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TOWARD A MORE SUSTAINABLE FOOD AND FARMING SYSTEM

THE UNIVERSITY OF PENNSYLVANIA

TOWARD A MORE SUSTAINABLE FOOD AND FARMING SYSTEM

A DIRECTED HONORS THESIS SUBMITTED
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BACHELORS IN PHILOSOPHY, POLITICS, AND ECONOMICS

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The Hidden Costs Associated with Cheap Food

Our food system has undergone immense change over the past century that has been driven by the quest for “cheap food”. Today, Americans spend less than 10% of their disposable income on food, less than any other country in the world¹. Not only is our food extremely affordable, cheap food has also enabled us to distance ourselves from around-the-year agriculture and pursue alternate economic opportunities in a burgeoning service-based economy. Furthermore, this separation from agriculture has proven conducive to our increasingly fast-paced and convenience-based culture, as well as the proliferation of urban and suburban life. Without food becoming cheaper, fast food, one-stop-shop supermarkets, and an increased ability to eat out would not be possible. Cheaper food has been facilitated by increasing crop yields from chemical fertilizers, pesticides, herbicides, and the genetic modification of plants, as well as additives prolonging shelf life. Despite cheap food seeming like a remarkable cornucopia, it is associated with a large number of economic, social, and environmental costs that prove its unsustainability. Obesity-related illnesses account for nearly 21% of annual medical spending in the United States², the federal government spends more than \$20 billion a year in farm subsidies³, farmers only receive 19 cents per food dollar⁴, 20% of all American meals are eaten in a car⁵, 78% of global ocean and freshwater eutrophication and 26% of global greenhouse gas emissions are caused by agriculture⁶, and we lost 94% of our vegetable seed varieties in the 20th century⁷. These are just a few of the many costs associated with cheap food. In our mission to achieve cheap food, we have overlooked the tenuous relationship between mass production and

¹ <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/food-prices-and-spending/>

² <http://www.healthycommunitieshealthyfuture.org/learn-the-facts/economic-costs-of-obesity/>

³ <https://www.downsizinggovernment.org/agriculture/subsidies>

⁴ Katz, *The Revolution Will Not Be Microwaved* (2003), 2.

⁵ <https://news.stanford.edu/news/multi/features/food/eating.html>

⁶ <https://ourworldindata.org/environmental-impacts-of-food>

⁷ *Seed: The Untold Story* (Collective Eye Films, 2017)

food quality. Treating food as a commodity based on efficient production and convenience has involved employing unsustainable practices, incurring hidden costs that greatly outweigh the benefits.

The Cheap Food Culture

There is a reason why our food system has developed in the way it has, namely because of the benefits of cheap, abundant, affordable food. People both want to and expect to be able to eat a wide variety of things in an affordable way. Our ability to eat the majority of whatever foods we want whenever we want year-round in an economical way is no small feat. Even more impressive, certain foods historically reserved for those with higher socioeconomic status, such as meat and foods that are high in sugar and fat, are now available to the majority of the American population. This is largely due to a third age of food processing technologies beginning after World War II that allowed us to feel as though we were improving on nature, and finally achieved liberation from the cycles of abundance and scarcity inherent in agriculture. Massimo Montanari, an Italian food historian, encapsulates this by explaining that fresh, local, seasonal food was actually “a form of slavery” for most of human history because it kept us dependent on the fluctuations of nature⁸. This ability to free ourselves can be seen in how the US farm population in 1920 was nearly 32 million or 30.2% of the population⁹, compared to 2.6 million or 1.3% of the population in 2019¹⁰. From an economic perspective, this shift away from an agrarian workforce can be seen as a positive change that reflects the US’s shift towards an industrialized and now service-based economy, as evidenced by how for the past four years the top job based on median income and job satisfaction has been a data scientist¹¹. It can be argued

⁸ Pollan, *The Omnivore’s Dilemma* (2006), 91.

⁹ <https://www.nytimes.com/1988/07/20/us/farm-population-lowest-since-1850-s.html>

¹⁰ <https://markets.businessinsider.com/news/stocks/farming-industry-facts-us-2019-5-1028242678#>

¹¹ <https://www.businessinsider.com/best-jobs-in-america-2019-1#1-data-scientist-50>

that this shift in our economy and workforce to jobs that require a higher degree of education and different skills could not have been possible without the shift from small, diversified farms in rural areas where more than half of the US population lived to large, specialized farms in rural areas where less than ¼ of the population lives¹². Being “freed” from our agricultural duties, while still being able to grow our food supply to sustain the growing population, has enabled America’s economic growth in many ways. And having more affordable food is an advantage that all of us enjoy as a product of the “cheap food” focus of the system. The primary remaining question, however, is at what cost?

Cheap Food and Healthcare Costs: Obesity

The most visible cost of cheap food is a diet that results in widespread obesity. We primarily view obesity as a public health issue, without realizing how it translates into immense economic costs for healthcare. According to the US Centers for Disease Control, obesity and related problems, such as diabetes and heart disease, cause 112,000 premature deaths and \$75 billion in extra medical costs in the United States¹³. Obesity is a matter of genetics, diet, and lack of exercise. As hunter-gatherers, humans have a genetic disposition to eat when food is plentiful in anticipation of food shortages. Our bodies store fat that will dissipate if food becomes scarce. But today, our genetic heritage tends to work against our weight. If we consume abundant food, we have to exercise to burn off the calories we are ingesting. Therefore, the general lack of activity stemming from becoming a more sedentary society is a major problem. Moreover, many Americans eat a diet heavy with meat and processed foods packed with large quantities of salt, fat, sweeteners and hundreds of chemical additives which are linked to other medical problems

¹² <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/farming-and-farm-income/>

¹³ Roberts, *The End of Food* (2009), 83.

such as hyperactivity¹⁴. And while encouraging more active lifestyles is an important aspect to fixing the obesity epidemic, the simple reality is that food is currently so cheap that it encourages overconsumption.

Since 1977, the average daily intake of calories for Americans has increased by over 10 percent¹⁵. Furthermore, three out of every five Americans are overweight, one out of every five Americans are obese, and a child born in 2000 has a one in three chance of developing diabetes. In fact, today's children are likely to be the first generation of Americans with a shorter lifespan than their parents¹⁶. These seriously concerning statistics do not come solely from our societal changes. According to the United Nations, the number of people suffering from overnutrition in 2000 surpassed the number suffering from malnutrition¹⁷. Thereby, proving that the abundance of food available to us in Western countries is a big piece of the puzzle.

Obesity and its related conditions create both direct and indirect costs. Outpatient and inpatient health services, laboratory and radiological tests, and drug therapies comprise the direct costs. Foregone resources are placed in the indirect cost category, including the value of lost work, higher life insurance premiums, and lower wages and household income¹⁸. Thus, there are many different healthcare costs associated with obesity. In 2016, the US spent 17.8% of its GDP on health care, while the average spending level among all high-income countries was 11.5% of GDP¹⁹. So, although we spend less of our disposable income on food than other high-income countries, we still incur higher healthcare costs in part because of our cheaper food coupled with our shortage of exercise. On a personal level, obesity and related diseases lead to widespread

¹⁴ *ibid*, 83.

¹⁵ Pollan, 102.

¹⁶ *ibid*.

¹⁷ *ibid*.

¹⁸ <https://www.hsph.harvard.edu/obesity-prevention-source/obesity-consequences/economic/>

¹⁹

<https://www.commonwealthfund.org/publications/journal-article/2018/mar/health-care-spending-united-states-and-other-high-income>

suffering among Americans. Beyond decreasing lifespans, obesity is associated with many psychological harms such as depression, anxiety, lowered self-esteem, stress and poor quality of life²⁰. Once put in this perspective, spending less on our food does not seem worth the economic burden of increased healthcare costs, as well as lower quality of life.

