in the general public in July – August 2024)

...and that “green” food should be taxed less than regular food and the world would be better off with less meat



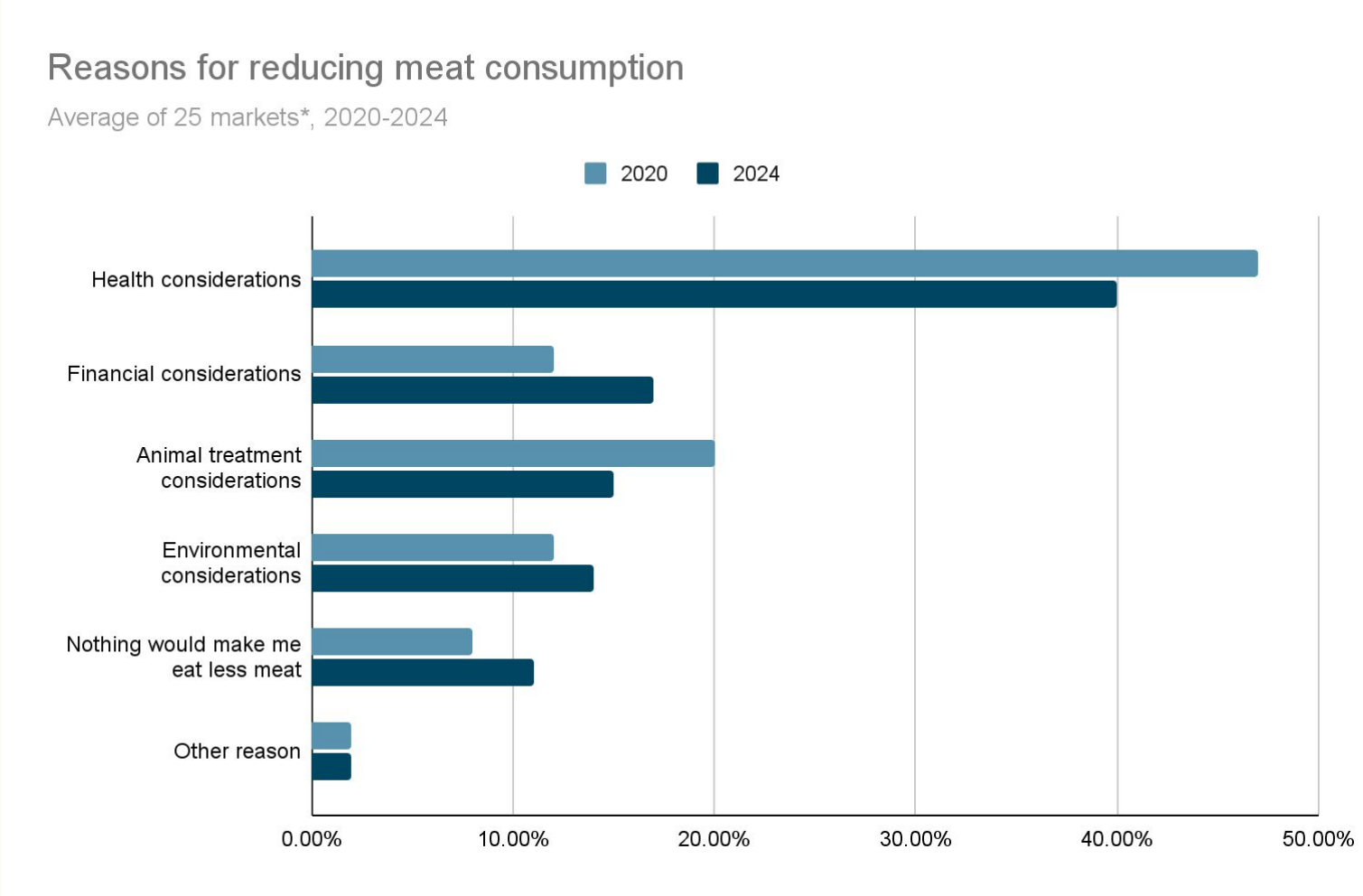
Source: GlobeScan-EAT Grains of Truth report (survey of 30,216 people in the general public in July – August 2024)

