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Plant-based Diet as a Sustainable Contribution to Climate Change Mitigation and Adaptation in California (Pflanzenbasierte Ernährung als nachhaltiger Beitrag zur Klimawandelmitigation und -adaption am Beispiel der USA)

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Table of Acronyms and Abbreviations

AB	Assembly Bill
CAFO	Concentrated Animal Feeding Operation
CBO	Community Based Organization
CCOF	California Certified Organic Farmers
CDE	California Department of Education
CDFA	California Department of Food and Agriculture
CNIP	California Nutrition Incentive Program
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CSA	Community Supported Agriculture
DFT	Dairy Farm Transition
DGA	Dietary Guidelines for Americans
DGAC	Dietary Guidelines for Americans Committee
DMC	Dairy Margin Coverage
EWG	Environmental Working Group
FAO.....	Food and Agricultural Organization of the United Nations
FEP	Food Empowerment Project
FMMO	Federal Milk Marketing Order
GHG.....	Greenhouse Gasses
GusNIP	Gus Schumacher Nutrition Incentive Program
HLPE.....	High Level Panel of Experts
MD	Mediterranean Diet
NGO	Non-Governmental Organization

NIHNational Institute of Diabetes and Digestive and Kidney Diseases
NO_xNitrogen Oxides
POC People of Color
SADStandard American Diet
SB Senate Bill
SCVH Santa Clara Valley Healthcare
SDG Sustainable Development Goal
SO₂.....Sulphur Dioxide
UC University of California
UN.....United Nations
USDA US Department of Agriculture
WD Western Diet
WICSupplemental Nutrition Program for Women, Infants, and Children

1 Introduction

1.1 Objectives of the Thesis

Current research findings underscore the existence of interactions between climate change and food security. Substantive evidence indicates that dietary practices in the US not only contribute to climate change but also that the ramifications of climate change pose significant threats to food security.

This paper seeks to clarify whether and to what extent a shift from the standard American diet to a plant-based diet can yield substantial contributions to sustainability in all three dimensions, especially considering altered agricultural conditions precipitated by a changing climate. Furthermore, it explores the extent to which this transition can contribute to the implementation of specific Sustainable Development Goals (SDGs) outlined in the Agenda 2030, as well as the limitations of this approach.

Subsequently, this thesis examines the impediments that hinder the widespread adoption of a plant-based diet within society. It evaluates initiatives aimed at the promotion of plant-based diets within the US.

Based on source research, a case study on the promotion of plant-based nutrition in California serves to deepen relevant insights. Grounded in findings from this case study, possible viable solutions and recommendations for the implementation of more sustainable nutrition models are subsequently developed.

1.2 Structure of the Work

This thesis consists of a theoretical foundation that examines the state of the research on climate change and food security in Chapter 2. In Chapter 3, the standard American diet, as well as alternative plant-based and plant-focused diets, are described and measured against their impact on the sustainable development goals.

The core of the thesis is a case study in chapter 4. The case study will present an overview of California's current food security and nutrition situation, examine the agricultural industry, and evaluate current strategies to advance plant-based diets in California.

The findings of the case study are presented in Chapter 5. Derived from these findings are potential solutions and recommendations in Chapter 6. A conclusion and outlook are closing this work in Chapter 7.

1.3 Methodological Approach

The methodological approach of this thesis is a case study. This approach has been selected because food and diets are complex systems deeply intertwined with the cultural, economic, and environmental settings in which they are observed. Solutions can only be developed within a specific context and cannot be generalized to be universally valid and applicable. For this work, California has been selected as the basis for the case study. It is the most populous state in the US, contributes significantly to the US's agricultural economy, and has a reputation for innovation and progressiveness. It has been the pioneer for many progressive changes in the US and the world; therefore, it lends itself to being a potential role model in the development of more sustainable diet patterns in Western societies.

The case study is based on source research to examine the current situation in California in regard to nutrition and food security as well as its agricultural landscape. Strategies for the promotion of plant-based diets are structured by state and local government initiatives, California corporations and non-profit initiatives, and lastly, individual and activist initiatives.

2 State of the Research on Climate Change and Food Security

2.1 Food Security as a Key Concept

Food is the basis for all human survival. Accordingly, an adequate food supply therefore is critical for any civilization. The global human population in 2023 is about 8 billion, and the United Nations Department of Economic and Social Affairs predicts a population growth to 10 billion by 2059. (United Nations Department of Economic and Social Affairs, Population Division, 2022, p. 3). With human population growth, the required quantity of food also increases. In addition, increased wealth in large parts of the world increases demand for food (Garnett et al., 2013, p. 33).

We are currently able to grow sufficient food for our human population and should also be able to grow enough food to feed 10 billion people (Berners-Lee et al., 2018, p. 3). However, over 700 million people worldwide are facing hunger, and 2.4 billion, or almost 30 % of the global population, are facing moderate or severe food insecurity (FAO et al., 2023, p. 13). In wealthier parts of the world and within wealthier parts of different societies, the demand, especially for meat and dairy but also other non-stable “luxury” items grows (Harris, 2015, p. 143).

Food security has historically centered around agriculture and the production of enough calories (Fanzo, 2023, p. 33). However, it is a complex topic that is not solved by growing the necessary amounts of human-edible foods and calories.

Food security has been a prominent topic for the international community. The United Nations Millennium Development Goals list the eradication of extreme poverty and hunger as their first goal (United Nations, 2023b). The second goal of the Sustainable Development Goals of the Agenda 2030 calls for “Zero Hunger” (United Nations, 2023a, p. 14).

Traditionally, food security has been defined by four pillars (FAO, 2006, p. 1). Food availability ensures sufficient quantity and diversity of foods available. Food access requires people to have adequate financial and physical resources to obtain nutritious food. Food utilization describes the capacity and resources to use food appropriately, for example, cooking and storage of food, as well as water and energy to prepare the available foods). Food stability calls for continued access to food, regardless of season, price volatility, or other short-term shocks. The HLPE (HLPE, 2020) and others (Clapp

et al., 2022, p. 3 ff.) suggest the addition of two pillars: Agency refers to the ability to make decisions about their food systems. Having agency over their food systems can address inequities and imbalances of power. Sustainability calls for the long-term viability of the ecological, economic, and social bases of the food system.

Based on these six pillars, food security describes a state in which all people, at all times, have physical, social, and economic access to sufficient food. The food needs to be safe and nutritious and meet the individual dietary needs and cultural food preferences to support a healthy life. Furthermore, the food systems need to be resilient to shocks like natural disasters and economic crises and able to adapt to a changing climate while continuing to provide food security for all. Food system resilience can be defined as “the capacity over time of a food system and its units at multiple levels, to provide sufficient, appropriate and accessible food to all, in the face of various and even unforeseen disturbances” (Tendall et al., 2015, p.19).

With this complexity, a systems approach to food security is called for. Factors such as globalization, trade, urbanization, and climate change all increase the complexity of the challenge to achieve food security for all. These factors are interconnected with each other and with the food systems. Hence, a systems perspective that invites integrative discussions and considers far-reaching consequences and interdependencies is necessary to solve the global food security challenge (Béné & Devereux, 2023, p. 32). Food supply chains, food environments, individual factors, consumer behavior, different diets and cultural preferences, health outcomes related to nutrition, the environment, social equity, racism, the changing climate, and economic sustainability are all parts of the systems perspective that need to be included in solutions to food security (Béné & Devereux, 2023, pp. 39-40). The following figure gives an overview of the food systems framework.

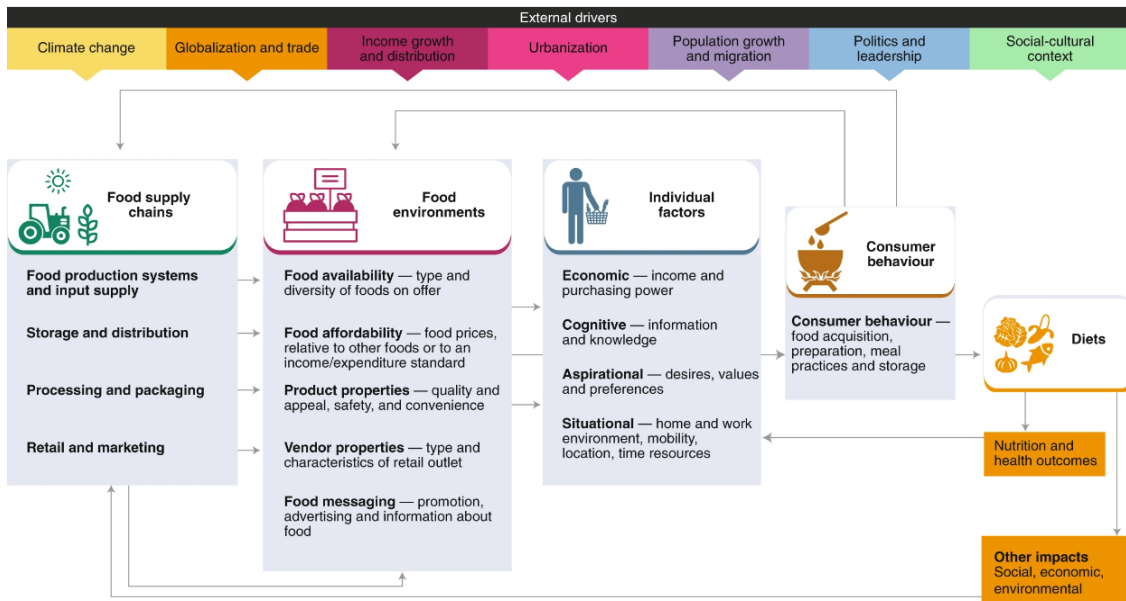


Figure 1: “Food systems framework” (Fanzo et al., 2020, p. 243)

Not one discipline, institution, people, or organization will be able to solve food security now and for future generations. However, it will take many to work in their respective fields and interdisciplinary towards a resilient and sustainable food system, both on regional and global levels. Action needs to be taken by the different stakeholders with an eye on the interdependencies and consequences of everyone’s decisions and actions as they affect the different parts of the system.

2.2 Interactions between Food and Climate Change

2.2.1 Presumed Effects of Food on Climate Change

The supply of food for the human population has several impacts on the environment and presumably also impacts climate change. The exact impacts of any human activity on a complex system as the climate can be scientifically deducted but not proven beyond doubt (cf. Spencer, 2018). All components of our food systems, including the production, transportation, processing, consumption, and disposal of food, have external effects. The main impacts of the food system are the emission of greenhouse gasses (GHG), water usage, biodiversity loss, and soil erosion. Although transportation, processing,

and food waste contribute, food production is the primary driver with the most significant impact and, therefore, will be prioritized.

According to different publications, food production is responsible for about 11% (agriculture only and without land-use change) to 30% (entire food system) of total **greenhouse gas emissions**, including Carbon Dioxide (CO₂), Sulphur Dioxide (SO₂), Nitrogen Oxides (NO_x), and Carbon Monoxide (CO) (Tubiello et al., 2013, p. 1; Ingram & Zurek, 2018, p. 548; Campbell et al., 2017, p. 5). However, it should be noted that at this point, we cannot identify the exact amounts of GHG emissions and their sources (Rypdal & Winiwarer, 2001, p. 108). The increasing amount of GHG in the atmosphere leads to a heating greenhouse effect by preventing energy from solar radiation from exiting the atmosphere. A leading source of GHG emissions in the food system is animal agriculture. Methane emissions by livestock cause about 37% of agricultural GHG emissions. Other significant sources of GHG are manure, which releases methane and nitrous oxide, synthetic fertilizer use, and rice cultivation (Tubiello et al., 2013, pp. 5-6). The conversion of wetlands, forests, and grasslands into agricultural lands releases significant amounts of stored carbon into the atmosphere.

Food production and processing consume about 70% of freshwater, which strains or **overexploits freshwater aquifers**. The amount of water needed varies considerably for different crops and animal agriculture; for one kilogram of cereal grain, approximately 1000 liters of water are required, while for the same amount of beef, 43,000 liters of water are needed (Pimentel et al., 2004, p. 911). Through fertilizers, pesticides, animal feedlots, and concentrated animal feeding operations (CAFOs), agriculture is a significant contributor to **water pollution** (Zahoor & Mushtaq, 2023, p. 165). Water pollution has detrimental effects on the environment and human health. It is causing infertile land and dead zones in the water, intensifying the biodiversity loss by disrupting ecosystems and natural habitats (Pimentel et al., 2004, p. 915; Zahoor & Mushtaq, 2023, pp. 170-171).

Food production contributes to about 60% of **biodiversity loss** through several mechanisms. Large amounts of land are needed to produce food, leading to agricultural expansion, which may lead to the loss of natural habitats such as forests and grasslands. An estimated 40% of the earth's surface is already dedicated to agriculture (Campbell et al., 2017, p. 1). Monocultures and the extensive use of pesticides and herbicides also lead to biodiversity loss by disrupting ecosystems and harming non-

target species, including insects, birds, and other wildlife (Dudley & Alexander, 2017, pp. 1-2).

Soil degradation can be defined as a “change in the soil health status resulting in a diminished capacity of the ecosystem to provide goods and services for its beneficiaries” (FAO, 2023). Food production is responsible for about 33% of **soil degradation** by overexploiting fertile land, the extensive use of chemical fertilizer, deforestation, and land conversion. The degradation is currently about 40 times faster than new soil formation (Ingram & Zurek, 2018, p. 548; Van der Elst & Williams, 2018, p. 202). As the FAO estimates, about a quarter of the global agricultural soils are in a state of severe degradation (Tittonell, 2018, p. 452).

A systems approach to research and judge the impacts of human activity is the **planetary boundaries** framework. Planetary boundaries are scientifically based assumptions on the environmental limits beyond which human activities could push the planetary system into a much less hospitable state. It defines a safe operating space to remain in a stable and resilient system. Nine processes have been defined as having environmental thresholds: Climate change, novel entities, stratospheric ozone depletion, atmospheric aerosol loading, ocean acidification, biogeochemical flows, freshwater use, land-system change, and biodiversity loss. Only some of the boundaries have identifiable control variables established by science. The boundaries are not to be seen as cliffs but rather as increasing the risks and uncertainties and can be used as guides for human activity.

The following figure shows the assumed current state of the variables of the nine planetary boundaries. Currently, biodiversity loss and biochemical flows, specifically nitrogen and phosphorus, are already considered in the high-risk zone (Steffen et al., 2015, pp. 3-7).

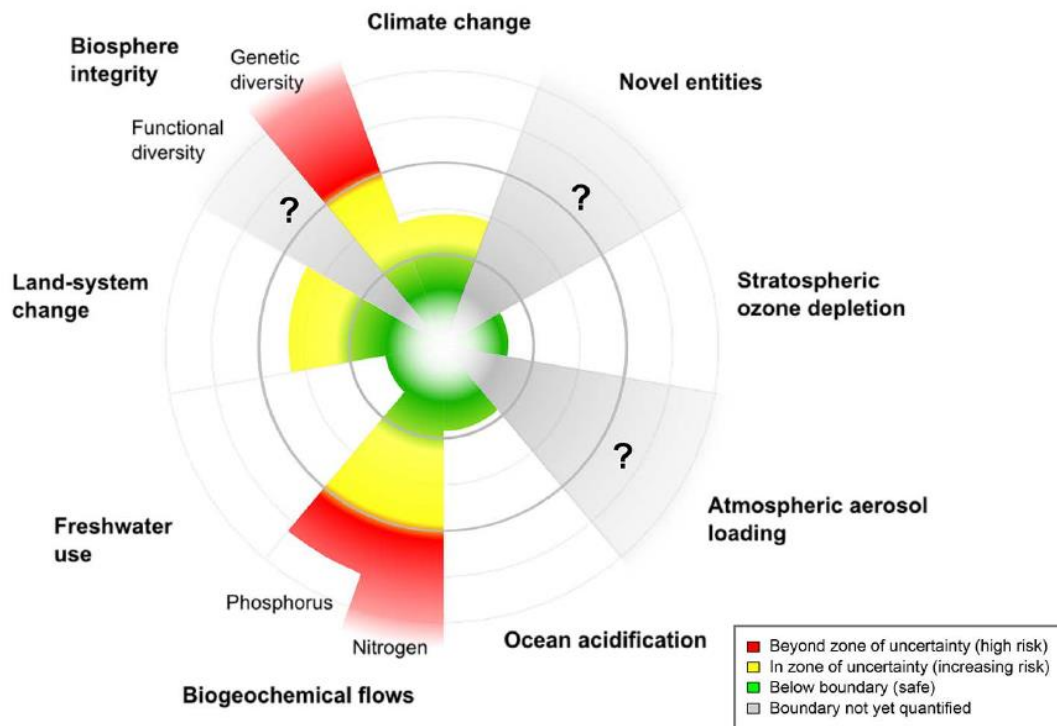


Figure 2: "The current status of the control variables for seven of the nine planetary boundaries" (Steffen et al., 2015, p. 6)

Agriculture significantly impacts several planetary boundaries (Campbell et al., 2017, pp. 1-3), including the boundaries already in the "red zone". Agricultural activities are the main source of Nitrogen and Phosphorus flows through the large-scale deployment of fertilizers.

The adverse effects of agriculture on the planet have many interdependencies and feedback loops, which means that an increase in one negative effect may also negatively impact another boundary. For example, fertilizer use increases are directly linked to increased biochemical flows and soil degradation and are indirectly connected to accelerated biodiversity loss.

2.2.2 Anticipated Impacts of Climate Change on Food Security

As discussed in the previous chapter, the earth and its climate are changing, and those changes impact agriculture and food security. The effects can be both negative and positive. However, the threat of climate change to food security is higher than the potential benefits, with some effects like declining wheat and corn production attributed to climate change already measurable over a decade ago (Lobell et al., 2011, p. 616).

The increasing mean temperature in many parts of the world is changing the **conditions for the cultivation of certain crops** in specific areas. Different crops might have to be selected for a specific area to adapt to the changing temperatures. The increase in mean temperature extends the growing season in areas that tend to be limited by cold temperatures. At the same time, the higher mean temperature will shorten the growing season in areas limited by high temperatures (Ruane & Rosenzweig, 2018, p. 169).

A potential positive effect of climate change is the fertilizing effect of **elevated CO₂** levels in the air, which promotes photosynthesis and higher yields. CO₂ also has the potential to alter plants' transpiration and improve their water retention. However, it has also been shown that higher CO₂ levels reduce key nutrients, especially protein, in crops (Medek et al., 2017).

Climate change and higher temperatures affect the humidity and moisture in the atmosphere and, therefore, cause changes in precipitation patterns.

In regions experiencing a decrease in precipitation, crop yields will decrease due to water stress unless irrigation infrastructure can be supplied. In certain regions, precipitation is expected to increase, which, in moderation, can benefit crop yields.

A significant concern with the changing climate is that weather becomes **more unpredictable and extreme weather events become more frequent**. Those effects can already be measured and are anticipated to increase. However, there is a level of uncertainty in measuring the frequency of extreme weather events. Long-term historical records only exist in some parts of the world, making it hard to gauge if and by how much the frequency of extreme weather events has increased (Ruane & Rosenzweig, 2018, pp. 166-169).

More frequent, longer, and more extreme droughts, heat waves, and other **extreme weather events**, like hail or torrential rain, have the capacity to severely damage or destroy crop yields in the affected areas. These events have the potential to become especially problematic for global food security if several breadbaskets of the world are affected at the same time.

Higher temperatures and more frequent droughts increase the need for water irrigation, while freshwater, as discussed in the previous chapter, becomes more scarce.

Climate change mitigation measures might also affect agriculture and food security. Phasing out fossil fuels will increase pressure to use agricultural land for the production of biofuels. Stopping deforestation and efforts to increase reforestation, which are needed to limit further acceleration of climate change, will limit the amount of land that can be used for food production. As discussed in the previous chapter, soil erosion is a significant challenge and further limits land suitable for food production.

Conclusively, the discussed changes lead to less fertile soil and fewer regions with a climate conducive to efficient food production.