The High Cost of Corn Masquerading as Cheap Food

It would be remiss to discuss obesity and healthcare costs without explaining the story of corn, which accounts for the majority of the surplus calories we are both growing and consuming. Furthermore, corn represents another substantial economic cost of our food system in the form of government subsidies. To be put simply, we would not be able to have cheap food without corn. While one of the biggest benefits we see to our current food system is the ability to get a wide variety of foods whenever we want them, we fail to realize we are eating a fairly specialized diet heavy in meat and processed foods. Corn is the primary feed for livestock, and corn is a common ingredient in processed foods, often in the form of high fructose corn syrup. Journalist Michael Pollan argues that corn is the biggest beneficiary of our modern food system, given that it is the basis of almost every aspect of the industrial food chain. He describes how embarking on a journey to see where his food comes from continuously led him back to the same place, a farm field in the American Corn Belt²¹. Corn is the primary source of feed for any industrially raised animal we eat, high fructose corn syrup is the sweetener present in the majority of processed foods, corn starch, oil, and flour are all used in many of the foods we consume, and corn is even the basis of ethanol used to fuel our cars and activities. Corn is found in many ingredients we may recognize from food labels, but do not even know as corn. These include but are not limited to unmodified or modified starch, glucose syrup, maltodextrin,

²⁰ <https://www.sciencedirect.com/science/article/abs/pii/S1871402118302820>

²¹ Pollan, 18.

crystalline fructose, ascorbic acid, lecithin, dextrose, lactic acid, lysine, maltose, MSG, polyols, caramel color, xanthan gum, and vegetable wax. All in all, out of the forty-five thousand items in an average American supermarket more than a quarter of them contain corn²². This leads to the question of how corn has become so ubiquitous in our food, to which the answer is government subsidization.

Corn is a unique crop in that it is extremely versatile and energy efficient. It adapts rapidly to new conditions and can outperform other crops in how much it can produce on a food to land ratio. This is attractive to farmers given that yield is measured in bushels per acre. Along with this, corn has the ability to self-fertilize and wind-pollinate, enabling humans to create strains of corn that show the qualities they want within one generation. This process of hybridization empowered breeders with a biological equivalent of a patent making farmers dependent on corporations for these highly efficient hybrid corn seeds²³. In short, corn is the ideal plant, in many ways, for commodification. For example, these hybrid corn seeds are able to make 180 bushels of corn from an acre of Iowa soil, which is slightly more than ten thousand pounds of food per acre²⁴, representing an unprecedented level of productivity. However, these strains of corn are hardly edible and therefore repurposed in a multitude of ways, most namely as animal feed, distilled into ethanol, or turned into high fructose corn syrup and its other many derivatives for processed food. While it may seem like this level of efficiency should be celebrated, it actually has resounding negative effects.

²² *ibid*, 19.

²³ *ibid*, 31.

²⁴ *ibid*, 36.

Corn Oversupply

Government policies have led to an abundance of corn that threatens to outstrip demand. This has created two situations: 1) the search for more uses of corn; and 2) a vicious cycle where the government is constantly subsidizing corn production using taxpayer dollars, given that farmers are now dependent on government subsidies. Federal payments to corn farmers account for nearly half the income of the average Iowa corn farmer and roughly a quarter of the \$19 billion US taxpayers spend every year on farmer payments²⁵. The way this works is that the government promises corn farmers a certain price per bushel no matter the market price of corn, as well as more if the price of corn drops below a certain threshold. Therefore, there are no free market principles of supply and demand at play. The farmers are encouraged to grow as much corn as they possibly can, regardless of demand, because they will be getting paid anyway. In fact, the typical Iowa farmer is selling corn for a dollar less than it costs him to grow it²⁶. Farmers are therefore discouraged from growing anything else, aside from rotating with soybeans, because corn represents a stable source of income. Additionally, at this point, their soil, once some of the richest in America, is ill suited to grow much else. These practices are what has led the mountains of corn to continue growing, for example from 4 billion bushels in 1970 to 10 billion bushels in 2006²⁷. So, where do these immense amounts of corn go? They go to feeding animals, enabling the creation of concentrated feeding animal operations where the animals live crowded lives and are fattened by corn until they are slaughtered with higher levels of fat than if they had been grass-fed, contributing to obesity. They go to the production of high fructose corn syrup which, since 1970 has been used as the sweetener of choice by corporations given how cheap it is despite the fact that it is harder for the body to metabolize and therefore is

²⁵ *ibid*, 61.

²⁶ *ibid*, 53.

²⁷ *ibid*, 62.

easier to consume larger quantities of it, contributing to obesity. They are exported to other countries as animal feed or directly as a food staple, such as to Mexico, displacing the farming practices of those countries by offering a cheaper alternative, causing socioeconomic strife and contributing to global obesity. It is converted into ethanol which is another example of finding a use for corn that we do not need. Ethanol from corn is less energy dense than gasoline, producing fewer miles per gallon. In other words, we are paying taxpayer dollars to grow a crop that is in such excess supply it is constantly being repurposed in ways that increase obesity and related diseases, therefore increasing our healthcare costs. So, do you still consider your food to be cheap?

Other Not-So-Hidden Costs of Cheap Food

Another economic cost of the modern food system is that we are often paying more for intermediary steps, such as transportation, processing, marketing, etc., and less for the actual food itself. Cheap energy in the form of cheap oil for gasoline and cheap oil for plastic packaging has enabled the transportation of food across long distances. California is thus able to supply \$28.6 billion worth of fruits, vegetables, and nuts, about 57% of the US total²⁸. Shipping long distances and plastic packaging are key to the national food system. California represents the top supplier of our fruits and vegetables, while the Midwest occupies a similar position for our nation's meat in the form of growing corn for animal feed and raising hogs²⁹. Despite comprising the basis of our nation's supply, both of these dominant food-producing regions are in a concerning state of accelerating ecological decline³⁰. California's dwindling water supplies in part from less snowpack, hotter temperatures, and drought conditions make its irrigated

²⁸ Philpott, *Perilous Bounty: The Looming Collapse of American Farming and How We Can Prevent It* (2020), 4.

²⁹ *ibid.*

³⁰ *ibid.*

agriculture less reliable. The Corn Belt farmers are literally mining their soil and have lost at least half of it to erosion. In addition, finding alternative energy sources for farm machinery and the transportation of farm products will therefore be essential in mitigating climate change.

Perhaps the most resounding and irreversible cost of our modern day food system is environmental. Globally, agriculture is the source of 10% to as much as 25% of greenhouse gas emissions. Given that storing carbon in the soil is a way to offset greenhouse gas emissions, many farmers have adopted no-till practices that avoid plowing up soil and releasing carbon. But, Midwest corn growers have mostly shied away from planting cover crops such as rye after they harvest their corn. This leaves the soil exposed from November to the following May, and results in serious soil erosion. Furthermore, corn is an especially “leaky” plant, meaning that as soil is washed off farm fields the ammonium nitrate and phosphorus often used to grow it runoff into rivers and streams causing algae blooms that deoxygenate water and create dead zones. For example, in the Gulf of Mexico there is a dead zone, meaning without aquatic life, the size of New Jersey from runoff from America’s corn belt. The loss of fishery production in this Gulf of Mexico dead zone is significant. Similarly, toxic algae blooms related to farm runoff in Lake Erie have caused the City of Toledo, Ohio to close and re-work its public water supply.

