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Adapting Consumer Climate Policy for United States Food Markets

By

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Abstract

Climate change poses a significant risk to every country, but some–including the United States–are currently responsible for a disproportionate amount of carbon emissions relative to their populations. Environmental legislation targeted at reducing emissions takes several forms, with the U.S. recently implementing a broad suite of interventions partially aimed at addressing the country's output. However, this legislation is insufficient for fully bringing U.S emissions down to target levels to properly address climate change. The current implementations also primarily focus on the supply-side, targeting financial incentives at producers and subsidizing technological improvements, whereas demand-side policy is relatively under-examined. This policy proposal outlines two potential additional measures that primarily target consumer behavior as a point for improvement, specifically focusing on the agricultural sector. The existing literature is thoroughly examined, taking findings from several other countries in order to estimate what categories of intervention would see the most success. First, I propose an alternative public education campaign that aims to emphasize the personal moral component of climate-related behavior in order to account for weaknesses in previous similar efforts. In addition, a sales tax targeting products like ruminant and processed meats could significantly reduce emissions by reducing consumption of the most damaging food products while simultaneously improving public health outcomes and not excessively intruding on perceptions of personal freedom. These interventions are relatively easy to implement and maintain, target an under-addressed component of the economy, and could–if successful–serve as a model for comparable nations to follow.

Background

Climate change is an issue that persists in modern American political discourse. Though rarely a primary focal point in the eyes of the nation, it nevertheless remains as a topic not far from the front of the minds of political officials and constituents alike. Recent years have seen the advancement of United States climate policy towards a more aggressive approach to curbing the country's emissions,[1] but such advancements are still insufficient for meeting the emissions goals recommended by prominent climate scientists. A 2010 report cites a target range of 170 to 200 gigatons–170 to 200 billion tons–of carbon dioxide equivalent emissions between the years of 2012 and 2050 as a potential long-term target for the U.S.[2] In light of this, President Joe Biden has established a target of at least a 50 percent reduction in carbon emissions from 2005 levels by the year 2030.[3] In 2005, net CO2-eq emissions totaled 6,645 million metric tons (MMT), or 6.645 billion tons.[4] This places Biden's goal at 3.3225 billion tons of annual emissions by 2030. In 2022, U.S. emissions are estimated to have totaled about 5.634 billion tons, still a significant distance from the 2030 target.[5] Further measures are necessary if this goal is to be met. This proposal will outline two measures that specifically target consumers and their behavior: an alternative educational intervention and a selective sales tax on uniquely environmentally damaging food items.

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[1] Lashof, Dan, *Tracking Progress: Climate Action under the Biden Administration,* (World Resources Institute, January 23, 2023).
[2] *Limiting the Magnitude of Future Climate Change*, (Washington, D.C.: National Academies Press, 2010), 37.
[3] *Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies,* The White House. (The United States Government, April 22, 2021).
[4] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020 – Energy*, (United States Environmental Protection Agency, 2022), 94-96.
[5] Rivera, Alfredo, *Preliminary US Greenhouse Gas Emissions Estimates for 2022,* Rhodium Group, January 10, 2023.

Potential failure to properly address climate change is expected to cause a further rise in global sea levels,[6] increased temperatures,[7] more frequent extreme weather,[8] and impaired water security,[9] among other large-scale consequences. Critically, several of the primarily impacted areas would, in turn, make it even more difficult to effectively approach the problem in the future. As such, it is imperative that all nations, especially those like the U.S. that are currently outputting some of the highest emissions levels, take meaningful steps to curb their impacts. However, the specifications of those steps are not as well agreed-upon, often fraught with disputes from culture, political ideology, and personal economic incentive. In the U.S., solutions must be not only effective, but also ideologically appealing to the citizens supporting them. Failure to properly tailor policy measures to the political climate may only worsen the problem.

Notably, Biden's current platform focuses primarily on top-town changes, establishing standards to be met by corporations producing greenhouse gasses and providing various financial resources to support clean energy projects.[10] However, some researchers have noted the significant potential for alterations in personal consumer behavior to aid in reducing greenhouse gas emissions, primarily through the broader effects their behaviors would have on supply chains. In particular, just addressing food and transportation-related consumption could, combined, address over half of the potential carbon emission reductions in one proposed

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[6] Oppenheimer, Michael, Bruce Glavovic, Jochen Hinkel, Roderik van de Wal, Alexandre K. Magnan, Amro Abd-Elgawad, Rongshuo Cai et al. "Sea level rise and implications for low lying islands, coasts and communities." (2019).

[7] Samset, Bjørn Hallvard, Jan S. Fuglestvedt, and Marianne Tronstad Lund. "Delayed emergence of a global temperature response after emission mitigation." *Nature Communications* 11, no. 1 (2020): 3261.

[8] National Academies of Sciences, Engineering, and Medicine. "Attribution of Particular Types of Extreme Events," *in Attribution of extreme weather events in the context of climate change*. National Academies Press, 2016.

[9] Pörtner, Hans-O., Debra C. Roberts, Helen Adams, Carolina Adler, Paulina Aldunce, Elham Ali, Rawshan Ara Begum et al. "Water," *in Climate change 2022: Impacts, adaptation and vulnerability*. Geneva, Switzerland:: IPCC, 2022.

[10] The White House, *Building a Clean Energy Economy: A Guidebook to the Inflation Reduction Act's Investments in Clean Energy and Climate Action*, Version 2, (Washington, D.C., 2023).

European model.[11] United States models are less clear, generally dividing total emissions along five sectors of the economy: (in order of most to least emissions) transportation, electric power, industry, commercial & residential, and agriculture.[12] Greenhouse gasses emitted by the generation of electricity effectively add onto the total emissions of other sectors, notably. When taking into account the distributed emissions from the generation of electrical power into other sectors–as most of the U.S.' electricity is generated through methods which themselves release greenhouse gasses–the figures change somewhat. The residential and commercial sector rises to the top, accounting for 31% of total emissions, followed closely by industry at 30%, transportation at 27%, and agriculture at 11%.[13]

The residential and commercial sector consists of two groups that intuitively may seem separate. The term refers to emissions that occur as a product of actions people take at or in non-industry and non-agricultural businesses, including cooking, water use, and air conditioning. Over half of the sector's total emissions are indirect–a product of the GHGs released by electricity generation, which primarily is utilized for artificial lighting and the operation of appliances. Dividing the residential and commercial sectors into separate groups sees residential use accounting for 361.952 million metric tons of carbon dioxide equivalent greenhouse gasses in 2020, to the 425.313 emitted by commercial uses. In simplified terms, the residential use accounts for just under 46% of the combined total, and the commercial use accounts for just over 54%.[14] The two are roughly comparable, leaving neither as a particularly more significant

[11] Moran, Daniel, Richard Wood, Edgar Hertwich, Kim Mattson, Joao FD Rodriguez, Karin Schanes, and John Barrett. "Quantifying the potential for consumer-oriented policy to reduce European and foreign carbon emissions." *Climate Policy* 20, no. sup1 (2020): S28-S38.
[12] "Inventory of U.S. Greenhouse Gas Emissions and Sinks," EPA (United States Environmental Protection Agency, 2021).
[13] Ibid.
[14] "Greenhouse Gas Inventory Data Explorer," EPA (United States Environmental Protection Agency, 2021).

priority for government officials than the other. However, when focusing on consumer-side interventions, the focus is placed primarily on residential issues.

Alterations in consumption can also help to mitigate societal issues that arise as secondary effects of harms done to the environment. For example, some climate researchers openly call for policy measures to be taken in an attempt to reduce water consumption, as natural events like droughts and floods are expected to harm the current water supply of several nations.[15] This flooding is especially of concern in poorer nations which have less flood-ready infrastructure.[16] Increased water consumption does not directly cause climate change, but if global temperature shifts are going to have a noticeable effect–even if properly mitigated–planning for decreases in the water supply is a critical component of responsive legislation. The same can be said of matters surrounding health, natural disasters, and biodiversity, among others. Our primary focus ought to be addressing the root cause–greenhouse gas emissions–but these issues behind just a single degree of separation should not be discounted.

Food

Several categories of consumer goods could be potentially valuable targets for climate-concerned legislation, including food, transportation, housing, and electronics, among others.[17] In particular, food and agriculture represent an extremely complex area of focus, given they are by nature deeply connected to various cultures and subcultures in a way that something like transportation is not, potentially making it more resistant to policy efforts to influence consumer demand patterns. In particular, many U.S. consumers likely have significant cultural

[15] MacDonald, Glen M. "Water, climate change, and sustainability in the southwest." *Proceedings of the National Academy of Sciences* 107, no. 50 (2010): 21256-21262.
[16] Douglas, Ian, Kurshid Alam, Maryanne Maghenda, Yasmin Mcdonnell, Louise McLean, and Jack Campbell. "Unjust waters: climate change, flooding and the urban poor in Africa." *Environment and urbanization* 20, no. 1 (2008): 187-205.
[17] Ibid, S31.

ties to meat, while meat remains one of the most consistently environmentally impactful food sources.[18] A fully-vegetarian diet could reduce individual GHG emissions by an estimated 55%, compared to the projected 2050 income-dependent diet.[19] At the same time, food is responsible for a large portion of our national water footprint, with research finding that Americans had average water footprints nearly three times the size of those of Chinese consumers between 1996 and 2005, primarily due to differences in food consumption.[20]

