Spring 5-15-2021

Farm to Boardroom: How Improving Farm Conditions Leads to Sustained and Ethical Profit

Emily Mueller
emueller2@fordham.edu

Farm to Boardroom:

How Improving Farm Conditions Leads to Sustained and Ethical Profit

Emily Mueller

Abstract:

As a society evolving and innovating at a pace faster than ever before seen in human history, we find ourselves at a crossroads of dealing with planetary boundaries and improving social standards. We are met with a crisis just thirty years away; the crisis of needing to be able to effectively and sustainably feed ten billion people across the globe. The 20th century brought on a booming age for industrializing the food system in order to increase yield and thus profit. The new process was a significant breakthrough at its time, but now we must face the question of when society might need another form of an agriculture shift. My aim for this thesis is to introduce how damaging our current food system operates and how altering current business strategies can lead to a healthier planet, healthier employees, and overall, more change in food corporations' pockets. Chapter 1 discusses both the science and causes of the global climate crisis and how the agricultural system impacts the overall health of the Earth. Chapter 2 shows the rise of how the present-day industrial agriculture practices came to be and why dismantling them can be so challenging. Chapter 3 discusses how farmers play a significant role in this struggle yet have no say in change. Chapter 4 discusses the current temporary fixes of our food system through individual and grassroots based movements. Chapter 5 introduces sustainable business practices that can help efficiently solve the issues we face across the food supply chain that can alleviate and ultimately improve the agricultural level in actual action proposals. In this specific chapter, I highlight concrete solutions and steps to achieve a sustainable business change based on how people at the very top of the business can improve the conditions at their company's lowest tier. Of course, society can shed immense light on these environmental and social issues, but with lack of company governance and strategy, there can be no change.

Keywords: industrial agriculture, sustainable business, farmers, health, economic inequality

Dedication

I would like to dedicate this work to my late grandmother, Valeria Mueller. She showed me the tenacity to work hard, blaze your own trail, and not care what others think. Not only did she introduce me to my passion in agriculture and food at her farm in Latium, TX, but she was a great example of how to make everyone she could feel loved and equal. She inspires me every single day in my path for food justice and striving to get good food to as many folks as possible. Through the many tears shed telling me to give up while working on this because I just couldn't handle the pressure, I kept reminding myself that it was my time to inspire her. Hope I make you proud, Mimi.

Acknowledgements

I would like to thank my incredible parents, Doug and Julie, and the best brother in the world, Grant, for their constant support in following my passion for food and trying to make the world a better place. I would like to also thank my amazing girlfriend, Meg, for putting up with my constant long winded discussions about the food system when we are just trying to have a nice dinner. Thank you to my greatest of friends: Caroline, Laura, Maggie, and Tess for listening to all my complaints about having to read all these books and write all these pages (and for just being some friends for life). Thank you to my Rethink family for giving me a space to be curious and mark my spot in the food industry. And finally, thank you to my dearest Rhodesian Ridgeback, Mila, for always putting a smile on my face and making my life a whole lot better. I know she will love reading this thesis the most.

Table of Contents

Introduction: The Complexity of Food

"One of the most fateful errors of our age is the belief that the problem of production has been solved" - E.F. Shumacher

When I was growing up, I remember always having a fascination with food and cooking. Initially thinking I wanted to be a chef and even open a restaurant one day; I began working in various kitchens throughout my hometown of Houston as an attempt to improve my culinary skills. Throughout that time, I slowly came to realize the significant holes and shortcomings of the current way our food system operates, from excessive food waste, to food inaccessibility all through food supply chain failures. I knew, at least for the time being, that I could not bring myself to ignore all of these problems and just cook for my own enjoyment and ambition. There was an exigent urge within me to do my part and, at the very least, look into possible ways to solve these various problems. It is up to our generation entering the food industry to look for viable solutions to create a withstanding food supply chain, not only for ourselves but for the future of our entire world.

This thesis specifically focuses on the very first step of food production, the farming and agricultural processes. I will explore the link, or lack thereof, between the land and lowest tier of people amongst the food production chain to the very top tier, major businesses and corporations. Our agricultural methods have not only had adverse effects on our global natural systems, but also on the boots on the ground who are working for these monopoly agricultural firms. The lowest tier of farmers, particularly those in overexploited and underdeveloped countries and communities, face several dangerous health and wellness risks, from unsafe working conditions to financial risks due to unfair wages and compensation. These farmers rarely have access to the

food they grow themselves once it reaches the end of the food supply chain, solely because of the underlying limited access imposed on them by large food corporations.

In the beginning, I plan to lay the groundwork of the environmental crisis our world is facing. I will specifically discuss how our current conventional agricultural methods further that damage and how that destruction will severely affect future generations' access to food more so than the current lack of access. This section will look into the details of soil composition and how focusing on the vitality of the soil itself is more important than producing a short term large yield of crops. This discussion is especially important as it will help me tie in the intersectionality of environmental effects on human well-being and livelihood.