Some argue that chemical fertilizers, herbicides, and pesticides are pro-sustainable given that they increase yields, therefore making it so that we need less land to produce more food. However, fertilizers, herbicides, and pesticides are carried by stormwater and snowmelt into waterways where they negatively impact water quality. Another aspect of the system that is diminishing and tarnishing water supply are CAFOs. In the United States alone, animal agriculture water consumption ranges from 36-74 trillion gallons of water annually³¹. Petroleum represents another unsustainable input in the production of modern meat, with 1/3 of America’s

³¹ <https://sites.psu.edu/skf5159revisedblogs/2016/05/03/water-sustainability-and-animal-agriculture/>

petroleum consumption going to produce and transport our food and one feedlot cow consuming nearly a barrel of petroleum in his lifetime³². By removing the animals from the farm and into confined operations, we have lost natural fertilization and had to use synthetic ammonium nitrate from natural gas to sustain our crops instead. In sum, CAFOs, and other industrial farming operations, cause pollution of water, immense amounts of energy use, acidification of the soil, land damage, killing of forests and habitats, and greenhouse gas emissions that contribute to climate change.

Farming, especially in the western states, often relies on irrigation. In California, farming accounts for the majority of the state's annual water consumption. Farmers in California's Central Valley have long depended on the melting snowpack in the Sierra Nevada Mountains for irrigation. They have supplemented this water with groundwater from wells, particularly during times of drought. Since 2011, California has experienced several years of extreme drought, casting doubts on the ability of the Central Valley to continue to serve as the main source of fruits and nuts and one-third of our vegetables. Farmers have responded by digging wells and withdrawing more groundwater. But climate change models predict that the snowpack in the Sierras will decline over time, and California recently passed a law to manage groundwater that will reduce the amount available for irrigation.

The California example is important because American agriculture has become fairly specialized by region. The Northeast is mainly a dairy country. Florida grows citrus and winter vegetables. The Midwest produces corn, soybeans, and meat. The Great Plains is wheat and meat. So, a hidden cost of cheap food is the lack of diversity in regional agriculture, again the result in large part of cheap fossil fuels that are generating huge amounts of greenhouse gases.

³² Pollan, 84.

Farmers only receive 19 cents per food dollar³³. This makes it difficult for farmers, specifically mid-size and smaller farms, to survive because they do not qualify for large government subsidies and corporate contracts that large scale operations survive on. In fact, the average US farm family now earns the majority of its income from non-farming activities³⁴. The large specialized farms in the Midwest threaten to trap us as consumers into eating various forms of corn and soybeans instead of a more diversified diet of fruits and vegetables. The food system additionally threatens to trap farmers into a form of modern serfdom in which farmers assume the risk, but corporations own the collateral, especially in the case of hog and chicken production³⁵. In today's agricultural age, being a farmer is more similar to manning a factory and many farming families are unable to have their children carry on the tradition because they cannot make a living. Food is one of, if not the, most universally elemental aspects of everyone's life. And yet the farmers and ranchers who provide us with it have a suicide rate that is now three times higher than the national average³⁶. The issue is that we now have a bifurcated system of agriculture in the US. The above-mentioned factory farms produce 85% of our food and are becoming increasingly concentrated and focused on big commodities such as soy, wheat and corn. There are then 1.1 million small farms however, these are primarily "hobby farms" that survive because they rely heavily on off-farm incomes. These small farms are not sufficient to sustain the growing population's demand for food. Mid-size farms are going out of business most rapidly because they are not big enough to get efficient, but are not specialized enough to be profitable. This poses an unfortunate dilemma given that these half a million farms between fifty to five hundred acres in size are ideal to try out new practices and ideas of more sustainable food

³³ Katz, 2.

³⁴ Baur, *The Farm Sanctuary* (2008), 275.

³⁵ *ibid*, 91.

³⁶ *ibid*, 92.

production³⁷. But, they are simply unable to compete with the large-scale operations that benefit from scale economies, market power, and government programs. Without these supports to sustain them, mid-size farmers would need to learn the skills necessary to sell directly to consumers to retain profit margins. This involves understanding the entire supply chain, studying grocery retailing, developing a brand and product story, and familiarizing themselves with the consumer which is something many farmers have no experience with and are hesitant to do³⁸. Therefore, our cheap food is often at the expense of farmers who are increasingly unable to afford their operations without the added support that primarily benefits large-scale operations, increasing our reliance on a diet of commodity crops.

The Convenience of Cheap Food: But at What Cost?

From a social perspective, we hugely benefit from the modern food system in terms of convenience. In fact, it's quite astounding how easily we are able to eat more or less whatever we want. Being able to spontaneously order virtually any cuisine to our door in less than an hour is a far cry from our ancestors who spent the majority of their days focused on food, whether it be on the farm or in its preparation and consumption. We are now able to spend our days focused on other pursuits because affordable food is all around us and therefore not a constant source of deliberation. Additionally, we have been able to transition to different systems of living. Rather than living in rural societies on farms, most of us now live in suburban and urban societies, enabling us to become more connected to each other as well as to a multitude of amenities. An advent that has been especially crucial for this transition, as well as epitomizes convenience, is the supermarket. We are now able to visit one store that, unless living in a food desert, is probably less than twenty minutes away and we can get everything we need; produce, meat,

³⁷ Roberts, 280.

³⁸ *ibid*, 281.

dairy, desserts, processed foods, frozen foods, prepared foods, and the list goes on and on. This is a huge advantage of the modern day and age that frees up an immense amount of time for us. Furthermore, cheap food has enabled an explosive growth of restaurants and fast food chains, adding to the time we are able to save by not cooking our own food. From 1972 and 1995, while the US population increased by $\frac{1}{3}$, the number of restaurants doubled and fast food restaurants tripled³⁹. 58% of Americans dine out once a week, 80% eat fast food once a month, and 24% of adults eat over three fast food meals a week⁴⁰. These facts prove that there is a demand and the majority of Americans are enjoying the added convenience afforded by our modern food system. However, as we just explored with the perceived advantage of affordable food, at what deeper cost?

Food is, without a doubt, an integral part of any culture. Especially in globalized and melting pot societies, such as the United States, food represents a cultural significance and history for every immigrant who has come and brought a part of their culture with them. Beyond being a key aspect of most cultures, food is also a nucleus for social interaction. Throughout history, eating and “breaking bread” together has been a point of social connection. Consequently, food has a greater significance to human society beyond just sustenance. Humans have always been viscerally connected to their food sources, but in today’s society the widening gap between producer and consumer has changed the way we make our food choices. The self-service supermarket ushered in a new era of prioritizing easy and cheap accessibility to food, with the indirect consequence of separating producer and consumer. This separation has led to a false sense of where our food actually comes from, and the greater convenience has caused us to forget the social benefits of communal meals. 20% of American meals are now eaten in the car⁴¹,

³⁹ *ibid*, 99.

⁴⁰ <https://www.partnersforyourhealth.com/fast-food-statistics>

⁴¹ <https://news.stanford.edu/news/multi/features/food/eating.html>

and Americans now eat nearly half of their meals alone⁴². These are troubling statistics given that research shows that the more people eat with others, the likelier they are to feel happy and satisfied with their lives⁴³. Furthermore this separation from the production process of our food has led to increased anxiety around eating. This is evidenced by how the prevalence of eating disorders has increased 7.8% from 2013 to 2018⁴⁴. And in a lot of ways this eating anxiety is not unfounded.