Meat demand in the U.S. has remained largely consistent over the past several years. Between 1998 and 2018, per-capita meat consumption fluctuated slightly from year to year, ultimately only rising 8% in total.[21] This roughly coincides with a 6% increase in total agricultural emissions from 1990 to 2020.[22] In this sector in particular, the country appears to be on an actively counterproductive trajectory in comparison to the relatively minor but positive changes seen in other industries. Research into factors behind the increase in meat consumption suggests a combination of broad societal trends are a primary driving force, namely urbanization and social globalization–specifically *not* economic globalization.[23] This is intuitively sensible, given exposure to different cultures and lifestyles naturally results in greater awareness of different manners of cooking, including more meatless options. Separating social and cultural globalization from economic globalization isolates the latter to specifically refer to international trade and investment. One potential explanation is that while international information flow

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[18] Poore, Joseph, and Thomas Nemecek. "Reducing food's environmental impacts through producers and consumers." *Science* 360, no. 6392 (2018): 987-992.
[19] Tilman, David, and Michael Clark. "Global diets link environmental sustainability and human health." *Nature* 515, no. 7528 (2014): 518-522.
[20] Hoekstra, Arjen Y., and Mesfin M. Mekonnen, "The water footprint of humanity," *Proceedings of the national academy of sciences* 109, no. 9 (2012): 3232-3237.
[21] Whitnall, Tim, and Nathan Pitts. "Global trends in meat consumption." *Agricultural Commodities* 9, no. 1 (2019): 96-99.
[22] "Inventory of U.S. Greenhouse Gas Emissions and Sinks," EPA (United States Environmental Protection Agency, 2021).
[23] Milford, Anna Birgitte, Chantal Le Mouël, Benjamin Leon Bodirsky, and Susanne Rolinski. "Drivers of meat consumption." *Appetite* 141 (2019): 104313.

increases awareness of meatless foods from various cultures, international economic flow makes meat more widely accessible and thus more frequently consumed in turn. Additionally, studies of countries' overall wealth indicate that developing countries are likely to continue to scale up their meat consumption in the future. National meat consumption follows a fairly linear positive correlation with average annual income up to about 45,000 USD (in inflation-adjusted current-day currency), where it reaches a point of inflection and begins to decrease.[24] With this in mind, it's possible that a greater burden may be placed on the wealthiest countries to scale back their own meat consumption to account for the increases from the rest of the world.

Categories of Meats

Taking GHG emissions as the primary variable of interest, one comprehensive review finds that the category of food clearly causing the most environmental damage is meat from "ruminant livestock." This term refers specifically to animals which possess specialized digestive systems that allow them to digest a broader variety of vegetation for food, most notably grass. Ruminants like cattle and lamb produce a considerable amount of greenhouse gasses in the form of methane, a natural byproduct of this digestive process. Other studies corroborate this finding, specifically implicating red meats as a primary area for potential GHG reductions in high-income, Western countries.[25] Also of note, non-meat products of ruminant animals (e.g. milk, cheese) as well as non-ruminant meat products (e.g. pork, shrimp) were also high GHG emitters, although they sit considerably below the impacts of beef and lamb. If one were to target food products, ruminant meats represent an attractive potential starting point, as reducing their

[24] Schmidhuber, Josef, and Prakash Shetty. "The nutrition transition to 2030. Why developing countries are likely to bear the major burden." *Acta agriculturae scand section c* 2, no. 3-4 (2005): 150-166; Cole, Jennifer Rivers, and Suzanne McCoskey. "Does global meat consumption follow an environmental Kuznets curve?." *Sustainability: Science, Practice and Policy* 9, no. 2 (2013): 26-36.

[25] Springmann, Marco, H. Charles J. Godfray, Mike Rayner, and Peter Scarborough. "Analysis and valuation of the health and climate change cobenefits of dietary change." *Proceedings of the National Academy of Sciences* 113, no. 15 (2016): 4146-4151.

consumption does not necessitate drastic changes in individual dietary habits. To put the relative scale in perspective, producing a kilogram of beef releases–on average–28.73 kg of carbon dioxide equivalent GHGs into the atmosphere, whereas a kilogram of pork only releases an average of 5.85 kg. This is not to say that other meats are wholly unimpactful, but the potential benefit of reducing ruminant meat consumption is staggering compared to the alternatives.[26]

If inclined to refine policy targets even further, it's worth noting that GHG emissions for ruminant meats vary somewhat based on the structure of the farm producing them. An analysis of U.S. beef farms found that cattle raised on a "conventional" farm produced less than 60 percent of the emissions of cattle raised in a grass-fed system. Similarly, beef produced with the use of artificial growth hormones released roughly 85 percent of the emissions of beef that was not treated with any growth-enhancing technology, even when fed a similar diet otherwise.[27] In addition, the land used for grazing cattle has a significant negative impact on biodiversity by displacing existing natural habitats, something which is less prevalent on more conventional cattle farms.[28] If targeting ruminant meats as a whole proves somewhat unviable, targeting the most damaging production styles may be more effective.

It's worth noting that solely examining the issue in terms of CO2-equivalent gasses, while a valuable lens, can sometimes miss some important nuances of climate change. Carbon dioxide, nitrous oxide, and methane are some of the most destructive GHGs, but carbon dioxide is unique in that continued emissions will always result in further global warming, even if the rate of emission remains static. Conversely, methane and nitrous oxide emissions can reach a point of

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[26] Clune, Stephen, Enda Crossin, and Karli Verghese. "Systematic review of greenhouse gas emissions for different fresh food categories." *Journal of Cleaner Production* 140 (2017): 766-783.
[27] Capper, Judith L. "Is the grass always greener? Comparing the environmental impact of conventional, natural and grass-fed beef production systems." *Animals* 2, no. 2 (2012): 127-143.
[28] Godfray, H. Charles J., Paul Aveyard, Tara Garnett, Jim W. Hall, Timothy J. Key, Jamie Lorimer, Ray T. Pierrehumbert, Peter Scarborough, Marco Springmann, and Susan A. Jebb. "Meat consumption, health, and the environment." *Science* 361, no. 6399 (2018).

equilibrium with the climate system, where continued emissions at a static rate do not contribute to further global warming. This is a significant factor behind what drives several policy-makers and climate researchers to specifically target net-zero carbon emissions as a desirable goal. However, it's important to keep this separation in mind, as our goals for different gasses are different. Maintaining carbon dioxide emissions at their current levels far into the future would be disastrous, whereas doing the same for other gasses is undesirable but not utterly catastrophic. Maintaining current levels of livestock agriculture for an entire century, the sector's carbon dioxide emissions would produce an increase of roughly 0.1°C in global temperatures, whereas methane and nitrous oxide emissions would collectively produce an increase of 0.44°C. However, for methane in particular, this would happen more quickly than for carbon dioxide, as the time required for the climate system to reach equilibrium with our current methane production is only about a single decade.[29] With methane as a particularly time-sensitive component of global temperature rise, and livestock agriculture standing as the single largest contributor to methane emissions, it is critical to stabilize–and ideally reduce–methane production in the very near future.

On the note of urgency, a large-scale 2019 analysis examining the potential for improvements in the food sector's emissions establishes a framework for understanding future prospects in both human health and the environment. It notes that healthy diets for the entire global population–including a projected population size of 10 billion people by 2050–can be maintained while holding sustainable levels of climate emissions. The scope of this "healthy diet" contains room for considerable cultural variance, but firmly establishes that any increase in red meat or dairy consumption would make the relevant goal almost impossible. Particularly, the authors note the need to drastically reduce pollution levels of nitrogen and phosphorus and to

[29] Ibid, p. 13

prevent any further increases in methane or nitrous oxide emissions.[30] This further implicates red and ruminant meats as a critical target for policy intervention, as nitrogen and phosphorus have been specifically identified as byproducts of animal manure from livestock farming. This affects more than just global temperatures, also damaging human health and some aquatic ecosystems.[31]

Consumption Quantity and Food Waste

To widen the scope from meats, some analysts argue in favor of broader pushes towards an overall reduction in total consumption. Rather than focusing solely on what we consume, it may be more beneficial to focus on the volume of what we consume. In a 2020 paper, a group of Australian researchers found a significant correlation between affluence and food waste, where wealthier nations generally waste considerably more food than their poorer counterparts, with the United States positioned as the single most wasteful country per capita.[32] This places consumption reduction measures in a uniquely significant position for the U.S., with much room to improve relative to even other wealthy nations. Specific figures for exactly how much food we waste vary based on method and scope of individual analyses, but generally, figures range from about 30 to 40 percent of the country's food supply. Processes related to food waste produce well over 100 million metric tons of carbon dioxide-equivalent emissions every year, often specifically in the form of methane due to the use of landfills in disposal.[33] Theoretically, significant reductions in carbon emissions from the agricultural sector could be achieved even while not actually reducing the total amount of food eaten by the U.S. population, if we were to

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[30] Willett, Walter, Johan Rockström, Brent Loken, Marco Springmann, Tim Lang, Sonja Vermeulen, Tara Garnett et al. "Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems." *The lancet* 393, no. 10170 (2019): 447-492.

[31] Godfray, H. C. J., et al. "Meat consumption, health, and the environment." (2018).

[32] van den Bos Verma, Monika, Linda de Vreede, Thom Achterbosch, and Martine M. Rutten. "Consumers discard a lot more food than widely believed: Estimates of global food waste using an energy gap approach and affluence elasticity of food waste." *PloS one* 15, no. 2 (2020): e0228369.