Especially the younger generations across the world are interested in eating more plant-based food



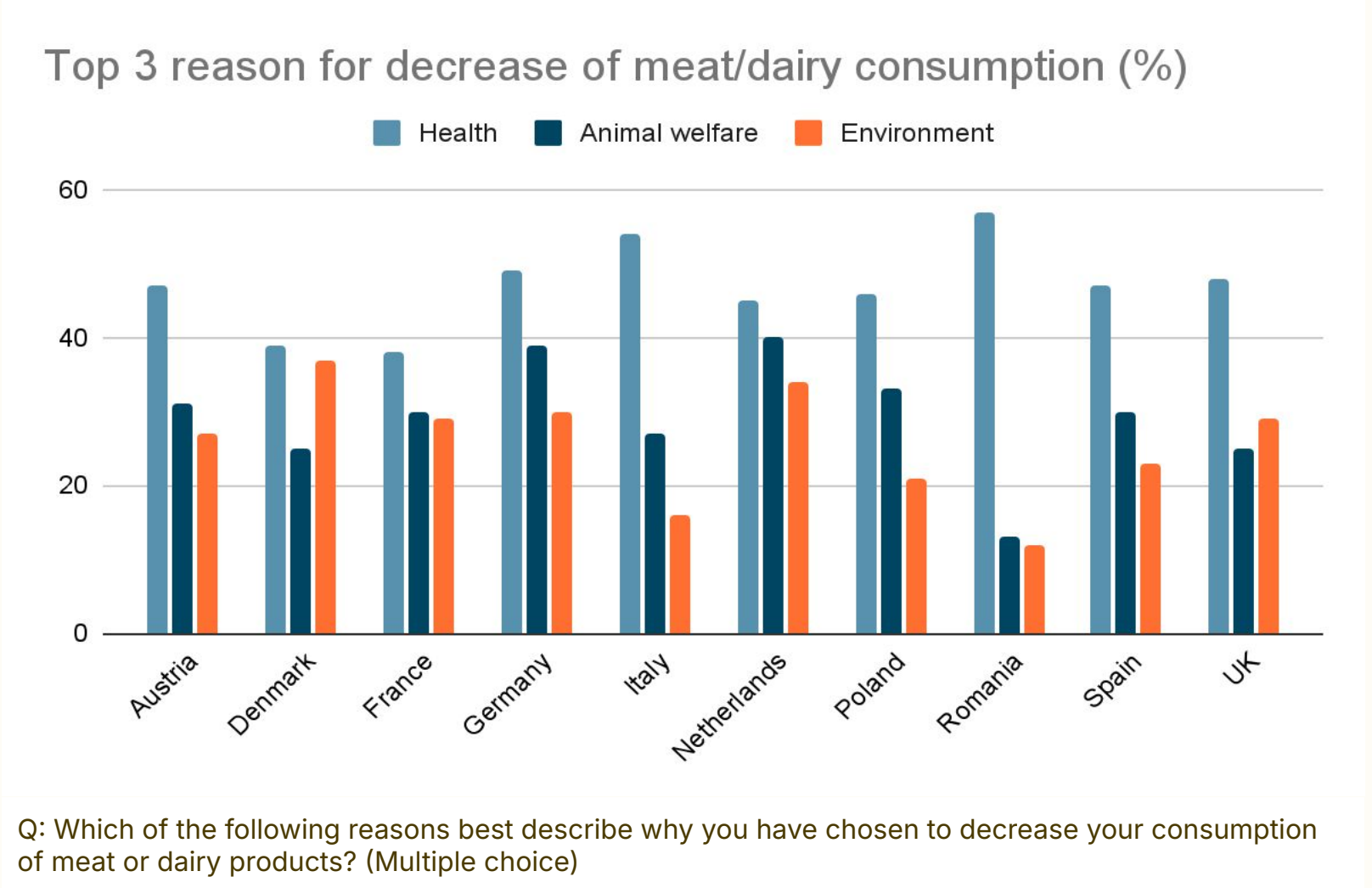
Source: GlobeScan-EAT Grains of Truth report (survey of 30,216 people in the general public in July – August 2024)

Health continues being the main reason for reducing meat consumption. Compared to 2021, financials outweigh treatment of animals. Environment gains ground but so does “meat at all cost”.