Climate change affects not only agriculture but all parts of the food system, from production to processing, distribution, retail, disposal, and waste (Ruane & Rosenzweig, 2018, p. 162). Extreme weather events especially have the potential to disrupt all parts of the food systems.

2.3 Organic Agriculture versus Intensive Agriculture

Different approaches to agriculture exist in the quest to ensure sustainable food security for a growing global population. Two main approaches are organic agriculture and intensive agriculture.

Intensive agriculture is currently the dominant form of food production. It relies heavily on technology, fossil fuel-based fertilizers, irrigation systems, high-yield and genetically modified crops, and monocultures. Intensive animal agriculture congregates large numbers of animals in mostly indoor confined spaces (CAFOs).

The intensification has significantly contributed to the increase in food production and the decrease in world hunger. However, it comes at great costs as it has several negative impacts on the environment as well as on society, as discussed in Chapter 2.2.1.

Intensive agriculture has economic benefits specifically for a relatively small number of global corporations. Smaller farmers become dependent on fertilizers, specialized seeds, and machinery. They continue to be pushed out of the market by larger companies, which can fully realize economies of scale and maximize their economic benefits of intensive agriculture.

Organic agriculture, on the other hand, focuses on the sustainability aspect of food production. The IFOAM Organics International, an international umbrella organization for organic agriculture, defines: "Organic Agriculture is a production system that sustains the health of soils, ecosystems, and people. It relies on ecological processes, biodiversity, and cycles adapted to local conditions rather than the use of inputs with adverse effects. Organic Agriculture combines tradition, innovation, and science to benefit the shared environment and promote fair relationships and good quality of life for all involved" (IFOAM Organics, 2021).

Organic agricultural practices are meant to work with natural ecological systems and cycles instead of against them. Soil health is a primary focus. Synthetic pesticides and fertilizers are largely avoided or eliminated. Instead, crop rotation, green manure, compost, and biological pest control techniques are utilized (Badgley et al., 2007, p. 87). Organic animal agriculture avoids the use of antibiotics and growth hormones. A balance between crop production and animal husbandry is sought. Air and water pollution is minimized. This approach to farming is more labor intensive, which can be seen as a benefit as it provides employment and, therefore, economic stability for a larger group of people (Yuvaraj et al., 2020, p. 6). The ultimate goal of organic, sustainable agriculture is to create closed systems where no additional energy has to be brought into the agricultural system, and no waste that has to exit the system is created. In addition to the environmental objectives, the concept of organic agriculture specifically includes social-economic goals.

Critics of organic agriculture claim that it uses more land and yields less than conventional agriculture (Badgley et al., 2007, p. 86). Badgley et al. show in their work

that organic agriculture does have the potential to feed the growing population while maintaining or improving soil health. A transition to a broad application of organic methods does provide “challenges - agronomically, economically, and educationally” (Badgley et al., 2007, p. 94) that need to and can be overcome. With that, it becomes a “serious alternative to green-revolution agriculture as the dominant mode of food production” (Badgley et al., 2007, p. 94).

Baroni et al. (2007). evaluated the environmental impact of different dietary patterns combined with conventional versus organic production (Baroni et al., 2007). They show that organic production has a lower environmental impact than conventional production regardless of dietary patterns (omnivore, vegetarian, vegan). This is true for the total impact as well as for nine out of 10 subcategories (carcinogens, respiratory organics and inorganics, climate change, ozone layer, ecotoxicity, acidification, minerals, and fossil fuels). Only land use is higher for the organic production of one specific diet.

Despite the advantages of organic farming, only a small percentage of agricultural land currently is used in this manner. Data from 2021 shows that only 1.6 percent of agricultural land is farmed organically (Willer & Schlatter, 2023, p. 20).

Sustainable intensification (Garnett et al., 2013) aims to combine both focuses of the previous two concepts: Agriculture needs to be intensified on some level to ensure the production of enough food for a growing population. At the same time, agricultural practices need to be sustainable and environmentally friendly to support the human population in the future. To reach the sustainability goal of this concept, an increase in inputs has to be avoided. Therefore, it might make sense to focus on “sustainable optimization” instead, where higher positive outcomes are achieved with the same or less input, while negative outcomes are minimized (Blumenstein, 2017, pp. 17-18). Sustainable intensification can also be achieved by increasing inputs that do no harm, like human labor or knowledge.

3 Sustainable Development versus US Standard Diet

3.1.1 General Composition of the Standard American Diet

As a large country with over 300 million people and many different cultures represented, the diets of US Americans vary. However, the vast majority of them, about 80%, are believed to follow the Standard American Diet (SAD) (Dixon et al., 2023, pp. 6-7). The SAD is also known as the “Western Diet” (WD). This diet is high in processed foods, refined carbohydrates, added sugar, and fat. The average daily calorie intake has increased by 761 calories from the late 1950s to 2010 (Grotto & Zied, 2010, p. 603) and is not over 2600 calories. Over 60% of purchased calories are highly processed foods, defined as “multi-ingredient industrially formulated mixtures” (Juul et al., 2021, p. 1861). More than half of the calories consumed come from animal sources. Protein intake is approximately two-thirds animal-based and one-third plant-based, with most plant protein coming from yeast bread (Pasiakos et al., 2015, p. 7061).

The average diet in the US differs considerably from the “Dietary Guidelines for Americans” (DGA) issued by the US Department of Agriculture (USDA). The DGA Committee (DGAC) updates those guidelines every five years. The DGAC is comprised of experts from academia and medical institutions. (Rowe, 2014, p. 367)

The current food production in the US does not support a DGA-conform diet for all US citizens; vegetables, fruits, whole grains, and dairy are not available in sufficient quantities (Grotto & Zied, 2010, p. 610).

3.1.2 Impact of the Standard American Diet on Sustainable Development

The Standard American Diet has several impacts on all three sustainability categories. The adverse health outcomes caused or supported by the average diet have significant social, environmental, and economic costs for the US.

The SAD contributes to several negative health outcomes, including cardiovascular diseases, obesity, diabetes, and cancer. At present, over two-thirds of US Americans are either overweight (30.7%) or obese (42.4%) ((NIH - National Institute of Diabetes and Digestive and Kidney Diseases, 2019). Research by Jardim et al. (2019) shows that

unhealthy diets are responsible for 45% of all cardiometabolic disease deaths. The annual diet-related cardiometabolic disease costs were estimated at \$50 billion for the US (Jardim et al., 2019: p. 6).

The economic sustainability of the food system is also negatively impacted by the current dominance of the SAD. A small number of corporations provide the majority of food for the American people. The “Time” found that the largest four corporations control over 80% of the US market (Kelloway, 2022). Corporations are increasing their profits while 44 million people in the US are food insecure (Feeding America, 2022).

In addition to the social and economic costs, the SAD also negatively impacts environmental sustainability. The agricultural practices needed for daily consumption of animal products and highly processed foods that rely on a small selection of plants (i.e., wheat, corn, sugar cane, oil seeds) produce GHG emissions, increase land use change, require large amounts of water and fossil fuel-based fertilizers (Vega Mejía et al., 2018). The industrialized processing of foods itself also requires significant amounts of energy input, almost exclusively from fossil fuels. In addition to that, the high portion of highly processed and packaged foods contributes to increasing plastic pollution (Dixon et al., 2023, p. 6)

According to the EAT-Lancet Report, North America consumes 638% of the amount of beef, 268% of the amount of eggs, and 234% of the amount of poultry that the EAT-Lancet Commission considers sustainable for the planet and health for people (EAT-Lancet Commission, 2019, p. 13 and Chapter 3.2.1 in this work).

3.2 Sustainable Alternatives to the Standard American Diet

Sustainable diet alternatives to the SAD need to be evaluated based on their impacts on all three sustainability dimensions. A sustainable diet should promote health while being affordable to all and minimizing its environmental impacts. Several alternative diets exist and generally focus on one or more aspects of reducing a variety of animal-based foods and highly processed foods, especially sugars and other carbohydrates (Fanzo, 2019, p. 167). This work focuses on the reduction of animal-based foods and only tangentially discusses the impact of highly processed foods. With this in mind, the selection of alternative diets has been restricted to the following.

3.2.1 Reducing the Consumption of Animal Products

Several diet patterns exist that have the reduction of animal-sourced foods as one of their main pillars. Discussed here are three diets that all limit but do not eliminate the consumption of animal-based foods.

The **Mediterranean diet** (MD) has been discussed widely since the Seven Countries Study in the 1950s, which described which foods were consumed by mainly poor, rural societies in the Mediterranean area. The modern MD is a plant-rich diet with whole grains, vegetables, legumes, olive oil, and fruit as the core. Those should be consumed with every meal. Daily consumption of nuts, seeds, and dairy is encouraged. It also includes moderate amounts of eggs, poultry, and fish consumed several times a week. Red meat and alcohol are included in low to moderate amounts (Bach-Faig et al., 2011, pp. 2274-2275). Pretty large amounts of fat from olive oil are part of the MD as well. No food groups are excluded, though sugar is very limited, and there are little or no highly processed foods in the MD. The MD is associated with a reduction in cardiovascular diseases and a higher life expectancy. It is also thought to have a higher nutrient adequacy when compared to Western Diets / SAD ((Sáez-Almendros et al., 2013: p. 2).

In 2013, a study in Spain by Saez-Almendros (Sáez-Almendros et al., 2013: p. 4) compared, among others, the MD and the Western Diet regarding their environmental footprints. They found that the agricultural land use of the MD is only about one-fourth of the land use of the WD. Energy consumption is reduced by two-thirds, and water consumption is almost cut in half. The most significant difference was the GHG emissions, which for the MD are supposedly only 16% of the WD's emissions. These numbers are based on an assumed 100% Western Diet, not on the average food consumption of people in Spain.

The **Vegetarian diet** includes all kinds of plant-based foods, including grains, vegetables, fruits, nuts, seeds, plant oils, and legumes. It also includes eggs and dairy products. Excluded is all animal flesh (meat, poultry, and fish). The elimination of animal flesh does reduce the environmental impact significantly. In their study, Baroni et al. found a reduction of the environmental impact of 30% to 50% when compared to an omnivore diet, while a vegan diet, which also excludes dairy and eggs, reduced the environmental impact further (Baroni et al., 2007). Especially dairy products (cheese, milk, and yogurt, in this order) have significant environmental impacts. In general, a

vegetarian diet does not necessarily place plants at the center of a diet; a diet consisting primarily of dairy and egg products is still considered a vegetarian diet but will have a higher environmental impact than a diet that only occasionally includes dairy or eggs and therefore has an environmental impact closer to that of a vegan diet.

The EAT-Lancet Commission, a group of independent scientists, developed the **Planetary Health Diet** as part of their work to establish science-based targets for sustainable food systems (Willett et al., 2019). EAT is a Norway nonprofit intending to “catalyze a food system transformation”. Their proposed Planetary Health Diet aims to be both healthy for humans and sustainable for the planet. About half of the diet should consist of vegetables and fruits, and the other half should consist primarily of whole grains, plant proteins like legumes, and unsaturated plant oils. The consumption of small amounts of animal-based foods is optional. Therefore, this is a flexitarian diet approach that can be adapted to include limited amounts of animal-based foods for people following an omnivore diet or be adapted to a vegetarian or vegan diet. The following overview shows the possible amounts and calories per day for each food group. It is apparent that there is flexibility with this dietary approach as different foods can be substituted for each other.








	Macronutrient intake grams per day (possible range)	Caloric intake kcal per day
 Whole grains Rice, wheat, corn and other	232	811
 Tubers or starchy vegetables Potatoes and cassava	50 (0–100)	39
 Vegetables All vegetables	300 (200–600)	78
 Fruits All fruits	200 (100–300)	126
 Dairy foods Whole milk or equivalents	250 (0–500)	153
Protein sources		
 Beef, lamb and pork	14 (0–28)	30
Chicken and other poultry	29 (0–58)	62
Eggs	13 (0–25)	19
Fish	28 (0–100)	40
 Legumes	75 (0–100)	284
Nuts	50 (0–75)	291
Added fats		
 Unsaturated oils	40 (20–80)	354
Saturated oils	11.8 (0–11.8)	96
Added sugars		
 All sugars	31 (0–31)	120

Figure 3: “Scientific targets for planetary health diet, with possible ranges, for an intake of 2500 kcal/day” (EAT Lancet Commission, 2019, p. 10)

Reducing animal products has a positive impact on the economic sustainability of diets. All diets that center around plants, especially whole grains, legumes, and vegetables, tend to be more affordable than omnivore diets. Vegetarian and vegan diets are, on average, 30% more cost-effective than the SAD and other current diets in Western societies (Springmann et al., 2021). However, especially in poorer communities in the United States, access to minimally processed plant foods might be limited.

3.2.2 Plant-based Diets as a Sustainable Alternative

Diets that eliminate all animal-based foods are vegan. Animal flesh, including fish, and animal products like dairy, eggs, and honey are not consumed. The Planetary Health Diet (see Chapter 3.2.1) considers all animal-based products optional and, therefore, supports a vegan diet as a healthy and sustainable diet. As described in the previous chapter, the reduction of animal-based foods has positive effects on the environmental impact of diets. Hence, eliminating all animal-based foods is even more beneficial for the environment.

While a vegan diet is healthy and considerably reduces diabetes type 2, cancer incidences, and cardiovascular risks, people following a strict plant-based diet are at risk of Vitamin B-12 deficiency, which is not found in sufficient quantities in plant-based foods. Deficiency can be prevented effectively by either B-12 supplements or foods fortified with B-12 (Madry et al., 2012).

Other health considerations frequently discussed with plant-based diets are iron, calcium, Vitamin D, and protein intake. Protein deficiency is a concern in the developing world; however, in the US, people generally consume more protein than the minimum recommended levels, even when strictly following a plant-based diet. Vitamin D deficiency is a concern for many populations regardless of diet and can be addressed with supplementation. Iron deficiency also is a known worldwide problem, especially in young women. However, iron and calcium are available in plant-based foods in sufficient quantities. As with any healthy diet, the consumption of a variety of different foods is necessary not to risk deficiencies (Fields et al., 2016).

People choose the previously mentioned diets with reduced animal product consumption for various reasons: availability of foods, cultural or religious, taste preferences, climate change concerns, and health concerns. The same reasons apply for people choosing a strictly plant-based diet; however, in addition to those, a large portion of vegans are naming ethical concerns for the animals as their main motivation to eat plant-based.

3.3 Impacts of Plant-based Diets on the SDGs of the 2030 Agenda

The United Nations adopted the 2030 Agenda for Sustainable Development in 2015 and committed to 17 Sustainable Development Goals (SDGs). They call for urgent action by all countries to end poverty, improve health and education, and address climate change (United Nations Department of Economic and Social Affairs, Sustainable Development, 2023). This chapter will discuss the impacts of plant-based diets on various SDGs and their interactions, with the understanding that plant-based diets can support SDGs as only a partial solution to the problems.

3.3.1 SDGs 1, 2, 3, and 4

SDG 1 calls for the “**end of poverty in all its forms everywhere**”. Poverty is recognized as a complex and multidimensional issue that goes beyond just income levels. A key aspect of poverty is access to sufficient and nutritious foods. A movement toward more plant-based diets can contribute to this as those diets tend to be more affordable than omnivore diets (Lusk & Norwood, 2009). In addition, the demand for animal-based products in developed and developing countries leads to increased prices of basic food staples through the increasing demand for animal feed. The land needed for industrial animal-based agriculture may remove access to land for subsistence farming in the Global South (Beverland, 2014, p. 374).

Closely related to SDG 1 “No Poverty” is SDG 2 “**Zero Hunger**”. Today, more people are hungry or food insecure than in 2015, when the SDGs were established, with about 9% of the global population suffering from chronic hunger and almost 30% being moderately to severely food insecure (United Nations, 2023a). Ending hunger is a complex problem with several factors contributing. Plant-based diets can play some role in alleviating hunger as they tend to be more affordable (see above) and nutritious. On the other hand, a fully plant-based diet for the entire global population is neither achievable nor desirable or helpful. Small-scale animal agriculture has its place in certain areas of the world, based on local agricultural conditions, especially in the Global South, where it can be necessary to ensure sufficient nutrition for the people. “Concurrently replacing all animal-based items in the US diet with plant-based alternatives will add enough food to feed, in full, 350 million additional people, well above

the expected benefits of eliminating all supply chain food waste. These results highlight the importance of dietary shifts to improving food availability and security” (Shepon et al., 2018).

SDG 3 calls for “**Good Health and Well-Being**“. Plant-based diets can significantly contribute to the achievement of this goal in several ways. They reduce the risk for non-transmissible chronic diseases like cancer, cardiovascular conditions, and diabetes. They also help maintain a healthy weight and fight obesity. Plant-based diets can be nutritious and good for digestive health with an adequate fiber intake. However, a plant-based diet does not necessarily have to be healthy if it consists mainly of highly processed and high-sugar foods.

SDG 4 “**Quality Education**” focuses on ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. The effects of plant-based diets on SDG 4 are more indirect than on the previous three goals. It could be argued that better nutrition provided by plant-based diets contributes to a healthier learning environment and easier studying. On the other hand, the goal of quality education impacts the expansion of plant-based diets on a global scale. Education can provide the knowledge to choose and prepare healthy plant-based foods and contribute to achieving the previous three goals.

3.3.2 SDGs 6 and 12

SDG 6 seeks to ensure the availability and sustainable management of **water and sanitation** for all. Freshwater is a scarce resource, only 1% of the global water supply, which must be conserved. Food production uses about 70% of global freshwater stocks; therefore, food systems are closely linked to SDG 6. Plant-based foods, in general, require less fresh water than animal-based foods, which can use up to ten times the amount of water (Beverland, 2014, p. 373). An estimated 20% reduction in freshwater use could be achieved by eliminating water-intensive meat production. However, some of those gains will be forfeited if the production of healthy but water-intensive foods like nuts, seeds, and certain vegetables offsets it (Chen et al., 2022, p. 11). Plant-based diets support SDG 6 when they center around crops with limited water usage, especially in more arid regions.

In addition to freshwater use, animal agriculture also plays a significant role in water pollution through animal waste and contamination with antibiotics, hormones, and zoonotic waterborne pathogens (Mate Sagasta et al., 2017, p.3).

SDG 12 aims to ensure **responsible and sustainable consumption and production**. A shift towards more plant-based food systems can support this goal if agricultural and food processing systems for plant-based foods are configured with sustainability practices in mind. Sustainable consumption can be encouraged with a plant-based diet and the limitation of over-consumption of foods. Focusing on less highly processed foods supports health and sustainable production, creating less waste. However, some trade-offs exist between SDG 3 and SDG 12 (Pradhan et al., 2017), as developed societies tend to have better health outcomes partially because they have higher consumption and production rates. Access to a balanced diet, whether plant-based or not, with a variety of high-quality foods tends to go along with higher rates of food waste, which SDG target 12.3 seeks to minimize.

3.3.3 SDGs 13, 14, and 15

SDG 13 calls to “take urgent action to **combat climate change** and its impacts”. A plant-based diet approach can make significant contributions to this goal. Plant-based diets reduce GHG emissions, mitigate deforestation, help preserve ecosystems by requiring less land for agriculture, and can reduce the reliance on fossil fuels. As less land is needed to feed the global population with a primarily plant-based diet, it also contributes to better resilience to a changing climate. (Chen et al., 2022, p. 12). SDG 13 connects directly with SDG 14 and SDG 15.

SDG 14 - **Life below Water** - seeks to “conserve and sustainably use the oceans, seas and marine resources for sustainable development.” A main contributor to the acidification and eutrophication of the oceans comes from nitrogen and phosphorus run-offs caused by agriculture, for both plant-based diets and animal-based diets in the form of feed for the animals. The negative impact can be reduced by sustainable agricultural practices that limit the use of nitrogen and phosphorus fertilizers.

According to the UN, more than a third of global fish stocks are overfished (United Nations Department of Economic and Social Affairs, Sustainable Development, 2023), a problem that could be solved by moving away from animal-based diets. Plant-

based would also support biodiversity in oceans and seas and reduce the risk of extinction for marine species.