[33] Thyberg, Krista L., and David J. Tonjes. "Drivers of food waste and their implications for sustainable policy development." *Resources, Conservation and Recycling* 106 (2016): 110-123.

eliminate a large portion of our food waste. This is especially desirable considering that wealthy countries have a greater obligation to reduce their consumption volume than their poorer counterparts.[34]

However, the efficacy of waste reduction interventions are not well studied in any nation, let alone the U.S., and what research does exist is not optimistic about their effects. A 2010 review of ethnographic research in Sweden found that even consumers who were willing to modify their consumption habits with regards to transportation, food, and electricity usage found it difficult to commit to overall reductions in their consumption volume.[35] These measures are also less easily compartmentalized into individual policies, more likely making up a portion of much larger projects. We cannot, for example, directly tax households on the food they waste without a substantial increase in government oversight, which would take up financial resources that could be more efficiently spent elsewhere. However, some policy approaches focused specifically on educating consumers have shown more promise.[36]

Health

The impact of processed and red meats on human health is only tangentially related to the environment, but could convincingly play a role in legislation regardless. Populations would likely be far more willing to support efforts to combat climate change if those efforts were presented as directly beneficial financially or health-wise, rather than solely meant to help the environment. The current body of evidence suggests that the personal concerns of individuals are significantly more impactful than environmental or social concerns in predicting someone's

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[34] Alfredsson, Eva, Magnus Bengtsson, Halina Szejnwald Brown, Cindy Isenhour, Sylvia Lorek, Dimitris Stevis, and Philip Vergragt. "Why achieving the Paris Agreement requires reduced overall consumption and production." *Sustainability: Science, Practice and Policy* 14, no. 1 (2018): 1-5.
[35] Isenhour, Cindy. "On conflicted Swedish consumers, the effort to stop shopping and neoliberal environmental governance." *Journal of Consumer Behaviour* 9, no. 6 (2010): 454-469.
[36] Thyberg, K. L. and Tonjes, D. J., "Drivers of food waste and their implications for sustainable policy development," 110-123.

willingness to support a certain policy.[37] As such, optimal environmental policies should take into account the potential benefits to the people they would affect.

For instance, diet health research consistently demonstrates that vegetarian–or similar–diets can play a large role in improving health outcomes across populations. Relative to normal diets, adherence to Mediterranean, vegetarian, and vegan diets significantly reduces rates of type II diabetes and cancer while reducing mortality rates overall by as much as 20 percent.[38] Unhealthy diets currently pose a greater mortality risk than the combined effects of unsafe sex, alcohol consumption, and drug use.[39] A model of potential healthier diets requires a greater than 50% total reduction in consumption of red meats and sugar worldwide, potentially reducing annual premature deaths by roughly 20-30 percent.[40] This concern generally doesn't require any trade-offs between environmental and health concerns, as the two are almost universally aligned across different types of foods. Foods associated with negative health outcomes–red meats, heavily-processed goods, foods with high sugar content, and such–are nearly all also associated with detrimental environmental effects.[41]

Consistent with the trends of environmental impacts, consumption of specifically red meat and processed meat is associated with higher mortality rates, whereas the same link does not exist for poultry. Processed meat specifically is classified by the WHO as carcinogenic to humans due to its association with colorectal cancer, while red meat is classified as "probably carcinogenic" for a similar link.[42] The shift towards plant-based diets has highly variable benefits

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[37] Schanes, Karin, Karin Dobernig, and Burcu Gözet. "Food waste matters-A systematic review of household food waste practices and their policy implications." *Journal of cleaner production* 182 (2018): 978-991.
[38] Tilman, David, and Michael Clark. "Global diets link environmental sustainability and human health." *Nature* 515, no. 7528 (2014): 518-522.
[39] Willett, W. et al., "Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems," (2019).
[40] Ibid.
[41] Clark, Michael A., Marco Springmann, Jason Hill, and David Tilman. "Multiple health and environmental impacts of foods." *Proceedings of the National Academy of Sciences* 116, no. 46 (2019): 23357-23362.
[42] Godfray, H. C. J., et al. "Meat consumption, health, and the environment." (2018).

based on region, but high-income Western countries actually stand to benefit the most. In addition, reductions in overall consumption quantities are associated with lowered rates of obesity, a concern that is particularly relevant for policymakers in the United States.[43] With these connections in mind, the U.S. has ample incentive from a public health perspective to shift dietary choices towards more environmentally friendly options.

Implementation

Design of specific policies must take into account several more factors than simply the intended targets. In order to reach any level of political viability in the United States, climate-conscious measures need to have significant public support, be practically viable to implement, and actually have the intended effect in practice. A theoretical proposal of taxing consumers based on exactly how much food they throw away may sound desirable, but the process of actually measuring per-household food waste may prove too laborious or costly to efficiently produce meaningful results. In addition, legislation in the U.S. is passed at several different levels, from the federal government down to individual towns and cities. Policies targeting a broader area would affect considerably larger populations, but they are also much more difficult to pass. As such, a careful balance must be struck between practicality, public support, breadth of influence, and direct effectiveness when designing potential interventions. This section considers two types of policy: educational campaigns intended to sway public sentiment and financial campaigns intended to directly impact the purchasing decisions of consumers.

[43] Springmann, M. et al., "Analysis and valuation of the health and climate change cobenefits of dietary change." (2016).

Educational interventions

Often, undesirable consumer actions can stem from a lack of understanding of the actual outcomes of certain choices. In Poland, consumers were significantly more willing to engage in climate-friendly behavior as their knowledge of climate change grew.[44] Swedish consumers, who are generally more informed on environmental issues than their American counterparts, are also more likely to endorse specific climate-related interventions.[45] In Canada, a country more culturally analogous to the U.S., sampled undergraduate students were significantly more likely to prefer personal actions aimed at reducing food waste than those aimed at modifying one's diet away from environmentally problematic meats or processed foods.[46] This is consistent with findings that students tend to produce more food waste than older individuals.[47] However, the apparent preference also expresses itself in media coverage. A comparative analysis of U.S. newspapers found a consistent trend in coverage of climate issues. Efforts to reduce food waste are often portrayed in a positive light, as a collaborative effort between consumers and various organizations, whereas similar efforts aimed instead at dietary alterations were often presented more neutrally, with a considered effort to present "both sides" of the issue. Often, this meant that researchers were directly opposed by representatives with strong ties to the livestock industry. Coverage was also overwhelmingly focused on advocating individual-level behavioral changes, painting a picture in the eyes of much of the population that the solution to climate

[44] Kurowski, Łukasz, Joanna Rutecka-Góra, and Paweł Smaga. "Is knowledge on climate change a driver of consumer purchase decisions in Poland? The case of grocery goods and green banking." *Journal of Cleaner Production* 369 (2022): 133444.
[45] Eib, "76% Of Swedish People in Favour of Stricter Government Measures Imposing Behavioural Changes to Address the Climate Emergency," European Investment Bank. European Investment Bank, November 10, 2021.
[46] Campbell-Arvai, Victoria. "Food-related environmental beliefs and behaviours among university undergraduates: A mixed-methods study." *International Journal of Sustainability in Higher Education* 16, no. 3 (2015): 279-295.
[47] Grainger, Matthew James, Lusine Aramyan, Katja Logatcheva, Simone Piras, Simone Righi, Marco Setti, Matteo Vittuari, and Gavin Bruce Stewart. "The use of systems models to identify food waste drivers." *Global food security* 16 (2018): 1-8.

change is individual efforts aimed primarily at reductions in food waste.[48] Such coverage runs counter to analyses finding, consistently, that voluntary efforts alone, even if adopted far more broadly than they are now, are entirely insufficient for reaching emissions targets.[49] This suggests a potential need for direct government messaging that broader change is required to address the problem.

These interventions can take forms other than simple information conveyance, as well. Some consumers' motivations are driven less by specific, established effects of their actions and more by passive values. For instance, several European respondents in one study indicated significant willingness to take food-related climate-friendly steps in part because those steps were associated with positive values, such as concern for animals. The authors also noted an inverse correlation between the expected impact of a certain action and participants' willingness to voluntarily do it.[50] This effect could potentially be mitigated through education campaigns intended to induce specific feelings of moral obligation in the population. However, proper conveyance of moral attitudes is likely much more difficult, as the approach has to be convincing to people of various backgrounds with various personal ethical systems.

A 2015 paper attempted to outline, categorize, and test the most common ethical justifications for eating meat. The authors noted that the overwhelming majority of beliefs–referred to in the study as "the 4Ns"–associated with meat-eating fit into four groups–the beliefs that meat consumption was natural, normal, necessary, and nice. "Nice" in their framework refers to the personal pleasure that eating meat provides to people, generally through

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[48] Fry, Jillian P., Brittany Stodden, Andrea M. Brace, and Linnea I. Laestadius. "A Tale of Two Urgent Food System Challenges: Comparative Analysis of Approaches to Reduce High-Meat Diets and Wasted Food as Covered in US Newspapers." *Sustainability* 14, no. 19 (2022): 12083.

[49] Dubois, Ghislain, Benjamin Sovacool, Carlo Aall, Maria Nilsson, Carine Barbier, Alina Herrmann, Sébastien Bruyère et al. "It starts at home? Climate policies targeting household consumption and behavioral decisions are key to low-carbon futures." *Energy Research & Social Science* 52 (2019): 144-158.

[50] Dubois, G. et al. "It starts at home? Climate policies targeting household consumption and behavioral decisions are key to low-carbon futures." *Energy Research & Social Science* 52 (2019): 144-158.

nourishment or taste. Roughly 80-90% of the justifications offered by meat-eating respondents in the study fit into one of these four belief categories. Somewhat counterintuitively, that doesn't necessarily mean that the participants were genuinely considering the ethical implications at the time of consumption. Indeed, the researchers found that endorsers of the 4Ns were not motivated by any particular ethical concerns when actually making food choices.[51] Rather, these are justifications that seem to emerge after the fact, only when individuals are specifically questioned about their consumption habits.