Source: GlobeScan-EAT Grains of Truth report (survey of 30,216 people in the general public in July – August 2024)

European study across 10 countries reinforcing strong impact of health followed by animal welfare and environmental concerns



Q: Which of the following reasons best describe why you have chosen to decrease your consumption of meat or dairy products? (Multiple choice)

Source:"Evolving appetites: an in-depth look at European attitudes towards plant-based eating" 2023

In Europe, for all generations, the top drivers are health, animal welfare, and environmental factors

Reasons for decrease of meat/dairy consumption by generations

	Total	Boomers	Gen X	Millenials	Gen Z
Health	47%	57%	52%	45%	36%
Animal welfare	29%	36%	24%	29%	27%
Environment	26%	33%	24%	26%	22%
Taste	15%	11%	11%	15%	22%
Concerns over antibiotics	15%	19%	16%	15%	10%
Other	12%	13%	15%	11%	9%
My social environment	10%	7%	9%	11%	11%
Major outbreaks of animal-to-human diseases (eg COVID-19)	9%	9%	8%	9%	9%

Question: Which of the following reasons best describe why you have chosen to decrease your consumption of meat or dairy products? (Multiple choice)

"51% of European meat consumers claim to have reduced their yearly meat intake, up from 46% in 2021. Germany (59%), France (57%), and Italy (59%) lead the way in terms of meat reduction."

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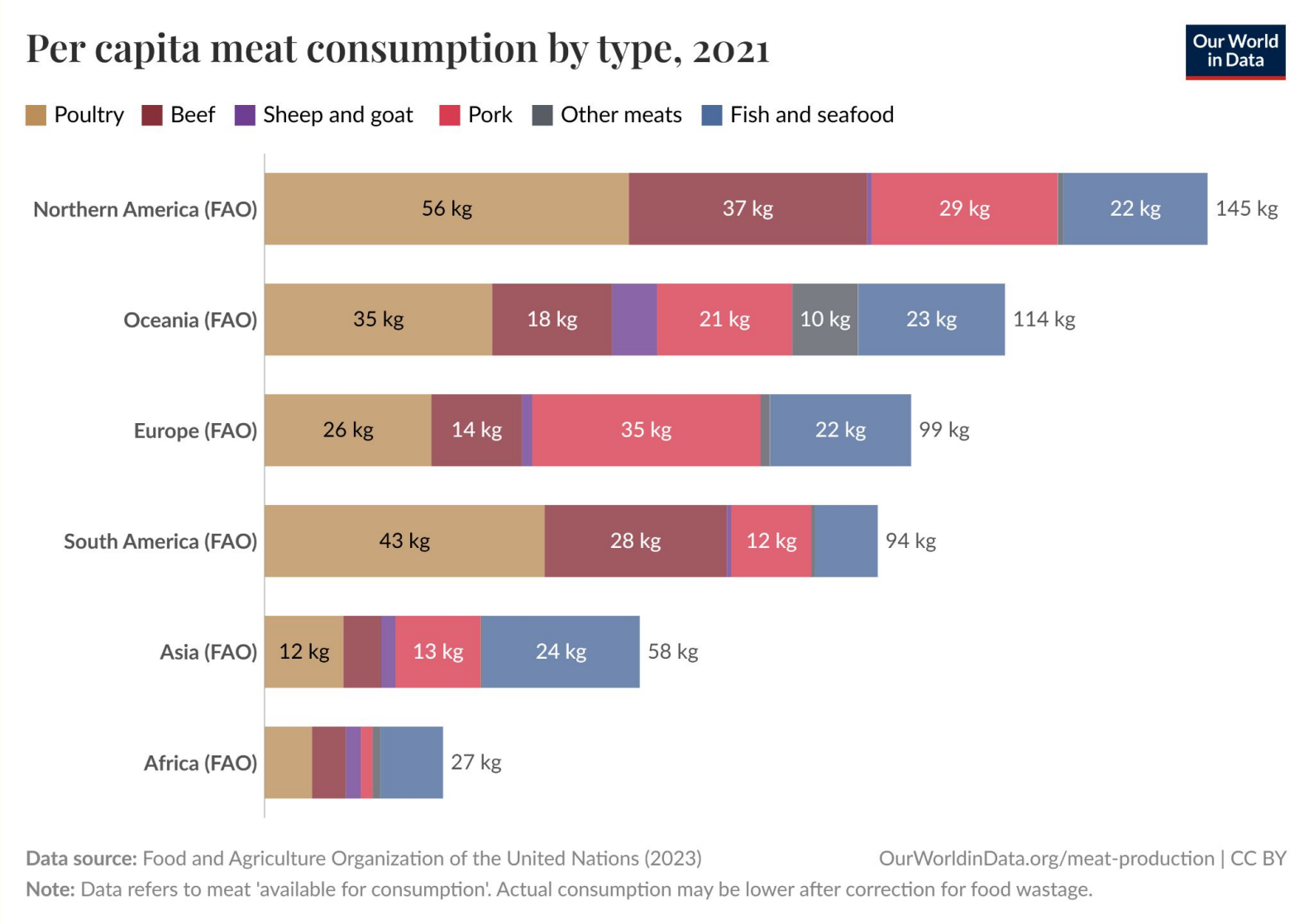
Source:"Evolving appetites: an in-depth look at European attitudes towards plant-based eating" 2023