SDG 15 - **Life on Land** - aims to “protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.” Animal-based agriculture needs more land and is a main driver for continued deforestation and desertification. Reducing land use needs through more plant-based diets could slow deforestation and desertification and reduce biodiversity loss. The protein conversion rate of animal feed to edible animal products is only about 8%. In the US, up to 190 million more people could be supplied with food if land used to grow feed for beef were converted to plant crops, supplying humans with the same amount of protein (Shepon et al., 2016).

However, Chen et al., 2022, argue that if the global population moved to the EAT-Lancet diet as described in Chapter 3.2.1, the positive contributions to SDG 15 of moving away from animal-based foods would be minimal since healthy foods like nuts and certain legumes require considerable amounts of land as well. The selection of sustainable crops can, therefore, maximize the impact of plant-based food.

The positive impact of plant-based diets will be enhanced by the implementation of sustainable agricultural practices, as those further contribute to the protection of ecosystems, prevent erosion, reduce deforestation, and promote sustainable land use.

4 Case Study of the Promotion of Plant-based Nutrition in California

4.1 Present Food and Nutritional Situation in California

4.1.1 Current Plant-based Share of Nutrition in California

Accurate data for the different diets is not easy to establish for several reasons. People might eat plant-based diets, but they do not identify as “vegan” when asked. People also might not report the food they are consuming but what they aspire to consume. Hence, some variability in data is to be expected. Data by Statistica shows the following numbers for September 2023: When asked what diet Americans follow, 4% identify as vegan, and 6% identify as vegetarian. 11% identify as flexitarian, which is described as mostly plant-based foods while occasionally allowing meat and fish (Bashir, 2023). A Gallup poll in August 2023 asked, “In terms of your eating preferences, do you consider yourself to be a vegetarian/vegan, or not?” with 4% identifying as vegetarian and only 1% (down from 3% in 2018) as vegan.

TotalShape (Robertson, 2021) used a different approach in estimating the number of people eating plant-based diets. They focused on Google searches by State for “vegan restaurants” as an indicator of how many people are interested in vegan foods. They also included the number of vegan restaurants, the number of vegan meetup groups, and the number of animal welfare groups in their research. With this data, they estimate California to be the second most vegan State in the US.

This author could not identify the share of plant-based foods in the average Californian diet as all the data available describes plant-based foods as only the highly processed plant-based meat, dairy, and egg alternatives and does not consider plant foods as plant-based.

4.1.2 Food Security and Food Access

The United States is one of the wealthiest countries on earth, with California being one of the wealthiest states in the country. Despite this wealth, food security and access to food are still unsolved problems for parts of the population. In 2022, 10.3% of Californians were food insecure, which means the households are “uncertain of having,

or unable to acquire, at some time during the year, enough food to meet the needs of all their members because they had insufficient money or other resources for food.” Of those 10.3% of food insecure households, 3.8% are very low food secure households. This means that “normal eating patterns of some household members are disrupted at times during the year, with self-reported food intake below levels considered adequate.” The US averages for those numbers are 11.2% and 4.3%, respectively (USDA Economic Research Service, 2022).

Latinx and Black households with children are more than twice as likely to experience food insecurity than White families (Ramos-Yamamoto, 2020).

Food access describes access to a variety of affordable, good quality, healthy food within one’s community. Proximity of food outlets is critical, especially for low-income communities, as travel costs and travel time might prevent access to food or increase the cost of healthy foods for low-income people compared to the prices that wealthier communities have to pay. Communities without sufficient food access are called “food deserts” and exist in low-income inner-city communities and rural areas. They are typically characterized by the lack of supermarkets, grocery stores, and farmers’ markets, and people have to rely on fast food chains and convenience stores for food (Improving Food Access in California - Report to the California Legislature, 2012).

Black and Latinx communities are more likely to be food deserts. Especially high rates of low income and low food access can be found in the top five agricultural countries, where food is produced by mostly Latinx farmworkers who themselves often have limited access to healthy foods (*Agriculture and Food Access in California*, 2020).

4.1.3 Present Dietary Recommendations and Nutrition Education

The State of California does not have its own dietary guidelines at present but refers to the Dietary Guidelines for Americans (DGA) of the USDA. The last California Food Guide is from 2008 and is no longer updated (*California Food Guide: Fulfilling the Dietary Guidelines for Americans*, 2008). It had been based on the DGA as well; hence, the DGA are the basis for the dietary recommendations of the State of California.

The DGA is co-sponsored by the US Department of Health and Human Services and the US Department of Agriculture and is updated every five years. “The process to

develop the Dietary Guidelines consisted of four stages: 1) identify the topics and supporting scientific questions to be examined; 2) appoint a Dietary Guidelines Advisory Committee to review current scientific evidence; 3) develop the new edition of the Dietary Guidelines; 4) implement the Dietary Guidelines through Federal programs” (USDA & HHS, 2020).

The DGA are written for a professional audience. For consumers, “MyPlate” translates the recommendations for lay people (USDA, 2020b).

The DGA recommends a varied and culturally appropriate diet that consists of vegetables, fruits, grains, dairy, “protein foods” (which include meat, poultry, eggs, seafood, nuts, seeds, and soy products), and oil. It also gives a daily allowance of 240 discretionary calories. The guidelines are heavily based on animal-sourced foods. Especially outstanding is the recommendation of three cups of dairy per day, with the notion that 90% of Americans would benefit from higher amounts of low-fat dairy intake (USDA, 2020a). The only recommended plant-based substitution for dairy products is fortified soy products.

In researching the scientific base for the high dairy recommendation, this author could only find scientific papers that various dairy industry groups sponsored. For example, Comerford et al. (2021) were supported by the California Dairy Research Foundation and the National Dairy Council, Quann et al. (2015) were supported by Dairy Management Inc., and Hirahatake et al. (2020) received funding from various dairy industry groups. While it might exist, no independent research supporting the high dairy recommendation for dairy intake could be identified.

The daily recommendation for meat, poultry, eggs, and fish is almost five ounces, translating to two pounds per week. However, the guidelines acknowledge that plant-based sources like legumes, nuts, seeds, and soy products may meet protein needs.

The following overview shows the recommended daily amounts by food groups based on a 2,000 calorie diet.

FOOD GROUP OR SUBGROUP^a	Daily Amount^b of Food From Each Group (Vegetable and protein foods subgroup amounts are per week.)
Vegetables (cup eq/day)	2 ½
	Vegetable Subgroups in Weekly Amounts
Dark-Green Vegetables (cup eq/wk)	1 ½
Red and Orange Vegetables (cup eq/wk)	5 ½
Beans, Peas, Lentils (cup eq/wk)	1 ½
Starchy Vegetables (cup eq/wk)	5
Other Vegetables (cup eq/wk)	4
Fruits (cup eq/day)	2
Grains (ounce eq/day)	6
Whole Grains (ounce eq/day)	≥ 3
Refined Grains (ounce eq/day)	< 3
Dairy (cup eq/day)	3
Protein Foods (ounce eq/day)	5 ½
	Protein Foods Subgroups in Weekly Amounts
Meats, Poultry, Eggs (ounce eq/wk)	26
Seafood (ounce eq/wk)	8
Nuts, Seeds, Soy Products (ounce eq/wk)	5
Oils (grams/day)	27
Limit on Calories for Other Uses (kcal/day)^c	240
Limit on Calories for Other Uses (%/day)	12%

Figure 4: “DGA Healthy US-style dietary pattern at the 2000 calorie level” (USDA & HHS, 2020a)

There are several concerns about a lack of a rigorous scientific process and the independence of the scientists on the Committee (Achterberg et al., 2022), that have been partially and superficially addressed by the Committee describing the process for the next iteration of guidelines. However, they have not been resolved. Research by Mialon et al. found that 95% of the committee members for the 2020 DGA guidelines had conflicts of interest with the food or pharmaceutical industries (Mialon et al., 2022).

In addition to the COI concerns of the scientists, the perception of the DGA as valid and valuable guidelines for healthy diets is further diminished by the fact that one of the two leading agencies, the UDSA, has the primary goal to further the domestic agricultural industry and not the health of Americans (Liu, 2022, p.4).

Overall, the federal Dietary Guidelines as a policy tool are not very helpful in advancing plant-based diets. However, even in the DGA, it is notable that the focus is slowly shifting away from the understanding that animal-based foods are necessary for a healthy diet.

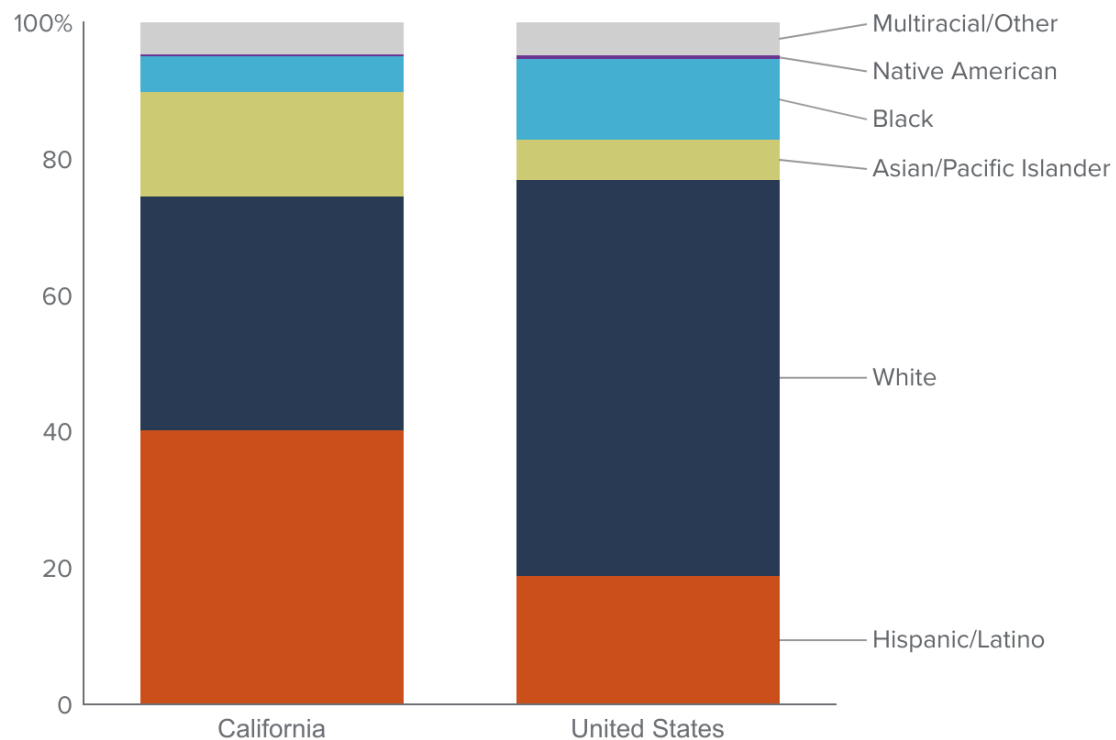
4.1.4 The Influence of Culture and Diversity on Food Preferences and Nutrition

Food plays a vital role in cultures far beyond nutrition and sustenance. The selection, preparation, and sharing of meals have deep meanings for the specific culture or social group (Sibal, 2018).

The dietary choices people make are closely related to their culture as well as psychosocial and socioeconomic factors. Food choices, cooking techniques, behaviors, and attitudes toward different foods are learned and typically established early in life (James, 2004). Changing one's dietary pattern might be challenging and “risky” for an individual’s feeling of belonging to their family, culture, or religious group. Sharing meals across different cultural groups can strengthen mutual understanding or further alienate groups.

The influence of culture on food choices is especially relevant in a state like California, with its great cultural diversity and being one of the most racially diverse states. Latinx are the most represented race in California, with none of the racial or ethnic groups constituting a majority. Twenty-seven percent of Californians (10.5 million) are immigrants. The largest group of immigrants comes from Mexico, followed by the Philippines, China, India, and Vietnam (Johnson et al., 2022). The following figure shows that the diversity in California is higher than the US average with significantly smaller share of white people.

California has higher percentages of Latinos and Asians than the US as a whole



SOURCE: American Community Survey 1-year estimates, 2021.

Figure 5: "Percentage of people in California by race" (Johnson et al., 2022)

The diversity of the people in California leads to a very diverse food culture, with restaurants and grocery stores providing easy access to a variety of foods and cuisines.

Animal-based foods are deeply ingrained in the American and Californian cultures as many regions have historically been associated, and still are, with animal-based agriculture. One example is Petaluma, California, with its reputation as the egg capital of the United States and its annual Butter & Egg parade, the city's main event of the year (Petaluma Downtown Association, 2024). Petaluma is surrounded by dairy and beef farms and is still a large producer of eggs and chicken. Production and consumption of animal-based foods are deeply ingrained in the history, soul, and diet of Petalumans.

4.2 Agriculture in California

“Agriculture refers to the cultivation of crops and the raising of animals for the “4Fs”: food, feed, fuel, and fiber.” (Lehner & Rosenberg, 2017, p. 10847) In the US, 655 million acres are grassland pasture and range, 130 million acres are grazed forestland, and 392 million are cropland (Bigelow & Borchers, 2017, p.2). Of the harvested crops, 20% are food crops, 3% are other crops like cotton and tobacco, and 77% are feed crops (Bigelow & Borchers, 2017, p. 24).

California has a large agricultural sector, with 69,000 farms operating in the state. 24.2 million acres are dedicated to farmland, covering 23% of the land area (CDFA, 2023, p. 2). About 63 million acres are rangeland, and much of the land used for grazing is federal land used through grazing permits. California agriculture generates \$49 billion in revenue annually, leading to an estimated additional \$100 billion in related economic activity (CDFA, 2022). The top three commodities are dairy, grapes, and almonds, with cattle and calves following in fifth place after “miscellaneous crops”. California agricultural exports (\$22.5 billion in 2021) account for 12.8% of total US agricultural exports.

4.2.1 Production of Plant-based Food Crops

The climate in California is favorable for the production of a wide variety of plants. Plant-based crops include food crops, feed crops, and crops for fiber and fuel. Fuel crops, however, play a minor role in California. As the following figure shows, feed crops like alfalfa, corn silage and haylage and other hay take up a good portion of the agricultural acreage and are exclusively grown as animal feed.

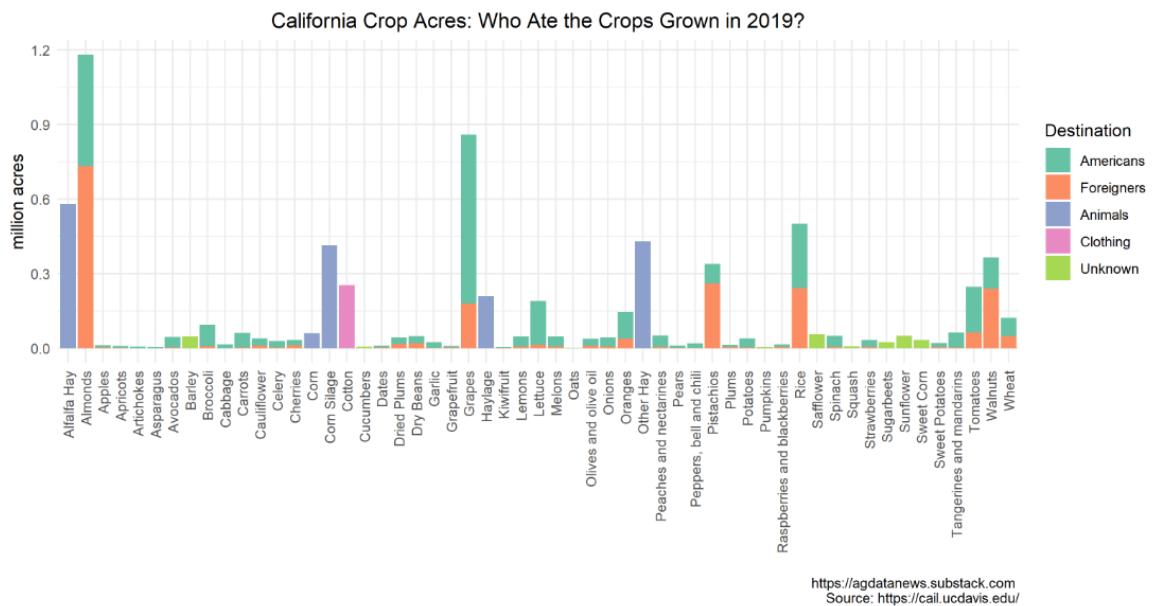


Figure 6: “California Crop Acres: Who Ate the Crops Grown in 2019” (Smith, 2022)

California is the leading producer of **vegetables** in the US, harvesting about 60% of the national vegetable production valued at \$7.5 billion annually. The leading vegetable crops are lettuce and tomatoes. The **field crop** production, including wheat, oil seeds, beans, rice, potatoes, but also cotton and hay, was valued at \$2.8 billion in 2021 (CDFA, 2023, p. 27ff.)

California is also a top producer of **fruits and nuts**, with almost 18 million tons produced in 2021, valued at \$22.2 billion. All US production of kiwi, nectarines, olives, plums, and prunes comes from California. The state also produces over 90 percent of the US's lemons, mandarins, strawberries, apricots, and grapes. California grows all of the nation’s almonds, pistachios, and walnuts.

The highest-value products are **grapes** (\$5.2 billion) and **almonds** (\$5 billion).

Another agriculturally significant production valued at almost one billion is the California **floriculture**, including bedding and garden plants as well as cut flowers.

California is a leading producer of organic foods and produces more than 90% of all US organic crop sales, with lettuce, grapes, berries, and nuts as some of the top crops (Klonsky, 2010). However, only about 5 percent of agricultural land in California is used for organic practices (Environmental Working Group, 2023). There are several initiatives

to promote organic agriculture in California as one solution to address the changing climate (CCOF (California Certified Organic Farmers), 2023).

With a focus on high-value nuts, fruits, and vegetable crops, production costs are driven by the cost of labor. The mentioned crops are all very labor intensive compared to field crops like rice or wheat. The strawberry industry is an example of the price and cost structure of labor-intensive crops. Strawberries are produced year-round in California and cover 40,000 acres. Sixty thousand workers are needed to pick the strawberries. The farm receives about 40% of the retail price for the strawberries, and labor accounts for 30 to 40% of production costs (Martin, 2020, p. 78).

About 90 percent of farm workers are employed in the plant-based agriculture sector, with the majority of them in those high-value, labor-intensive crops that California is known for. California agriculture provides nearly half a million jobs and employs up to 800,000 workers annually. The actual number of farm workers remains somewhat elusive because of high turnover and seasonality, with one job filled with several workers in a given year and the high number of workers without US work authorization. It is estimated that more than half of the farm workers are “undocumented”, with no resident status or work authorization (Martin, 2020, p. 103). Over 80% of hired farm workers are born in Mexico. About one-third earn less than the poverty line; three-quarters earn less than 200% of the poverty line, the threshold for many public assistance programs (*31 California Farmworker Facts You Should Know*, 2023).

4.2.2 Animal-based Food Production

California’s livestock and livestock products total \$12.8 billion annually. Of this, almost 60% come from dairy and dairy products, and about one-quarter from cattle and calves.

California is the leading milk producer in the US, with 1.7 million **dairy** cows, and dairy is the top farm commodity in California (Sumner, 2020, p. 135). About half of the dairy products are sold outside of California, while fluid milk is sold locally because of the high cost of transportation.

The dairy industry in California had seen rapid growth until 2010 and has since stabilized at a high level. (Sumner, 2020, p.137). The number of farms is declining, but herd size is increasing as economies of scale are realized and production per cow is maximized.

Almost all dairy farms are confinement style, with the majority of cows in herds of 2,500 or more cows. (Sumner, 2020, p.140). About 90 percent of the dairy revenue comes from the San Joaquin Valley, with almost all dairy farms being very large confinement-style operations (Sumner, 2020, p.143). There are many dairies across the country in proximity to customers, as fluid milk is expensive to transport. Northern California is home to organic and pasture-based dairies with lower milk per cow and smaller herds. They yield higher prices but continue to be a niche market, with about 8 percent of fluid milk certified organic (Sumner, 2020, p.150).