This is consistent with some results on common education measures. A survey of respondents from several European countries found that sustainability labels, a fairly popular form of consumer-oriented environmental education, have no significant impact on consumers' purchasing decisions, even when considering the consumers' relative degree of concern for climate issues.[52] This is somewhat unsurprising, given the overwhelming majority of Americans are well-aware of climate change, with the primary failing coming from the lack of a perception that it's a serious threat.[53] An education effort can seem beneficial, but if it doesn't result in substantial modifications to consumer behavior, it might as well not exist. Such a nature of moral thinking is well-accepted among several academics in the field of moral psychology; although they disagree on the degree to which intuitionist judgements play a role in our moral thinking, they generally accept that their role is significant.[54] This poses some questions about how,

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[51] Piazza, Jared, Matthew B. Ruby, Steve Loughnan, Mischel Luong, Juliana Kulik, Hanne M. Watkins, and Mirra Seigerman. "Rationalizing meat consumption. The 4Ns." *Appetite* 91 (2015): 114-128.
[52] Grunert, Klaus G., Sophie Hieke, and Josephine Wills. "Sustainability labels on food products: Consumer motivation, understanding and use." *Food policy* 44 (2014): 177-189.
[53] Lee, Tien Ming, Ezra M. Markowitz, Peter D. Howe, Chia-Ying Ko, and Anthony A. Leiserowitz. "Predictors of public climate change awareness and risk perception around the world." *Nature climate change* 5, no. 11 (2015): 1014-1020.
[54] Haidt, Jonathan. "The emotional dog and its rational tail: a social intuitionist approach to moral judgment." *Psychological review* 108, no. 4 (2001): 814; Greene, Joshua D., Sylvia A. Morelli, Kelly Lowenberg, Leigh E. Nystrom, and Jonathan D. Cohen. "Cognitive load selectively interferes with utilitarian moral judgment." *Cognition* 107, no. 3 (2008): 1144-1154.

specifically, we ought to address undesirable moral beliefs. The existing models broadly suggest that any sort of attempt at "moral education" must either provide reasoning that properly engages the deliberative part of our brains *or* convince audiences that intended beliefs are socially desirable.[55] If consumer behavior is largely unaffected by sustainability labels, it may be because the labels are failing to effectively tap into our moral cognition. Similarly, such labels may fail to accurately convey the degree of urgency associated with environmental threats. Both shortcomings likely stem from affective factors, rather than strict deficits in information.

Much of the existing research on environmental education focuses primarily or solely on children in public schools, aiming to provide a long-term solution to the problems previously discussed.[56] However, the majority of the population–and the people whose choices are the most immediately impactful–are largely unaffected by changes in the curricula of K-12 schools. The existing research may be informative, but children do not learn in the same way as adults. Critically, although its exact nature is somewhat contentious, significant changes in moral development unquestionably take place at multiple points in a person's life, primarily from infancy to early adulthood.[57] As such, environmental education that is effective for children may not be effective for adults who are less malleable in their personal ethics. This severely limits the power of available data, forcing policymakers to rely more heavily on theoretical models of morality than on well-established, working case studies.

Alternative educational intervention

One conceptualization of moral belief in adults–established and popularized primarily by the work of Jonathan Haidt, Jesse Graham, and Craig Joseph–describes morality as stemming

[55] Haidt, J., "The emotional dog and its rational tail: a social intuitionist approach to moral judgment." (2001), 818.
[56] Aikens, Kathleen, Marcia McKenzie, and Philip Vaughter. "Environmental and sustainability education policy research: A systematic review of methodological and thematic trends." *Environmental education research* 22, no. 3 (2016): 333-359.
[57] Bloom, Paul, and Karen Wynn. "What develops in moral development." *Core knowledge and conceptual change* (2016): 347-364.

from a set of foundational values, namely concern for harm, fairness, ingroup loyalty, authority, purity, and liberty. Within moral foundations theory (MFT), very liberal individuals tend to place weighted value on harm and fairness, whereas strong conservatives value the various dimensions roughly equally.[58] Intuitively, one might assume that this means we ought to structure policy to appeal differently to conservatively minded populations, but the evidence doesn't necessarily support this. Examinations of climate action indicate that concern for harm and fairness are uniquely correlated with willingness to take personal measures to slow or stop climate change, even while controlling for factors like ideology, descriptive belief in climate change, and level of political activity. Valuation of ingroup loyalty, authority, and purity had no significant impact.[59] Therefore, an ideal education policy would actively encourage valuation of harm and fairness, particularly with regards to environmentally conscious actions. These foundations provide a good alternative target as opposed to political ideology itself, as testing of MFT indicates that they are considerably more flexible over time than ideology.[60] This can also potentially help avoid effects of attitude polarization, wherein people with very strongly-held beliefs can be driven even more towards those beliefs by oppositional dialogue, rather than having their beliefs moderated.[61] Additionally, research surrounding education-oriented policy about recycling efforts has found that liberals and conservatives are both vastly more receptive to messaging that matched their moral and ideological tendencies, regardless of the intended take-away message.[62]

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[58] Graham, Jesse, Jonathan Haidt, and Brian A. Nosek. "Liberals and conservatives rely on different sets of moral foundations." *Journal of personality and social psychology* 96, no. 5 (2009): 1029; Iyer, Ravi, Spassena Koleva, Jesse Graham, Peter Ditto, and Jonathan Haidt. "Understanding libertarian morality: The psychological dispositions of self-identified libertarians." (2012): e42366.

[59] Dickinson, Janis L., Poppy McLeod, Robert Bloomfield, and Shorna Allred. "Which moral foundations predict willingness to make lifestyle changes to avert climate change in the USA?." *PloS one* 11, no. 10 (2016): e0163852.

[60] Smith, Kevin B., John R. Alford, John R. Hibbing, Nicholas G. Martin, and Peter K. Hatemi. "Intuitive ethics and political orientations: Testing moral foundations as a theory of political ideology." *American Journal of Political Science* 61, no. 2 (2017): 424-437.

[61] Haidt, J., "The emotional dog and its rational tail: a social intuitionist approach to moral judgment." (2001).

[62] Kidwell, Blair, Adam Farmer, and David M. Hardesty. "Getting liberals and conservatives to go green: Political ideology and congruent appeals." *Journal of Consumer Research* 40, no. 2 (2013): 350-367.

However, this research was only conducted on messaging related to behavior changes that are near-universally considered good, such as recycling. More contentious, ideologically split actions may not share this effect.

In particular, our concern is with modifying individuals' personal moral norms, potentially using more specific moral foundational targets as a proxy. In addition to increasing willingness to take personal measures, increases in valuation of the "harm" and "fairness' dimensions also correlate with strength of affective personal norms related to climate change.[63] Therefore, educational measures ought to be taken at multiple levels to steer the personal norms of Americans in a productive direction. This can be done in several ways, with the most obvious stemming from the aforementioned connection that climate change has to human health. Taking anti-smoking campaigns as an analogous societal effort, the research notes variable effectiveness depending on the nature of the messaging. The connections are fairly clear, in a general sense. The production, consumption, and transportation of tobacco represent a not-insignificant harm to the environment.[64] Tobacco is well-established as negatively impacting the health of users[65] and is potentially more difficult to stop individuals from consuming than meat due to its considerable addictive properties.[66] These advertisements were often effective, but ads that made viewers feel as if their freedom was infringed upon had the opposite of the intended result.[67] On the other hand, ads that were disproportionately impactful tended to emphasize potential harms done to

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[63] Jansson, Johan, and Ellen Dorrepaal. "Personal norms for dealing with climate change: results from a survey using moral foundations theory." *Sustainable Development* 23, no. 6 (2015): 381-395.
[64] World Health Organization. *Tobacco and its environmental impact: an overview*. World Health Organization, 2017.
[65] Musk, Arthur William, and Nicholas Hubert De Klerk. "History of tobacco and health." *Respirology* 8, no. 3 (2003): 286-290.
[66] Stolerman, Ian P., and Mohammed Shoaib. "The neurobiology of tobacco addiction." *Trends in Pharmacological Sciences* 12 (1991): 467-473.
[67] Grandpre, Joseph, Eusebio M. Alvaro, Michael Burgoon, Claude H. Miller, and John R. Hall. "Adolescent reactance and anti-smoking campaigns: A theoretical approach." *Health communication* 15, no. 3 (2003): 349-366.

other citizens, often making specific note of the dangers of secondhand smoke.[68] As such, effective climate education campaigns will take similar examples as a reference point and design advertisements to evoke specific feelings about one's personal obligations to society and the world. Smoking-related campaigns have been fairly cost-effective when studied in the U.S., with the TIPS effort costing $480 per person who quit smoking because of the advertisements.[69] However, regardless of effectiveness, such campaigns are generally a net loss–at least in the short term–for government bodies, which spurs further need for direct interventions to cover the costs.

