Plant-Based Diets for Succulence and Sustainability

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Routledge
Taylor & Francis Group
LONDON AND NEW YORK

earthscan
from Routledge

First published 2020
by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

and by Routledge
52 Vanderbilt Avenue, New York, NY 10017

Routledge is an imprint of the Taylor & Francis Group, an informa business

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data
A catalog record for this book has been requested

ISBN: 978-1-138-38540-5 (hbk)
ISBN: 978-0-429-42713-8 (ebk)

Typeset in Sabon
by Apex CoVantage LLC

This collective effort is dedicated to the renewable energies of sunlight, wind, water, love, and values. To live well on this planet, we are indebted to the life forms that nourish us sustainably and succulently, and we are grateful.

3 The solution on our plates

Why sustainable plant-based diets are needed to reverse the food-climate-health-equity crisis

David A. Cleveland

Introduction

What do we want from our food system? I assume that most of us want food that is delicious and nutritious, environment and climate friendly, and in ethical and just ways supports our human and non-human communities. The food system that both drives our diets and is driven by them jeopardizes all of these goals by creating a food-climate-health-equity crisis (Figure 3.1). That means that what we choose to eat is not just a personal decision – it's an existential choice for our species and the earth.

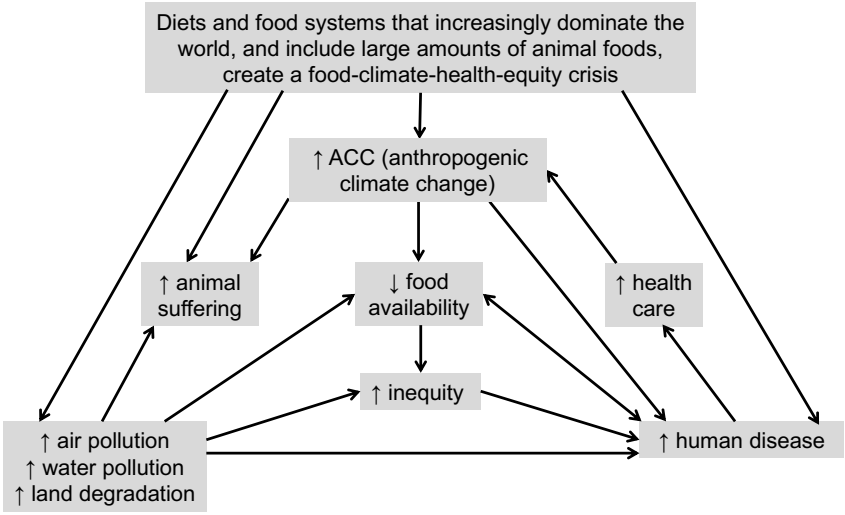

Figure 3.1 Our diets are driving the food-climate-health-equity crisis

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In 2019, the world's food system strives to feed 7.7 billion people daily, but has large and unsustainable negative effects, including deteriorating human health, soaring health-care costs, increasing inequity, animal suffering, ecological destruction, and anthropogenic climate change (ACC). Yet the broad impacts of the food system remain noticeably absent from the policies

of most governments or the mind-sets of non-governmental organizations (NGOs) and corporations, and from the daily food choices of most people. Is diet change needed to avert catastrophe?

In this chapter, I answer questions about the relationship of our diets, especially in the global North, to the food-climate-health-equity crisis and evaluate the potential of sustainable – in terms of environmental (focusing on climate, health, and social indicators) – plant-based diets (SPBDs) as a necessary part of the solution to the crisis. I also give examples in the third section of potential and existing efforts to move towards SPBDs.

Are more plant-based diets needed to solve the food-climate-health-equity crisis?

Since the Neolithic revolution that marked the transition from foraging to agriculture beginning about 12,000 years ago, the human response to increasing demand for food and other resources from a growing population with increasing consumption rates has been to increase production – a *supply-side solution* which has had increasing negative environmental and social impacts, including ACC, human sickness and death, and inequity (Cleveland, 2014).

This Neolithic supply-side strategy has led to prioritizing production over human and environmental health, with impacts close to or already exceeding the limits of sustainable social systems and the planetary boundaries for many biophysical systems, including the climate (Steffen et al., 2018). The human impacts on the planet are so large that a new epoch, the Anthropocene, has been suggested, and the term is now in wide use (Ruddiman, Ellis, Kaplan, & Fuller, 2015). Our food system is the largest contributor (Willett et al., 2019).

The Neolithic supply-side strategy is no longer viable in the Anthropocene. Therefore, we need *demand-side solutions* that reduce demand on social and biophysical systems; don't require extensive research, technology development, or resources; and can make a major difference over the short term. It is important to understand whether changing to SPBDs is one of many mitigation strategies to choose from, or whether it is *required* to successfully reverse the food-climate-health-equity crisis.

SPBDs are needed to avert climate catastrophe

One of the largest and most threatening impacts on the earth is the human impact on the climate, mostly via greenhouse gas emissions (GHGE). There is virtually complete consensus amongst scientists that humans have caused an increase in GHGE, leading to an accumulation of greenhouse gases in the atmosphere, the main cause of increasing average global temperatures and increasing weather extremes. The 2015 Paris Agreement was created to keep "the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to

1.5°C above pre-industrial levels" (UNFCCC, 2015) in order to avoid catastrophic effects on the earth's ecosystems and human society. The current average global temperature is 1.0ºC over pre-industrial levels. To limit warming to 1.5°C will require a reduction in GHGE far beyond the national commitments in the Paris Agreement and system changes at a scale that have no "documented historic precedent" and will still bring large negative impacts, although less than with 2ºC (IPCC, 2018, p. 17). If we don't stabilize and reduce GHGE to slow and reverse these trends, they will lead to environmental and social catastrophe. While I focus on the effect of the food system on the climate, climate change is also making it more difficult to produce food (FAO, 2016).

Food system GHGE probably began ~7,000 years ago as a result of land clearing and animal domestication (Ruddiman et al., 2015). Our global food system contributes a large share of current GHGE. While estimates vary due to the use of different system boundaries, as well as other assumptions, it likely accounts for at least 25%–30% of total anthropogenic emissions. Vermeulen, Campbell, and Ingram's (2012) commonly cited estimate is that global food systems contribute 19%–29% of total GHGE (p. 198).