The main production cost for dairy is the feed. Hay and silage are typically produced locally because of the high shipping cost. However, there is competitive pressure for land to produce hay or corn for silage, especially from the almond and grape industry. Another pressure point is the need for irrigation and growing tensions over water rights, especially in the San Joaquin Valley. Other feeds, like oilseed and grain feed, come from the Midwest. In addition to that, dairy cows are fed by-products of plant agriculture, like almond hulls and cottonseed (Sumner, 2020, p.144).

Dairy CAFOs produce large amounts of manure and typically “store animal manure in open lagoons and apply manure to nearby fields.” (Quist et al., 2022, p. 1). The manure leads to water and air pollution, affecting the health and well-being of surrounding communities. Large Dairy CAFOs are disproportionately located in proximity to communities of People of Color (POC), especially Latinx and Native American communities (Quist et al., 2022). The water pollution is especially concerning in arid parts of California with very low water tables. The San Joaquin Valley is such an area and also home to most California dairy CAFOs. In the San Joaquin Watershed, many small water systems already fail to meet safe drinking water standards (*Actions for Cleaner Water*, 2023).

The State of California has implemented regulations to curb some of the pollution and especially to lower the methane emissions caused by dairy manure. It has also subsidized facilities to use the emitted methane to produce renewable fuels in the San Joaquin Valley (Sumner, 2020, p.146).

The dairy industry is subsidized on the state and federal levels. Those subsidies explain the economic success of the dairy industry. After a long history of government protection of milk prices, the newest iteration of federal support is the Dairy Margin Coverage

(DMC) program and the Federal Milk Marketing Order (FMMO), both established in their current iteration in 2018 as part of the Farm Bill.

The DMC is a federally financed, voluntary risk management tool that aims to provide financial assistance to dairy producers when the margin between the price of milk and the cost of feed falls below a certain level (USDA Farm Service Agency, 2023). It incentivizes smaller farms to expand their herd sizes (Sumner, 2020, p.152).

The FMMO (*An Overview of the Federal Milk Marketing Order Program*, 2019) has applied to California since 2018, replacing California state government policy. It establishes minimum prices that have to be paid for milk used in different classes (Class I - fluid milk, Class II - soft dairy, Class III - cheese, Class IV - butter and dry milk). It helps ensure a stable market for dairy products.

The **beef industry** in California consists mostly of calves and yearling cows, which are started in California on grazeland and then sold by the age of 10 to 12 months to Midwestern States for finishing in CAFOs and slaughtering (Saitone, 2020: p.211). Farmers receive lower prices for their calves and yearling cows than other states because of the high transportation cost. California farmers also have to follow stricter rules, for example, regarding the use of antibiotics, than farmers in other states. There is a niche market for organic, grass-fed and finished local beef, which sells at higher prices. One limiting factor for this is the lack of slaughterhouses that can process “certified humane” slaughtered beef.

Cattle often graze on public lands through grazing permits. This part of the agricultural industry is heavily dependent upon rain to grow enough forage resources and avoid the need for supplement feed. Therefore, it is climate-sensitive and becomes more risky as the droughts in California intensify and become more frequent. In addition to the climate risks, public perception is also changing, with more pressure to conserve the environment, limiting cattle farmers' access to grassland (Saitone, 2020, p. 218).

Other significant sectors of animal-based agriculture in California are poultry, pigs, and egg production. Approximately 14 million hens produced 335 million eggs in 2021. About 260 million meat chickens (not including laying hens) and 2.6 million pigs were slaughtered in 2021.

4.2.3 Climate Impacts on California Agriculture

California has a very favorable climate for agriculture, which is why so much of the American food supply is produced in California. However, there are also several challenges to the climate, and they seem to increase in intensity.

California has a history of frequent, periodic droughts that seem to become more frequent and more severe over time. At the same time, the average temperature is increasing, as the following graphs show over a period of the last 70 years.

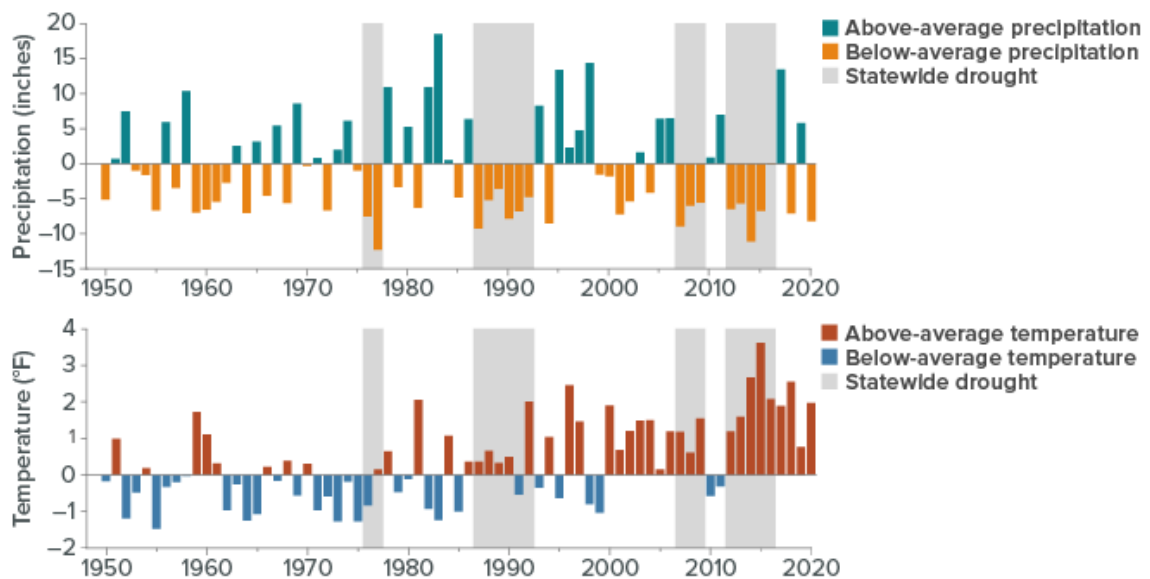


Figure 7: "Precipitation and Temperature in California, 1950 - 2020" (Mount et al., 2021, p. 2)

Especially heavily water-dependent agricultural industries are affected by those droughts: the dairy and beef industry, but also grapes and almonds require large amounts of water. Periods of excessive heat are also increasing, proving challenging for agriculture in California, especially in the Central Valley, which has the highest temperatures and the heaviest aggregation of agricultural production. This area is also affected by groundwater overdraft, meaning that more groundwater is used than rainfall can regularly replenish. The following graphic shows net groundwater withdrawal and recharge for the San Joachin Valley for the years of 1988 to 2017. Most years, more water was used than replenished by rain.

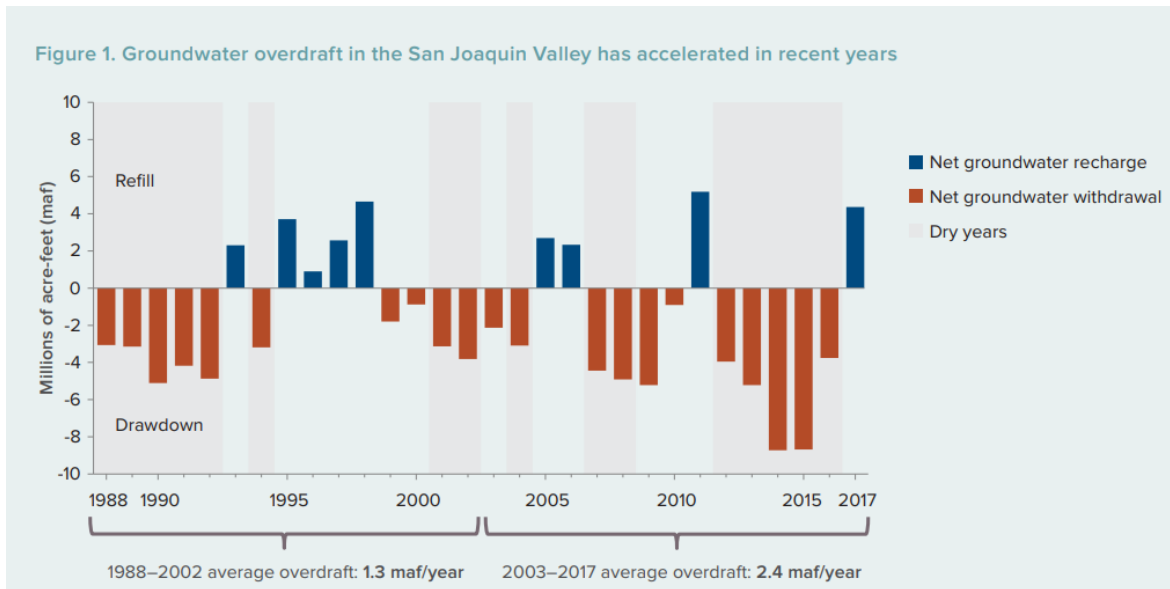


Figure 8: “Groundwater overdraft in the San Joaquin Valley 1988 - 2017” (Hanak et al., 2019)

One suggested solution to the dwindling water resources is the extensive fallowing of farmland, where the change to less water-intensive agriculture is not sufficient (Mount et al., 2021). Fallowing farmland will reduce the area of arable land.

In addition to that, California is also at risk for extensive rain- and snowfall and flooding. The water year 2022 was one of the wettest in history, and the melting of the massive snowpack combined with additional rain led to widespread flooding in spring 2023 (EarthSky, 2023). Floods in the Central Valley and other agricultural areas have the potential to destroy entire harvests.

4.3 Strategies to Advance Plant-based Diets in California

4.3.1 Governmental Initiatives

State-Level Governmental Initiatives

In the past few years, the State of California had two major governmental initiatives to promote a plant-based diet, one bill in 2018 and one in 2022.

In 2018, Governor Jerry Brown signed Senate Bill 1138, “Healthy Food Options in Hospitals”, into law, requiring hospitals and state prisons to offer at least one plant-based option per meal (K. Smith, 2018). As a result, more and more hospitals are expanding

their food choices to include robust plant-based options in their menus. For example, the Santa Clara Valley Healthcare (SCVH) system, a public hospital system, introduced 2023 a plant-based, allergen-free food program, “Universal Meals”, offered at no additional cost (Foreman, 2023).

In 2022, the passing of Assembly Bill (AB) 558 was an even bigger success as it set out to change school meals. Since 2003, school food authorities have been urged by the California Healthy School Lunch Resolution to develop healthy school menus that include plant-based vegetarian entrees. However, according to the California Department of Education (CDE), alternatives to cow’s milk, for example, had to be either documented by a health professional or requested and signed by parents (CDE Nutrition Services Division, 2021). With the 2022-2023 school year, California established, through Assembly Bill 130, the “California Universal Meals Program,” which makes breakfast and lunch free for all students from kindergarten to High School (CDE Nutrition Services Division, 2023). At the same time, the requests of AB 558 had been incorporated by Governor Gavin Newsom into the State budget. With this budget, California earmarked \$700 million for supporting plant-based and sustainable initiatives at public schools as the first state to invest public funds into plant-based school meals. Of those, \$100 million reimburses schools that procure and offer plant-based, sustainable, or local foods. Over three years, \$600 million is invested in school kitchen infrastructure, training, and wages for food service workers (Starostinetskaya, 2022).

The California Office of Farm to Fork, located within the CDFA, is committed to increasing access to healthy local food for all Californians. While its focus is not necessarily the advance of plant-based diets, two of its major strategic initiatives do further plant-based nutrition significantly: The California Farm to School Program, and, described further below, the California Nutrition Incentive Program (CNIP).

The Farm-to-School Incubator Grant Program by the CDFA, housed under the Office of Farm to Fork, invested \$8.4 million in the fiscal year 2021 and \$25.5 million in the fiscal year 2022 in farm-to-school projects in California. Programs that were awarded funds through this grant developed education and cooking classes, increased access to local fruits and vegetables for students, and created school gardens and compost areas, among various healthy food initiatives (CDFA, 2023a).

These school-focused initiatives have been significant investments in healthier, more plant-based nutrition for school-aged children in California, which appear to be paying

off. Comparing 2019 to 2022 (Stewart & Hamerschlag, 2023), the share of California schools offering plant-based entrees at least once a week increased from 44% to 68% as shown in the following graphic.

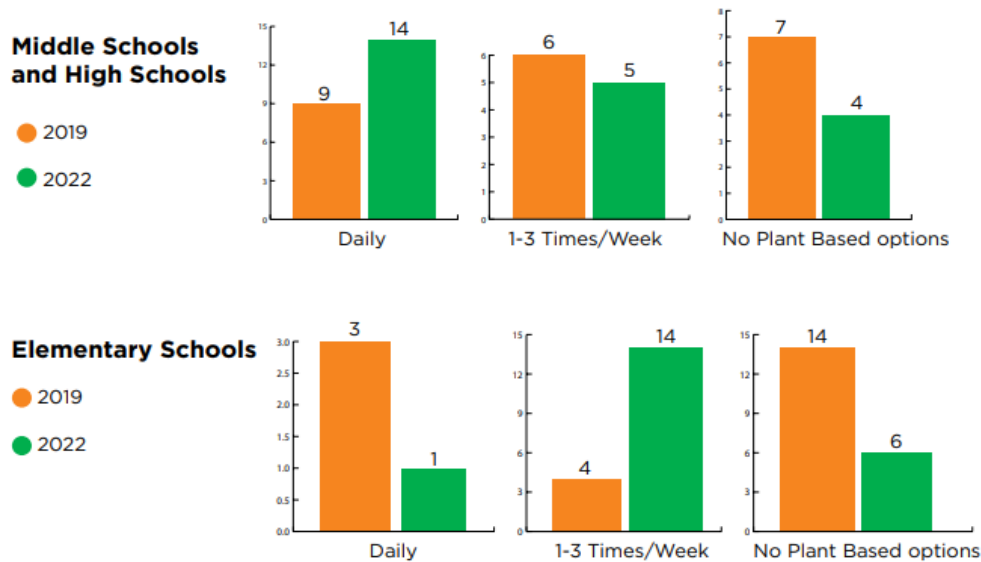


Figure 9: “Availability of Plant-Based Entree Options” (Stewart & Hamerschlag, 2023: p. 5)

The quality and diversity of those meals increased as well, with options like teriyaki tofu or chana masala added, so that the standard peanut butter and jelly sandwich no longer is the only plant-based alternative in school cafeterias.

While improvements can be seen, the majority of meals are still centered around meat and dairy, with 48% of meals including meat and 57% including cheese. The top three school lunches offered most often are chicken sandwiches, cheese pizza, and meat pizza. All school meals still include a serving of cow’s milk as required by federal regulations (USDA Food and Nutrition Service, 2012). The following pie chart shows the frequency of menu entrees by protein category for the schools in 2022.

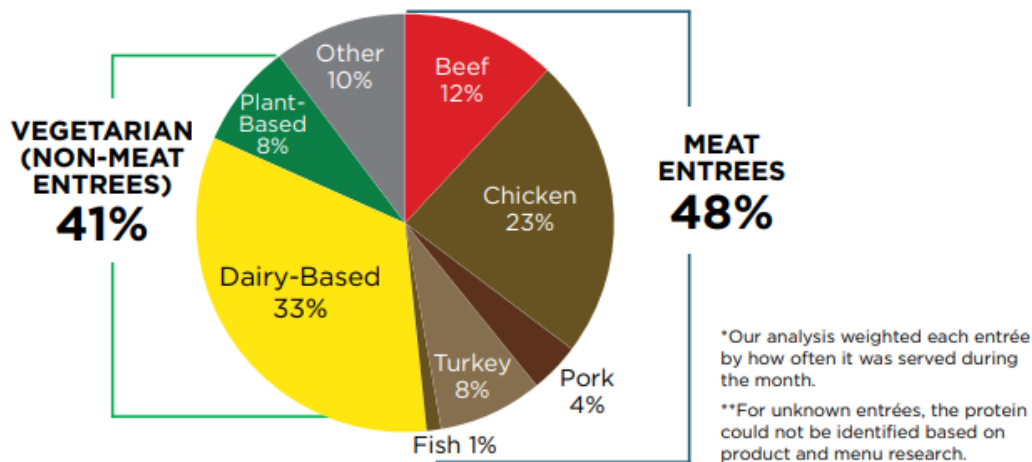


Figure 10: “Frequency of 2022 Menu Entrées by Protein Category” (Stewart & Hamerschlag, 2023, p. 5)

Many of the plant-based options that are now added to school menus are highly processed foods and not the healthy whole foods options that would be ideal for the children’s nutrition. Current animal sources based options also are mostly highly processed foods. This is based on two reasons that will require time and effort to change: Currently, many school kitchens, especially in lower-income school districts, are not equipped to cook from scratch and do not have the staff with the needed cooking skills. Secondly, all school lunches must fulfill the National Standards for School Lunch and Breakfast, which require schools to offer a “meat/meat alternate” (USDA Food and Nutrition Service, 2012) with every meal. Therefore, the plant-based solution often replaces the beef patty with a plant-based meat alternative patty.

To see widespread change to Californian’s school lunch menus will take time. To date, for example, the school lunch menu for Petaluma City Schools (a school district in the San Francisco Bay Area) has no vegan lunch; all dishes have meat or cheese as the main ingredient and are served with a side of cow’s milk with no easily available plant-based alternative. The following figure shows the menu for Petaluma City School in January 2024.

January 2024		LUNCH		
Monday	Tuesday	Wednesday	Thursday	Friday
8	9	10	11	12
	Chicken Bites w/ Mashed Potatoes Baby Carrots (1/2 C) Orange (1/2 C)	Chicken Teriyaki w/ Yakisoba Noodles & Carrot-Cabbage Mix Roasted Chickpeas Banana (1/2 C)	Cheesy Turkey Nachos w/ Refried Beans & Tortilla Chips Cucumber Slices (1/4 C) w/ Tajin Apple (1/2 C)	Deep Dish Pepperoni Pizza Side Salad - Lettuce, Carrot, Tomato w/Ranch (1 C) Orange (1/2 C)
15	16	17	18	19
	Cheese Baked Ziti Baby Carrots (1/2 C) Orange (1/2 C)	Chicken Bites & Waffles w/ Roasted Potatoes Roasted Chickpeas Banana (1/2 C)	Cheese Tamale w/ Black Beans Celery Sticks (1/4 C) Apple (1/2 C)	Deep Dish Pepperoni Pizza Side Salad - Lettuce, Carrot, Tomato w/Ranch (1 C) Orange (1/2 C)
22	23	24	25	26
Hot Dog w/ Oven Baked Fries Baby Carrots (1/4 C) 100% Fruit Juice 4 oz	Cheese Lasagna w/ Tomato Basil Sauce Baby Carrots (1/2 C) Orange (1/2 C)	Chicken Tamale w/ Diced Carrots Roasted Chickpeas Banana (1/2 C)	Chicken Burrito Bowl w/ Black Beans Jicama Slices (1/4 C) Apple (1/2 C)	Deep Dish Cheese Pizza Side Salad - Lettuce, Carrot, Tomato w/Ranch (1 C) Orange (1/2 C)
29	30	31		
Crispy Chicken Sandwich w/ Oven Baked Fries Baby Carrots (1/4 C) 100% Fruit Juice 4 oz	Chicken Bites w/ Mashed Potatoes Baby Carrots (1/2 C) Orange (1/2 C)	Bean & Cheese Burrito w/ Pinto Beans Roasted Chickpeas Banana (1/2 C)		
All entrées served with choice of 1% milk or fat free milk. All grain items offered are Whole Grain Rich. This institution is an equal opportunity provider. Menus are subject to change without notice.				