North America has the highest meat consumption per capita AND the highest beef consumption



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A study from 2023 on beef consumption in the **US population** indicate that a small segment of consumers eat the far majority.

"...12% of disproportionate beef consumers accounted for 50% of the total beef consumed."

"The strongest and most consistent predictor of disproportionate beef intake was gender. Men were more likely to do this, in both bivariate and multivariable models. In other bivariate results, the frequency of disproportionate beef consumers appeared to peak at 50–65 years (14.8%) and also among high school graduates (14.4%), and is lower among younger (18–29 years) and older (>65 years) consumers, college graduates, nonHispanic Blacks, and non-Hispanic Asians. These associations remained significant in the multivariable models."

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Source: Willits-Smith et all, 2023: Demographic and Socioeconomic Correlates of Disproportionate Beef Consumption among US Adults in an Age of Global Warming

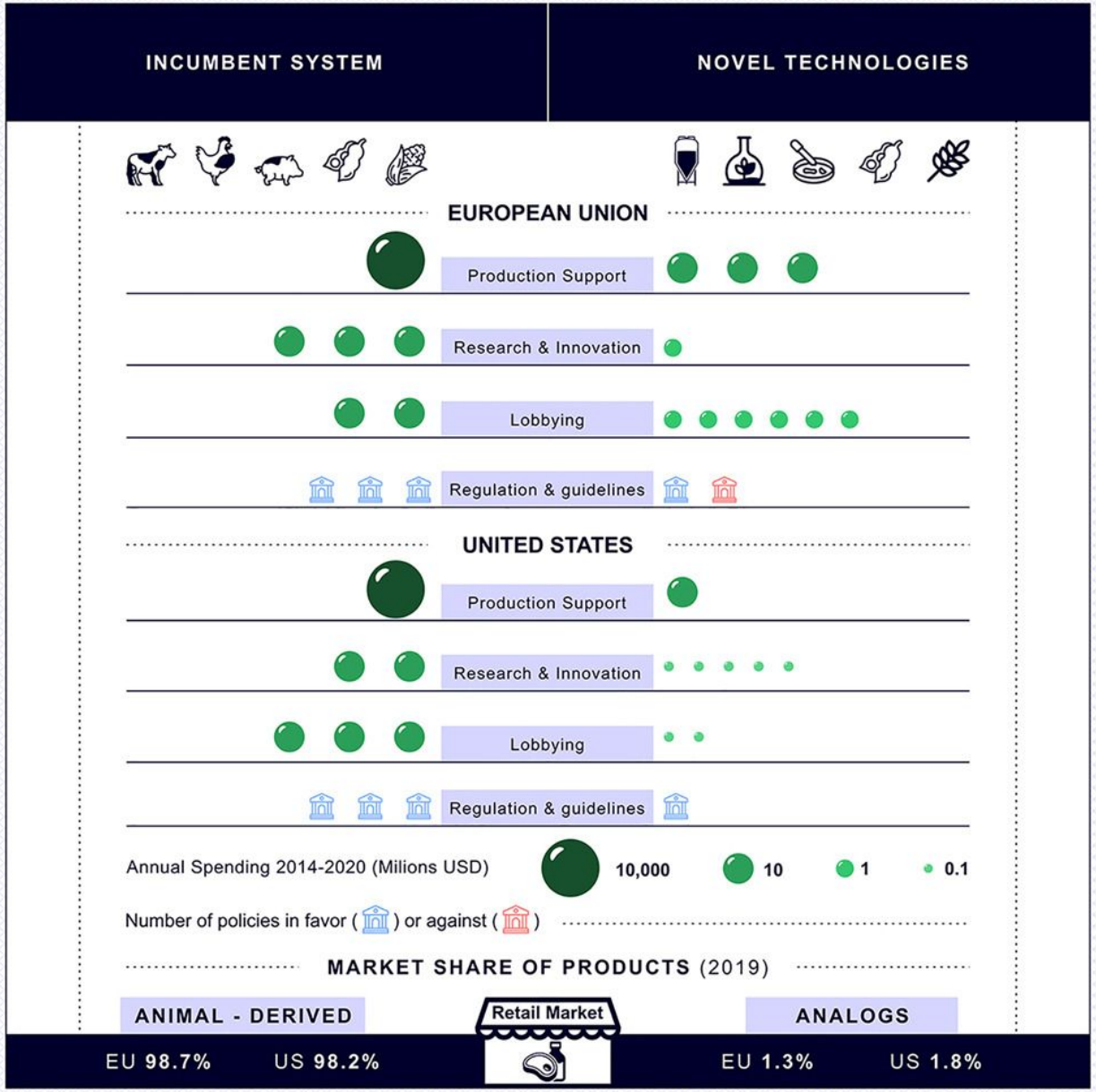
But in general, the far majority of people have intentions to cut down on red meat intake for health reasons.

- 78% of participants reported consuming red meat 1 to 4 times per week, with 14% consuming it 5 or more times weekly
- Nearly 70% said they had reduced red meat consumption in the past year, primarily citing health (64%) and price (32%) as reasons
- Six percent of those reducing red meat cited environmental sustainability as a factor
- Health (85%) and taste (84%) were rated as the most important considerations when purchasing meat overall
- Environmental sustainability (29%) and animal welfare (28%) were rated as least important

Source: Downs et al, 2024: Sustainability considerations are not influencing meat consumption in the US

Meanwhile, a “greener” diet is obscured by lawmakers and the livestock sector both in the **United States** and the **EU**

- Animal farming receives most of the public financial support for food producers
- Animal product analogs are spearheaded by a few private sector companies
- The livestock sector resists a food system transformation through instrumental power
- Governments largely ignore the climate-mitigation potential of animal product analogs



Vallone & Lambin, 2023, One Earth 6, 1213–1226 September 15, 2023 ª 2023 The Authors. Published by Elsevier Inc.
https://www.cell.com/action/showPdf?pii=S2590-3322%2823%2900347-0

Another research shows that science illiteracy and industry lobbying are powerful headwinds against change

“A transition to a low carbon society can significantly benefit from a special focus on the food-related options to involve more consumers and to improve mitigation.”