Animal foods currently account for most food system GHGE, with livestock alone comprising 14.5% of all anthropogenic emissions (Gerber et al., 2013). An analysis of 120 life-cycle assessment publications found that plant foods (e.g. grains, soy and other legumes, refined sugars, oils, and fruits and vegetables) had relatively low to very low GHGE per kcal, per gram of protein, and per serving, compared with animal foods (meat, fish, and dairy), especially ruminant meat, which, for example, has emissions per gram of protein about 250 times those of legumes (Tilman & Clark, 2014). As a consequence, animal foods have a disproportionately large effect on food waste emissions: for example, in the USA, animal foods account for 33% of food wasted at the retail and consumer levels, yet this waste produces 74% of the GHGE of all food wasted at these levels (Heller & Keoleian, 2015).

Animal food production emits a large proportion of anthropogenic methane and nitrous oxide, greenhouse gases that have a 100-year global warming potential, respectively, of 34 and 298 times that of CO_2 (Myhre et al., 2013, p. 714). In the USA in 2016, agriculture accounted for 80% of nitrous oxide emissions, mostly from soil, and 30% of methane emissions, 94% of which is from enteric fermentation of ruminants and manure management (calculated using data in EPA, 2018). Because methane has a short life span in the atmosphere, with a 20-year global warming potential of 86, reducing the rate of methane emissions is especially important for achieving climate change mitigation over the shorter term (Balcombe, Speirs, Brandon, & Hawkes, 2018; Godfray et al., 2018).

Our food system also emits CO_2 from the use of fossil fuels to produce and transport inputs, such as fertilizer and irrigation water, to power farm machinery and to produce, transport, process, store, and prepare food. In 2007,

the food system accounted for 13.6% of all fossil fuel CO_2 emissions in the USA economy (Canning, Rehkamp, Waters, & Etemadnia, 2017).

Because animal foods have higher GHGE than plant foods, diets containing them are also higher in GHGE. In the UK, for example, the self-reported diets of 65,000 people showed that a high meat eater had 1.9 times and a medium meat eater 1.5 times the GHGE of a lacto-ovo-vegetarian, and that an average meat eater had about 2 times and a high meat eater 2.5 times the GHGE of a vegan eater (Scarborough et al., 2014).

While changing the food system is absent from many climate change mitigation strategies, a growing body of research supports food system change, including diet change, as an effective strategy. Diet change, emphasizing reducing animal product consumption, is also beginning to be promoted as a policy, mostly by NGOs such as Friends of the Earth, Center for Biological Diversity, and the Natural Resources Defense Council.

Increasingly the scientific community supports the evidence that more SPBDs are needed to avert a climate crisis and that there is a positive correlation between health benefits and lower GHGE for many foods and diets (Cleveland & Gee, 2017; Hallström, Carlsson-Kanyama, & Börjesson, 2015; Swinburn et al., 2019; Willett et al., 2019). One of the earliest analyses of the role of healthier diets in meeting climate mitigation targets found that for the UK, agricultural technology improvements and a 30% reduction in livestock production would be needed to meet the 2050 target of 80% reduction in the level of 1990 emission (Friel et al., 2009). Less meat consumption would lower dietary saturated fat and cholesterol, resulting in a 15% reduction in the burden of coronary artery disease (Friel et al., 2009). A global plant-based diet could, by 2050, prevent about 11,600,000 deaths per year, 23.6% of total deaths amongst adults, and reduce GHGE by 80% (Willett et al., 2019, pp. 15, 26).

Bajželj et al. (2014) found similar results using different methods, a model relating global land use and agricultural biomass flow. They compared the annual GHGE of different scenarios in relation to the estimated GHGE threshold for 2050 required to stay under a 2ºC increase in average global temperature (Bajželj et al., 2014). They found that if no changes are made in the food system, its GHGE alone would almost reach this threshold, meaning that all sources of GHGE other than food would have to reduce emissions to almost zero to stay under 2ºC (Figure 3.2, A). Even the scenario that improved yield by increasing irrigation and fertilizer application efficiency, plus a 50% reduction in food waste, reached half of the GHGE threshold by 2050 (Figure 3.2, B). Only by adding diets with reduced meat and dairy was food system GHGE lowered to one-quarter of the threshold – the level required for a pro rata reduction in GHGE to stay below a 2ºC increase over pre-industrial temperature (Figure 3.2, C).

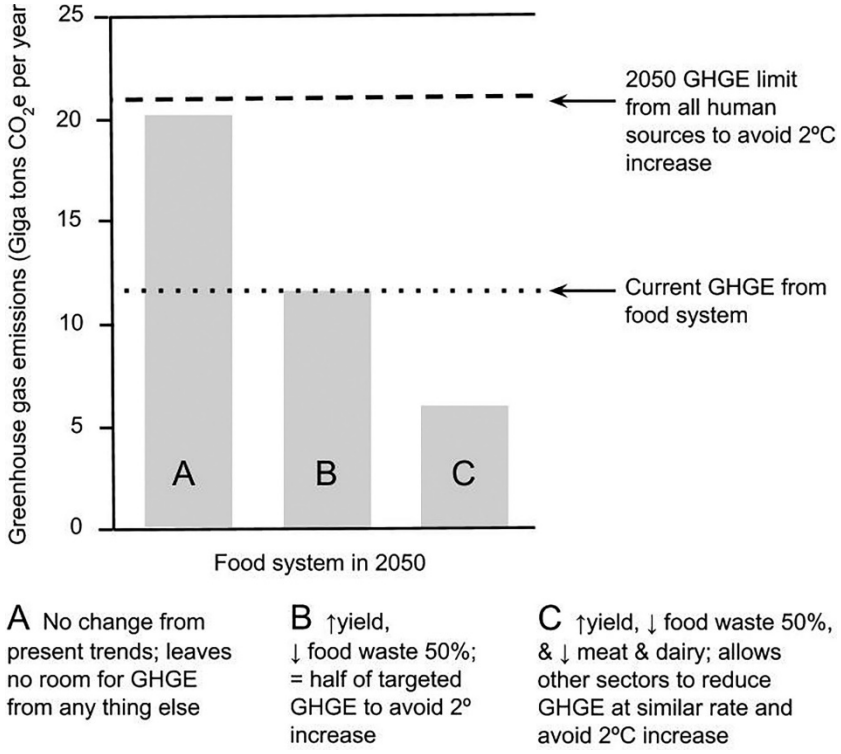

Figure 3.2 Moving to more sustainable plant-based diets is needed to avert climate catastrophe. Based on (Bajželj et al., 2014)

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SPBDs are needed to reverse the pandemic of deadly non-communicable diseases

Our diets have become increasingly unhealthy due to rising consumption of meat and dairy, saturated fats, sugar-sweetened beverages, refined grains, and processed and prepared foods, as well as decreasing consumption of healthier foods, such as fruits, vegetables, whole grains, and legumes (Willett et al., 2019).