Figure 11: Petaluma City School lunch menu January 2024 (Petaluma City Schools, 2024)

The California Nutrition Incentive Program (CNIP), under the CDFA Office of Farm to Fork, offers financial incentives for people receiving government food assistance to purchase healthy, fresh, local produce and nuts. The CNIP receives both public and private funding, with a combination of federal funding through the Gus Schumacher Nutrition Incentive Program (GusNIP), California State funding, grants, donations, and in-kind contributions (CDFA Office of Farm to Fork, 2023). People with low income living in California may qualify for various nutrition benefits: CalFresh (formerly known as food stamps), Supplemental Nutrition Program for Women, Infants, and Children (WIC), and Senior Farmers Market Nutrition Program. CNIP supports farmers' markets, grocery stores, and community-supported agriculture (CSA) to offer CNIP benefits where qualified shoppers receive additional funds (typically a \$1 for \$1 match up to \$10 or \$20) if they buy local fruits, vegetables, and nuts. This program is aimed at increasing the consumption of produce and nuts.

Comparing the purchases of CNIP recipients at participating versus non-participating farmers' markets revealed no significant difference in produce consumption. However, the program significantly reduces the odds of experiencing food insecurity (Gosliner et al., 2022). Increasing food security should arguably be the primary goal. Gosliner et al. could also show that people eligible for food assistance who did not shop at farmers' markets are often unaware of the program. More communication and outreach could improve awareness, bring more people to farmers' markets and to utilize CNIP benefits.

Another notable investment in plant-based foods, the State of California supported three California Universities (UC Berkeley, UC Los Angeles, and UC Davis) to further their research and development of plant-based and cultivated meat proteins with \$5 million in the 2022-2023 budget year (Jamali, 2022).

In 2021-2022, Assembly Bill (AB) 1289 (Smart Climate Agriculture Program, 2021) was introduced to the House of Representatives to support small and mid-size farmers in transitioning livestock and feed agriculture to plant-based agriculture. Support would have been provided in the form of technical assistance as well as grants. However, this bill did not pass and died in the House.

Local-Level Governmental Initiatives

In addition to the governmental initiatives on the state level, there have been many initiatives by local governments on the county and city levels to further plant-based nutrition.

One of the first local governments to establish a Healthy and Sustainable Food Policy was the City & County of San Francisco, California, in 2009. This policy commits to healthy and sustainable food, establishes a Food Policy Council, and directs various city departments to align their policies and practices with this Executive Directive (Healthy and Sustainable Food for San Francisco, 2009). It does not specify plant-based foods or the reduction in animal-based foods. However, by now, this policy serves as a template for developing and implementing sustainable food policies for cities and other local ordinances.

In collaboration with several other nonprofits, the nonprofit organization Friends of the Earth developed a municipal guide to climate-friendly food purchasing, "Meat of the

Matter" (Hamerschlag et al., 2017). It references, among several others, the Healthy and Sustainable Food Policy of San Francisco and creates a template for other cities to follow suit. They suggest a two-phase plan. The first phase creates a working group, enacts the policy, and develops the desired climate-friendly food standards. The second phase focuses on implementing the policy and standard by developing a communication and training plan, updating bid solicitations and contract language, and tracking and reporting progress.

Since then, several municipalities have enacted sustainable food policies, with bolder plant-forward policies emerging.

The City of Berkeley, home of UC Berkeley and known for its progressive stance, started in 2015 with a "Meatless Monday" and in 2018 transitioned to a "Vegan Monday," requiring city-operated facilities and programs to offer a vegan meal on Mondays or one other day in the week (Aidoo et al., 2023). In 2021, the city passed a resolution to "Support Vision 2025 for Sustainable Food Policies" and later that year added a resolution "To Accelerate the City of Berkeley's transition to Plant-Based Foods," which asks to cut the purchase of animal-based foods in half and replace it with plant-based and plant-forward meals by 2024. This last resolution is more concrete and directly asks the City Manager for implementation, which will affect the food provided at Berkeley's city-managed senior centers, youth programs, and the jail.

The City of Los Angeles is part of the C40 network, a network of mayors of major cities working to find solutions for the climate crisis (C40 Cities Climate Leadership Group, 2023). In 2019, Los Angeles committed to the C40 Good Food Cities Declaration, which calls for the reduction of food waste and a planetary health diet accessible to all residents by 2030 (*C40 Good Food Cities Declaration*, 2019).

Many cities are starting similar commitments. For example, the City of Petaluma partnered in 2023 with local nonprofits and the local hospital to participate in the Blue Zones Project. Participating cities commit to healthier policies, environments, and choices to improve quality of life and extend the residents' lifespan. One part of this initiative is increasing access to plant-based food options. However, these projects take time to spread and have a measurable impact. As of now, no changes to local policies have been implemented.

4.3.2 Initiatives by California Businesses

California, and especially the San Francisco Bay Area with adjacent Silicon Valley, is a perfect location for plant-based alternative protein companies. It is known for its “hippies” and health-conscious residents, for its technology and invention spirit, and for investors willing and able to invest large amounts in tech start-ups who are ready to change the world. Many innovations have been born in California.

Plant-based Food Companies

California is home to more than 100 alternative plant-based food companies, including some of the major global players in the market. Both leading plant-based burger companies, **Impossible Foods** and **Beyond Meat**, are based in California.

Beyond Meat, founded in 2009 by CEO Ethan Brown, is headquartered in El Segundo, California, and is the first publicly traded plant-based meat company. It produces a variety of meat alternatives designed to replicate the taste and texture of animal meat products. Its marketing tries to appeal to ethical considerations as well as health and climate concerns (Beyond Meat, Inc., n.d.).

Beyond Meat is not a profitable company as of 2023, with struggles only slowly improving as high inflation and reduced consumer spending have negatively affected the industry (Beyond Meat, Inc., 2023). Initial losses are expected to a certain extent for a new industry, using new technology and building both production and marketing pipelines. Plant-based meat alternatives still struggle to convince consumers to consider their products a healthy choice compared to animal meat, as animal rights and the climate prove not to be strong enough arguments for many potential consumers. In addition to that, plant-based meat alternatives try to compete with prices for their animal-based counterparts, which the US government heavily subsidizes.

Impossible Foods was founded in 2011 by Patrick O. Brown (not related to Ethan Brown) and is headquartered in Redwood City, CA. Similar to Beyond Meat, it produces a plant-based meat alternative, with its signature product a “beef” burger that “bleeds” like its animal counterpart thanks to yeast-based heme. Patrick O. Brown created Impossible Foods out of concern for the climate and his belief that the meat industry would best be fought by creating a consumer product. Impossible Foods is experiencing

some of the same sales struggles as Beyond Meat in recent years, again based on dropping sales of meat alternatives, high inflation, supply, and labor costs. However, Impossible Foods seems to fare better than its competitors, with a year-over-year revenue growth of 70%. The larger revenue growth might partially be due to contracts with large businesses like Burger King, Trader Joe's, and Costco, and therefore, the farthest reach in the market (Soclof et al., 2023).

Eat JUST is another plant-based food company headquartered in the San Francisco Bay Area. They started with JUST Egg, a plant-based egg substitute made out of mung beans. JUST Egg has had success not only in the typical vegan and health-conscious niche markets but is also sold at mainstream places like Walmart and Peet's Coffee. JUST Egg is marketed as an egg alternative that has a smaller environmental footprint than eggs and is healthier for the consumer. The founder of Eat JUST, Josh Tetrick, set out to replicate eggs as he was appalled by the industrial egg production and the living conditions of the hens (Steel, 2021: p. 11). However, the marketing does not center on ethical considerations but focuses on health, planetary health, and taste (Just Eggs, 2024). With rising egg prices in 2023 due to the avian flu outbreak in the US, JUST Egg successfully advertised the lower, stable cost and consistent availability of its products, which increased its sales again ("As Egg Prices Surge, JUST Egg Runs 'Plants Don't Get Flu' Ads Outside US Supermarkets," 2023).

Eat Just's subsidiary, **GOOD Meat**, develops and sells lab-grown cell-based meats. These meats are grown from animal cells in the laboratory. GOOD Meat got approval from Singapore in 2020 to sell their cell-based chicken meat for consumption. In 2023, they also received approval from the FDA to sell it in the US. The company managed to receive significant amounts, \$267 million to date, of funding from investors (*Tracxn - GOOD Meat Company Profile*, 2024). The company is not profitable yet and is not able to produce large amounts of cell-based chicken meat. The technology has just been developed in recent years. It will take time and financial investments to learn if this endeavor could become profitable and an alternative to animal meat (Coyne, 2023).

Miyoko's Creamery is a plant-based dairy alternative producer in Petaluma. It was founded by former CEO Miyoko Schinner in her home kitchen in 2014 (Miyoko's Creamery, n.d.). Miyoko Schinner's motivation to create plant-based dairy products lies in concern for the animals. By now, Miyoko's Creamery has grown to be sold in 30,000

stores across the country and is exported to Canada and Australia. Miyoko's Creamery focuses on cultured cheeses and butter.

In 2021, it won a lawsuit against the California Department of Food and Agriculture (CDFA), which demanded that Miyoko's Creamery cease to label their plant-based products "dairy" and "butter" and to remove a picture from the website with Miyoko Schinner hugging a rescued cow. According to the US District Court for the Northern District of California, Miyoko's and other plant-based dairy producers are protected by free speech under the First Amendment to call their products by traditionally animal-based food names (Starostinetskaya, 2021).

Miyoko's Creamery created the Miyoko's Dairy Farm Transition Program (DFT Dairy Farm Transition, 2019). It wants to support dairy farmers in transitioning to plant-based agriculture. The reasons are multifaceted. Based in Northern California, dairy farms are struggling with droughts, increasing costs to operate their farms, and a reduction in milk product demand. Miyoko's Creamery needs specific crops to produce its cheeses and seeks to reduce its cost and environmental footprint by sourcing locally. It also considers the farmers as stewards of the land and members of the community who need viable options to move away from animal agriculture. Miyoko's, therefore, offers financial and strategic support for interested farmers. It would guarantee income during the transition, provide education, and create a stable demand as the buyer of the products. The program launched in 2019. However, no farm conversion has been completed through this program so far (Buxton, 2022).

As one of the oldest and most successful companies in the plant-based food industry, **Amy's Kitchen**, a vegetarian convenience food company based in Petaluma, California, has been in business since 1987 and is expanding their vegan options, with 120 out of 250 products already being plant-based.

Large animal-based food industry groups and companies have tried to sue plant-based companies not to use terms like "butter", "egg", or "mayo" for their plant-based alternatives. However, they have lost those lawsuits, with courts stating that the First Amendment, the right to free speech, protects plant-based companies.

Several large food companies that currently focus on animal-based foods have invested shares in California's plant-based alternative meat and dairy companies. For example, Tyson Foods invested in Beyond Meat. Danone bought Follow Your Heart, a plant-based dairy company from Southern California (Berke, 2022).

Healthcare Industry

Besides the food sector, the health sector can play a major role in the advancement of plant-based nutrition. **Kaiser Permanente** is an integrated managed care provider based in Oakland, California. It provides integrated health insurance and medical care to 9.4 million people in California (*Kaiser Permanente - Our Impact In California*, n.d.).

Kaiser Permanente promotes “Plant-based Eating” (*Plant-Based Eating - Using the Healthy Plate to Eat Well*, 2020), which it defines as “eating plant foods in their whole, unprocessed forms. This includes vegetables, fruits, beans, lentils, nuts, seeds, whole grains, and small amounts of healthy fats”. It suggests this diet can help limit animal products, processed foods, and sweets. It further suggests “The Healthy Plate” consisting of $\frac{1}{4}$ of plant-based protein, $\frac{1}{4}$ healthy grain or starchy vegetables, and $\frac{1}{2}$ of the plate non-starchy vegetables, with fruit, salad, and nuts as snacks.

It further addresses the common concerns of people just starting to consider a plant-based diet, like protein, calcium, vitamin B12, and iron intake.

Kaiser Permanente’s strategy is to encourage its members to create plans and commit to moving to a more plant-based diet, even if they are not able to eat 100% plant-based. It states that “any movement towards more plants and fewer animal products, processed foods, and sweets can improve your health.” This is in contrast to “MyPlate,” suggested by the DGA, which still recommends meat and dairy.

Kaiser Permanente has been promoting plant-based diets for a long time, making it more central to their health messages in recent years (*Plant-Based Nutrition - Frequently Asked Questions & Concerns*, 2012).

Its hospitals offer a dedicated vegetarian/vegan menu, which has a similar number of options to choose from as their regular menu (*Patient Menu-Vegan/Vegetarian Diet*, 2023).

4.3.3 Initiatives of Local NGOs and CBOs

California has a strong culture of nonprofit organizations. This chapter will focus on selected nonprofits at the intersection of social justice, climate, sustainability, and animal

rights. The advancement of plant-based food has many angles, and the selected nonprofits tackle one or more aspects of it.

Animal Rights Organizations

Animal rights organizations are fighting against industrial animal farming or the production and consumption of any animal products. Since they often have a strong ethical theme and tend to judge anyone who does not follow their strong ethical beliefs, their sphere is somewhat limited to a specific section of the population (Leenaert, 2017: p. 108). One notable nonprofit in California is the **Animal Legal Defense Fund**, whose mission is “to protect the lives and advance the interests of animals through the legal system” (Animal Legal Defense Fund, 2023b). They file high-profile lawsuits to protect animals, provide legal assistance and training, and use their platform for advocacy for animal rights and against animal farming. Many of their lawsuits are directly linked to the abuse of farm, research, and domestic animals. They support legislation protecting farm animals as large-scale animal farming remains the status quo. They are also involved in advocacy and lawsuits to further plant-based diets. As one of their initiatives, they urge the FDA not to discriminate against plant-based dairy products by requiring a “milk comparison statement” on their packages (Animal Legal Defense Fund, 2023a). The Animal Legal Defense Fund has successfully represented Miyoko’s Creamery in their case against CDFA regarding the use of dairy vocabulary for plant-based dairy products (Animal Legal Defense Fund, 2020).

They are also advocating that school children need access to plant-based milk as easily as they can access cow’s milk, claiming dietary racism since especially POC are less likely to be able to digest cow’s milk properly. They urge the USDA to change their standards to align with the DGA, which consider soy milk as part of the dairy food group; therefore, cow’s milk and soy milk should have the same availability for children (Animal Legal Defense Fund, 2023c).

Social Justice Organizations

Nonprofits in the social justice realm of plant-based food focus on many different key aspects. This paper selects two nonprofits in this sphere: The Transformation Project and the Food Empowerment Project.

One aspect of the social justice lens is supporting farmers and farm workers in escaping industrial animal agriculture. The **Transformation Project** (The Transformation Project, 2024), based in Los Angeles, California, is an initiative by the nonprofit Mercy for Animals, realizing the intersectionality of the impacts of industrial animal agriculture. They offer support to animal farmers to convert their farms to plant food for human consumption. The project assumes that many animal farmers are considering transitioning to plant crops as they see the many problems with animal agriculture but are caught within the system without the opportunity to change.

Almost all chicken and hog farmers in the US have contracts with big producers like Tyson Foods. With those contracts, the farmer is responsible for the purchase and upkeep of the barns and the equipment, and has contracts with the producer to sell the chicken or hogs. The farmers are also forced to update their barns and make other investments as the producer requires. The farmer receives the chicks from the producer. After five weeks of raising them, the farmers under contract are paid based on a tournament system that pays more to the farmer who managed to raise the heaviest chickens with the least amount of feed and deducts pay for the other farmers. The farmers entirely carry the risk. The contracts lead to continued debt for most farmers to finance the requirements, forcing them to continue to raise animals as cheaply as possible and sell them to the producer. Getting out of the contract would most often lead to bankruptcy (Moodie, 2017).

The Transformation Project's mission is to support farmers in escaping this cycle by transitioning to plant-based crops. They provide resources and training for the farmers, support the drafting of business plans, and assist in securing initial investment funds and buyers for their new product. Existing animal facilities are converted and repurposed in this transition. The Transformation Project makes all their research and transition plans public to support more farmers in the exploration of a transition to a just, sustainable, and profitable plant-based business (The Transformation Project, 2023). They also provide advocacy to create change through policies and other governmental initiatives.

This initiative takes multiple perspectives into consideration. With the transformation of industrial animal farms into plant-based farms, the animals, the environment, and nearby communities all benefit, more local plant-based food is available, and the farmers are set up for a sustainable income.

Centered at the intersection of veganism, racism, workers' rights, and food security is the Northern California-based nonprofit **Food Empowerment Project**. Its mission is to "create a more just and sustainable world by recognizing the power of one's food choices" (*FEP - Mission and Values*, 2024). Food security is identified as a primary concern, distinguishing this nonprofit from other vegan organizations. The Food Empowerment Project always prefaces their advocacy for vegan diets with the notion that people first need reliable access to healthy foods before concerning their choices with plant-based versus animal-based foods. A main initiative of their mission to advance plant-based diets is the creation of recipe sites with vegan cuisines from different cultures: currently, they have recipe databases for vegan Mexican, Filipino, and Chinese cuisines, making plant-based diets more accessible to people with different cultures and specifically for people of color and immigration history, who historically might not have the financial means to support healthy diets. The websites are also available in different languages, increasing access to them.

To increase access to healthy food, the Food Empowerment Project works to identify and highlight low-income communities in California and their lack of access to healthy foods, especially to organic fruits and vegetables. For example, they researched and reported on the food deserts in Silicon Valley (Ornelas, 2010) and Vallejo, California (Ornelas et al., 2018). Access to healthy plant-based foods is the foundation that needs to be secured before plant-based diets can be promoted and successfully adopted by people.

Community Based Organizations

Across the state, many Community Based Organizations (CBOs) are forming to further plant-based nutrition, especially for low-income communities. One example is **Rooted Santa Barbara County**. Their focus is to increase health and well-being through access to information about plant-based nutrition. Plant-based foods are presented as a way to prevent negative health outcomes for individuals. Rooted provides "low to no cost nutrition and food skills education and a network of community support to encourage

healthy, plant-centered lifestyles” (Rooted Santa Barbara County, 2024). Their resources and programs are bilingual, English and Spanish, to increase reach with immigrant communities. Nutrition education and cooking classes are offered in person and online for individuals to start their own journey. They also partner with other local nonprofits and health initiatives to advance health equity and resilience in their communities. Train the Trainer initiatives are supposed to “equip the healthcare community with the knowledge, resources and support to prioritize preventive health and nutrition in patient care” (Rooted Santa Barbara County, 2023).

A similar initiative in Northern California is **HomeGrown Bay Area**, “a coalition of individuals and organizations dedicated to fostering a sustainable and equitable food system across the Bay Area.” (Acterra, 2024b). HomeGrown is part of Acterra, a San Francisco nonprofit committed to further climate change solutions by supporting an “informed and empowered citizenry” (Acterra, 2024a).

Think Tanks

The nonprofit Good Food Institute takes a different angle to advance plant-based diets. It is a California-based nonprofit and think tank to promote the development of plant-based protein. The Good Food Institute hosted the Good Food Conference 2023 in San Francisco, bringing together companies, nonprofits, and consumers to further plant-based nutrition.

The selected nonprofits are examples of the range of California’s nonprofit sector, each taking on a different slice of the movement toward plant-based diets.

4.3.4 Individual Behavior and Social Media

The daily dietary choices ultimately constitute a personal decision. This decision is undeniably shaped by the social-political, economic, and cultural environment in which individuals live. However, at its core, the act of eating remains an expression of individual agency. In addition, change always starts with a small group of people doing things differently and moving a cause forward.

California boasts a rich history and culture steeped in activism and is home to many individuals dedicated to various causes. It is renowned for its health-conscious residents and stands as a melting pot of diverse global communities. Additionally, California has been a source of numerous inventions and innovations. It has a progressive political landscape. The combination of these factors fosters a diverse and vibrant plant-based community in California.

In recent years, more companies offer plant-based options for their events. The last three business events this author attended all offered clearly labeled plant-based food options, even though the organizations behind the events are not committed to plant-based food. The events included the holiday party of Epic Games, a large video game developer, a staff retreat of Canal Alliance, a nonprofit serving Latino immigrants in Marin County, California, and the “2023 Women of Industry Award” luncheon of the San Rafael Chamber of Commerce. Plant-based foods are not in their purview. The keynote speakers of the industry award ceremony were three local dairy owners, and one of the nominees is the CEO of a local beef company. All three events had a good selection of plant-based foods that were labeled accordingly and not just an afterthought or a side dish. This is initiated by individual employees in charge of coordinating the events that step up and decide that this selection is important. It is also pushed forward by employees and attendees of events who ask for plant-based options. There has been a notable change over the last decade from the accidental plant-based side dish to the conscious inclusion of full plant-based meals offered at business events.