“The low awareness of the option's effectiveness can also be explained by the fact that policy-makers in government, industry, and even environmental NGOs are often **reluctant to inform** consumers on this option”

“This result [low awareness] can be partly explained by the complexity of the links between meat eating and climate change. Communicating information on these links appears to be a challenge for **science education**”

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de Boer J, de Witt A, Aiking H. 2016. Help the climate, change your diet: A cross-sectional study on how to involve consumers in a transition to a low-carbon society. Appetite. 98:19–27. doi:10.1016/j.appet.2015.12.001.

Attempting to place regions within framework reveals a complex picture and reinforces the need for contextualized interventions

1 - Moral recognition

Both **Europe** and **North America** have experienced this phase. Some locations are further ahead in "moral recognition" (eg Netherlands, Germany, Denmark and California) where other locations like Romania are earlier in this phase. The diversity across these locations, including variations in cultures, socio-economic indicators, and other factors, makes it hard to generalize as the reality is a more complex picture.

2 - Moral Amplification

North America: The debate over meat consumption is gaining traction, driven by climate change awareness, health movements, and ethical concerns. Consumption of plant-based meals are growing, but there is also resistance from the meat industry and parts of the population.

3 - Approaching tipping points

Europe: Many European countries are approaching a turning point. Governments are implementing policies supporting plant based initiatives, while there are also policies against new technologies. Consumer behavior is shifting towards plant-based diets, but meat remains a key part of traditional cuisine.

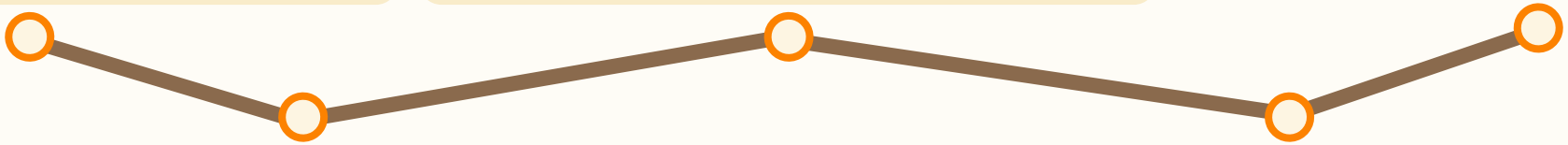
4 - Institutionalization

Europe: Countries are implementing strong policies, such as banning meat advertising (e.g., in Haarlem, Netherlands), taxing high-emission foods, government backed research and promotion of alternative proteins. Plant-based diets are widely accepted, and major food industries are adapting.

Some parts of North America (e.g., Canada, California): Certain regions are beginning to institutionalize meat reduction efforts through policy measures, corporate shifts, and public health campaigns.

5 - Norm abandonment

No major region has fully abandoned meat as a norm, though parts of **Europe** and some urban areas in **North America** may be moving toward this stage. If trends continue, some areas may experience a phase where eating meat is socially discouraged or significantly reduced.



Conclusions

- A significant reduction in greenhouse gas emissions is essential for achieving short-term climate impact. Raising awareness through targeted resource allocation can help drive this change.
- Cultural change to reduce beef consumption depends on growing awareness of the impacts on environment, health, and animal welfare. As awareness grows, so does the moral recognition of a needed change.
- Health emerged as highest leverage point in impacting cultural change to reduce beef consumption.
- There is a societal consensus across regions in favor of reducing beef consumption, but also significant pushback from industry and policymakers.

Moving Forward

- Design a communication / educational plan highlighting the direct link between beef consumption and atmospheric methane emissions to enhance environmental literacy among the general public.
- Develop a communication / educational plan—or integrate it into existing efforts—that highlights the health risks associated with high beef consumption. Use health concerns as a key leverage point to influence behavior, specifically targeting populations with high beef intake.
- Conduct further research into specific high-consumption per capita groups to identify effective behavioral influence mechanisms.
- Explore ways to foster collaboration between industry, policymakers, and environmental groups, using their shared interests as a strategic leverage point for promoting sustainable practices.

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