Direct consumer interventions

The most obvious financial policy is a GHG-based tax. The United States does not currently have a national carbon tax, despite considerable evidence that implementation of one could significantly reduce GHG emissions nationwide. In addition, a carbon tax demonstrably reduces demand for high-emissions products, such as gasoline, to a far greater degree than a standard price increase stemming from other sources.[70] However, the specifics of such a policy implementation are difficult to determine, and the benefits of such legislation can be nullified if it is designed poorly. An excessively high carbon tax can cause negative downstream effects on the economy that turn public opinion against the effort's implementation, which can hurt its longevity, a critical component of any effective environmental legislation. An excessively low carbon tax would be more likely to sustain political viability but would fail to achieve the ideal

[68] Goldman, Lisa K., and Stanton A. Glantz. "Evaluation of antismoking advertising campaigns." *Jama* 279, no. 10 (1998): 772-777.
[69] Xu, Xin, Robert L. Alexander Jr, Sean A. Simpson, Scott Goates, James M. Nonnemaker, Kevin C. Davis, and Tim McAfee. "A cost-effectiveness analysis of the first federally funded antismoking campaign." *American journal of preventive medicine* 48, no. 3 (2015): 318-325.
[70] Metcalf, Gilbert E. "On the economics of a carbon tax for the United States." *Brookings Papers on Economic Activity* 2019, no. 1 (2019): 405-484.

results.[71] One solution is to initially set a fairly conservative tax rate and include provisions that automatically raise the rate if emissions do not sufficiently decline, but this would require a degree of oversight that could become prohibitively expensive. In addition, it is somewhat uncommon for carbon taxes to target food consumption, more often being aimed at products like gasoline.[72]

However, public support for a carbon tax is fairly low. This effect is mitigated when a tax is actually implemented and consumers begin to see benefits firsthand, but such implementation requires a firm foundation of political capital to get off the ground.[73] Carbon taxes on food emissions specifically also have several downsides in their implementation. While they can demonstrably reduce emissions, their effect size is relatively small, owing to the relative inelasticity of most common food items.[74] Similarly, they do not distinguish between various types of greenhouse gasses, which is especially concerning for food consumption, given the agricultural sector emits the majority of methane pollution. They also tend to place the majority of the tax burden on lower-income households, which is generally an unwanted effect.[75] In addition, much of the benefit of a carbon tax primarily emerges when implemented on a large scale, potentially only worldwide.[76] This results from the limited scope that some governments have for tangibly controlling producers. In California, for example, the San Francisco Bay Area Air Quality Management District (BAAQMD) levies a carbon tax on GHG emissions from

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[71] Marron, Donald B., and Eric J. Toder. "Tax policy issues in designing a carbon tax." *American Economic Review* 104, no. 5 (2014): 563-568.
[72] Sumner, Jenny, Lori Bird, and Hillary Dobos. "Carbon taxes: a review of experience and policy design considerations." *Climate Policy* 11, no. 2 (2011): 922-943.
[73] Carattini, Stefano, Steffen Kallbekken, and Anton Orlov. "How to win public support for a global carbon tax." *Nature* 565, no. 7739 (2019): 289-291.
[74] Andreyeva, Tatiana, Michael W. Long, and Kelly D. Brownell, "The impact of food prices on consumption: a systematic review of research on the price elasticity of demand for food," *American journal of public health* 100, no. 2 (2010): 216-222.
[75] Kehlbacher, Ariane, Richard Tiffin, Adam Briggs, Mike Berners-Lee, and Peter Scarborough. "The distributional and nutritional impacts and mitigation potential of emission-based food taxes in the UK." *Climatic Change* 137 (2016): 121-141.
[76] Ibid, 291.

facilities within the jurisdiction of the BAAQMD, but emissions from anywhere else are a blind spot to the legislation.[77] If consumers in the region purchase goods produced anywhere else, their economic impact is wholly unaffected by the tax. This isn't generally a problem for controlling the sale of gasoline, but emissions from food production occur throughout multiple stages of the supply chain.

Taxation

An appealing alternative is to instead levy a direct sales tax on certain food items that are uniquely harmful, without directly calculating emissions per item. Evidence has been outlined for the consideration of ruminant and processed meats as a particular object of concern, and several studies have established a firm link between price increases of meat and benefits to both the environment and the health of the affected population.[78] In addition, to again cite smoking as an example, the implementation of a direct tax on tobacco products significantly reduced rates of consumption in the UK over several decades.[79] Implementation of such a tax could vary based on state, but Illinois' tax code provides a fairly reliable starting point. Illinois currently maintains a statewide sales tax of 6.25%, but this is reduced to 1% for–among other goods–certain qualifying food items. The food items that do not qualify include alcohol, soft drinks, and candy.[80] This selection could be expanded to include items that are consistently the most damaging to the environment, regardless of specifics in their production. Including red meats, for instance, would have a similar effect to the GHG-related taxes in other areas without the costly oversight required by more demand-side interventions. This would also avoid placing the tax burden as heavily on low-income populations, as red meat is already more costly than poultry, suggesting that its

[77] Sumner, J., Lori B., and Hillary D. "Carbon taxes: a review of experience and policy design considerations." (2011), 17.
[78] Godfray, H. C. J. et al. "Meat consumption, health, and the environment." (2018).
[79] Royal College of Physicians, "Fifty years since Smoking and health," *Royal College of Physicians*, (2012).
[80] IL Administrative Code, title 86, ch. I, pt. 130, § 130.310.

primary consumers are already more capable of shouldering the burden of further cost increases.[81] Even more favorably, given the necessary infrastructure exists in a given region, a local or federal public health department could further divide red meat products according to how they were farmed and the expected such environmental impacts, placing direct labels on items to signify that they are among those who do not qualify for the reduced sales tax rate. Tying this modification to existing provisions in the tax code also allows it to be justified for similar reasons to other foods. The currently existing exclusions primarily exist for health-related reasons, and red meat is demonstrably less healthy than alternatives of poultry or fish. Focusing on a state-level change also allows for easier progress than is feasible nationally, given the relative unviability of demand-side climate legislation at a federal level.

Conclusion

Climate change is a complex phenomenon that requires multifaceted work from hundreds of governing bodies across the world to properly address. While existing measures to address environmentalist concerns are in place, they are clearly insufficient for placing the United States on a promising trajectory. This inquiry examined the existing body of research on climate legislation, proposing both ethics-oriented educational campaigns and an increased tax on red meats, both of which would be expected to reduce emissions where implemented. However, as mentioned, no singular policy or set of policies will unilaterally solve the crisis, and significantly more work must be done to alleviate global temperature increase and environmental damages resulting from greenhouse gas emissions.

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[81] Zeng, Luxian, Mengyuan Ruan, Junxiu Liu, Parke Wilde, Elena N. Naumova, Dariush Mozaffarian, and Fang Fang Zhang. "Trends in processed meat, unprocessed red meat, poultry, and fish consumption in the United States, 1999-2016." *Journal of the Academy of Nutrition and Dietetics* 119, no. 7 (2019): 1085-1098.

Literature Review

The research on climate change and environmentally targeted policies is broad and often somewhat conflicting in its conclusions. A majority of analysis also takes place in Europe, which is sometimes non-applicable in North American countries, as European attitudes towards personal and collective obligations–alongside a noticeably different overall food culture–cause the average citizens of each region to purchase and consume food differently. Trends in belief and economic practice can also radically change over time, making older research potentially misleading. Regardless, the data appears near unanimous on one front: nearly every country in the world is not currently doing enough to mitigate the crisis at hand. This section is intended to investigate some of the research background that did not directly justify policies outlined in the main proposal.

The HOPE Project, a mixed-methods study of 308 households across four European cities (in France, Germany, Sweden, and Norway) identified meat/dairy consumption, air travel, and heating as the primary causes of household inflation. An analysis of the study's findings noted several interesting trends among the data. There was very little variance between the studied cities in specific personal preferences about climate policy, but significant differences emerged between various living situations. However, even claims of parallel opinions between locations are somewhat unreliable, given the study was only conducted in Europe and in urban environments. They found that current climate policies in the relevant countries fell noticeably short with individual perceptions of personal responsibility for addressing climate change, but this may be owed to the fact that urban residents tend to be more politically liberal than their rural counterparts. In addition, the agricultural sector was uniquely under-regulated compared to the amount of legislation passed to address the transportation and residential sectors. Although,

once again, this may not be applicable to the United States. One particularly noteworthy point that *is* relevant across countries is that renters often struggle to implement certain reduction measures–even when motivated to do so–because said measures tend to require modifications to the property that are explicitly forbidden by lease agreements. This is a clear example of the need for regulation on more than just the supply side, as no amount of consumer-oriented regulation could possibly compensate for solid, legal barriers in renters' contracts. The analysis also noted a distinct trend in citizen preferences which suggested a firm need for "forced" policy measures. The HOPE Project's study design distinguished between "voluntary" and "forced" environmentally-positive changes, and while participants did endorse several voluntary measures, all of them were entirely insufficient for reaching 2030 emissions targets. However, this issue vanished when discussing willingness to support "forced" measures, suggesting a level of increased support for certain actions when individuals can be confident in collective action following suit.[82]

The main proposal argued confidently that raising livestock on grassland is particularly harmful to the environment, as it causes cattle to produce more methane, takes up more land, and damages water supplies through the chemical impact of manure. This conclusion constituted a large component of the recommendation that red meat in particular should be a target for government interventions. Some researchers would argue that there are considerable benefits to raising livestock through grazing that went unmentioned, but particularly intentioned analyses into the holistic effects of different types of cattle raising found otherwise. In particular, the potential of grasslands as a form of carbon dioxide storage is noteworthy, but ultimately the estimated benefits of such processes are highly dependent on regional differences in environment

[82] Dubois, G. et al. "It starts at home? Climate policies targeting household consumption and behavioral decisions are key to low-carbon futures." (2019).

and do not come anywhere close to outweighing the other damage done by grazing cattle.[83] In short, red meat remains uniquely concerning in spite of this effect.

Much of the evidence cited connecting climate and health concerns mentioned red meat among other products, namely processed meat and foods high in sugar. These other two groups were not directly targeted in the recommended policies for separate reasons. Processed meat is extremely damaging, but the health risks have been well-established for some time and are far more commonly understood than those of red meat.[84] Educational campaigns aimed towards them are more likely to fall on deaf ears, similar to the results of educational campaigns on alcohol consumption. Efforts aimed at reducing consumer purchase and use of alcohol were often somewhat ineffective, which stands in stark contrast to the findings of similar efforts targeting cigarette smoking.[85] The cause for these contrasting results is not clear, but it's not unlikely that health messaging experiences diminishing returns over time, where the sustained presence of certain pushes from health authorities causes those pushes to become less and less noticeable and, as a result, less impactful.