There are many vegan social media groups, for example, Vegan California (Vegan Shift, 2024) or Sonoma County Vegans (Lifvendahl, 2024) on Facebook. These social media groups tend to be very strict vegan and have a tendency to condemn any behavior or expression of thought that is not aligned with animal rights-based veganism. Even vegans for health reasons are negatively judged by the majority of the vocal group members. They tend to alienate people curious about plant-based diets or just starting out on a healthier, plant-forward diet.

A more positive and inclusive approach is selected by various vegan influencers on different social media platforms. Notable examples are Los Angeles-based Mexican American “Queer Brown Vegan” Isaias Hernandez (Hernandez, 2023) and Berkeley-based “Bizerkeley Vegan” Erika Hazel (Hazel, 2024).

Isaias Hernandez describes himself as an environmental educator, public speaker, and creative. His mission is to educate not only about veganism but also the intersectionality of veganism, systemic racism, white supremacy, capitalism, and climate change. He comes with lived experiences growing up poor and living in affordable housing projects, and he then pursued an environmental science degree (Godin, 2022). He believes that education should be free, and his content creation is centered around informing his audience, who are then free to draw their own conclusions.

Erika Hazel is a California native living in Berkeley, California, and a vegan food influencer and event planner. She shares recipes and Bay Area restaurant reviews, and she puts on the Bizerkeley Food Fest, an annual vegan food festival, and a monthly vegan Brunchfest, among other events (Hazel, 2023). She aims for positivity and inclusivity without judging non-vegans, inviting people to have fun with plant-based foods.

In this author's experience, the public opinion on plant-based diet choices has been shifting. Plant-based diets are becoming normalized, and a request for a plant-based option is almost always kindly accepted. The conversations have changed from disbelief and health concerns associated with a plant-based diet to the acknowledgment that, indeed, plant-based meals would be the healthier choice but are hard to accomplish for most.

Whether it is Miyoko Schinner, who created Miyoko's Creamery, Lauren Ornelas, who initiated the Food Empowerment Project, social media influencers, event coordinators or consumers asking for plant-based options: All change starts with individuals' decisions to do something different and is sustained by other individuals' willingness to listen, follow and contribute to change.

5 Findings of the Case Study

5.1 Solution for Food Security in a Changing Climate

California needs strategies to increase its resilience to a changing climate and to ensure food security for its population. Climate change poses multiple threats to agricultural production and the food security of the people. Droughts, excessive heat, and floods all have the potential to impact food production negatively. With significant certainty, California will continue to lose arable land, reducing its capacity to grow food and feed crops. With a more uncertain supply of food, food prices increase, and with it, food insecurity, especially for low-income communities.

Animal-based foods need more land and water than most plant foods since feed for the animals needs to be grown first, and the calorie conversion of feed to food in animal food production is rather poor. Therefore, the focus on plant-based food production has the potential to build climate resilience and support food security for more people.

However, plant-based foods are not per se more climate resilient than animal-based foods. California might have to consider its agricultural strategies to grow almonds and grapes on the current large scale. Both crops contribute considerably to the economic success of California's agriculture but are also very water-intensive. In addition to that, they pose a higher economic risk in climate disasters. Since they are trees and vines with a life span of 20 or more years, a drought or flood has the potential to destroy the harvest and income for many years. In contrast, annual field crops are typically only at risk for the loss of harvest in the year of the climate disaster.

Plant-based foods are, on average, cheaper than animal-based foods, potentially providing more food security to a wider range of income levels.

Plant-based foods can be one piece of the solution to build resilience to climate change and increase food security for a growing population.

5.2 Intersectionality of the Food System

The food systems, including production, distribution, and consumption, are very complex, with many interdependencies. Any change to any part of the food system can

lead to a wide variety of expected and unexpected consequences. The intersectionality of food systems (further in: Motta, 2021) can not be fully discussed here but needs to be mentioned as it will significantly influence the implementation of changes to the food system.

Farm workers and workers in CAFOs are mostly POC, many immigrants, and low-income. They are dependent on their income and potentially not transferable to other jobs. Farm workers are also at increased risk for heat exposure.

Promotion of a reduction of highly processed foods might once again solidify patriarchal structures as cooking food from scratch requires more time, typically more often from women than men.

With the current food systems in California, healthy plant-based foods are often not affordable or accessible for some socio-economic groups. They are forced to eat a highly processed, high sugar, high animal-based food diet. A poorer diet consecutively also leads to poorer health outcomes, which in turn need financial and educational resources to be addressed. Once access is achieved, nutritional education and teaching of cooking skills also need to be made accessible.

The development of policies and initiatives needs to consider the intersectionality of food and the existing interdependencies.

5.3 Impediments to Change

Animal-based diets are the status quo in California, and several forces work to prevent changes toward sustainable plant-based diets. Externalities describe the market failure behind the economic success of industrial animal agriculture. Special interest groups are the driving force behind keeping the systems in place that allow this economic success. The inertia of people and culture involuntarily supports the resistance of big business to change.

External Costs

External costs or externalities are “indirect effects of consumption or production activity” (Laffont, 2018, p. 4318). They are not borne by the responsible party but by others, which could be individuals, groups of people, the society as a whole, or, in case of environmental externalities, the earth and its inhabitants.

In the food systems and agriculture, those externalities are environmental and health impacts that are incurred involuntarily by society and the environment. “When such externalities are not included in prices, they distort the market by encouraging activities that are costly to society” (Pretty et al., 2001, p. 265).

Industrial agriculture is causing extensive damage to several systems but is not held responsible for those external costs (Tegtmeier & Duffy, 2004). The companies are not held accountable for the long-term consequences of water or air pollution or the deterioration of arable soil. In the same logic, they are also not accountable for the cost of adverse health outcomes due to poor diets. They are not held accountable for the long-term health outcomes of farm workers and people living near CAFOs and their water and air pollution.

These externalities illustrate the classical economics problem of market failure. If the true cost of business were to be paid by the companies who create them, industrial agriculture, including industrial animal farming, would be priced out of the market. Parel argues that the true cost of a fast food burger, with all external costs internalized, would cost \$200 (Patel, 2009, p. 15). It is the existence of externalities that have to be paid for by society, future generations, and the environment that makes industrial animal agriculture successful and financially viable.

Special Interest Groups

Special interest groups greatly influence the development of governmental policies and regulations that govern the food system. The case study shows the significant influence that the American dairy industry, with their various interest groups like the National Dairy Council, have on the development of the DGA. The DGA in turn influence many policies and government decisions on all levels, down to the type of milk served behind schools.

The agricultural industry has a very strong lobby and influences government policies.

Food and Culture

Food is an essential part of culture. Food choices are learned from a young age and deeply ingrained. For California, that not only includes food choices and food cultures associated with all the different nationalities and cultures that immigrated to California but also the dominance of American food culture. Many people grew up with animal-based foods as the center of their diets, cow milk promoted as a healthy necessity, and highly processed fast food being available at all times and at low cost. The food palate is developed in childhood, and adjusting it later in life takes initiative and effort.

In American culture, animal-based foods are associated with masculinity, dominance, and wealth, while plant-based diets are linked to femininity, weakness, and deviance (Beverland, 2014, p. 374). Food choices are, therefore, linked to people's self-perception.

Changing policies, for example, which foods are offered at school lunches, therefore, does not necessarily lead to immediate behavior changes. Similarly, teaching healthy food choices does not necessarily lead to behavior changes. People would need to learn how to cook healthier food and find healthier alternatives as delicious as their usual food choices.

Food choices are influenced by a wide variety of factors, including biological, social, cultural, and environmental drivers. Changing only one variable, for example, the information provided, will most likely not change individuals' food choices long-term. Monterrosa et al. (2020) show the interconnectedness of social and environmental factors in the diet choices of individuals.

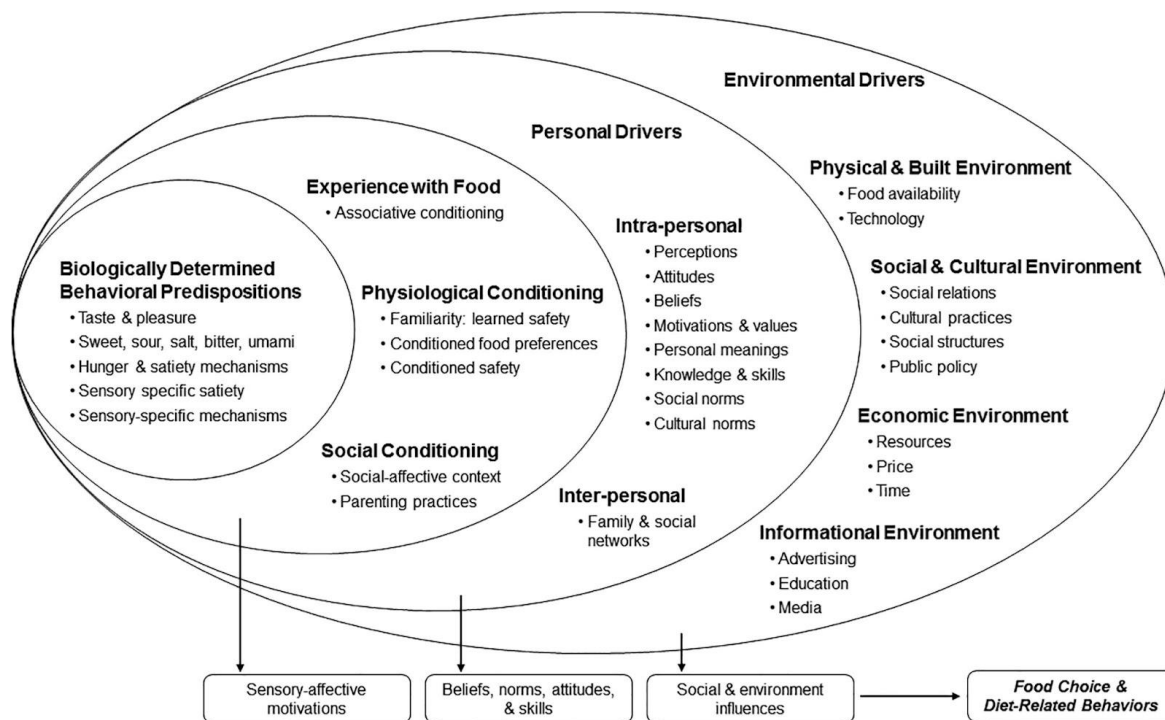


Figure 12: “Social and environmental influences at multiple levels on food choice and diet-related behaviors” (Monterrosa et al., 2020)

5.4 Advances in the Promotion of Plant-based Diets

The insufficiencies of the current industrial agriculture, and especially of industrial animal agriculture, are becoming more visible to a broader audience. Public awareness is a precursor to change.

The case study shows that progress has been made over the past decade in the promotion and advancement of plant-based diets as one step towards a more sustainable future. The described governmental initiatives are going in the right direction, even though they are taking rather incremental steps. It has to be noted that the effects of newly implemented policies take time, and many of those policies and regulations enacted over the last few years have not yet been fully realized.

Initiatives on different levels of government to improve nutrition in schools and offer plant-based options at school lunches are crucial steps as they start to educate young people. Children are more adaptable to change, and as discussed in Chapter 5.3, childhood builds the foundation of their food palate and future food choices.

Corporations are starting to invest more heavily in plant-based processed foods. In a capitalist society, this is a clear indicator that the general corporate agreement is that the society will become more interested in plant-based food choices. Unprocessed plant-based foods do not yield the same profit margin as highly processed foods, which explains the corporations' focus on creating plant-based meat and dairy alternatives and other highly processed plant-based foods.

As a major healthcare provider promoting plant-based diets, Kaiser Permanente is a clear indicator that the narrative is changing in California and that it is becoming clear that plant-based diets are also economically feasible.

Nonprofits are critical to the advancement of plant-based diets as they can counteract agricultural special interest groups. The plurality of perspectives that the vast array of nonprofits in California bring to the public discussion promotes change in different parts of society and in different ways. Nonprofit organizations are especially successful in advocacy efforts to influence government officials to support their initiatives.

All change is lastly initiated by individuals and their individual choices and convictions. People choose their cause and find different ways to involve themselves in shaping the society they live in.

6 Potential Solutions and Recommendations

The challenges to moving toward a plant-based food system are manifold and complex. Potential solutions, therefore, also need to be manifold and address the complexity. There are a myriad of potential initiatives that can support the change towards sustainable food systems, and they will have to be pursued simultaneously to see substantial and timely change.

6.1 Public Awareness, Education, and Marketing

The public awareness about the effects of animal-based foods is increasing. As animal-based foods are still a main component of the Standard American Diet, education campaigns are needed to change the public narrative about healthy and sustainable diets. Campaigns focusing on the health and well-being of people instead of the more abstract concept of climate change or the more contentious topic of animal rights will have more success. Most people are interested in their health and well-being; at least in Western cultures, extending one's own life is an important objective.

In this author's opinion, two distinct topics need to be included in public awareness and education campaigns. First, more information is needed that animal-based foods are not needed for a healthy diet. Second, people need to have resources and opportunities to learn how to prepare plant-based foods. Plant-based meat alternatives can play an important role in people transitioning away from animal-based foods. However, people who know how to prepare a variety of plant-based dishes will be more successful in adjusting their diet long term. Corporations invested in plant-based meat and dairy alternatives and other highly processed plant-based foods will focus their marketing on those products, which also, to some extent, undermines the health message in advocating for plant-based foods. Governmental and nonprofit initiatives are better positioned to advertise healthy and affordable plant-based diets based on fresh vegetables, legumes, and healthy grains.

There are already many initiatives to combat food insecurity in California by governmental entities and nonprofits. One part of their initiatives should be access to unprocessed plant-based foods that support health and are more affordable than the highly processed foods available at corner stores in current food deserts. Again, those

foods need to be culturally appropriate for the specific communities, and people need access to resources how to prepare healthy plant-based foods.

Industrial animal agriculture can be so exceptionally successful, despite its detrimental effects on health and the environment, because it has a strong lobby and great marketing. Nonprofits and activists dedicated to human and planetary health could learn from the tactics of industrial agriculture to become more effective messengers for their cause. The statements that red meat protein is superior and that cow's milk is critical for bone health have been disproven by several studies, but they are still held as a general belief. This is mainly due to excellent and strategic marketing by the beef and dairy industries (for example, the "Got Milk?" campaign (*Got Milk?*, n.d.)).

Professional marketing agencies will be able to design similarly effective strategies to promote plant-based diets and change the public belief system. There is no big industry behind a plant-based diet approach besides the small meat and dairy alternatives segment that could fund large-scale marketing campaigns.

Campaigns can be designed and implemented by various stakeholders. Schools can teach it, nonprofits can run campaigns, and social media influencers also play a critical role. Holistic concepts that consider the various variables that affect dietary choices will have to be developed and implemented.

Currently, animal-based diets are still the norm. It will take concerted efforts to change this narrative. In the dominant Western culture, animal-based diets are associated with masculinity and strength, while plant-based foods are associated with femininity, weakness, and deviance from the norm. One strategy, therefore, is using "positive role models, particularly sports stars or those engaged in physically demanding roles" (Beverland, 2014) to change the narrative and image of plant-based diets. Promoting stories of people like Nick Squires, a successful powerlifter and long-term vegan (Landsverk, 2023), will help change perceptions. In this author's opinion, the role of trailblazers and influencers who work to change the narrative of what a healthy diet looks like can not be underscored enough. People tend to look up to role models, and athletes and other celebrities can play a big role in changing perceptions.

People eating plant-based diets for health reasons are the most accepted in mainstream society. It might be most effective for campaigns to focus on the individual health aspect as the main communication tool to increase the reach across different parts of society.

To overcome the resistance in large parts of society, it might be helpful to promote plant-forward diets first to make it easier for people to get started. The prospect of a full plant-based diet where animal products are prohibited indefinitely is daunting to most people who are used to animal-based foods as a significant part of their diets. Progress should be celebrated as every plant-based meal is one step in the right direction.

Education and marketing campaigns need to take different cultures into account. Recipes that are shared through campaigns need to be sensitive to the cultural heritage of their target audiences. As the Food Empowerment Project shows in their recipe collections for vegan Mexican, Filipino, Lao, and Chinese foods, culture plays a critical role, and the variety of vegan dishes is immense.

6.2 Internalization of Externalities

The current capitalist market system does not consider environmental and health costs, leading to market failure in the global food system. Those externalities will need to be internalized in order to move to a more sustainable food system. The Californian government, along with the US federal government and international organizations, should work towards regulations and policies that further the internalization of environmental and social externalities caused by the industrial food system. Possible initiatives are environmental or health taxes, fees, and subsidies (Pretty et al., 2001, p. 272). For example, animal-based foods could be taxed differently than plant-based foods. Currently, food is not subject to California sales tax, but models similar in content have been discussed and implemented. For example, the city of Berkeley implemented a sales tax on sugar-sweetened beverages in 2014 to discourage their consumption (Falbe et al., 2020). Alcoholic beverages are already taxed in California. Taxing animal-based foods would be a strategy implemented on the demand side of the equation, which would encourage a behavior change from the consumer, which in turn will cause a change in the supply.

One supply side leverage could be the pricing system for water for a direct change to the supply of animal-based foods. Groundwater use currently is not priced to ensure long-term conservation of groundwater levels and, therefore, environmental and social sustainability. Water rights in California are very complex and beyond this work's scope. Water rights reform is necessary, with the first steps taken towards a more just and

sustainable future (SB-389 State Water Resources Control Board: Investigation of Water Right., 2023). Increasing the cost of water to ensure its sustainability will make the production of animal-based foods less financially viable and, based on market dynamics will encourage businesses to seek alternatives. As adjustments to business models are relatively slow, the first effect of an increase in water prices would be the increased cost of animal-based foods, which reduces demand. The pivot from animal agriculture to waterwise crop agriculture will subsequently follow.

Governmental subsidies that support livestock operations and incentivize animal feed crops over food crops need to be phased out (Hamerschlag, 2022).

Through the CDFA, California has several “Climate Smart Agriculture” initiatives that incentivize good land and water stewardship, which play a role in creating a more sustainable agriculture. However, they are government-funded and do not change the price structure of the food system. To rely on the invisible hand of the market (Smith, 1976, p. 477), the true cost of production and consumption need to be figured into food prices. In this author’s opinion, it would be preferable to internalize all costs into food prices and make government funding available for low-income households to ensure a sufficient supply of healthy food for everyone. This would create appropriate market incentives for producers and consumers to make production and consumption choices aligned with environmental sustainability while ensuring social sustainability through broadly available food assistance.

6.3 Effective Cooperation and Lobbyism

Industrial animal agriculture is a big and powerful industry, using their size and influence to shape the public view through large marketing campaigns and the political landscape through large-scale lobbying.

One strength of the nonprofit and activism sphere is the complexity and plurality of perspectives. This complexity also can work to the detriment of the common goal of promoting a plant-based diet as different interest groups either work in silos or, in some instances, even against each other. This is very visible in the different vegan communities, where self-declared ethical vegans insist that only animal rights concerns are the valid reason to become vegan and anything less than a perfectly vegan lifestyle is unacceptable. Health-based reasons for a plant-based diet are not sufficient in the

mind and messaging of many ethical vegans. This leads to the alienation of people interested in a plant-based diet or taking initial steps to reduce their consumption of animal-based foods (Leenaert, 2017). Many people do not want to be associated with “radical” vegans.

The different groups and stakeholder are involved in their own lobbying and marketing to message their cause. However, it would create more impact if the different groups joined forces to lobby their government with the common goal to reduce animal-based food production and consumption, and to increase plant-based foods. The cause behind the involvement needs to become second for effective large-scale lobbying to succeed.