There is a remarkable disconnect between the farmer and the company as many of our world's largest food producers follow a profit-focused model rather than focusing on the dignity of the environment and their employees. Many of these food corporations operate with the understanding that it is not feasible for them to improve workers' conditions and integrate sustainable practices because they see themselves taking money out of their own pocket in order to do so. Major corporations consider this the only way to improve overall conditions. While this might be true in the short run, research and evidence consistently show that investing in more sustainable practices leads to better profit, more product, and company wide resilience in the long run.

In order to reach that point, my paper will focus on three environmental study disciplines: environmental science, environmental history, and environmental policy. I will be using the discipline of environmental sciences to achieve a more comprehensive understanding of the ecological affects our current conventional agricultural practices have on both the environment and the world's population. By introducing environmental history, we will get a better

understanding of exactly how we came to the problem we are currently facing due to market pressures. I will then use the discipline of social environmental policy when looking into the conditions of farmers and their access to good food in order to figure out long term solutions. Following the discussion of these various conditions, I will talk about the temporary fixes that we have tried to implement as ways to combat the crisis of degradation in the food system. I will then conclude with a sustainable business model approach to solving these problems found through the previous two disciplines. As most complex issues do, this change requires a significant amount of people in power to make real change.

Despite many wonderful people in the environmental sector sounding the alarms and trying to lead sustainable lifestyles, there is still a vast majority of those who simply do not believe, care, or feel the need to be concerned about these issues. Many people with whom I am surrounded fall into this category and do not fully understand why this matters to me and to the future of our world. The most important thing for these people to do in order to understand is to be willing to listen and learn, as I did throughout my time here at Fordham. The widely held belief that people who care about the environment are trivial, tree-hugger hippies has further inspired me to seek out solutions to the greatest threat to our society and future generations, not just to prove those people wrong but to do what is right for our society before it is too late. I am hoping this paper can provide insight into how we can work together to persuade those with power to take action and improve the system that nourishes our world.

Chapter 1. The Crisis of Feeding 10 Billion

At some point in our lives, we have all seen the cliche television commercials featuring footage of starving children somewhere in Africa or Central America. The emotional videos and melancholy music play while a C-list celebrity attempts to convince you to donate a few quarters

a day to save the children. Just thirty seconds later, the commercial ends and life quickly moves on. We forget about the sad kids on the screen, because not only do these commercials paint countries in Africa and Central and South America in an unfortunate light, but they also make hunger seem so far away and disconnected from many of us in a seemingly more fortunate and developed society. We forget, or perhaps refuse to acknowledge, the prevalence of how widespread hunger is and the many forms it can take. Most people with the power and means to do something of significance to improve the hunger and food access crisis typically do not do so because it is considered a distant and unrelated issue in comparison to their own personal problems. Inaccessibility to nutritious food, or food in general, is one of the greatest health and ecological threats of our time.

Globally, one in nine people do not get the minimum amount of food needed to stay healthy and meet the minimum number of calories and nutrients needed to keep their bodies functioning properly. This means that hunger is a bigger health risk than malaria, AIDS, and tuberculosis combined.[1] Despite these statistics, the issue of hunger has yet to be properly addressed and ultimately eradicated other than through temporary aid campaigns.

The substantial gap in access to food has only grown over the years, and more and more people experience the struggle with hunger on this planet. According to the United Nations' *State of Food Security and Nutrition in the World*, a 2020 publication updating our universal progress with combating food insecurity, 8.9% of the world's population faces hunger, a rate that has steadily continued to rise since 2014. In just one year, the UN found an additional ten million people on earth are hungry from 2019's 680 million estimate.[2] The most daunting thing is not

[1]Godfray, H. C. J., J. R. Beddington, I. R. Crute, L. Haddad, D. Lawrence, J. F. Muir, J. Pretty, S. Robinson, S. M. Thomas, and C. Toulmin.

[2] FAO, IFAD, UNICEF, WFP and WHO. 2020.

just that withstanding numbers itself, but that we can only expect it to exponentially rise coinciding with our population's growth rate.

Since it is difficult to determine a concrete metric of those who are hungry since it is experienced in a multitude of ways, the UN has come up with an advanced way to accurately reflect on how serious the issue of hunger is. These projections and estimates are based off of extensive PoU using variables such as, "the computation of per capita levels of Dietary Energy Supply (DES), estimates of the minimum dietary energy requirement (MDER), estimates of the coefficient of variation of food consumption that can be traced to differences in energy requirements (CV|r) and parameters that are used to calculate the number of undernourished people".[3] Another metric used for this estimation is an extensive Food Balance sheet which tracks changes in food supply and production within every country on the planet. This sheet provides evidence of not only decreasing weight and volume in food supply, but also a sharp decrease in variety of food using diverse variables.[4] The development of such a detailed metric allows the UN to show which factors contribute to hunger in an effort to find solutions, whether that be through certain lacking nutrients or geographical correlations.