One mentioned study discussed what the authors called "the 4Ns," a categorization scheme for better understanding justifications for eating meat. A particularly insightful component of their analysis was the finding that most people who endorsed the 4Ns–in other words, the majority of the population–did not seem to feel a particular degree of moral concern for animals, regardless of connection to dietary sustenance. The presence of these justifications

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[83] Godfray, H. et al. "Meat consumption, health, and the environment." (2018).
[84] Qian, Frank, Matthew C. Riddle, Judith Wylie-Rosett, and Frank B. Hu. "Red and processed meats and health risks: how strong is the evidence?." *Diabetes care* 43, no. 2 (2020): 265-271.
[85] Young, Ben, Sarah Lewis, Srinivasa Vittal Katikireddi, Linda Bauld, Martine Stead, Kathryn Angus, Mhairi Campbell et al. "Effectiveness of mass media campaigns to reduce alcohol consumption and harm: a systematic review." *Alcohol and alcoholism* 53, no. 3 (2018): 302-316; Scribner, Richard A., Katherine P. Theall, Karen Mason, Neal Simonsen, Shari Kessel Schneider, Laura Gomberg Towvim, and William Dejong. "Alcohol prevention on college campuses: The moderating effect of the alcohol environment on the effectiveness of social norms marketing campaigns." *Journal of studies on alcohol and drugs* 72, no. 2 (2011)232-239.

also aided in alleviating feelings of guilt for people who consumed animal products.[86] However, it is unclear whether belief in the 4Ns actually *causes* this level of moral distance from animals. Various different moral frameworks would likely offer different interpretations.

On that note, the rationale behind education initiatives is highly informed by research in moral psychology. In particular, the recommendation was written taking the social intuitionist model (SIM) as a primary frame of reference for explaining seemingly contradictory behavior in many consumers. In essence, the model describes a set of six links that encapsulate essentially all human moral thinking. The "intuitive judgment" link describes the model's most contentious claim: that when presented with a situation that prompts a moral judgment, an actor's intuition is the primary causal factor determining the specifics of their response. This response, through the "post-hoc reasoning" link, motivates the individual to retroactively justify their intuitive conclusion in order to avoid cognitive dissonance. In a vacuum, this is where reasoning ends, when someone has reached a judgment and convinced themselves that their thoughts are rational. However, when presented with another person–or, more realistically, another group of people–who believe something different, additional links come into play. The "reasoned persuasion" link describes the process by which one person's outward post-hoc justifications for their beliefs go on to modify the intuitions of someone else, and the "social persuasion" link refers to the persuasive power of the mere expression of a belief. In the former, a moral agent provides explanatory reasons for their conclusions, whereas in the latter, the agent vocalizing their belief can cause others' intuitions to trend towards agreement, as we are generally predisposed to follow the beliefs and actions of our ingroup.[87]

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[86] Piazza, J. et al. "Rationalizing meat consumption. The 4Ns." (2015).
[87] Haidt, Jonathan. "The emotional dog and its rational tail: a social intuitionist approach to moral judgment." *Psychological review* 108, no. 4 (2001): 1025.

The final two links are rarer, according to the authors, but still play a significant role for some people. The "reasoned judgment" and "private reflection" links describe the relatively uncommon process by which someone can change their mind about an issue solely through self-reflection, without any social influence being necessary. This process is explicitly described as only taking place in a relative minority of the population that is, for one reason or another, more inclined towards thinking intensely about these sorts of issues. As such, educational policy measures probably should not be designed assuming that viewers will consistently self-reflect on their beliefs and actions. In other terms, we can view the average consumer's day-to-day climate-related choices as existing in the domain of rapid, subconscious moral cognition, as outlined by other researchers in moral psychology. Joshua Greene and his colleagues have developed a considerable body of research arguing that moral cognition exists within two primary processes, referred to as "system 1" and "system 2," which are employed in different contexts.[88] The former, also called the automatic-emotional process, is the primary driver of our actions when we aren't presented with direct conflicts that require some sort of resolution. In consumer choice, this can take the form of following a preexisting habit of purchasing decisions. For instance, if someone has spent several years of their life regularly buying red meat when they get groceries, the intuitive choice will be to continue to do so in the future. Therefore, intentionally prompting people to engage system 2 thinking, which is more deliberative, could drive some people to change their habits. However, specific evidence connecting the dual-process theory to environmental actions does not exist in the same vein as evidence doing so for the SIM, so it was not as heavily considered when proposing educational public policy measures.

[88] Greene, Joshua D., Sylvia A. Morelli, Kelly Lowenberg, Leigh E. Nystrom, and Jonathan D. Cohen. "Cognitive load selectively interferes with utilitarian moral judgment." *Cognition* 107, no. 3 (2008): 1144-1154.

One disagreement that arises in the literature surrounding the social intuitionist model surrounds the validity of all six separate constructs. The majority of research reinforces the existence of these various factors, but some competing evidence also argues that the model should more accurately be condensed into only two categories: individualizing and binding foundations. Some researchers–including a few who established the original model–have published some work that utilizes the two-factor approach as a means of further examining political ideology.[89] Subsequent studies from different authors have taken this further, with results that dispute the existence of any validity for the original five or six-factor models at all.[90] However, the latter case has far less research in its support, suggesting that this dispute may be the result of a lack of statistical power in some studies.

Waste classification

Sometimes, issues with measurement run parallel to issues with policy implementation. If a certain metric is difficult to quantify, be it emissions, level of food waste, or otherwise, it is likely to pose problems to both academics and government institutions. Food waste in particular provides a clear example of this in effect. Often, studies will use self-reported data, which is not necessarily unreliable, but likely lacks a degree of specificity that's important for precise targeting. On the other hand, one can examine trash itself, either on an individual household basis or in larger MSW systems, which is more precise and reliable, but requires a great deal of time and resources. The Food and Agriculture Organization (FAO) maintains a database of all the available data on food waste, broken down by year, country, food type, and other factors,

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[89] Graham, Jesse, Brian A. Nosek, and Jonathan Haidt. "The moral stereotypes of liberals and conservatives: Exaggeration of differences across the political spectrum." *PloS one* 7, no. 12 (2012): e50092; Kidwell, B. et al, "Getting liberals and conservatives to go green: Political ideology and congruent appeals,"(2013).

[90] Smith, Kevin B., John R. Alford, John R. Hibbing, Nicholas G. Martin, and Peter K. Hatemi. "Intuitive ethics and political orientations: Testing moral foundations as a theory of political ideology." *American Journal of Political Science* 61, no. 2 (2017): 424-437.

which is a valuable source, but potentially imperfect.[91] One analysis argues that the FAO's gathered estimates are very low relative to the actual amount of food waste, using a method that measures waste in terms of the potential human energy it could have provided.[92] This disparity in potential measurement methods casts a layer of doubt on any analysis attempting to quantify the environmental damages caused by food waste.

The concept of "food waste" in academic study is less straightforward than it may seem from the outside. Over a dozen slightly different definitions for the term exist across different analyses, with no universal consensus on what the default assumed meaning should be. Researchers have made attempts at formulating a reliable, consistent definition, distinguishing between food *loss*–food that is lost during the supply chain prior to human consumption–and food *waste*–food that is lost through being discarded by consumers–but these definitions do not appear to have caught on in subsequent studies anywhere near broadly enough to be considered universal.[93] They also distinguish, for the sake of categorizing previous studies in a meta-analysis, between "formal" and "informal" food waste, where the former refers strictly to food disposed of in municipal solid waste systems and the latter to everything else.

Convincing populations to do something that the vast majority of them agree that they should be doing–but aren't–is surprisingly difficult. One set of policy recommendations specifically mentions the potential for governments to set up programs providing education to reduce food waste, primarily centering around an increase in planning.[94] A majority of waste

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[91] Food and Agriculture Organization of the United Nations. "Food Loss and Waste Database." *Technical Platform on the Measurement and Reduction of Food Loss and Waste* (2019). https://www.fao.org/platform-food-loss-waste/flw-data/en/.

[92] van den Bos Verma, M. et al. "Consumers discard a lot more food than widely believed: Estimates of global food waste using an energy gap approach and affluence elasticity of food waste." (2020).

[93] Thyberg, K. L. and D. J. Tonjes. "Drivers of food waste and their implications for sustainable policy development." (2016).

[94] Thyberg, K. L. and Tonjes, D. J., "Drivers of food waste and their implications for sustainable policy development," 110-123.

stems from people making consumption choices without necessarily fully planning ahead. People frequently report buying items from grocery stores without a good idea of how they intend to actually use them, which often causes said food to be thrown away. Teaching people more efficient grocery planning habits would be desirable, but again, actual data on the effectiveness of such programs does not exist in large quantities.

A literature review that focuses on food waste noted that a majority of the literature on FW viewed actions that resulted in wasted food under the lens of the theory of planned behavior. As the authors describe it, this perspective views our actions as determined by an intention which leads to a certain level of motivation to act.[95] They move past the theory of planned behavior, describing newer social science research that favors social practice theory (SPT) to provide a different perspective on the issue. SPT prefers to view food waste as a consequence of the attitude towards food seen in a society or culture as a whole, rather than primarily the product of an individual's decisions. An example of this in effect is the nature of portion sizes in the United States. The U.S. is well-established as having larger portion sizes for meals in average restaurants and grocery stores as equivalent nations elsewhere.[96] The authors of the review suggest, as one potential measure to address excessive portion sizes, a reduction in plate sizes used in restaurants and the home. To be clear, they are not referring to food portion sizes directly, but literal reductions in the physical dimensions of kitchenware.[97] While this sounds somewhat far-fetched on its face, there is actually a substantial body of research supporting the connection. Several authors have, in experimental and observational settings, measured the impact of

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[95] Schanes, K., K. Dobernig, and B. Gözet. "Food waste matters-A systematic review of household food waste practices and their policy implications." (2018).
[96] Rozin, Paul, Kimberly Kabnick, Erin Pete, Claude Fischler, and Christy Shields. "The ecology of eating: smaller portion sizes in France than in the United States help explain the French paradox." *Psychological science* 14, no. 5 (2003): 450-454.
[97] Schanes, K., K. Dobernig, and B. Gözet. "Food waste matters-A systematic review of household food waste practices and their policy implications." (2018).

physically larger plates on the eating habits of various different people.[98] This effect emerged beyond simple settings like restaurants. In addition to regular, everyday environments, abnormally large plates even prompted excessive consumption habits among health conference attendees who had been shown a presentation on this very effect less than two hours prior.[99] Amusing as that is, it gives credence to the SPT approach to solving food waste problems. As it is unlikely to see legislation pass that places a hard cap on actual portion sizes in terms of something like calorie count–aside from the measures in some states on very specific items, namely sugary drinks–indirect measures that target the environment in which food is served do provide an attractive alternative.