If those lobbying initiatives prove successful and plant-based diets increase, all causes will benefit. Animals are not slaughtered whether people choose plant-based foods because of animal rights concerns or out of consideration for their health. People’s health improves with a plant-based diet regardless of the reason for that diet.

The common denominator for all nonprofit and activism groups is the human experience. Whether it is working to end child hunger in California through access to healthy nutrition, fighting for farm workers’ rights, tackling the diabetes and obesity crises, or hoping to end violence against animals, all causes are different perspectives of the common goal to improve human life. Generally, no one is opposed to improving the lives of animals along the way. Details can still be negotiated as plant-based diets are becoming the norm.

In this author’s opinion, there is much strength to be gathered by combining forces and lobbying Congress and local governments together, even if parts of a shared proposal are not perfectly aligned with one’s primary cause. It will be helpful to realize the strength that comes from the intersectionality of the subject, as it can create a comprehensive alignment in fighting for change. Extending kindness toward fellow activists who might have a different focus but still share the same ultimate goal will be vital to the success of all initiatives.

Partnerships between different causes, nonprofits, companies, and governments will create more impact than each individual initiative could. Perfectionism has to be set aside, and a more pragmatic approach can be taken to create faster progress even if the ultimate goal is still out of reach.

7 Conclusion and Outlook

The evidence is clear that plant-based diets can have a multitude of benefits for humans and the environment. However, animal-based foods are still the norm in California.

California is slowly making progress towards a more sustainable plant-based food system. Changing diet habits is a big cultural change that needs time, commitment, and change management. Future research will be needed to identify the most effective strategies to promote plant-based diets for a broader range of people. Many stakeholders are working towards plant-based diets, and synergies could be used to more effectively further their common goal.

Plant-based foods do not necessarily have to be healthy or environmentally friendly; they are, on average, gentler on humans and the environment than animal-based foods. They will not solve all food security issues, but they are an essential puzzle piece.

The promotion of plant-based foods should be applied concurrently with all other important initiatives to reach food security for all and to work towards a livable planet for all living beings and future generations.

Last but not least, there is an ethical argument in the pursuit to promote plant-based diets. It is an ethical consideration to aim to feed all humans. It is also an ethical consideration to protect the environment for all living species and future generations. The question of whether it is ethical to eat animals can be answered in different ways. Using capitalism as our market system is a choice with ethical implications. As humans, we do have the capability to make those choices, and they have to be made deliberately. In a pluralistic society, we cannot answer this question in unison, but every individual will have to make those decisions for themselves. The impact of the individual decision is small but not zero (Widdau, 2021, p. 132). People coming together with a shared moral conviction and working toward the implementation of a common vision will lead to change.

Bibliography

- 31 California Farmworker Facts You Should Know. (2023, March 28). La Cooperativa - Campesina de California. Retrieved January 7, 2024, from <https://lacooperativa.org/31-california-farmworker-facts-you-should-know/>
- Achterberg, C. et al. (2022). An analysis of the recent US dietary guidelines process in light of its federal mandate and a National Academies report. *PNAS Nexus*, 1(3), pgac107. <https://doi.org/10.1093/pnasnexus/pgac107>
- Acterra. (2024a). Acterra—About Us. Acterra: Action for a Healthy Planet. Retrieved January 27, 2024, from <https://www.acterra.org/about-us>
- Acterra. (2024b). HomeGrown Bay Area. Acterra: Action for a Healthy Planet. Retrieved January 27, 2024, from <https://www.acterra.org/homegrown>
- Actions for Cleaner Water. (2023). United States Environmental Protection Agency. Retrieved January 4, 2024, from <https://www.epa.gov/sanjoaquinvalley/actions-cleaner-water>
- Agriculture and Food Access in California. (2020). Retrieved December 27, 2023, from <https://storymaps.arcgis.com/stories/e92d92db0acd43958e850fdd0b53d813>
- Aidoo, R. et al. (2023). Sustainable healthy diet modeling for a plant-based dietary transitioning in the United States. *Npj Science of Food*, 7(1), 61. <https://doi.org/10.1038/s41538-023-00239-6>
- An Overview of the Federal Milk Marketing Order Program. (2019). USDA Agricultural Marketing Service. Retrieved January 7, 2024, from <https://www.ams.usda.gov/sites/default/files/media/DairyFMMOBooklet.pdf>
- Animal Legal Defense Fund. (2020). California Unconstitutionally Restricts the Marketing of Plant-Based Dairy Products. Retrieved January 15, 2024, from <https://aldf.org/article/california-unconstitutionally-restricts-the-marketing-of-plant-based-dairy-products/>

- Animal Legal Defense Fund. (2023a). Animal Legal Defense Fund Urges FDA Not to Discriminate Against Plant-Based Milk Producers with Voluntary Nutrient Statement. <https://aldf.org/article/aldf-urges-fda-not-to-discriminate-against-plant-based-milk-producers-with-voluntary-nutrient-statement/>*
- Animal Legal Defense Fund. (2023b). Animal Legal Defense Fund—About. <https://aldf.org/about-us/>*
- Animal Legal Defense Fund. (2023c). USDA Restricting Access to Plant-Based Milks in National School Lunch Program is Dietary Racism. <https://aldf.org/article/usda-restricting-access-to-plant-based-milks-in-nslp/>*
- As Egg Prices Surge, JUST Egg Runs “Plants Don’t Get Flu” Ads Outside US Supermarkets. (2023). Vegconomist. <https://vegconomist.com/marketing-and-media/just-egg-bird-flu-ad/>*
- Bach-Faig, A. et al. (2011). Mediterranean diet pyramid today. Science and cultural updates. *Public Health Nutrition*, 14(12A), 2274–2284. <https://doi.org/10.1017/S1368980011002515>*
- Badgley, C. et al. (2007). Organic agriculture and the global food supply. *Renewable Agriculture and Food Systems*, 22(2), 86–108. <https://doi.org/10.1017/S1742170507001640>*
- Baroni, L. et al. (2007). Evaluating the environmental impact of various dietary patterns combined with different food production systems. *European Journal of Clinical Nutrition*, 61(2), 279–286. <https://doi.org/10.1038/sj.ejcn.1602522>*
- Bashir, U. (2023). Diets and nutrition in the US as of September 2023 [dataset]. <https://www.statista.com/forecasts/997223/diets-and-nutrition-in-the-us>*
- Béné, C., & Devereux, S. (Eds.). (2023). Resilience and food security in a food systems context. Palgrave Macmillan.*
- Berke, A. (2022). How Should California Lead on Alternative Meat? Stanford Institute for Economic Policy Research. Retrieved January 13, 2024, from*

- <https://california100.org/wp-content/uploads/2023/10/California100-Policy-Brief-Issue2.pdf>
- Berners-Lee, M. et al. (2018). *Current global food production is sufficient to meet human nutritional needs in 2050 provided there is radical societal adaptation*. *Elementa: Science of the Anthropocene*, 6, 52. <https://doi.org/10.1525/elementa.310>
- Beverland, M. B. (2014). *Sustainable Eating: Mainstreaming Plant-Based Diets in Developed Economies*. *Journal of Macromarketing*, 34(3), 369–382. <https://doi.org/10.1177/0276146714526410>
- Beyond Meat, Inc. (n.d.). *Beyond Meat. Beyond Meat US*. Retrieved February 3, 2024, from <https://www.beyondmeat.com/en-US>
- Beyond Meat, Inc. (2023). *Beyond Meat Reports Third Quarter 2023 Financial Results*. *Beyond Meat US*. Retrieved February 3, 2024, from <https://www.beyondmeat.com/en-US>
- Bigelow, D., & Borchers, A. (2017). *Major Uses of Land in the United States 2012*. USDA Economic Research Service. Retrieved January 3, 2024, from <https://www.ers.usda.gov/webdocs/publications/84880/eib-178.pdf?v=0>
- Blumenstein, B. (2017). *Sustainable intensification of organic and low-input agriculture through integrated bioenergy production: System analysis, economic implications and risk assessment*. Kassel University Press.
- Buxton, A. (2022, February). *Miyoko's Creamery Launches Program That Helps Struggling Dairy Farmers Transition to Successful Plant-Based Crops*. *Green Queen in Conversation*. Retrieved January 14, 2024, from <https://www.greenqueen.com.hk/miyokos-creamery-dairy-farm-program/>
- C40 Cities Climate Leadership Group. (2023). *C40*. Retrieved January 14, 2024, from <https://www.c40.org/about-c40/>

- C40 Good Food Cities Declaration. (2019). Retrieved January 14, 2024, from https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000A8SW/Z45IFaakw5zMEyhWudkesqWQ1dDAjoDoXF_pPEAKipA
- California Food Guide: Fulfilling the Dietary Guidelines for Americans. (2008). CA Department of Health Care and CA Department of Public Health. Retrieved December 27, 2023, from <https://bscc.ca.gov/wp-content/uploads/2008-California-Food-Guide.pdf>
- Campbell, B. M. et al. (2017). Agriculture production as a major driver of the Earth system exceeding planetary boundaries. *Ecology and Society*, 22(4), art8. <https://doi.org/10.5751/ES-09595-220408>
- CCOF (California Certified Organic Farmers). (2023). Roadmap to an Organic California. Retrieved December 14, 2024, from <https://ccof.org/page/roadmap-organic-california>
- CDE Nutrition Services Division. (2021). Plant-based Meal Options in CNPs. California Department of Education. Retrieved December 31, 2023, from www.cde.ca.gov/ls/nu/he/vegmealoptionscnp.asp
- CDE Nutrition Services Division. (2023). Universal Meals FAQ. California Department of Education. Retrieved December 31, 2023, from <https://www.cde.ca.gov/ls/nu/univmealsfaq.asp>
- CDFA. (n.d.). CDFAHistory. Retrieved December 29, 2023, from www.cdfa.ca.gov/CDFA-History.html
- CDFA. (2023a). CA FARM TO SCHOOL INCUBATOR GRANT PROGRAM 2022 PROJECT SUMMARIES. California Department of Food & Agriculture. Retrieved December 29, 2023, from https://www.cdfa.ca.gov/caf2sgrant/docs/final_project_summaries_2022_ca_f2s_incubator_grant_program.pdf

- CDFA. (2023b). *California Agriculture Statistics Review 2021-2022*. California Department of Food & Agriculture. https://www.cdfa.ca.gov/Statistics/PDFs/2022_Ag_Stats_Review.pdf
- CDFA Office of Farm to Fork. (2023). *California Nutrition Incentive Program*. <https://cafarmtofork.cdfa.ca.gov/cnip.html>
- Chen, C., Chaudhary, A., & Mathys, A. (2022). Dietary Change and Global Sustainable Development Goals. *Frontiers in Sustainable Food Systems*, 6, 771041. <https://doi.org/10.3389/fsufs.2022.771041>
- Clapp, J. et al. (2022). Viewpoint: The case for a six-dimensional food security framework. *Food Policy*, 106, 102164. <https://doi.org/10.1016/j.foodpol.2021.102164>
- Comerford, K. B. et al. (2021). Global Review of Dairy Recommendations in Food-Based Dietary Guidelines. *Frontiers in Nutrition*, 8, 671999. <https://doi.org/10.3389/fnut.2021.671999>
- Coyne, A. (2023). "It's a massive challenge" – Good Meat's Josh Tetrick on scaling up production of lab-grown meat. *Just Food*. <https://www.just-food.com/interviews/its-a-massive-challenge-good-meats-josh-tetrick-on-scaling-up-production-of-lab-grown-meat/?cf-view>
- DFT Dairy Farm Transition. (2019). *DFT - dairy farm transition*. <https://www.dairyfarmtransition.com/>
- Dixon, K. A., Michelsen, M. K., & Carpenter, C. L. (2023). Modern Diets and the Health of Our Planet: An Investigation into the Environmental Impacts of Food Choices. *Nutrients*, 15(3), 692. <https://doi.org/10.3390/nu15030692>
- Dudley, N., & Alexander, S. (2017). Agriculture and biodiversity: A review. *Biodiversity*, 18(2–3), 45–49. <https://doi.org/10.1080/14888386.2017.1351892>
- EarthSky. (2023, April 19). California flood risk rises as snow melts. *EarthSky*. <https://earthsky.org/earth/california-flood-risk-rises-snow-melts-2023/>

- EAT Lancet Commission. (2019). *Food Planet Health—EAT-Lancet Commission Summary Report*. Retrieved December 24, 2023, from https://eatforum.org/content/uploads/2019/07/EAT-Lancet_Commission_Summary_Report.pdf
- Environmental Working Group. (2023). *Organic California*. Retrieved January 27, 2024, from <https://www.ewg.org/organiccalifornia/>
- Falbe, J. et al. (2020). *Implementation of the First US Sugar-Sweetened Beverage Tax in Berkeley, CA, 2015–2019*. *American Journal of Public Health*, 110(9), 1429–1437. <https://doi.org/10.2105/AJPH.2020.305795>
- Fanzo, J. (2019). *Healthy and Sustainable Diets and Food Systems: The Key to Achieving Sustainable Development Goal 2? Food Ethics*, 4(2), 159–174. <https://doi.org/10.1007/s41055-019-00052-6>
- Fanzo, J. (2023). *Achieving Food Security Through a Food Systems Lens*. In C. Béné & S. Devereux (Eds.), *Resilience and Food Security in a Food Systems Context* (pp. 31–52). Springer International Publishing. https://doi.org/10.1007/978-3-031-23535-1_2
- Fanzo, J. et al. (2020). *The Food Systems Dashboard is a new tool to inform better food policy*. *Nature Food*, 1(5), 243–246. <https://doi.org/10.1038/s43016-020-0077-y>
- FAO. (2006). *Food Security* (pp. 1–4) [Policy Brief]. Retrieved November 25, 2023, from https://www.fao.org/fileadmin/templates/faoitally/documents/pdf/pdf_Food_Security_Cocept_Note.pdf
- FAO. (2023). *FAO Soils Portal*. Retrieved November 25, 2023, from <https://www.fao.org/soils-portal/soil-degradation-restoration/en/>
- FAO, IFAD, UNICEF, WFP, & WHO. (2023). *The Brief to The State of Food Security and Nutrition in the World 2023. Urbanization, agrifood systems transformation and healthy diets across the rural-urban continuum*. Rome, FAO. Retrieved November 25, 2023, from <https://www.fao.org/3/cc6550en/cc6550en.pdf>

- Feeding America. (2022). Hunger in America. Retrieved December 27, 2023, from <https://www.feedingamerica.org/hunger-in-america>*
- FEP - Mission and Values. (2024). Food Empowerment Project. Retrieved February 19, 2024, from <https://foodispower.org/mission-and-values/>*
- Fields, H. et al. (2016). How to Monitor and Advise Vegans to Ensure Adequate Nutrient Intake. *Journal of Osteopathic Medicine*, 116(2), 96–99. <https://doi.org/10.7556/jaoa.2016.022>*
- Foreman, P. (2023). Hospitals In California Adopt “Inclusive” Vegan Meal Program in US First. *Plant Based News*. Retrieved January 1, 2024, from <https://plantbasednews.org/lifestyle/health-and-fitness/california-hospitals-vegan-universal-meals/>*
- Garnett, T. et al. (2013). Sustainable Intensification in Agriculture: Premises and Policies. *Science*, 341(6141), 33–34.*
- Godin, M. (2022, October 17). Queer Brown Vegan Wants to Make the Climate Movement More Inclusive. *Teen Vogue*. Retrieved January 27, 2024, from <https://www.teenvogue.com/story/queer-brown-vegan-interview>*
- Gosliner, W. et al. (2022). The California Nutrition Incentive Program: Participants’ Perceptions and Associations with Produce Purchases, Consumption, and Food Security. *Nutrients*, 14(13), 2699. <https://doi.org/10.3390/nu14132699>*
- Got Milk? (n.d.). Got Milk? Retrieved January 29, 2024, from <https://www.gotmilk.com/>*
- Grotto, D., & Zied, E. (2010). The Standard American Diet and Its Relationship to the Health Status of Americans. *Nutrition in Clinical Practice*, 25(6), 603–612. <https://doi.org/10.1177/0884533610386234>*
- Hamerschlag, K. (2022). Farm Subsidies in California: Skewed Priorities and Gross Inequities. *Environmental Working Group*.*

- Hamerschlag, K. et al. (2017). *Meat of the Matter*. Friends of the Earth. Retrieved January 2, 2024, from https://foe.org/wp-content/uploads/2017/12/Municipal_Report_ko_120117_v2-1.pdf
- Hanak, E. et al. (2019). *Water and the Future of the San Joaquin Valley—Overview*. Public Policy Institute of California. Retrieved January 24, 2024, from <https://www.ppic.org/wp-content/uploads/water-and-the-future-of-the-san-joaquin-valley-overview.pdf>
- Harris, S. M. (2015). *The Myth of Sustainable Food Supply and the Urgent Need for Radical Change from Competitive Corporatism to Sustainable Stewardship*. In *Strategies Towards the New Sustainability Paradigm* (pp. 141–154). Schwarz-Herion / Omran (Editors).
- Hazel, E. (2023). *The Bizerkeley Vegan*. <https://www.thebizerkeleyvegan.com/>
- Hazel, E. (2024). *Itserikahazel*. Instagram. <https://www.instagram.com/itserikahazel/>
- Healthy and Sustainable Food for San Francisco, Executive Directive 09-03 (2009)*. Retrieved January 2, 2024, from <https://bap-home.net/gfc/wp-content/uploads/sites/3/1970/01/6-SanFranciscoCA-Healthy-SustainableFoodForSanFranciscoExecutiveDirective09-03-2009.pdf>
- Hernandez, I. (2023). *The Queer Brown Vegan*. <https://queerbrownvegan.com/story/>
- Hirahatake, K. M. et al. (2020). *Potential Cardiometabolic Health Benefits of Full-Fat Dairy: The Evidence Base*. *Advances in Nutrition*, 11(3), 533–547. <https://doi.org/10.1093/advances/nmz132>
- HLPE. (2020). *Food security and nutrition: Building a global narrative towards 2030*. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome. Retrieved November 23, 2023, from <https://www.fao.org/3/ca9731en/ca9731en.pdf>

- IFOAM Organics. (2021). *Definition of Organic Agriculture*. Retrieved December 9, 2023, from <https://www.ifoam.bio/why-organic/organic-landmarks/definition-organic>
- Improving Food Access in California—Report to the California Legislature*. (2012). California Department of Food & Agriculture. Retrieved December 27, 2023, from https://www.cdfa.ca.gov/exec/public_affairs/pdf/ImprovingFoodAccessInCalifornia.pdf
- Ingram, J., & Zurek, M. (2018). *Food Systems Approaches for the Future*. In *Agriculture & Food Systems To 2050: Global Trends, Challenges And Opportunities*, edited by Rachid Serraj, and Prabhu.
- Jamali, D. (2022, July 12). *GFI commends California's landmark \$5 million investment in the future of protein*. Good Food Institute. Retrieved January 1, 2024, from <https://gfi.org/blog/gfi-commends-californias-landmark-5-million-investment-in-the-future-of-protein/>
- James, D. (2004). *Factors influencing food choices, dietary intake, and nutrition-related attitudes among African Americans: Application of a culturally sensitive model*. *Ethnicity & Health*, 9(4), 349–367. <https://doi.org/10.1080/1355785042000285375>
- Jardim, T. V. et al. (2019). *Cardiometabolic disease costs associated with suboptimal diet in the United States: A cost analysis based on a microsimulation model*. *PLOS Medicine*, 16(12), e1002981. <https://doi.org/10.1371/journal.pmed.1002981>
- Johnson, H. et al. (2022). *Race and Diversity in the Golden State*. Public Policy Institute of California. Retrieved December 27, 2023, from www.ppic.org/publication/race-and-diversity-in-the-golden-state/
- Just Eggs. (2024). *How do we make eggs from plants?* Retrieved February 24, 2024, from <https://www.ju.st/learn>