The amount of processing that goes into our foods now in order to get it supermarket-ready leads to added calories that often come in the form of unhealthy fats and sugars in quantities that are too high for our bodies to process. As a result, the excess gets stored in our liver and adipose tissue (fat cells), creating inflammation and contributing to the rapidly increasing numbers of obesity, diabetes, high cholesterol and high blood pressure. Additionally, portion sizes have skyrocketed with many of the meals eaten out at restaurants containing as many calories as needed in an entire day, and many individual food staples doubling in calorie count. So, we see that obesity is not limited to just an economic cost, but also a social cost. The convenience we enjoy from cheap food comes at the hidden social costs of an immense disconnect from our food which manifests itself in more isolation, less positive feelings from a lack of eating communally, increased eating disorders, and obesity.

Another pressing social and health cost is the threat to food safety in the form of pathogens and antibiotic resistance, which are not regulated to the extent that we assume by the US Department of Agriculture (USDA) and Food and Drug Administration (FDA). The need to utilize the growing supply of corn made it “efficient” to shift animals from grazing on land and into concentrated animal feeding operations (CAFOs) with corn being used as animal feed.

⁴² <https://www.wsj.com/articles/eating-alone-loses-its-stigma-11570024507>

⁴³ <https://www.ox.ac.uk/news/2017-03-16-social-eating-connects-communities>

⁴⁴ <https://academic.oup.com/ajcn/article/109/5/1402/5480601>

However, in order to sustain animals crowding together in confined spaces, usually standing in their feces and being fed diets that go against what their natural diet would be, the animals have to be pumped with extreme amounts of antibiotics. This has led to so-called emergent pathogens which are microbes that until recently existed only in mild forms that did not bother the human food chain, but have now become more prevalent, pathogenic, and antibiotic resistant⁴⁵. An example of this is *Escherichia coli O157:H7* which has gradually become more acid-resistant due to the fact that feeding corn to cows pushed their guts to become more acidic, to the point where this new strain of E.Coli is able to withstand the acidity of the human stomach⁴⁶. O157:H7 is responsible for 73,480 illnesses, 2,168 hospitalizations, and 61 deaths annually in the US⁴⁷. This increased acidity from an unnatural diet is further evidence in how 15-30% of slaughtered feedlot cows have abscessed livers⁴⁸. It is imperative that we understand we inhibit the same microbial system as the animals we consume, and what happens to them will happen to us as well⁴⁹. Beyond just the animals we consume, the massive consolidations that have occurred even within produce leaves us vulnerable to keeping pathogens out of something as seemingly innocent as a salad.

These pathogens and diseases are evidence of the unsustainability of our modern food system, as well as the lack of general regulation within the system. When there is a disease outbreak, typically of E. Coli or Salmonella, consumers are blamed for not preparing their foods properly, when often the industrial food system and lack of government censure is culprit⁵⁰. For example, the FDA currently examines less than 2% of food shipments entering the country⁵¹.

⁴⁵ Roberts, 177.

⁴⁶ *ibid*, 181.

⁴⁷ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3320345/>

⁴⁸ Pollan, 78.

⁴⁹ *ibid*, 81.

⁵⁰ Baur, 94.

⁵¹ Roberts, 185.

Additionally, there is an immense amount of confusion between the USDA and FDA and who is regulating what. For example, the USDA regulates sausages, but the FDA regulates sausage casings. The USDA regulates egg products, but the FDA regulates eggs still in their shells. The USDA regulates farmed catfish, but the FDA regulates fish, shellfish, and all other seafood⁵². This nonsensical breakdown between which organization is regulating what ultimately leads to a lack of clarity and therefore regulation in general. Furthermore, these agencies have become interchangeable with agribusiness given a revolving door of people going from one to the other. This can be seen in how the USDA's grading system for beef is actually structured to reward marbling, or intramuscular fat, that comes from a corn-fed diet⁵³. It is highly troubling, yet extremely important, to realize that our food safety is more or less in the hands of the same people who drive to commodify our food system for their bottom line.

Another advent that is a byproduct of the emphasis on convenience in our current system is food additives which are sometimes championed as pro-sustainable given that they help with food preservation and minimize food waste. However, 80 billion pounds of food are thrown away each year in the US, or nearly 40% of the US food supply⁵⁴. So, despite the fact that additives prolong shelf life and increase convenience, they do not seem to be having much impact in terms of our decision whether or not to throw out food. If anything, having such a surplus of cheap food makes us more willing to throw out edible food!

These additives are often used for processed foods which contribute to environmental harm in the form of, often plastic, packaging. About 1/3 of the average landfill is made up of packaging material and packaging represents about 65% of household trash⁵⁵. Additionally, a big

⁵² <https://www.eater.com/2017/3/24/15041686/fda-usda-difference-regulation>

⁵³ Pollan, 75.

⁵⁴ <https://www.rts.com/resources/guides/food-waste-america/>

⁵⁵ <https://www.usi.edu/recycle/solid-waste-landfill-facts/>

portion of food waste happens during the production, processing, and transportation process, which is a direct byproduct of living so far from our food. We live farther than we ever have before from food, which means we also incur environmental costs when it comes to the transportation of our food. It is estimated that meals in the United States travel about 1500 miles to get from farm to plate, translating into putting in almost ten calories of fossil fuel energy for every one calorie we get as food⁵⁶. Clearly, there are an overwhelming amount of environmentally unfriendly byproducts of our cheap food, that far outweigh any potential environmental benefits. And most sadly, rather than using the technology, knowledge and research at our disposal to come up with more sustainable solutions, we remain paralyzed by the enormity of today's system, therefore continuing to perpetuate it.

Conclusion and Recommendations

The modern food system is far from simple, but rather extremely complex and multifaceted. However, we have been able to discern that our focus on and preference for cheap food is unsustainable given the hidden costs associated with it from an economic, social, and environmental standpoint. Furthermore, we have only explored this from an American perspective, but as developing countries continue to become more industrialized and foster preferences for processed foods and meat-based diets at a low cost, we will only see these effects multiply across the world. This is extremely problematic given that cheap food presents an almost direct tradeoff with environmentally sustainable practices, meaning that globally we will all be affected by this. We therefore must begin looking ahead at potential solutions, rather than letting these vicious cycles continue. Given the magnitude of the industry, consumer preferences, and lack of adequate government intervention at this point, there is no quick fix.

⁵⁶ <https://www.theconsciouschallenge.org/ecologicalfootprintbibleoverview/food-transportation>

One of the most important things we can do is recognize that in an effort to commodify one of the only things that is not built for commodification we have created a system that operates under duress. We need to realize creating mass production of food at low prices is not sustainable and that we cannot conquer land and animals, but rather we need to work with them, even if that means paying a bit extra at the grocery store, putting a bit more effort into thinking about where our food comes from, and employing more people on farms. As consumers, we have more power to shape the system than we realize. For example, organic food sales have been increased 20% year over year, farmers markets have increased almost 400% since 1994, and there are now over 4,000 Community Supported Agriculture (CSA) systems connecting producers and consumers. Getting educated and grasping that slightly higher food costs is worth it for real food will create substantial shifts in a system we have let run rampant for too long. However, as consumers we are entrenched in our habits and beyond a change in mindset, promising and necessary structural shifts are imperative. These could include less confusion and higher regulation among the FDA and USDA, taxation on overly unhealthy foods such as soda taxes, making the Farm Bill more focused on the various facets it actually encompasses such as nutrition and assistance to low-income consumers, rethinking how our government subsidies are allocated to move away from unnecessarily fueling corn and soybean overproduction, providing assistance to midsize farmers to try out new innovations, a greater proliferation of small, diversified farms, creating a sustainable certification similar to organic but without a prohibitive cost, and funding research that provides new solutions rather than new ways to continue the existing system. There is no doubt that overhauling a system that is so ingrained in our lives seems like an impossible task, but it is no longer a matter of choice. And the first step is recognizing our food is not actually as cheap as we like to think.