The spread of unhealthy diets in the industrial countries of the global North, and then to the global South, is part of a major human nutrition transition (Popkin, 2006). Along with other factors, such as lack of physical activity, these diets are an important driver of a pandemic of non-communicable diseases (NCDs) – including cancers, type 2 diabetes, and cardiovascular disease (Popkin, 2006). Even though life expectancies are increasing in industrialized societies as age-specific mortality for NCDs declines, the years

lived with debilitating disease are increasing, such as in Denmark (Andersson & Vasan, 2017).

Many animal foods increase the risk of NCDs like type 2 diabetes, cancer, and cardiovascular disease (Bouvard et al., 2015; Micha et al., 2017; Schwingshackl et al., 2017; Talaei, Wang, Yuan, Pan, & Koh, 2017), and almost all the nutrients provided by animal foods can be found in healthy plant foods (USDA & HHS, 2015a). While consumption of unhealthy plant foods like refined grains and added sugars increase the risk for NCDs, healthy plant foods, such as fruits and vegetables, decrease the risk of cardiovascular disease, cancer (Aune et al., 2017), and type 2 diabetes (Toumpanakis, Turnbull, & Alba-Barba, 2018). Many, though not all, components of unhealthy diets are also foods with significantly larger GHGE relative to healthier foods. Because of this, SPBD offer opportunities for health and climate co-benefits, as discussed in the previous section.

However, more plant-based diets don't always optimize climate and health co-benefits. For example, one study of 100 dietary patterns found that reduced GHGE from diets were associated with poorer health indicators, because some low GHGE diets, which are low in animal foods, saturated fat, and salt, are often also low in essential micronutrients and high in sugar, which has large negative health effects but relatively small GHGE (Payne, Scarborough, & Cobiac, 2016).

In addition to food system GHGE from unhealthy animal foods, there are GHGE from the health-care costs for diet-related NCDs. It has been estimated that the global health-care costs for NCDs could reach $47 trillion by 2030 (Bloom et al., 2011), and that in the USA, all NCDs will cost $265,000 per person from 2015–2050, a total of $95 trillion (Chen, Kuhn, Prettner, & Bloom, 2018). For example, type 2 diabetes is a major cause of renal failure, leading to the need for dialysis according to the US National Institutes of Health, making diabetes a very greenhouse gas intensive disease – in the USA about 9.7% of adults had diabetes in 2017, with annual per capita health-care expenditures 2.3 times higher than people without diabetes, costing an estimated $327 billion that year (ADA, 2018).

To estimate the climate and health co-benefits of more SPBDs, Hallström and colleagues created counterfactual healthy alternative diets (HADs) based on dietary recommendations and the foods with very strong evidence of their effect on NCDs (Hallström, Gee, Scarborough, & Cleveland, 2017) (Figure 3.3). We found that for the healthiest diet (HAD-3) which eliminated all red and processed meat, the relative risk of coronary heart disease, type 2 diabetes, and colorectal cancer decreased 29%–45%, and health-care costs reduced by $93 billion out of a total cost of $230 billion for those three diseases, which in turn reduced GHGE by 84 kg per person per year. The decreases in GHGE from both food and health-care systems with HAD-3 were equal to 23% of the USA Climate Action Plan (Executive Office of the President, 2013) goal of a 17% reduction below USA 2005 net emission levels by 2020.

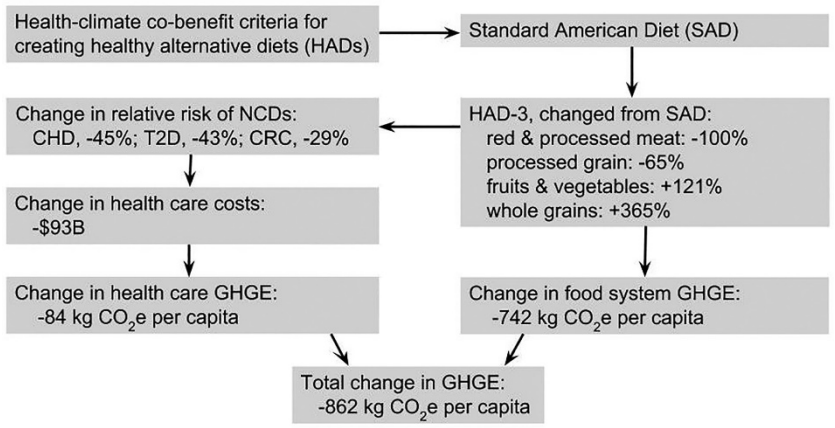

Figure 3.3 Healthier, more plant-based diets can reduce health-care costs and their greenhouse gas emissions. Based on (Hallström et al., 2017)

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While reduction in health-care GHGE was only 10% of the total reduction in GHGE due to dietary change (the other 90% was from the food system), it underestimates the potential for healthy diets to reduce GHGE from the health-care system. This is because we didn't include many diseases (e.g. hypertension, stroke, and forms of cancer other than colorectal cancer) associated with the foods changed in the diets and many potential diet-disease links for foods not changed in the HADs (e.g. added sugar and dairy) that are associated with NCDs due to a lack of quality data. As these data become available, estimates of GHGE from the care of food-related NCDs will increase.

SPBDs are needed to reduce inequality and suffering

The recent *Lancet* report on the global syndemic of obesity, undernutrition, and ACC states the need to recognize that the world system currently incentivizes business to drive this syndemic and prevents policies to counter business as usual – a classic case of market failure where profits are privatized and costs externalized onto society, with the poorest suffering the most (Swinburn et al., 2019, p. 32). Food companies are often aided by governments: for example, in the USA, low-income and minority groups eat the most government-subsidized, obesogenic commodities and have the highest risk for associated NCDs (Siegel et al., 2016) (Figure 3.4).