- Juul, F. et al. (2021). Trends in food consumption by degree of processing and diet quality over 17 years: Results from the Framingham Offspring Study. *British Journal of Nutrition*, 126(12), 1861–1871. <https://doi.org/10.1017/S000711452100060X>
- Kaiser Permanente—Our Impact in California. (n.d.). Kaiser Permanente. Retrieved January 11, 2024, from <https://about.kaiserpermanente.org/commitments-and-impact/public-policy/our-impact/news-perspectives-on-public-policy-california>
- Kelloway, C. (2022). U.S. Food Prices Are Up. Are the Food Corporations to Blame for Taking Advantage? *Time*. Retrieved December 27, 2023, from <https://time.com/6139127/u-s-food-prices-monopoly/>
- Klonsky, K. (2010). A Look at California's Organic Agriculture Production. Giannini Foundation of Agricultural Economics - University of California. https://www.cdfa.ca.gov/is/pdfs/A_Look_at_California's_Organic_Agriculture_Production.pdf
- Laffont, J. J. (2018). Externalities. In Macmillan Publishers Ltd (Ed.), *The New Palgrave Dictionary of Economics* (pp. 4318–4321). Palgrave Macmillan UK. https://doi.org/10.1057/978-1-349-95189-5_126
- Landsverk, G. (2023). A champion powerlifter shares his high-protein vegan diet and training routine. *Business Insider*. Retrieved February 3, 2023, from <https://www.businessinsider.com/vegan-powerlifter-high-protein-diet-training-routine-2023-12>
- Leenaert, T. (2017). *How to create a vegan world: A pragmatic approach*. Lantern Books.
- Lehner, P., & Rosenberg, N. (2017). Legal Pathways to Carbon-Neutral Agriculture. *Environmental Law Reporter*, 47, 10845–10876.
- Lifvendahl, M. (2024, January 27). Sonoma County Vegans. Facebook. Retrieved January 3, 2024, from <https://www.facebook.com/groups/425309160881928>

- Liu, M. (2022). *Policy Recommendation: Promotion of Plant-based Foods among Federal Agencies*. *Cornell Policy Review*. Retrieved December 30, 2023, from <https://www.cornellpolicyreview.com/policy-recommendation-promotion-of-plant-based-foods-among-federal-agencies/?pdf=6419>
- Lobell, D. B., Schlenker, W., & Costa-Roberts, J. (2011). *Climate Trends and Global Crop Production Since 1980*. *Science*, 333(6042), 616–620. <https://doi.org/10.1126/science.1204531>
- Lusk, J. L., & Norwood, F. B. (2009). *Some Economic Benefits and Costs of Vegetarianism*. *Agricultural and Resource Economics Review*, 38(2), 109–124. <https://doi.org/10.1017/S1068280500003142>
- Madry, E. et al. (2012). *The Impact of Vegan Diet on B-12 Status in healthy omnivores: Five-Year Prospective Study*. *Acta Sci. Pol. Technol. Aliment.*, 11(2), 209–212.
- Martin, P. (2020). *Chapter 4. Immigration and Farm Labor: Challenges and Opportunities*. In *California Agriculture: Dimensions and Issues* (2nd ed., pp. 73–104). Sieber J. (Editor)
- Mate Sagasta, J. et al. (2017). *Water pollution from agriculture: A global review. Executive Summary*. FAO and IWMI. Retrieved December 26, 2023, from <https://www.fao.org/3/i7754e/i7754e.pdf>
- Medek, D. E., Schwartz, J., & Myers, S. S. (2017). *Estimated Effects of Future Atmospheric CO₂ Concentrations on Protein Intake and the Risk of Protein Deficiency by Country and Region*. *Environmental Health Perspectives*, 125(8), 087002. <https://doi.org/10.1289/EHP41>
- Mialon, M. et al. (2022). *Conflicts of interest for members of the U.S. 2020 Dietary Guidelines Advisory Committee*. *Public Health Nutrition*, 1–28. <https://doi.org/10.1017/S1368980022000672>
- Miyoko's Creamery. (n.d.). *Miyoko's Creamery*. Retrieved January 14, 2024, from <https://www.miyokos.com/pages/about-us>

- Monterrosa, E. C. et al. (2020). *Sociocultural Influences on Food Choices and Implications for Sustainable Healthy Diets*. *Food and Nutrition Bulletin*, 41(2_suppl), 59S-73S. <https://doi.org/10.1177/0379572120975874>
- Moodie, A. (2017). *Fowl play: The chicken farmers being bullied by big poultry*. *The Guardian*. Retrieved January 21, 2024, from <https://www.theguardian.com/sustainable-business/2017/apr/22/chicken-farmers-big-poultry-rules>
- Motta, R. (2021). *Social movements as agents of change: Fighting intersectional food inequalities, building food as webs of life*. *The Sociological Review*, 69(3), 603–625. <https://doi.org/10.1177/003802612111009061>
- Mount, J., Escriva-Bou, A., & Sencan, G. (2021). *Droughts in California*. Public Policy Institute of California. Retrieved January 27, 2024, from <https://www.ppic.org/wp-content/uploads/droughts-in-california.pdf>
- NIH - National Institute of Diabetes and Digestive and Kidney Diseases. (2019). NIH - NIDDK - Overweight & Obesity Statistics. Retrieved December 16, 2023, from <https://www.niddk.nih.gov/health-information/health-statistics/overweight-obesity>
- Ornelas, L. (2010). *Shining a Light on the Valley of Heart's Delight—Taking a Look at Access to Healthy Foods in Santa Clara County's Communities of Color and Low-Income Communities*. Food Empowerment Project. Retrieved January 21, 2024, from https://foodispower.org/wp-content/uploads/2021/04/FEP_SantaClara_Report_EN.pdf
- Ornelas, L., Aalborg, A., & Strouse, C. (2018). *Brining Community Voices to the Table: Food Access in Vallejo, CA Focus Group—Qualitative Data Analysis Results*. Food Empowerment Project. Retrieved January 21, 2024, from www.foodispower.org/wp-content/uploads/FEP-Focus-Group-Report-Oct-2018-English-FA-PRINT.pdf

- Pasiakos, S. et al. (2015). *Sources and Amounts of Animal, Dairy, and Plant Protein Intake of US Adults in 2007–2010*. *Nutrients*, 7(8), 7058–7069. <https://doi.org/10.3390/nu7085322>
- Patel, R. (2009). *The value of nothing: How to reshape market society and redefine democracy (First edition)*. Picador.
- Patient Menu-Vegan/Vegetarian Diet. (2023). Kaiser Permanente South Sacramento. Retrieved January 21, 2024, from <https://thrive.kaiserpermanente.org/care-near-you/northern-california/southsacramento/departments/nutrition-and-food-services/patient-menu-vegan-vegetarian-diet/>
- Petaluma City Schools. (2024). *Petaluma City Schools—Food Services*. Retrieved January 14, 2024, from <https://www.petalumacityschools.org/foodservices>
- Petaluma Downtown Association. (2024). *Butter and Egg Parade*. Petaluma Downtown. Retrieved February 3, 2024, from <https://petalumadowntown.com/butter-eggs-parade.html>
- Pimentel, D. et al. (2004). *Water Resources: Agricultural and Environmental Issues*. *BioScience*, 54(10), 909. [https://doi.org/10.1641/0006-3568\(2004\)054\[0909:WRAAEI\]2.0.CO;2](https://doi.org/10.1641/0006-3568(2004)054[0909:WRAAEI]2.0.CO;2)
- Plant-Based Eating—Using the Healthy Plate to Eat Well. (2020). Kaiser Permanente. Retrieved January 13, 2024, from https://thrive.kaiserpermanente.org/care-near-you/southern-california/center-for-healthy-living/wp-content/uploads/sites/30/2020/03/plant_based_diet_e.pdf
- Plant-Based Nutrition—Frequently Asked Questions & Concerns. (2012). Kaiser Permanente. Retrieved January 13, 2024, from https://thrive.kaiserpermanente.org/care-near-you/northern-california/santarosa/wp-content/uploads/sites/15/2015/09/1082-E-Rev-9-12-CL_tcm75-614811.pdf

- Pradhan, P. et al. (2017). A Systematic Study of Sustainable Development Goal (SDG) Interactions. *Earth's Future*, 5(11), 1169–1179. <https://doi.org/10.1002/2017EF000632>
- Pretty, J. et al. (2001). Policy Challenges and Priorities for Internalizing the Externalities of Modern Agriculture. *Journal of Environmental Planning and Management*, 44(2), 263–283. <https://doi.org/10.1080/09640560123782>
- Quann, E. E., Fulgoni, V. L., & Auestad, N. (2015). Consuming the daily recommended amounts of dairy products would reduce the prevalence of inadequate micronutrient intakes in the United States: Diet modeling study based on NHANES 2007–2010. *Nutrition Journal*, 14(1), 90. <https://doi.org/10.1186/s12937-015-0057-5>
- Quist, A., Johnston, J., & Fliss, M. D. (2022). Disparities of Industrial Animal Operations in California, Iowa, and North Carolina. *Earth Justice*. Retrieved January 7, 2024, from https://earthjustice.org/wp-content/uploads/quistreport_cafopetition_oct2022.pdf
- Ramos-Yamamoto, A. (2020). Not Enough to Eat: California Black & Latinx Children Need Policy Action. California Budget & Policy Center. Retrieved December 27, 2023, from <https://calbudgetcenter.org/resources/not-enough-to-eat-california-black-latinx-children-need-policy-action/>
- Robertson, I. (2021, October 26). California is the second most vegan State for 2021. KPFK. Retrieved December 27, 2023, from <https://www.kpfk.org/blogs/kpfk-news-department/post/california-is-the-second-most-vegan-state-for-2021/>
- Rooted Santa Barbara County. (2023). Rooted Santa Barbara County's Take Root Campaign Deck. Rooted Santa Barbara County. Retrieved January 22, 2024, from <https://rootedsantabarbara.org/pdf/Rooted-SBC-Take-Root-Campaign.pdf>
- Rooted Santa Barbara County. (2024). Rooted Santa Barbara County. Retrieved January 22, 2024, from <https://rootedsantabarbara.org/>

- Rowe, S. (2014). *US evidence-based dietary guidelines: The history and the process*. *Nutrition Bulletin*, 39(4), 364–368. <https://doi.org/10.1111/nbu.12115>
- Ruane, A., & Rosenzweig, C. (2018). *Climate Change Impacts on Agriculture*. In *Agriculture & Food Systems To 2050: Global Trends, Challenges and Opportunities*, edited by Rachid Serraj, and Prabhu (pp. 161–191).
- Rypdal, K., & Winiwarter, W. (2001). *Uncertainties in greenhouse gas emission inventories—Evaluation, comparability and implications*. *Environmental Science & Policy*, 4(2–3), 107–116. [https://doi.org/10.1016/S1462-9011\(00\)00113-1](https://doi.org/10.1016/S1462-9011(00)00113-1)
- Sáez-Almendros, S. et al. (2013). *Environmental footprints of Mediterranean versus Western dietary patterns: Beyond the health benefits of the Mediterranean diet*. *Environmental Health*, 12(1), 118. <https://doi.org/10.1186/1476-069X-12-118>
- Saitone, T. L. (2020). *Chapter 9: Livestock and Rangeland in California*. In *California Agriculture: Dimensions and Issues (2nd ed.)*. Sieber, J. (Editor)
- SB-389 State Water Resources Control Board: *Investigation of Water Right.*, SB-389, Californai Senate (2023). Retrieved February 3, 2024, from https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202320240SB389
- Shepon, A. et al. (2016). *Energy and protein feed-to-food conversion efficiencies in the US and potential food security gains from dietary changes*. *Environmental Research Letters*, 11(10), 105002. <https://doi.org/10.1088/1748-9326/11/10/105002>
- Shepon, A. et al. (2018). *The opportunity cost of animal-based diets exceeds all food losses*. *Proceedings of the National Academy of Sciences*, 115(15), 3804–3809. <https://doi.org/10.1073/pnas.1713820115>
- Sibal, V. (2018). *Food: Identity of culture and religion*. Retrieved December 27, 2023, from <https://www.wathi.org/food-identity-of-culture-and-religion-researchgate/>

- Smart Climate Agriculture Program, AB 1289 (2021). Retrieved January 11, 2024, from <https://pluralpolicy.com/app/legislative-tracking/bill/details/state-ca-20212022-ab1289/685204>
- Smith, A. (1976). *An inquiry into the nature and causes of the wealth of nations*. University of Chicago Press.
- Smith, A. D. (2022). *Who Eats California Crops*. Retrieved January 4, 2024, from <https://asmith.ucdavis.edu/news/ca-ag-exports>
- Smith, K. (2018). *California Law Requires Hospitals and Prisons to Offer Vegan Meals*. LiveKindly. Retrieved January 1, 2024, from <https://www.livekindly.com/california-law-hospitals-prisons-vegan-meals/>
- Soclof, A. et al. (2023). *Impossible Foods—Memo*. Contrary Research. Retrieved January 14, 2024 from <https://research.contrary.com/reports/impossible-foods>
- Spencer, R. (2018). *Global Warming Skepticism for Busy People*.
- Springmann, M. et al. (2021). *The global and regional costs of healthy and sustainable dietary patterns: A modelling study*. *The Lancet Planetary Health*, 5(11), e797–e807. [https://doi.org/10.1016/S2542-5196\(21\)00251-5](https://doi.org/10.1016/S2542-5196(21)00251-5)
- Starostinetskaya, A. (2021). *Miyoko’s Creamery Wins Lawsuit Against California, Setting Precedent for Using “Dairy” Labels on Vegan Butter*. VegNews. Retrieved January 14, 2024, from <https://vegnews.com/2021/8/california-court-sides-with-miyoko-s-allowing-free-speech-lawsuit-against-the-state-s-food-and-agriculture-department-to-go-forward>
- Starostinetskaya, A. (2022). *California Is First State to Support Plant-Based School Meals with Historic \$700 Million Investment*. VegNews. Retrieved January 1, 2024, from <https://vegnews.com/2022/7/california-plant-based-school-meals-investment>
- Steel, C. (2021). *Sitopia: How food can save the world*. Vintage.

- Steffen, W. et al. (2015). *Planetary boundaries: Guiding human development on a changing planet*. *Science*, 347(6223), 1259855. <https://doi.org/10.1126/science.1259855>
- Stewart, N., & Hamerschlag, K. (2023). *Plant-Based Trends in California's School Lunches*. Friends of the Earth. Retrieved January 1, 2024, from https://foe.org/wp-content/uploads/2023/09/Plant-Based-Trends-in-California-School-Lunches_Final.pdf
- Sumner, D. (2020). Chapter 6. *California Dairy: Resilience in a Challenging Environment*. In *California Agriculture: Dimensions and Issues* (2nd ed., pp. 133–162). Siebert, J. (Editor)
- Tegtmeier, E. M., & Duffy, M. D. (2004). *External Costs of Agricultural Production in the United States*. *International Journal of Agricultural Sustainability*, 2(1), 1–20. <https://doi.org/10.1080/14735903.2004.9684563>
- Tendall, D. et al. (2015). *Food system resilience: Defining the concept*. *Global Food Security*, 6, 17–23. <https://doi.org/10.1016/j.gfs.2015.08.001>
- The Transformation Project. (2023). *Farmer Resources*. Retrieved January 21, 2024, from <https://thetransformationproject.org/farmer-resources/>
- The Transformation Project. (2024). *Transformation—A Farmer-Led Movement for a Better Food System*. Retrieved January 21, 2024, from <https://thetransformationproject.org/>
- Tittonell, P. (2018). *Ecological Intensification of Agriculture*. In *Agriculture & Food Systems To 2050: Global Trends, Challenges and Opportunities*, edited by Rachid Serraj, and Prabhu (pp. 437–472).
- Tracxn—GOOD Meat company profile. (2024). Retrieved January 1a, 2024, from https://tracxn.com/d/companies/good-meat/___etdqvbXGRQoFuA5gaMbZDpCJ4943uV2aTggQ7yMdnlk

- Tubiello, F. N. et al. (2013). The FAOSTAT database of greenhouse gas emissions from agriculture. *Environmental Research Letters*, 8(1), 015009. <https://doi.org/10.1088/1748-9326/8/1/015009>
- United Nations. (2023a). *The Sustainability Development Goals Report 2023. Special Edition*. United Nations. Retrieved November 25, 2023, from <https://unstats.un.org/sdgs/report/2023/The-Sustainable-Development-Goals-Report-2023.pdf>
- United Nations. (2023b). *UN Millenium Development Goals*. Retrieved November 25, 2023, from <https://www.un.org/millenniumgoals/>
- United Nations Department of Economic and Social Affairs, Population Division. (2022). *World Population Prospects 2022: Summary of Results: Summary of Results*. UN DESA/POP/2022/TR/NO. 3. Retrieved December 3, 2023, from https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/wpp2022_summary_of_results.pdf
- United Nations Department of Economic and Social Affairs, Sustainable Development. (2023). *The 17 SDG*. United Nations. Retrieved December 26, 2023, from <https://sdgs.un.org/goals>
- USDA. (2020a). *MyPlate—Dairy*. MyPlate. Retrieved December 27, 2023, from <https://www.myplate.gov/eat-healthy/dairy>
- USDA. (2020b). *MyPlate—What is MyPlate?* MyPlate. Retrieved December 27, 2023, from <https://www.myplate.gov/eat-healthy/what-is-myplate>
- USDA & HHS. (2020a). *Dietary Guidelines for Americans, 2020-2025, 9th Edition*. : U.S. Department of Agriculture and U.S. Department of Health and Human Services. Retrieved December 27, 2023, from https://www.dietaryguidelines.gov/sites/default/files/2020-12/Dietary_Guidelines_for_Americans_2020-2025.pdf

- USDA & HHS. (2020b). *The Process to Develop the DGA, 2020-2025* [US Government]. Dietary Guidelines. Retrieved December 27, 2023, from <https://www.dietaryguidelines.gov/resources/about-process-2020>
- USDA Economic Research Service. (2022). *Trends in U.S. food security* [dataset]. Retrieved December 27, 2023, from <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/interactive-charts-and-highlights/#trends>
- USDA Farm Service Agency. (2023). *Dairy Margin Coverage Program*. USDA Farm Service Agency. Retrieved January 7, 2024, from <https://www.fsa.usda.gov/programs-and-services/dairy-margin-coverage-program/index>
- USDA Food and Nutrition Service. (2012). *Nutrition Standards in the National School Lunch and School Breakfast Programs*. Retrieved January 2, 2024, from <https://www.govinfo.gov/content/pkg/FR-2012-01-26/pdf/2012-1010.pdf>
- Van der Elst, K., & Williams, A. (2018). *Environment and Natural Resources*. In *Agriculture & Food Systems To 2050: Global Trends, Challenges and Opportunities*, edited by Rachid Serraj, and Prabhu (pp. 193–214).
- Vega Mejía, N. et al. (2018). *Implications of the Western Diet for Agricultural Production, Health and Climate Change*. *Frontiers in Sustainable Food Systems*, 2, 88. <https://doi.org/10.3389/fsufs.2018.00088>
- Vegan Shift. (2024). *Vegan California* [Social Media]. Facebook. Retrieved January 27, 2024, from <https://www.facebook.com/groups/VeganCalifornia/>
- Widdau, C. S. (2021). *Einführung in die Umweltethik*. Reclam.
- Willer, H. & Schlatter, B. (2023). *The World of Organic Agriculture. Statistics and Emerging Trends 2023*. <https://doi.org/10.5281/ZENODO.7572890>
- Willett, W. et al. (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](https://doi.org/10.1016/S0140-6736(18)31788-4)

Yuvaraj, M., Mahendran, P. P., & Hussien, E. T. (2020). Role of Organic Farming in Agriculture. In Organic Agriculture.

Zahoor, I., & Mushtaq, A. (2023). Water Pollution from Agricultural Activities: A Critical Global Review. International Journal of Chemical and Biochemical Sciences, 23(1), 164–176.

Statement of Originality

I hereby declare that I have independently authored this master's thesis using only the specified sources and aids, and have clearly indicated any passages taken verbatim or in content from the sources used.

Petaluma, February 26, 2024

Johanna Schleret

Eigenständigkeitserklärung

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