Toward a More Sustainable Food and Farming System

The modern American food system has evolved into a behemoth that pervasively impacts everyone on a very elemental level, given that it deals with the one thing we interact with on a daily basis - food. As global populations rise and the environment worsens, we are confronted with a challenge in terms of how long we can continue propping up an unsustainable system. Agriculture counts for 25% of global and 10% of US greenhouse gas emissions.⁵⁷ These numbers would need to be reduced by two thirds to meet the International Panel on Climate Change's (IPCC) standard of 1.5 degrees Celsius as the upper limit for global warming. Yet, global food demand is projected to grow 56% between 2010 and 2050 due to population growth.⁵⁸ So, how is it possible to increase crop and livestock yields to match growing populations and reduce emissions?

Both the problem of and solution to increasing yields are multifaceted and complex. The companies that now control much of the food production process herald magic bullet solutions such as first pesticides and now transgenic foods, also known as genetically modified foods, to accomplish this. However, all this achieves is the perpetuation of a fundamentally untenable system and a further consolidation of power of food in the hands of a few companies. In actuality what is needed is a systematic and collaborative approach to remedy the deeply rooted issues in the food system.

This approach includes changing farming practices to focus on carbon sequestration and nitrogen reduction techniques such as no till, cover crops, rotational grazing, and mixed-crop livestock operations to reduce fertilizer use. Additionally, the federal government needs to rework the Farm Bill to incentivize farmers to use these techniques rather than the current model

⁵⁷ <https://www.wri.org/blog/2020/08/us-agriculture-emissions-food>

⁵⁸ Ibid.

of allocating crop subsidies and insurance farmers who use unsustainable practices that add to water pollution and greenhouse gas emissions. Changes to the Farm Bill should also include payments for environmental services, such as carbon offsets, stream bank buffers, and methane digesters, as well as funding research for sustainable technologies that do not involve fossil fuels. Local, state and regional governments have a responsibility to create pathways for their constituents to eat more locally, as well as create climate change and land planning action plans. And finally, as consumers there needs to be an effort to buy more local produce, consume less meat and packaged foods, eat more efficient proteins when meat is consumed, and get educated about nutrition. Collectively, all of this still may not be enough to reach the necessary two-thirds greenhouse gas emissions reduction, but it will force vital changes to a system that needs to become reoriented towards the environment on which it depends.

Farmers are the Frontline in Reforming the Food System

American farmers are some of the most productive workers in the world. Between 1950 and 1973, farmers were able to double their grain harvest through a combination of increased use of fertilizers, expanding irrigation, and the development of higher-yielding crop varieties. However, productivity has now lagged, only increasing 1.3% annually from 1990 to 2008.⁵⁹ Furthermore, despite the increases in productivity, the contribution of the agricultural industry as a percentage of GDP is the lowest it's been since the USDA began tracking it in 2007.⁶⁰ This suggests that the continued use of synthetic fertilizers and the development of transgenic foods may be hitting a wall in terms of increasing yields. In fact, transgenic crops have only shown fractional gains over their nontransgenic counterparts, and are actually lower in some cases⁶¹.

⁵⁹ Brown, *Plan B 4.0* (2009), 217.

⁶⁰ <https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=58270>

⁶¹ Roberts, *The End of Food* (2009), 257.

Furthermore, big yield gains that have been engineered transgenically only hold up in the laboratory or narrow set of field conditions, but the yield effect goes away when the plant is moved to a new environment.⁶² Beyond no longer substantially increasing yields, pesticides are harmful as they degrade the soil and are carried by stormwater and snowmelt into waterways where they negatively impact water quality. Therefore, there needs to be new thinking on how to raise cropland productivity or else recognize the limits to crop yields.

From a sustainability perspective, decreasing greenhouse gas emissions will come most prevalently from carbon sequestration and reducing the use of nitrogen. High modern crop yields can be maintained while reducing nitrogen fertilizer use by simply restoring biodiversity. Adding a third crop to typical corn-soybean rotation, such as rye, and alfalfa as a fourth crop requires just 10 to 20% of the fertilizer and herbicide use, as well as increases yields by 8%, leading to a 60% decrease in soil erosion.⁶³ Rye and alfalfa fix nitrogen from the air into the soil. Another practice that stores carbon in the soil and reduces soil erosion is no-till farming, which involves farmers simply not disturbing the soil through tillage but drilling in seeds instead. Combining no-till farming and cover crops helps farmers rapidly store carbon in the soil, helping farmers adapt to climate change by facilitating carbon rich soils that stay put during storms and hold water during drought.⁶⁴ However, the majority of farmers in the US Corn Belt do not take part in these practices and invest in their land because federal crop subsidies and subsidized crop insurance buffer farmer's losses, so there is little short-term incentive to make changes.⁶⁵

An example of a farmer who is willing to make a change is Tom Frantzen, whose farm, contrary to his neighbors in Iowa's corn belt, includes hogs, cattle, and three hundred acres of

⁶² Ibid, 258.

⁶³ Philpott, *Perilous Bounty* (2020), 157.

⁶⁴ Ibid, 173.

⁶⁵ Ibid, 174.

field crops, grown mostly for feed.⁶⁶ Frantzen epitomizes the cover crop approach by rotating between corn, soybeans, and rye. His rye-fed pigs gain weight at the same rate as those on a typical diet⁶⁷, yet by adding rye to his crop rotation as a cover crop he is able to sequester carbon and build richer soils. He believes that simply adding rye to the rotation could be enough to turn around the rapid soil erosion occurring in the Corn Belt, and prepare the soil for greater resilience against the cataclysms of the warming climate.

One way to motivate farmers to participate in these environmentally friendly practices is to create a carbon credit marketplace. Fifth generation Iowa farmer Kelly Garrett sells credits from removing 5,000 metric tons of carbon dioxide off his farm yearly to Shopify through a carbon-credit marketplace run by Nori LLC. He adds soil nutrients that increase carbon absorption, adopts no-till, and uses manure from his cows for fertilizer. Garrett explains that by engaging in these practices he's helping his soil, his yields, and his profits.⁶⁸ This marketplace gives farmers an incentive to reduce emissions, as well as gives firms a way to offset their own emissions and get involved in sustainability efforts. Beyond no-till and cover crops, a third way farmers can get credits is through a methane digester which separates the solids from liquids in cow manure to produce electricity to power a farm. The solid is used for cattle bedding and liquid is used to fertilize the land. Although an upfront investment, a methane digester can help farmers save money in the form of lower energy costs. However, farmers like Garrett and Frantzen are still taking a chance and making a change that many farmers are resisting. Until farmers are faced with a necessity or given a financial incentive to explore new options - like they were forced to buy into synthetic fertilizer, pesticides and herbicides to increase

⁶⁶ Ibid, 149.

⁶⁷ Ibid, 153.

⁶⁸ <https://www.bloomberg.com/news/articles/2020-10-28/iowa-farmer-finds-fortune-in-selling-carbon-credits-to-shopify>

monoculture crop yields to compete for government subsidies - they are likely to continue the practices with which have grown comfortable and complacent.