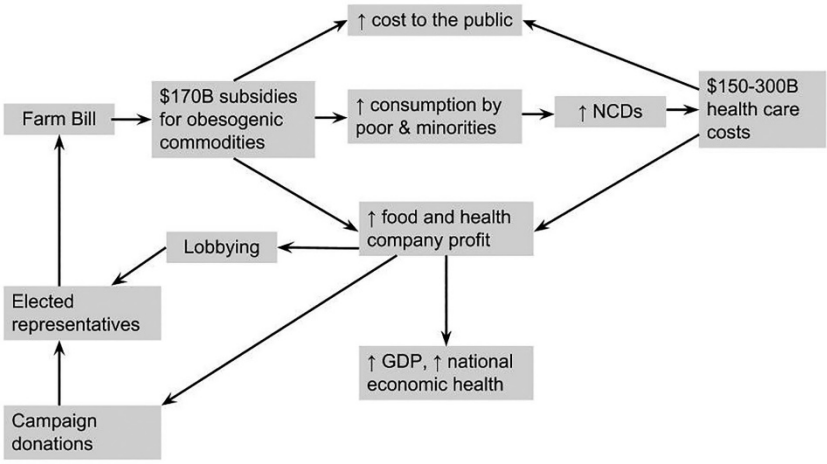

Figure 3.4 The links amongst USA government agricultural subsidies, private profits, disease, and inequality. Based in part on (Siegel et al. 2016)

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Vulnerable minority and low-income communities are targeted with advertising for junk food by corporations. For example, in the USA, advertising nutritionally poor products (e.g. fast food, candy, sugary drinks, and snacks) is almost exclusively targeted to black and Hispanic youth (Harris, Frazier, Kumanyika, & Ramirez, 2019), a contributing cause of significantly higher rates of obesity – black (22%), Hispanic (26%) – compared with whites (14%) (Hales, Carroll, Fryar, & Ogden, 2017). In the USA, lower food security is strongly related to the risk of diet-related and other NCDs (Gregory & Coleman-Jensen, 2017).

Because resources are increasingly limited in the Anthropocene, reduced consumption by over-consumers is needed to make food resources available to under-consumers. If food over-consuming and GHGE over-producing populations like those of the USA reduced their food consumption, it could free up resources for under-consuming populations with very low GHGE, like that of Haiti, whose overall well-being would also increase (Figure 3.5). Because animal foods produce the majority of food GHGE and much of the food-related NCDs, this shift would mean a global move towards more SPBDs (e.g. Willett et al., 2019). Importantly, the well-being of over-consuming populations would not have to decrease, as shown by the example of Costa Rica, which, compared with the USA, has almost eight times lower GHGE per capita, over five times lower GDP per capita, 23% less food energy, and 42% less ruminant meat available per capita, yet slightly higher self-reported happiness (explained by income, healthy life expectancy, social support, freedom, trust, and generosity). This pattern follows the well-known economic principle that each equal increase in consumption provides less

value to consumers whose consumption is already relatively high than to ones that are relatively low.

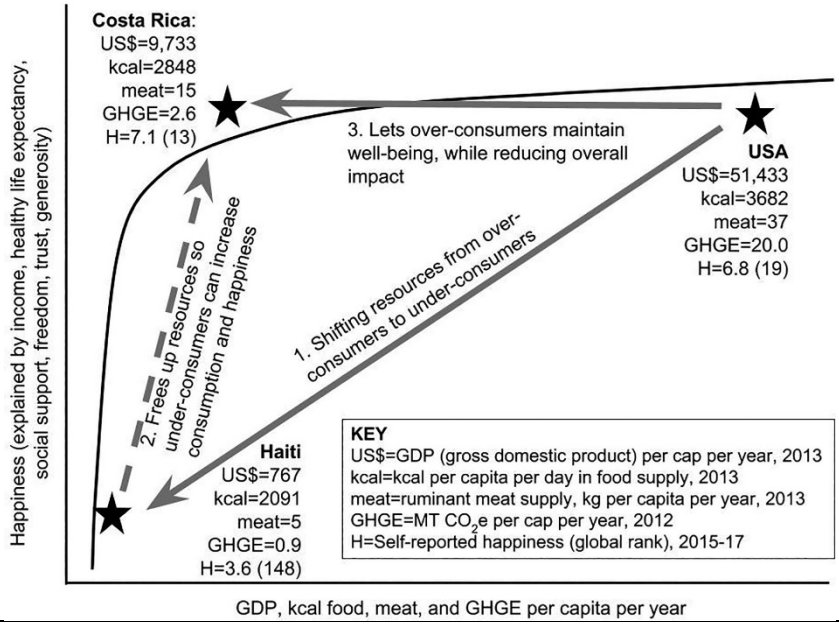

Figure 3.5 More plant-based diets can increase global equity

Sources: GDP: (World Bank, 2019); kcal and meat: (FAOSTAT, 2018); GHGE: (EDGAR, 2016); HI: (Helliwell et al., 2018: Statistical Appendix 1 for Chapter 2, pp. 28–30). © 2019 David A. Cleveland, used with permission.

How could diet change actually happen?

At the macro-level, the food system determines the biophysical, economic, and sociocultural parameters within which people make food and diet choices, and at the individual level, these choices are also influenced by people's unique environments and personal characteristics (cf. Garnett, Mathewson, Angelides, & Borthwick, 2015, pp. 18–19) (Figure 3.6).

The major obstacle to increasing SPBDs at the macro-level is the economic and political power of the food industry, which controls so much of our food and diet choice contexts in part through its corrupting influence on governments, civil organizations, and university researchers (Nestle, 2018; Swinburn et al., 2019, p. 32). Many government bodies and NGOs believe they need to rely on public-private partnerships to implement nutrition programmes, with for-profit businesses even seen as leaders (Koh, Singer, & Edmondson, 2019), which can lead to subversion of the public-serving mission of the public-sector bodies (Marks, 2017; Nestle, 2018).