The main policy recommendations in this proposal notably do not include any specific measures addressing food waste, despite waste being well-established as an attractive target for climate proposals. A primary issue with educational efforts surrounding waste stems from concerns about universal viability. Composting is an excellent option for reducing emissions from wasted food, allowing a large majority of it to be disposed of in a fairly climate-friendly way, even if those doing so are still over-consuming food, which continues to produce excess emissions.[100] However, this relies on people having access to the means to compost their unwanted food, which is not particularly common in several parts of the U.S., notably in more urban areas where most residents do not have any sort of backyard area. Proposals have been made for establishing government-funded community composting areas in public parks to account for this deficit in urban composting infrastructure, but they have their own

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[98] Wansink, Brian, and Koert Van Ittersum. "Portion size me: plate-size induced consumption norms and win-win solutions for reducing food intake and waste." *Journal of Experimental Psychology: Applied* 19, no. 4 (2013): 320; Van Ittersum, Koert, and Brian Wansink. "Plate size and color suggestibility: The Delboeuf illusion's bias on serving and eating behavior." *Journal of Consumer Research* 39, no. 2 (2012): 215-228.
[99] Wansink, B. and K. Van Ittersum. "Portion size me: plate-size induced consumption norms and win-win solutions for reducing food intake and waste." (2013).
[100] Ibid.

shortcomings.[101] Primarily, community composting would require that residents take the additional effort to travel a not-insignificant distance to dispose of food waste, as opposed to simply throwing it in their household garbage receptacles. The authors do attempt to account for this, using willingness to travel to reach public transportation as a proxy, but such a proxy is imperfect and does not necessarily reach the real levels of distance deterrence.[102] Notably, public transportation does not have as simple an alternative as community compost does. If a resident of a city needs to travel somewhere, it may very well be the case that public transportation is the most convenient way of doing so for them. With composting, however, there is very little self-interested motivation behind spending considerably more time and effort traveling to community facilities. It is possible that willingness would be high, but existing projections do not adequately establish confidence in participation rates.

Said analyses can also be somewhat misleading, given the wide variety of causes that food waste can have. When we think of "food waste," a significant number of people think of it as food that is thrown away because humans–whether it's at the grocery store, in a restaurant, or in one's home–actively chose not to eat it. However, factors that are less controllable like undesirable weather conditions, sub-optimally functioning machinery, and infestation are also considered "food waste" in many measures, which are far more difficult to directly address.[103] Looking at the amount of emissions that could be reduced by completely eliminating food waste makes the effort seem more simple than it actually is. Consumers are quick to endorse general survey response items like "We should make an effort to throw away less food," without always understanding what that would actually entail.

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[101] Pai, Shantanu, Ning Ai, and Junjun Zheng. "Decentralized community composting feasibility analysis for residential food waste: A Chicago case study." *Sustainable Cities and Society* 50 (2019): 101683.
[102] Ibid, 3.
[103] Kantor, Linda Scott, Kathryn Lipton, Alden Manchester, and Victor Oliveira. "Estimating and addressing America's food losses." *Food Review/National Food Review* 20, no. 1482-2016-121447 (1997): 2-12.

Method Analysis

Given the myriad of existing potential policy implementations that have been recommended and discussed by various analysts, determining which to particularly recommend poses a difficult task. The policies directly advocated in this paper are the process of a multi-step process of reasoning that ultimately determined specific types of red meat to be a favorable target. First, the decision to specifically target demand-side policies was made, as such efforts are relatively uncommon among existing climate legislation, in spite of being widely considered–among climate researchers–to be a necessary component of addressing the crisis. Three sectors of the economy were then identified as primarily destructive in their levels of GHG emissions: agriculture, residential, and transportation. In order to narrow the focus of this research, the agricultural sector was isolated, as it also is relatively under-addressed in terms of overall climate policy, especially on the consumer side. The residential sector was excluded due to the relatively large proportion of residential GHG emissions that do not result from particularly conscious choices, rather from regional, technological, and financial factors. Use of air conditioning, for instance, varies heavily by local climate, but is not something that is often the product of a resident's personal decision-making process. Transportation was excluded as it is likely more easily addressed on the supply side than the demand side. Individuals are somewhat rarely making decisions as complex as in the agricultural sector when deciding how to travel to a particular destination. Air travel produces demonstrably high levels of GHG emissions, but even the most climate-conscious consumers often do not have much of a choice in whether to use it or not.[104] No amount of personal regard for one's carbon footprint can make the more environmentally friendly U.S. trains move as quickly as the average airplane. As such,

[104] Brueckner, Jan K., and Chrystyane Abreu. "Airline fuel usage and carbon emissions: Determining factors." *Journal of Air Transport Management* 62 (2017): 10-17.

consumer choice within the agricultural sector was targeted as a particularly underdeveloped area in current climate policy.

Current research and under-examination

The supply side of environmental legislation is well-explored, with a substantial body of clear recommendations for carbon taxes, cap-and-trade programs, technological investment, and other such interventions that would guide us towards emissions targets.[105] These measures generally target larger bodies, industries and corporations, which is sensible, given the greater ease of monitoring. With a carbon tax, for example, the negative externality is targeted directly, which more reliably produces the intended consequent behavior. A local governing body can also far more easily measure the activity of 200 corporations than 2 million members of its population. However, these advantages do not mean that demand-side interventions should be completely ignored. A diverse set of various policies can aid in addressing climate change where a narrower scope may miss some potential gains. A demand-side focus places this examination in a less densely-populated region of the existing literature.

The same trend is true of agricultural interventions. The recently-passed Inflation Reduction Act (IRA) focuses on areas like transportation infrastructure and energy grids, both of which are doubtless important components of legislative efforts, but only addresses the agricultural sector with funds for "climate-smart agriculture."[106] The nearly $20 billion in funds will hopefully help to significantly reduce the sector's emissions, but as discussed in the primary proposal, there is only so much that technological improvements can achieve. Cattle farming will produce noticeably more emissions than other foods regardless of how advanced the technology

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[105] *Climate policy recommendations*. National Wildlife Federation. (n.d.). Retrieved April 28, 2023, from https://www.nwf.org/Our-Work/Environmental-Threats/Climate-Change/Policy; Tol, Richard SJ. "Targets for global climate policy: An overview." *Journal of Economic Dynamics and Control* 37, no. 5 (2013): 911-928.

[106] The White House, *Building a Clean Energy Economy: A Guidebook to the Inflation Reduction Act's Investments in Clean Energy and Climate Action*, Version 2, (Washington, D.C., 2023).

used is or what methods the farmers use, even though both do make a significant difference. Furthermore, given the aforementioned intent to focus on demand-side policies, the agricultural sector is a preferable target, as transportation and residential emissions are less prone to alteration by individual actions.

Transportation interventions

U.S. transportation emissions are incredibly high, making up 31% of the emissions and energy use by transportation globally in 2005, far more than would be expected for its population size. Nearly 80% of those figures stem from use of highway vehicles, with an additional 10% emerging from air travel.[107] This is consistent with research noting that highway vehicles–namely personal cars–emit considerably more emissions than alternative means of transportation, such as passenger trains.[108] In addition, public bus systems, while still considered highway vehicles, produce generally lower carbon emissions per mile traveled per passenger than personal cars.[109] As such, one could accurately conclude that increased investment in public transportation is a viable strategy for reducing emissions. However, there are issues which make broad-scale policy recommendations difficult.

First and foremost, the viability of public transit systems depends on the layout of the area of implementation. Per-capita carbon emissions are generally at their lowest in urban areas, with dramatic reductions observed in per-capita vehicle miles traveled specifically because of the availability of public transportation.[110] Most European countries, for instance, have robust public transportation networks partially due to their far greater population density overall compared to

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[107] Greene, David L., Howard H. Baker Jr, and Steven E. Plotkin. "Reducing greenhouse gas emissions from US transportation." (2010): 11.
[108] Graver, Brandon M., and H. Christopher Frey. "Highway vehicle emissions avoided by diesel passenger rail service based on real-world data." *Urban Rail Transit* 2 (2016): 153-171.
[109] Vincent, William, and Lisa Callaghan Jerram. "The potential for bus rapid transit to reduce transportation-related CO2 emissions." *Journal of Public Transportation* 9, no. 3 (2006): 219-237.
[110] Andrews, Clinton J. "Greenhouse gas emissions along the rural-urban gradient." *Journal of Environmental Planning and Management* 51, no. 6 (2008): 847-870.

the U.S. This is obviously not to say that investment is completely worthless here; every major American city could make further improvements to their transportation systems to further encourage use of communal public transit over private, individual vehicles. One could easily make the case for heightened investment in public transportation in urban centers in the U.S., but just suggesting we build more passenger trains is not a solution for emissions from rural Nebraska. Put simply, the transportation issue is incredibly hard to address in a manner that can be applied all across the country in the U.S. specifically the way it can be in other, denser nations. Long-distance travel is a more compatible prospect, but even then, the country's sheer size makes it less efficient than in other areas. A high-speed railway from San Francisco to New York City (NYC) would almost surely reduce airline emissions if it were comparably fast–something which is itself fairly difficult to achieve–but such a railway would need to cover thousands of miles of ground, requiring collaboration from every single state the tracks passed through. This leads into the second problem with trying to target transportation.