Diversified and mixed crop livestock operations that emulate natural ecosystems are another key to building a more sustainable food system. Joel Salatin of Polyface Farm in Virginia is a prime example of how this operation is possible in a real-world context. Salatin is a grass farmer who practices rotational grazing with his cattle, meaning that he moves them onto fresh grass every day, keeping both his ruminants and soil healthy.⁶⁹ The cows harvest their own feed by grazing on the grass and then spread their waste as a natural fertilizer where it is most needed, creating a short and simple food chain.⁷⁰ Salatin additionally practices rotational grazing with his chickens who effectively sanitize his pastures.⁷¹ This approach is lightyears away from the current system that generates immense waste by separating animals in Concentrated Animal Feeding Operations (CAFOs) and using synthetic fertilizers, pesticides, and herbicides on crops. The secret to Salatin's perennial operation that produces 30,000 dozen eggs, 12,000 broilers, 800 stewing hens, 25,000 pounds of beef, 50,000 pounds of pork, 800 turkeys, and 500 rabbits per season on only one hundred acres of grass⁷² is that it operates as an ecosystem rather than separate parts that need to be maximized for efficiency. Each organism has a function and a role, making it so that Salatin has little need for machinery, fertilizer or chemicals, therefore achieving a sustainable model.

Along with the need to reduce greenhouse gas emissions and preserve soil, another important aspect of building a more sustainable farming approach is raising water productivity. Water shortages constrain food production growth, as evidenced by how it takes 1,000 tons of

⁶⁹ Pollan, *The Omnivore's Dilemma* (2006), 192.

⁷⁰ Ibid, 195.

⁷¹ Ibid, 212.

⁷² Ibid, 222.

water to produce 1 ton of grain. Worldwide, 70% of water use is devoted to irrigation⁷³, and given the constraints on water in the face of rising populations, it will be necessary to make water irrigation systems as efficient as possible. Doing so requires a shift from current furrow or flood systems to overhead sprinklers that reduce water use by 30%, and even better, drip irrigation which cuts water use in half. Drip systems additionally raise yields because of steady water supply with minimal loss.⁷⁴ The reason why this is not an issue of greater focus is because low water productivity is often a result of low water prices. Subsidies lead to irrationally low water prices, making it seem like an abundant resource when it is actually scarce.⁷⁵ Therefore, once again farmers are not encouraged to make changes, including to their irrigation systems.

One creative approach to this problem is vertical farming, where food is grown in vertically stacked layers allowing production of 10 to 20 times the output of traditional farms with the same footprint. Vertical farms are typically housed in waterhouses or shipping containers to provide a controlled environment, enabling them to be situated in urban areas to cut down on transportation costs, both monetary and environmental. Vertical farming requires 95% less water than traditional farming, yet yields are almost 90% which is higher than traditional farming yields of around 70%. This is achieved by using hydroponic systems that submerge the plants in a solution of nutrients rather than soil. The controlled indoor environment enables crops to grow regardless of the time of year or location and allows growers to control the most efficient quantity of light and nutrients, as well as mitigate pest proliferation. Vertical farming has been attracting both public and private sector interests, including a federal grant of \$2.4 million that has been awarded to Cornell University for vertical farm research.⁷⁶ While very promising, we

⁷³ Brown, 223.

⁷⁴ Ibid.

⁷⁵ Ibid, 225.

⁷⁶ <https://news.cornell.edu/stories/2017/10/viability-indoor-urban-agriculture-focus-research-grant>

are still many years away from a widespread implementation of vertical farming and still in need of much more research and development in the field, as well as both producers and consumers adopting it. In addition vertical farming like urban farming in general is limited to vegetable production, rather than meat, grains, and dairy products which require large amounts of land.

Two main themes are clear from the discussion of potential solutions in the farming space. The first is that much of the change hinges on the farmer's willingness to embrace these solutions, such as no-till, cover crops, diversified operations, and switch to drip irrigation systems. In the current system, this is unlikely given that government subsidies are allocated to farmers based on yield rather than the sustainability of their practices, disincentivizing them to try new approaches. Additionally, these new approaches require more time and commitment from farmers. An obstacle is that farmers are now used to their mix of machinery and chemicals. Farming needs to be reestablished as a respectable profession that draws people with a genuine commitment to it, such as Joel Salatin, Tom Frantzen, and Kelly Garrett, for these changes to be possible. The other theme is that there is no one clear cut approach for farmers to adopt.

Although more operations such as Salatin's need to be encouraged, these operations alone will not be enough to produce the mass amounts of food necessary for the growing population.

Although vertical farming is extremely promising, it is better suited for growing leafy greens and being situated in urban areas rather than being a solution for critical grain production in middle America. Although carbon markets incentivize cover crops and no-till practices, the need to monitor carbon sequestration over time and prove the farmland will not be developed for other purposes makes it more suited for rural areas where there is less development pressure and more land to justify the upfront costs of qualifying to sell carbon credits. It is only when these

approaches are used conjointly that an ability to feed the population while also cutting down on emissions will emerge.

The most important change that needs to be made on the production side of the food system is recognizing that it is an ecosystem rather than disparate parts, and that it has immense impacts on the environment. Rather than a fixation on monetary costs, a switch to understanding environmental costs is needed. For example, one-third of edible produce remains unharvested in fields because the cost of harvesting it outweighs the price of selling it⁷⁷, or because it is not cosmetically perfect enough to be sold in grocery stores. Food waste such as this has additional costs of contributing to 2.6% of all of the US's greenhouse gas emissions, as well as contributes to food insecurity.⁷⁸ Transitioning to an environmentally focused mindset is too large of a burden for farmers to bear on their own, but rather must be supplemented with changes in the federal, regional, state and local government's approach, as well as consumers attitudes and preferences.

The Federal Government's Role in Transitioning From Cheap to Sustainable Food System

The Farm Bill is a package of legislation that is passed once every five years and sets the funding for national food and farm systems. It was started in 1933 as part of the New Deal legislation with three goals in mind: to keep food prices fair for farmers and consumers, ensure an adequate food supply, and protect and sustain the country's vital natural resources.⁷⁹ However, as discussed, the current system is severely lacking in protecting US natural resources, especially soil, water, and air quality. Only one-third of agricultural land has optimal soil conditions for growing and erosion is outpacing new soil formation by 100 times. Additionally, the leading carbon sink in the US are forests which absorb 13% of carbon emissions.⁸⁰ Yet, more than 83

⁷⁷ <https://civileats.com/2019/08/20/study-finds-farm-level-food-waste-is-much-worse-than-we-thought/>

⁷⁸ Ibid.

⁷⁹ <https://sustainableagriculture.net/our-work/campaigns/fbcampaign/what-is-the-farm-bill/>

⁸⁰ U.S. Environmental Protection Agency, *Greenhouse Gas Emissions and Sinks* (1990-2009), 10.

million acres of forestland has been lost to wildfires caused by climate change from 2005 to date.⁸¹ Therefore, changes are needed to the Farm Bill to help it achieve its goals.

There are 12 titles in Farm Bill. In 2014, the Farm Bill cost \$489 billion over five years with the major allocations going to commodities, nutrition (which comprises SNAP or food stamps), and crop insurance, also known as subsidies.⁸² Therefore, the majority of the Bill is going towards throwing money at the problem, in the form of relying on existing commodity-based programs and paying farmers to continue their unsustainable practices. In order to create a more forward-thinking approach, it is necessary to take some of the funding from these areas of the Bill and reallocate it to five titles; conservation, research, extension and related matters, forestry, energy and specialty crops and horticulture.

Within conservation, more money would be allocated to preserving pastures and cropland through the use of land retirement and conservation easement programs. Protecting and maintaining productive agricultural soils for current and future production of food is a vital aspect of maintaining the national food supply, and therefore worthy of greater investment. The Bill could also stipulate that subsidies are conditional on farmers following land preservation practices. Within the Corn Belt, Ohio is the only state with a successful state-level farmland preservation program and there is only one local government in Illinois, Kane County, with an agricultural land preservation program.⁸³ Therefore, creating this stipulation would create the opportunity for farmland preservation programs to be enacted in an area that needs it most.