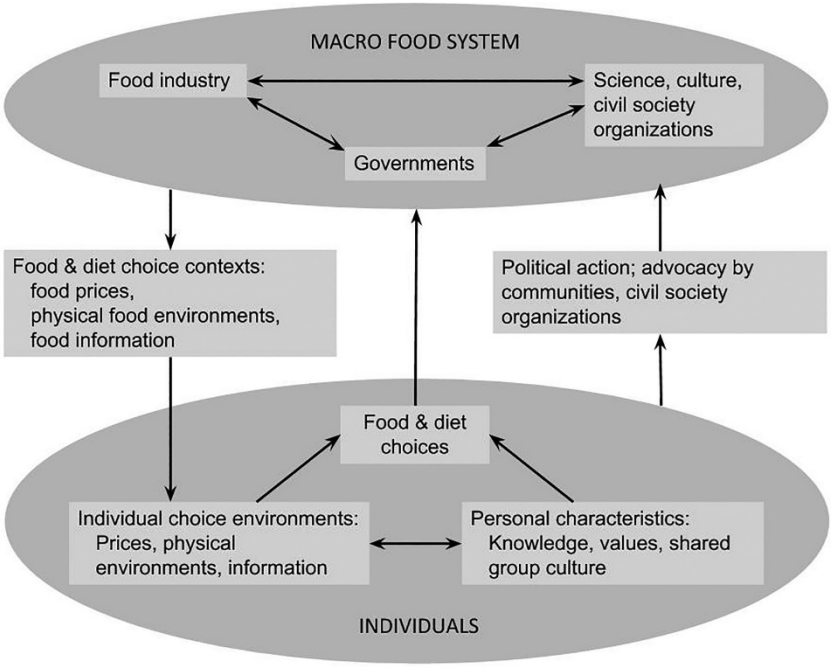

Figure 3.6 Some important variables and processes determining food and diet choice

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At the individual level, a major challenge is people's reluctance to change their diets, which is compounded by the food industry's creation of physical food environments dominated by inexpensive, unhealthy, addictive foods, and its aggressive advertising that dominates food information.

In the following sections, I give some examples of how changes in individual choice environments and personal characteristics, influenced by changes in the macro food system, could move us towards SPBDs.

Prices

Internalizing negative externalities to the food industry (for example, by taxing animal foods and junk foods based on their GHGE or negative health effects) and subsidizing low GHGE, healthy plant foods are ways to move towards SPBDs, since as we have seen, animal foods have negative health effects and the highest GHGE.

Taxes on soda and other sugar-sweetened beverages (SSBs) based on their negative health effects show the potential for taxing animal foods. SSB taxes have been instituted in a number of sites globally and approved by voters in several USA cities, despite strong opposition from the SSB industry, and they have had generally promising results (Redondo, Hernández-Aguado, &

Lumbreras, 2018). The first USA SSB tax, implemented in 2015 in Berkeley, California, was followed by an average 52% decrease in SSB consumption and a 29% increase in water consumption in 2015–2017 (Lee et al., 2019). While most life-cycle assessments show sugar having low GHGE, added sugar in the diet is a major cause of obesity, diabetes, and associated health care, as described earlier, which means that sugar makes contributions to GHGE through the health-care system.

A model of the effects in 2020 of taxes on all unhealthy food commodities globally, including using tax revenues to increase the availability of fruits and vegetables, reduced GHGE by 8.6% – two-thirds due to reduced beef consumption and one-quarter due to reduced milk consumption (Springmann et al., 2017). A tax on saturated fat from October 2011 to January 2013 in Denmark resulted in a 4.0% reduction in saturated fat intake, as well as a decrease in salt and increase in vegetable consumption for most people (Smed, Scarborough, Rayner, & Jensen, 2016). Since most saturated fat in the diet is in animal foods, this tax would also decrease GHGE.

Physical environments

Food environments are often dominated by unhealthy animal and other foods but can be managed to increase the availability of plant-based food and decrease the availability of animal foods. Many K–12 schools are implementing policies for healthier, more plant-based, less GHGE intensive meals. For example, the Oakland Unified School District reduced total meat in its school food by almost 30%, resulting in a 14% reduction in GHGE, in spite of a slight increase in beef (Hamerschlag & Kraus-Polk, 2017). In 2019, the California Climate-Friendly Food Program bill was introduced in the state legislation to encourage public schools to provide plant-based food and milk options to pupils to "support California's climate change mitigation goals, and to promote the consumption of healthy food" (California Government, 2019). 2019 July: passed out of nutrition committee, next to senate.

Changed food environments resulting in rapid changes in health are also not rare. The North Karelia Project in Finland is a well-known example of a shift towards a more plant-based food environment with dramatic health results (Puska & Stahl, 2010). In response to a very high incidence of cardiovascular mortality in a dairy farm region, the Finish government instituted a campaign to change diets in 1972, including reducing or eliminating subsidies for dairy foods, encouraging dairy farmers to switch to cultivating wild berries, and developing alternative sources of oil from plants. Despite strong opposition from the national dairy industry, dramatic changes in diet resulted and were associated with equally dramatic improvements in health, including an 85% reduction in heart disease mortality by 2005.

Information and knowledge

Research has shown that providing missing information is often not sufficient to change behaviour but can do so if it resonates with or changes values. An experiment with US consumers demonstrated their lack of knowledge of the GHGE of foods, which they most underestimated for animal foods (Camilleri, Larrick, Hossain, & Patino-Echeverri, 2019). When they were provided labels with information on the GHGE of canned vegetable and beef soup, they chose the vegetable soup that had lower emissions more often. An experiment comparing the effects of two, two-quarter freshman year courses on university student food choice found that information about the climate effects of animal foods led to decreased consumption (Jay et al., 2019). Students in a course on the environmental impact of the food system had similar diets as students in a course on cosmology and evolution at the beginning of the courses, but at the end, food systems students reported diets 309 kg CO2e per person per year lower (a 17% reduction), mostly due to lower beef consumption, which declined from 3.5 to 2.5 servings per week).

Dietary guidelines issued by governments are an important source of information for consumers and in guiding policy, and there is increasing movement towards including climate and other environmental impacts of the food system as criteria in creating dietary guidelines, although there is pushback from the food industry (Gonzalez Fischer & Garnett, 2016). In the USA, the Dietary Guidelines Advisory Committee recommended basing dietary recommendations on environmental impact as well as health (USDA & HHS, 2015b) in the new edition of the Dietary Guidelines for Americans (USDA & HHS, 2015a), but this was rejected by the government, most likely because of pressure from the food industry, especially the meat industry (Gonzalez Fischer & Garnett, 2016, pp. 37–38).

Values

Psychological experiments support the hypothesis that tapping into peoples' sense of fairness and worth can motivate diet change. Experiments with adolescents used an exposé treatment for one group that presented data on food company manipulation of their food choices, while a comparison group received only information on the negative health effects of their food choices. The exposé group saw healthy eating as aligned with the values of autonomy and social justice, and significantly increased their healthy food choices, compared with the control group members, who did not change their food choices (Bryan et al., 2016).