As this effort was conceptualized as specifically targeting demand-side behaviors, potential in the transit sector is limited even further. Bluntly, the cause of our national transportation emissions are very rarely the sole result of individual choice in the same way that food is. Theoretically, if governments could directly modify the behavior of their populations, we could considerably reduce agricultural emissions very quickly if everyone simply purchased different foods, and this behavioral shift would come at little cost to said individuals. However, the same is not true of transit. If an American wants to travel from, for instance, San Francisco to NYC, as mentioned, that individual doesn't have much of a choice to make in their method of transportation. The cheapest *and* fastest route is often through air travel, by a significant margin,

with the only common alternative being the use of a *personal* highway vehicle.[111] Similarly, those in rural areas don't simply choose to take their cars to get to their places of work, do grocery shopping, or seek recreational activities. Often, they straightforwardly do not have the option to do anything else. Demand-side interventions are nigh impossible to implement if consumers have so few viable options to choose from as-is. Transportation emissions are much better addressed on the supply-side, currently.

Residential interventions

Similar difficulties are posed for policies targeting residential carbon output as on the transportation side. Many residential emissions stem from processes that researchers consider "operational requirements," such as cooking, interior temperature control, and lighting.[112] Addressing these pollutants could be done in two ways: by reducing the amount which we use these systems and by using less environmentally damaging technologies in doing so. For an example of the former, look to educational programs in schools that provide information about reducing home electricity use. However, these are not generally very successful, exhibiting the strongest benefits in the short term and falling off as time passes.[113] Thus, the latter is a more attractive route, but the adoption of more energy-efficient technologies, while providing potentially significant emissions, is not logistically easy in all areas.[114] Approximately 36% of Americans are currently renting, and renters do not generally have full control over the

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[111] Ashiabor, Senanu, Hojong Baik, and Antonio Trani. "Logit models for forecasting nationwide intercity travel demand in the United States." *Transportation Research Record* 2007, no. 1 (2007): 1-12.
[112] Norman, Jonathan, Heather L. MacLean, and Christopher A. Kennedy. "Comparing high and low residential density: life-cycle analysis of energy use and greenhouse gas emissions." *Journal of urban planning and development* 132, no. 1 (2006): 10-21.
[113] Gill, Carrie, and Corey Lang. "Learn to conserve: The effects of in-school energy education on at-home electricity consumption." *Energy Policy* 118 (2018): 88-96.
[114] Dietz, Thomas, Gerald T. Gardner, Jonathan Gilligan, Paul C. Stern, and Michael P. Vandenbergh. "Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions." *Proceedings of the national academy of sciences* 106, no. 44 (2009): 18452-18456.

appliances in their homes.[115] Properly-targeted policies aimed at reducing residential emissions would need to target both homeowners and landlords while properly incentivizing them to absorb the personal costs of actually implementing new technologies. In addition, some of the improvements, such as low-flow shower heads, pose a potential reduction in quality of life that some residents may be hesitant to accept. As such, the agricultural sector poses the most attractive potential policy target, at least for demand-side interventions.

Methods in existing research

An issue that permeates climate research is variance among methods used to measure and classify emissions, which can cause disputes and uncertainty in understanding the specific impacts of certain industries. One of the most contested underlying facts surrounding meat involves its price elasticity. I ultimately come to the conclusion that food is relatively inelastic, but with red meat being slightly more susceptible to price shifts than several other food items. However, the methods utilized to determine elasticity can shift the results quite a bit. A meta-analysis by Craig Gallet analyzed the state of the literature as of 2010, finding a great deal of variance between studies.[116] In particular, he was searching for differences between types of meat, effect of the specification of demand, the impact size of differences in data, sensitivity to demand estimation method, influence of the publication outlet, and influence of regional differences.[117] He makes the particular criticism that the overwhelming majority of existing models are single-layered, where demand for meat is a single, continuous variable. This is contrasted with a preferred two-layer construct of demand, wherein the decision to purchase

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[115] DeSilver, Drew. "As National Eviction Ban Expires, a Look at Who Rents and Who Owns in the U.S." Pew Research Center. Pew Research Center, August 3, 2021. https://www.pewresearch.org/short-reads/2021/08/02/as-national-eviction-ban-expires-a-look-at-who-rents-and-who-owns-in-the-u-s/.

[116] Gallet, Craig A. "Meat meets meta: a quantitative review of the price elasticity of meat." *American Journal of Agricultural Economics* 92, no. 1 (2010): 258-272.

[117] Ibid, 1.

meat in the first place and the decision of how *much* meat to purchase occur separately and are differently susceptible to market forces.[118] For example, in the case of red meat, a household may have a consistent grocery routine in which they go out and purchase all of their food items the same day every week, generally buying about the same list of products every time. If prices of a certain item increase, they are unlikely to stop buying it entirely, but they may be likely to buy it in lesser amounts. The decision to change to an entirely different item is one that would presumably take much more pressure.

One significant result of the meta-analysis involved elasticity of different types of meats. It is relatively common for analyses to be done somewhat broadly, often of meat as a whole or even of food in general. However, when split among different sub-categories, the author found that poultry was uniquely inelastic compared to alternatives like beef, lamb, and fish.[119] Additionally, as one would expect, elasticity varied significantly by geographical region. Particularly relevant for this discussion was North America, which was more inelastic than every single other region except for "Other Africa," referring to every part of Africa that wasn't considered "South Africa" in the analysis.[120] In particular, the finding that the West and East Europe regions were considered elastic in their meat demand *specifically when compared to North America* was significant in interpreting the results of other studies, given a noteworthy portion of the research backing the policy recommendations pulled data from various European countries. It's possible that research in these specific regions of Europe could portray economic interventions on meat consumption to be more effective in reducing demand than in the United States. This analysis' findings do provide support to policies that distinguish between different

[118] Ibid, 4.
[119] Ibid, 11.
[120] Ibid, 12.

types of meat in their targets, as the effect of equivalent price modifications on demand for different meat products are expected to be significantly different.

A primary difficulty in interpreting much of the research in the field stems from issues with self-reporting. One might intuitively assume that respondents to studies asking them to self-report their environmentally positive or negative behavior are likely to stretch the truth a bit to make themselves seem more environmentally concerned than they actually are, as can be found in other research that relies primarily on self-reported data. Fortunately, this does not appear to be a primary concern for environmental studies. An analysis was conducted on university students with the specific intent of identifying potentially social desirability influence in environmental studies, and the results implied a significant but fairly weak link between concern for social desirability and particular responses to surveys on environmental beliefs, as well as no link at all between social desirability concern and self-reported environmental actions.[121] This is encouraging, but the study does have limitations. As mentioned, the participants were undergraduate university students, who may be substantially different from the general population in several aspects that may be relevant, and the study only included eight environmentally positive actions on its environmental behavior scale, which may be an overly narrow focus. The specific survey items used are described in a previous paper, including actions like “recycled cans or bottles” and “conserved gasoline by walking or bicycling.” Notably, the only direct measure of consumer choice included in the survey was “purchased products in reusable or recyclable containers,” which may not necessarily reflect tendencies towards reporting on specific food item consumption.[122] However, this is a fairly minor weakness in the

[121] Milfont, Taciano L. "The effects of social desirability on self-reported environmental attitudes and ecological behaviour." *The Environmentalist* 29 (2009): 263-269.
[122] Milfont, Taciano L., and John Duckitt. "The structure of environmental attitudes: A first-and second-order confirmatory factor analysis." *Journal of environmental psychology* 24, no. 3 (2004): 289-303.

study, and the majority of research examining meat consumption finds consistent trends across both self-reporting and actions in-practice.

Failure to reliably separate meats into different subcategories was a common issue in the existing body of research. There is always theoretically room for further specification, but given the massive gaps in emissions for certain food items over others, more work should be done to consistently separate the relatively broad categories currently used. In particular, one group that was almost never broken down further was "fish," which is an extremely broad category to be referred to so generally. One comprehensive literature review of roughly 370 existing studies (as of 2015) was extremely thorough in some regards, even taking the time to distinguish between root vegetables, field-grown vegetables, passive greenhouse vegetables, and heated greenhouse vegetables. However, "fish" remains an entire collective, unseparated category, with the only other seafood represented in the "prawn/shrimp" group. The categorization of shellfish is not made entirely clear, presumably becoming part of the broad "fish" category.[123] As the paper itself notes in the initial overview of the gathered data, emissions by weight for some species of fish can be over ten times as high as emissions for other species.[124] The issue is not–at least in this case–the result of a lack of specificity in the source data, so researchers should make an effort to better separate these groups. This is all without mentioning the further distinction between how fish are acquired, as well. Wild-caught fish are consistently far more heavy in their GHG emissions than farmed fish–although it's worth noting that farmed fish are not free of their own environmental downsides–but this is also rarely mentioned.[125] The divide is similar to the

[123] Clune, Stephen, Enda Crossin, and Karli Verghese. "Systematic review of greenhouse gas emissions for different fresh food categories." *Journal of Cleaner Production* 140 (2017): 766-783.
[124] Ibid, 15.
[125] Sonesson, Ulf, Jennifer Davis, and Friederike Ziegler. "Food production and emissions of greenhouse gases: an overview of the climate impact of different product groups." (2010).

distinction made between cattle raised in different types of farms, which is somewhat better-established, but still not mentioned as often as it should be.

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