Research, extension and related matters is one of the most important areas of the Farm Bill needing greater investment. As previously stated, a solution will not be found to the complex issue of food production and the environment without creative solutions that need to be fueled by

⁸¹ https://www.nifc.gov/fireInfo/fireInfo_statistics.html

⁸² <https://sustainableagriculture.net/our-work/campaigns/fbcampaign/what-is-the-farm-bill/>

⁸³ Daniels and Keene, *The Law of Agricultural Land Preservation in the United States* (2018), Chapter 8.

research. For example, aquaculture is the fastest-growing source of animal protein since 1990 and is an area for great growth potential given that herbivorous fish convert feed into protein very efficiently.⁸⁴ However, the way that aquaculture functions in the US now is essentially as a floating CAFO, as compared to China which has developed a fish polyculture that uses four types of carp feeding at different levels of the food chain emulating natural aquatic ecosystems. This has made China the first country where fish farming has eclipsed poultry farming.⁸⁵ Especially since the US currently imports more than 90% of its seafood, aquaculture offers a powerful opportunity to increase domestic supply and address the need for more protein sources. If aquaculture were developed in only the most productive areas, oceans could theoretically produce the same amount of seafood that the world's wild-caught fisheries currently produce globally, but in less than 1% of the total ocean surface.⁸⁶ However, the only way to capitalize on this opportunity in a sustainable way is through research. Similarly, vertical farming is an area of potential that needs further research. Research will prove to be a vital part of balancing growing populations with the increasing need to take the climate into account and create more resilient crops and livestock. Additionally, funds have to be reallocated from researching ways to prolong the current system to research on actual new and environmentally-friendly solutions.

Forestry is an important aspect of the Farm Bill to invest in given that forests are the largest carbon sink in the US, making them a key part of reducing greenhouse gas emissions. Investing more funds in the federal Forest Legacy Program would help to keep forests undeveloped except for forest uses and open space. A federal greenhouse gas cap-and-trade program similar to California's could include a forest carbon offset credit program. This program enables forest owners to generate carbon credits to sell to emitters to meet their emissions

⁸⁴ Brown, 227.

⁸⁵ Ibid.

⁸⁶ <https://www.universityofcalifornia.edu/news/tiny-fraction-oceans-could-satisfy-world-s-fish-demand>

allowances. The offset credit program requires that carbon sequestration be in addition to sequestration from business-as-usual practices; the sequestration must be measurable and verifiable over time. Also, there must be proof that the forest will not be developed, except for limited harvesting. Here, the sale of a conservation easement by a forest landowner with funding in part from the Forest Legacy program can keep the forest undeveloped except for forestry over the long run.

Since wildfires caused by climate change are one of the biggest threats to forests, preserving forests goes hand in hand with water conservation efforts. For example, one thing the federal government could do is price water to reflect its actual cost as a scarce resource. Agriculture accounts for 80% of water consumption in the American West, where drought is making water an increasingly limited resource, yet agriculture water bills can be as low as few pennies for thousands of gallons.⁸⁷ Pricing water as a scarce resource rather than an overly abundant resource would incentivize farmers to make the investment to implement more efficient irrigation systems, such as drip irrigation. Increased water conservation, especially within agriculture, would cause an immense impact on the proliferation of drought and wildfires in the country that are threatening forests.

Within the energy title of the Farm Bill, fossil fuels should similarly be priced to reflect their actual cost rather than the artificially low costs that stem from failure to take negative externalities into account. Costs accrue at every point of the fossil fuel supply chain, from extraction processes generating air and water pollution, to transportation causing air pollution and serious accidents and spills, to burning the fuels and emitting toxins and global warming emissions, and finally even the waste products are hazardous to public health and environment.⁸⁸

⁸⁷ <https://www.theatlantic.com/business/archive/2015/03/finding-the-right-price-for-water/388246/>

⁸⁸ <https://www.ucsusa.org/resources/hidden-costs-fossil-fuels>

Given that agriculture primarily runs on fossil fuel energy, incentives to switch to renewable energy sources will be an imperative initiative. Pricing fossil fuels to reflect their externality costs could help farmers choose to make switches that may require more upfront cost but are a better long-term investment, such as electric tractors. Another area within this title is ethanol, which is a fossil fuel directly subsidized by the US government through Congress's enactment of the ethanol purchase quota. 40% of the US corn crop is transformed into ethanol⁸⁹, despite it remaining unclear whether burning gasoline mixed with ethanol in an internal combustion engine actually generates less air pollution. Therefore, another initiative the federal government should undertake is to remove incentives for turning corn into ethanol.

Finally, specialty crops and horticulture involves government support of fruits, vegetables, nuts, nursery crops, organic produce, farmers markets and local food programs, such as farm to school. Despite comprising everything that comes to mind when thinking about the future of food and nutrition, this part of the bill only received \$1 billion in the 2019 Farm Bill, as compared to \$31 billion for commodities, \$39 billion for crop insurance, and \$326 billion for food assistance programs.⁹⁰ Therefore, greater investment should be made to these programs specifically for local food programs. California currently supplies 57% of fruits, vegetables and nuts for the entirety of the US. Given the dwindling water supplies in California, as well as the environmental costs of transporting and storing food, creating pathways for regional and local agriculture will be an important aspect of building a more sustainable system.

The federal government has a responsibility to its constituents to work towards the development of a food system that will accommodate growing populations, reduce greenhouse gas emissions and provide healthy and nutritious food options. The Farm Bill as it currently

⁸⁹ <https://www.scientificamerican.com/article/time-to-rethink-corn/>

⁹⁰ <https://crsreports.congress.gov/product/pdf/IF/IF11126>

stands is not doing this. Given that it is the primary funding source from which food policy is shaped from, different titles, such as Conservation, Research, Forestry, Energy and Horticulture, within the Bill need to be prioritized over the existing ones, most specifically Commodities and Crop Payments, in order to meet this goal. Additionally, within the Nutrition title, which is the largest recipient of the Bill, but is mostly SNAP food assistance, there should be greater emphasis on nutritional education. The USDA operates a Farm to School Grant program and provides information on the steps to help operators incorporate local foods into their child nutrition programs. However, currently only 42% of US school districts are actively participating in farm to school, while another 16% are interested but do not have access.⁹¹ Given that studies have shown having a school garden increases student's fruit and vegetable consumption, academic performance, and willingness to try and like healthy foods⁹², creating more grants to grow the level of participation to 100% should be a priority for the federal government. As well as creating more stringent regulations for nutrition standards, limiting the sale of competitive foods that undermine more nutritious options, and creating new nutrition guidelines that are focused on fruit, vegetable and protein consumption rather than six to eleven servings of grain a day. By creating healthier eating environments in schools, the federal government has a big opportunity to shape healthier eating habits in the nation.

State, Local, Regional Governments: Supporting the Transition of the Food System

_____ While the federal government has a responsibility to set the stage for the national food system, as well as allocate resources accordingly, regional, state and local governments are often more impactful through creating pathways for constituents to eat locally, land and climate change planning, and food waste initiatives. One city that exemplifies what this could look like is

⁹¹ USDA Office of Community Food Systems Resources

⁹² *ibid.*

Portland, Oregon. The region of Multnomah County has drafted a fifteen year action plan with the goal of establishing a thriving regional food system engaging the community in healthy food production, equitable food access, opportunities for collaboration, low environmental impact, and local economic vitality by 2025. The plan seeks participation from local government, businesses, non-profits, faith communities, learning institutions and individual community members to achieve this goal. They state that an increase in regional food consumption of 5% could translate into a net \$100 million benefit for the region.⁹³ It would be virtually impossible for the federal government to create such a fleshed-out well-researched plan with clear numerical indicators of progress given the wide variety in what each region in the country needs to achieve. This shows the importance of regional governments to step in and take on that responsibility.