Documentary filmmaker Richard Ray Perez tells a story from his childhood in 1960s California. Young Perez asked his head start teacher why the teacher was not eating the grapes in his lunch (Aguilar, 2014). The teacher told Perez it was because of the United Farm Worker boycott to demand improvement in the unjust working conditions of farm workers. All of a sudden, the grapes,

which had only been a source of personal pleasure, activated Perez's value of social justice – he stopped eating his grapes.

Conclusion

There is a food-climate-health-equity crisis that threatens the future of humanity and many other organisms that live on Earth. Our diets, and the food systems they are both driven by and support, are key causes of this crisis. Fortunately, many foods have both positive health and climate environment impacts, and can promote social equity by reducing the overall demand for food and resources. These foods are mostly plant based, and by replacing animal foods, they can reduce the suffering of domestic animals (through reduced demand) as well as wild animals (due to lower demands for land). *The information in this chapter supports the conclusion that change to more SPBDs is a key demand-side solution and is required as part of any strategy to reverse the food-climate-health-equity crisis* (Figure 3.7). We can all choose more SPBDs and advocate for policies to move to more SPBDs, including countering the negative influence of the mainstream food industry.

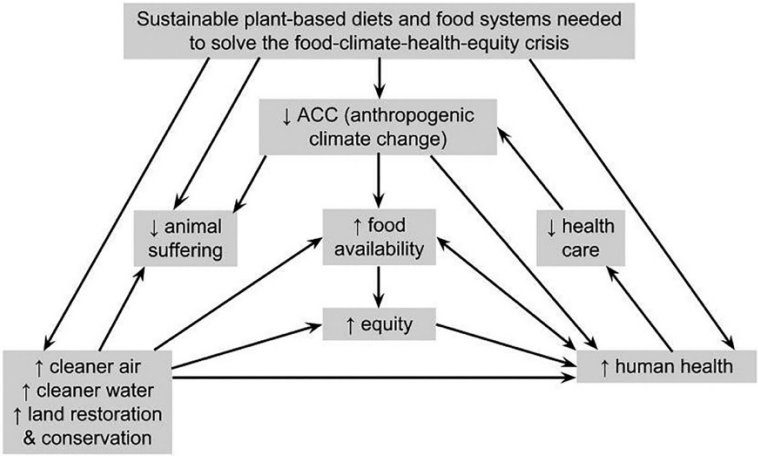

Figure 3.7 Sustainable plant-based diets are needed to avert the food-climate-health-equity crisis

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One key is changing values. Will the new empirical realities of the food-climate-health-equity crisis in the Anthropocene activate values that can drive diet change, for example, by expanding the ways in which food can give us pleasure? Like Perez's epiphany about the grapes in his lunch, we need to empathize with all of the processes that bring food to our plates and make our personal choices and social advocacy responsive to our goals for food that

promotes a habitable climate and environment, healthy people, social justice, and animal welfare, as well as being delicious.

Acknowledgements

I thank Daniela Soleri, Kathleen May Kevany, and one anonymous reviewer for valuable comments on drafts, as well as the students and Teaching Assistants in my Diet and Global Climate Change course at UCSB for many enlightening discussions, including challenging my assumptions.

Competing interests

I have no competing interests.

References

ADA. (2018). Economic costs of diabetes in the U.S. in 2017. *Diabetes Care*, *41*, 917–928. doi:10.2337/dci18-0007

Aguilar, C. (2014, April 24). *Dir. Richard Ray Perez on "Cesar's Last Fast" Part 2: An imperfect man capable of great things*. Retrieved from www.indiewire.com/2014/04/dir-richard-ray-perez-on-cesars-last-fast-part-2-an-imperfect-man-capable-of-great-things-168721/

Andersson, C., & Vasan, R. S. (2017). Epidemiology of cardiovascular disease in young individuals. *Nature Reviews Cardiology* [Advance online publication]. doi:10.1038/nrcardio.2017.154

Aune, D., Giovannucci, E., Boffetta, P., Fadnes, L. T., Keum, N., Norat, T., . . . Tonstad, S. (2017). Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality – A systematic review and dose-response meta-analysis of prospective studies. *International Journal of Epidemiology*, *46*(3), 1029–1056. doi:10.1093/ije/dyw319

Bajželj, B., Richards, K. S., Allwood, J. M., Smith, P., Dennis, J. S., Curmi, E., . . . Gilligan, C. A. (2014). Importance of food-demand management for climate mitigation. *Nature Climate Change*, *4*, 924–929. doi:10.1038/nclimate2353

Balcombe, P., Speirs, J. F., Brandon, N. P., & Hawkes, A. D. (2018). Methane emissions: Choosing the right climate metric and time horizon. *Environmental Science: Processes & Impacts*, *20*(10), 1323–1339. doi:10.1039/C8EM00414E

Bloom, D. E., Cafiero, E. T., Jané-Llopis, E., Abrahams-Gessel, S., Bloom, L. R., Fathima, S., . . . Weinstein, C. (2011). *The global economic burden of non-communicable diseases*. Retrieved from http://apps.who.int/medicinedocs/en/m/abstract/Js18806en/

Bouvard, V., Loomis, D., Guyton, K. Z., Grosse, Y., Ghissassi, F. E., Benbrahim-Tallaa, L., . . . Straif, K. (2015). Carcinogenicity of consumption of red and processed meat. *The Lancet Oncology*, *16*(16), 1599–1600. http://dx.doi.org/10.1016/S1470-2045(15)00444-1

Bryan, C. J., Yeager, D. S., Hinojosa, C. P., Chabot, A., Bergen, H., Kawamura, M., . . . Steubing, F. (2016). Harnessing adolescent values to motivate healthier eating. *Proceedings of the National Academy of Sciences*, *113*(39), 10830–10835. doi:10.1073/pnas.1604586113

California Government. (2019, February 12). *AB-479. School meals: Plant-based food and milk options: California climate-friendly food program*. Retrieved from www.leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201920200AB479

Camilleri, A. R., Larrick, R. P., Hossain, S., & Patino-Echeverri, D. (2019). Consumers underestimate the emissions associated with food but are aided by labels. *Nature Climate Change*, *9*(1), 53–58. doi:10.1038/s41558-018-0354-z

Canning, P., Rehkamp, S., Waters, A., & Etemadnia, H. (2017). *The role of fossil fuels in the U.S. food system and the American diet, ERR-224*. Retrieved from www.ers.usda.gov/publications/pub-details/?pubid=82193

Chen, S., Kuhn, M., Prettner, K., & Bloom, D. E. (2018). The macroeconomic burden of noncommunicable diseases in the United States: Estimates and projections. *PLoS One*, *13*(11), e0206702. doi:10.1371/journal.pone.0206702

Cleveland, D. A. (2014). *Balancing on a planet: The future of food and agriculture*. Berkeley, CA: University of California Press.

Cleveland, D. A., & Gee, Q. (2017). Plant based diets for mitigating climate change. In F. Mariotti (Ed.), *Vegetarian and plant-based diets in health and disease prevention* (pp. 135–156). Waltham, MA: Academic Press/Elsevier.

EDGAR. (2016). GHG time series 1990-2012 per capita emissions for world countries. Retrieved from http://edgar.jrc.ec.europa.eu/overview.php?v=GHGts_pc1990-2012

EPA. (2018). *Inventory of U.S. greenhouse gas emissions and sinks: 1990–2016*. Retrieved from www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2016

Executive Office of the President. (2013). *The President's climate action plan*. Washington, DC: The White House.

FAO. (2016). *The state of food and agriculture 2016 (SOFA): Climate change, agriculture and food security*. Rome, Italy: FAO. Retrieved from www.fao.org/publications/card/en/c/18679629-67bd-4030-818c-35b206d03f34/

FAOSTAT. (2018). Food and agriculture data. Retrieved from http://www.fao.org/faostat/en/#home

Friel, S., Dangour, A. D., Garnett, T., Lock, K., Chalabi, Z., Roberts, I., . . . Haines, A. (2009). Public health benefits of strategies to reduce greenhouse-gas emissions: Food and agriculture. *The Lancet*, *374*(9706), 2016–2025. Retrieved from http://linkinghub.elsevier.com/retrieve/pii/S0140673609617530

Garnett, T., Mathewson, S., Angelides, P., & Borthwick, F. (2015). *Policies and actions to shift eating patterns: What works?* Food Climate Research Network. Retrieved from www.fcrn.org.uk/fcrn-publications/reports/policies-and-actions-shift-eating-patterns-what-works

Gerber, P. J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., . . . Tempio, G. (2013). *Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities*. Retrieved from www.fao.org/ag/againfo/resources/en/publications/tackling_climate_change/index.htm

Godfray, H. C. J., Aveyard, P., Garnett, T., Hall, J. W., Key, T. J., Lorimer, J., . . . Jebb, S. A. (2018). Meat consumption, health, and the environment. *Science*, *361*(6399), eaam5324. doi:10.1126/science.aam5324

Gonzalez Fischer, C., & Garnett, T. (2016). *Plates, pyramids and planet – Developments in national healthy and sustainable dietary guidelines: A state of play*

assessment. Retrieved from www.fcrn.org.uk/fcrn-publications/reports/plates-pyramids-and-planet-%E2%80%93-developments-national-healthy-and-sustainable

Gregory, C., & Coleman-Jensen, A. (2017). *Food insecurity, chronic disease, and health among working-age adults* (Economic Research Report No. ERR-235). Retrieved from https://www.ers.usda.gov/webdocs/publications/84467/err-235.pdf?v=0

Hales, C., Carroll, M., Fryar, C., & Ogden, C. (2017). *Prevalence of obesity among adults and youth: United States, 2015–2016* (NCHS Data Brief, No. 288). Hyattsville, MD: National Center for Health Statistics. Retrieved from www.cdc.gov/nchs/data/databriefs/db288.pdf

Hallström, E., Carlsson-Kanyama, A., & Börjesson, P. (2015). Environmental impact of dietary change: A systematic review. *Journal of Cleaner Production*, *91*, 1–11.

Hallström, E., Gee, Q., Scarborough, P., & Cleveland, D. A. (2017). A healthier US diet could reduce greenhouse gas emissions from both the food and health care systems. *Climatic Change*, *142*(1–2), 199–212. doi:10.1007/s10584-017-1912-5

Hamerschlag, K., & Kraus-Polk, J. (2017). *Shrinking the carbon and water footprint of school food: A recipe for combating climate change. A pilot analysis of Oakland unified school district's food programs*. Retrieved from www.foe.org/projects/food-and-technology/good-food-healthy-planet/school-food-footprint

Harris, J. L., Frazier, W., Kumanyika, S., & Ramirez, A. G. (2019). *Increasing disparities in unhealthy food advertising targeted to Hispanic and Black youth*. Retrieved from http://uconnruddcenter.org/files/Pdfs/TargetedMarketingReport2019.pdf

Heller, M. C., & Keoleian, G. A. (2015). Greenhouse gas emission estimates of U.S. dietary choices and food loss. *Journal of Industrial Ecology*, *19*(3), 391–401. doi:10.1111/jiec.12174

Helliwell, J. F., Layard, R., & Sachs, J. D. (2018). World Happiness Report 2018. New York: Sustainable Development Solutions Network (SDSN).

IPCC. (2018). Summary for policymakers. In V. Masson-Delmotte, P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P. R. Shukla . . . T. Waterfield (Eds.), *Global warming of 1.5°C: An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* (Glossary). Geneva, Switzerland: World Meteorological Organization.

Jay, J. A., D'Auria, R., Nordby, C., Rice, D. A., Cleveland, D. A., Friscia, A., . . . Wesel, E. (2019). Reduction of the carbon footprint of college freshman diets after a food-based environmental science course. *Climatic Change*. doi:10.1007/s10584-019-02407-8

Koh, H. K., Singer, S. J., & Edmondson, A. C. (2019). Health as a way of doing business. *JAMA*, *321*(1), 33–34. doi:10.1001/jama.2018.18935

Lee, M. M., Falbe, J., Schillinger, D., Basu, S., McCulloch, C. E., & Madsen, K. A. (2019). Sugar-sweetened beverage consumption 3 years after the Berkeley, California, sugar-sweetened beverage tax. *American Journal of Public Health*, *109*(4), 637–639. doi:10.2105/ajph.2019.304971

Marks, J. H. (2017). Caveat partner: Sharing responsibility for health with the food industry. *American Journal of Public Health*, *107*, 360–361. doi:10.2105/AJPH.2016.303645

Micha, R., Shulkin, M. L., Peñalvo, J. L., Khatibzadeh, S., Singh, G. M., Rao, M., . . . Mozaffarian, D. (2017). Etiologic effects and optimal intakes of foods and nutrients for risk of cardiovascular diseases and diabetes: Systematic reviews and meta-analyses from the nutrition and chronic diseases expert group (NutriCoDE). *PLoS One*, *12*(4), e0175149. doi:10.1371/journal.pone.0175149

Myhre, G., Shindell, D., Bréon, F.-M., Collins, W., Fuglestvedt, J., Huang, J., . . . Zhang, H. (2013). Anthropogenic and natural radiative forcing. In T. F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung . . . A. Nauels (Eds.), *Climate change 2013: The physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 659–740). Cambridge, UK: Cambridge University Press.