Since implementing the plan, Multnomah County has been able to increase the number of farms with direct sales by 25%, as well as the acres of land enrolled in the Conservation Reserve Enhancement Program, the percentage of fruit and vegetables vs prepared foods per capita, and the number of full service grocery stores by 20%. They have also decreased the number of farms using chemicals by 25%, and fast-food expenditures by 10%. There has additionally been a decrease in the low-income preschool obesity rate and adult diabetes rate, and increases in the average wage paid to farm laborers and number of farmers markets. All of their school districts now participate in farm to school programs.⁹⁴ Multnomah County demonstrates the capacity that regions have to collect the data and create a comprehensive plan with real impact.

Another area in which Portland, Oregon is paving the way is in climate change action planning. In 1993, Portland adopted the nation's first carbon dioxide reduction plan and in 2009 they created a climate action plan with the goal of reducing greenhouse gas emissions by 80%

⁹³ <https://multco.us/file/36863/download>

⁹⁴ Ibid.

below the 1990 level by 2050. Similar to their regional food action plan, they broke down the overarching goal into smaller goals with actionable steps and measures. For example, one goal was to increase solar power installations to 10 megawatts by 2012, they met this and actually exceeded it with 15 megawatts by the end of 2011. As of 2010, Portland achieved 6% reduction in greenhouse gas emissions below the 1990 level, has built the most LEED-certified platinum buildings per capacity in any US city, operates the greatest number of hybrid cars per capita of any city in the US, has doubled transit ridership, tripled recycling rate, and increased community travel by bike five times.⁹⁵ The example of Portland shows how regional, state, and local governments have the capacity to shape and change the system in their jurisdictions through making thorough plans focused on numerical and concrete metrics. However, this relies heavily on the governments to take charge and keep up with the plans they put forward. Currently, the Northeast leads in both land and climate change action plans, but the majority of agricultural production in the country comes from California, the Corn Belt, and the Southeast, showing that it is vital for more areas in the US to adopt these action plans.

Consumer Shift in Attitudes and Preferences

Consumer preferences have the capacity to shape the food system, as evidenced by organic food sales increasing 20% year over year, farmers markets increasing almost 400% since 1994, and there now being over 4,000 Community Supported Agriculture (CSA) systems connecting producers and consumers. In fact, because of consumer preference and willingness to pay for organic, big food conglomerates such as ConAgra, Heinz, Kellogg, Kraft, and more have invested in organic as well, co-opting the organic movement by the market it set out to change. Furthermore because federal organic standards do not specifically address erosion, climate or

⁹⁵ Daniels, *Food Production in Climate Action Plans* (2014), Chapter 4.

energy use, organic farmers are not as financially inclined to worry about these externalities.⁹⁶ Therefore, as consumers it is necessary to shift from just being willing to pay for organic to also being willing to pay for local or more sustainably-grown produce. Food from more distant locations boosts carbon emissions while losing flavor and nutrition as evidenced by conventional produce travelling on average 1,500 miles, as compared to 56 miles for local food.⁹⁷ Similar to how consumer preferences for organic made it the fastest growing sector of the food industry, consumers have the power to do the same for local and sustainable food.

Another aspect where consumers can make a difference is by consuming less meat, milk, and eggs, as well as eating more efficient proteins such as fish and poultry when eating meat. In every society where incomes have risen, so has meat consumption, leading to a global increase from 44 million tons in 1950 to 260 million tons in 2007.⁹⁸ This astounding escalation puts immense pressure on land and grain production, as illustrated by meat production being directly responsible for 85% of all soil erosion in the US.⁹⁹ The system is not built to handle meat consumption growing almost twice as fast as population and egg consumption growing more than twice as fast.¹⁰⁰ Therefore, simply scaling back on the consumption of meat and animal products can have a big impact on the sustainability of the food system. When eating meat, the efficiency with which each animal converts grain into protein should be taken into account. For example, for cattle in feedlots it takes roughly seven kilograms of grain to produce one kilogram gain in live weight, it takes three kilograms for pork, just over two kilograms for poultry, and less than two kilograms for herbivorous species of farmed fish.¹⁰¹ Therefore, poultry and herbivorous

⁹⁶ Roberts, 266.

⁹⁷ Brown, 232.

⁹⁸ Ibid, 226.

⁹⁹ <https://www.peta.org/about-peta/faq/how-does-eating-meat-harm-the-environment/>

¹⁰⁰ Brown, 230.

¹⁰¹ Brown, 226.

fish should be the consumer proteins of choice in an effort to raise the productivity of land and water.

The third responsibility for consumers is to get educated about nutrition. In today's cheap food system it is astonishingly easy to over consume calories, eat more packaged foods, and become generally uninformed about nutrition, all of which perpetuate the unsustainability of the system. US students receive less than eight hours of required nutrition education each school year, which is far below the 40 to 50 hours necessary for affecting behavior change.¹⁰² Therefore, until federal regulations are changed to reflect the level of education that is needed, it is in the consumer's hands to become more knowledgeable about what they are putting into their bodies.

Increased nutrition education has been shown to decrease the intake of junk foods and increase the consumption of fruits and vegetables.¹⁰³ Given that the transportation, packaging, and emissions of volatile organic compounds during the preparation of junk foods, along with the high percentage of wastage involved in junk food¹⁰⁴, causes environmental harm, cutting out packaged foods is a crucial aspect of a more viable system, as well as better health outcomes. Because packaged foods are often high-calorie and low-nutrient, a healthier diet less focused on packaged foods will also lead to decreased calorie consumption. Since 1970, there has been a 23% increase in the amount of average daily calories consumed by Americans¹⁰⁵, causing greater stress on the food system to produce more food in addition to already needing to support growing populations. Becoming more aware of what a healthy diet consists of will lead to decreased consumption of packaged foods and calories, leading to more sustainable outcomes.

Conclusion

¹⁰² https://www.cdc.gov/healthyschools/nutrition/school_nutrition_education.htm

¹⁰³ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4579763/>

¹⁰⁴ <https://exclusive.multibriefs.com/content/the-environmental-impact-of-unhealthy-foods/food-beverage>

¹⁰⁵ <https://www.pewresearch.org/fact-tank/2016/12/13/whats-on-your-table-how-americas-diet-has-changed-over-the-decades/>

There is no straightforward or easy way to build a more sustainable food and farming system. Rather, it will take a collective effort from every player in the system. The federal government needs to make changes to the Farm Bill to incentivize farmers to employ more environmentally friendly farming practices, educate and connect consumers with proper nutrition, and most importantly fund research to find more creative solutions to overhaul an extremely untenable system. Local, regional, and state governments have a responsibility to create concrete action plans based on the unique aspects of their jurisdictions, like those seen in Portland, that lead to substantive change. Consumers need to understand that the ability to have such widespread access to cheap food is not natural and change their eating habits accordingly. Most crucially, the externalities, specifically environmental, of the existing system need to be recognized and addressed by all parties. We no longer have the time to continue exploiting our land and resources because the climate is fighting back, calling food security into question. Furthermore, our bodies are fighting back against the overconsumption of calories and lack of proper nutrition in the form of increased obesity, diabetes, healthcare costs and more. It is hard to say whether, if every proposed solution is adopted, that will be enough to reduce emissions to the needed level. But it will definitely lead to lower environmental harm and healthcare costs, and help to restructure the food system based on the understanding that food is part of a larger ecosystem rather than an area up for commodification.

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