Nestle, M. (2018). *Unsavory truth: How food companies skew the science of what we eat*. New York, NY: Basic Books.

Payne, C. L. R., Scarborough, P., & Cobiac, L. (2016). Do low-carbon-emission diets lead to higher nutritional quality and positive health outcomes? A systematic review of the literature. *Public Health Nutrition*, *19*(14), 2654–2661. doi:10.1017/S1368980016000495

Popkin, B. M. (2006). Global nutrition dynamics: The world is shifting rapidly toward a diet linked with noncommunicable diseases. *The American Journal of Clinical Nutrition*, *84*(2), 289–298. Retrieved from <Go to ISI>://000239674300004

Puska, P., & Stahl, T. (2010). Health in all policies – The Finnish initiative: Background, principles, and current issues. *Annual Review of Public Health*, *31*, 315–328. Palo Alto, CA: Annual Reviews.

Redondo, M., Hernández-Aguado, I., & Lumbreras, B. (2018). The impact of the tax on sweetened beverages: A systematic review. *The American Journal of Clinical Nutrition*, *108*(3), 548–563. doi:10.1093/ajcn/nqy135

Ruddiman, W. F., Ellis, E. C., Kaplan, J. O., & Fuller, D. Q. (2015). Defining the epoch we live in. *Science*, *348*(6230), 38–39. doi:10.1126/science.aaa7297

Scarborough, P., Appleby, P., Mizdrak, A., Briggs, A. M., Travis, R., Bradbury, K., . . . Key, T. (2014). Dietary greenhouse gas emissions of meat-eaters, fish-eaters, vegetarians and vegans in the UK. *Climatic Change*, *125*(2), 179–192. doi:10.1007/s10584-014-1169-1

Schwingshackl, L., Hoffmann, G., Lampousi, A.-M., Knüppel, S., Iqbal, K., Schwedhelm, C., . . . Boeing, H. (2017). Food groups and risk of type 2 diabetes mellitus: A systematic review and meta-analysis of prospective studies. *European Journal of Epidemiology*, *32*(5), 363–375. doi:10.1007/s10654-017-0246-y

Siegel, K. R., McKeever Bullard, K., Imperatore, G., Kahn, H. S., Stein, A. D., Ali, M. K., . . . Narayan, K. M. (2016). Association of higher consumption of foods derived from subsidized commodities with adverse cardiometabolic risk among us adults. *JAMA Internal Medicine*, *176*(8), 1124–1132. doi:10.1001/jamainternmed.2016.2410

Smed, S., Scarborough, P., Rayner, M., & Jensen, J. D. (2016). The effects of the Danish saturated fat tax on food and nutrient intake and modelled health outcomes: An econometric and comparative risk assessment evaluation. *European Journal of Clinical Nutrition*, *70*(6), 681–686. doi:10.1038/ejcn.2016.6

Springmann, M., Mason-D'Croz, D., Robinson, S., Wiebe, K., Godfray, H. C. J., Rayner, M., . . . Scarborough, P. (2017). Mitigation potential and global health impacts from emissions pricing of food commodities. *Nature Climate Change*, *7*, 69–74.

Steffen, W., Rockström, J., Richardson, K., Lenton, T. M., Folke, C., Liverman, D., . . . Schellnhuber, H. J. (2018). Trajectories of the Earth system in the Anthropocene. *Proceedings of the National Academy of Sciences*, *115*(33), 8252–8259. doi:10.1073/pnas.1810141115

Swinburn, B. A., Kraak, V. I., Allender, S., Atkins, V. J., Baker, P. I., Bogard, J. R., . . . Dietz, W. H. (2019). The global syndemic of obesity, undernutrition, and climate change: The Lancet Commission report. *The Lancet*, *393*(10173), 791–846. doi:10.1016/S0140-6736(18)32822-8

Talaei, M., Wang, Y.-L., Yuan, J.-M., Pan, A., & Koh, W.-P. (2017). Meat, dietary heme iron, and risk of type 2 diabetes mellitus: The Singapore Chinese health study. *American Journal of Epidemiology*, *186*(7), 824–833. doi:10.1093/aje/kwx156

Tilman, D., & Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*, *515*(7528), 518–522. doi:10.1038/nature13959

Toumpanakis, A., Turnbull, T., & Alba-Barba, I. (2018). Effectiveness of plant-based diets in promoting well-being in the management of type 2 diabetes: A systematic review. *BMJ Open Diabetes Research & Care*, *6*(1), e000534. doi:10.1136/bmjdrc-2018-000534

UNFCCC. (2015). *Adoption of the Paris agreement* (Report No. FCCC/CP/2015/L.9/Rev.1). Retrieved from http://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf

USDA, & HHS. (2015a). *2015–2020 Dietary guidelines for Americans* (8th ed.). Retrieved from http://health.gov/dietaryguidelines/2015/guidelines/

USDA, & HHS. (2015b). *Scientific report of the 2015 dietary guidelines advisory committee*. Retrieved from www.health.gov/dietaryguidelines/2015-scientific-report/

Vermeulen, S. J., Campbell, B. M., & Ingram, J. S. I. (2012). Climate change and food systems. In A. Gadgil & D. M. Liverman (Eds.), *Annual review of environment and resources* (Vol. 37, pp. 195–222). Palo Alto, CA: Annual Reviews.

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., . . . Murray, C. J. L. (2019). Food in the Anthropocene: The EAT – Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4

World Bank. (2019). Data Bank: World Development Indicators. Retrieved from https://databank.worldbank.org/data/reports.aspx?source=2&series=NY.GDP.PCAP.CD&country