Additionally, these contributors will only be exasperated as our anticipated population grows by 2050. Scientists expect a global population of approximately ten billion people which would respectively result in a 56% increase in demand for food. Interestingly enough, the population increase is only 25%, so why does the food demand increase more than twofold? Well, affluence-based societal trends, such as consuming significantly more rare and expensive

[3] FAO, IFAD, UNICEF, WFP and WHO. 2020.
[4] Ibid.

foods, in the developed world led experts to assume this exponential growth is caused by such demand. [5]

Even though this may make sense at face value, scientists, activists, leaders, and food insecure people are scratching their heads as to how, in a world of increasing efficiency, development, and technological advancements, we are able to feed less and less people every year. Common attributes of food insecure communities include, but are not limited to, increasing poverty rates, weak or deteriorating economies, and unequal distribution of resources and income. Unfortunately, those who are most impoverished, commonly in developing countries and communities, have the most disproportionate rates of food insecurity.[6] It is important to note that the main *reason* food insecurity is so prevalent from the attributes above is the unequal distribution of resources.

The flaws in our global food supply are strongly linked to our food waste problem along the supply chain. Annually, about one third of the world's entire food supply gets wasted or lost somewhere along the food chain. That is 1.3 billion tons of food which approximates to $936 billion wasted every single year.[7] Depending on a given country's infrastructure and practices, we lose more food to waste at different levels of the chain. So, for example, underdeveloped countries' technological challenges, improper storage, and poor practices result in 44% of the global food loss. More developed countries, such as the US, contribute 56% of the world's total food loss. Of that 56%, over 40% is due to growing demands for consumption, or for lack of

[5] Mann, Charles.
[6] Godfray, H. C. J., J. R. Beddington, I. R. Crute, L. Haddad, D. Lawrence, J. F. Muir, J. Pretty, S. Robinson, S. M. Thomas, and C. Toulmin.
[7] Ishangulyyev, R., Kim, S., & Lee, S. H

better words, over consumption. In high-income countries, such as ours, food consumption per capita is four times higher than that of lower-income countries.[8]

Developed countries' supply approach makes it seem as though food is limitless. The current system works in a way where "farmers often overproduce in order to protect against pest attacks, weather, and market uncertainties, and to guarantee the contractual obligation with the buyers. Oversupply decreases the market price and leads to more crops left unharvested". [9] Overproducing may seem like the right idea in the short run as it decreases market volatility in the case of possible external factors coming into play. However, this unsustainable overproduction has led to a surplus in food and therefore significant food loss once it goes bad. Typically, in the food supply chain, once food is harvested, farmers struggle to store, transport, and sell the excess food that surpasses the market's demand. This leaves the food products to spoil or go to waste since there are currently no universal systems in place to utilize this excess.

This overproduction is a direct product of overworking usable agriculture land. Since farmers are trying to meet their company's demands in lieu of the market, they are forced to do whatever it takes to get the most output from their production. Unfortunately, this short-term approach comes at a cost. That cost, which is displayed in the poor practices to meet these needs, leads to the harmful effects of climate change.

Arguably the worst part about our current food system's relationship to climate change is that it's cyclical. Climate change experts have expressed serious concern regarding the rise in greenhouse gas emissions. One of the worst gases we are currently emitting at an exasperated rate is carbon dioxide. In a moderated sense, carbon dioxide can be effective in how it regulates

[8] Ishangulyyev, R., Kim, S., & Lee, S. H
[9] Ibid.

the atmospheric temperature by absorbing and radiating heat. Without it, the average temperature on Earth would be well below freezing rather than the typical 60 degrees Fahrenheit.

The problem, however, is the exponentially growing amount of carbon recorded in our atmosphere today. According to the NOAA, "the annual rate of increase in atmospheric carbon dioxide over the past 60 years is about 100 times faster than previous natural increases".[10] This increase results in intense stratospheric atmospheric depletion that remarkably damages many living forms on the planet's surface. At high levels, carbon dioxide traps solar energy thus heating up our atmosphere to an unmanageable level rather than regulating it and allowing some of that heat to escape to space. Known as the "Greenhouse Effect", this entrapment of solar energy has already shown irreversible, detrimental effects on earth. In an agricultural sense, this effect forces farmers to move to more temperate zones to care for their crops, especially from the warmer climates heating up closer to the equator.

Carbon dioxide emissions are mainly a result of the mass burning of fossil fuels such as coal, oil, wood, gas and solid waste. We emit such materials for a multitude of reasons ranging from electricity to transportation to just needing to burn waste due to limited disposal options. However, instead of only worrying about the effects of this on our quality of air, we should also consider directing our efforts towards our soil to regulate carbon sequestration. The worldwide agricultural system releases 25% of all greenhouse gas emissions which includes carbon dioxide as well as methane, nitrous oxide, and ozone.[11] But if we focused on carbon dioxide solely, as it is the main contributor to the crisis, soil contains twice as much carbon than the atmosphere which makes it incredibly important to not only keep the carbon in the soil to keep it healthy, but also limit the emission of carbon that we already have too much of in the atmosphere.

---

[10] NOAA

[11] L. Schreefel, R.P.O. Schulte, I.J.M. de Boer, A. Pas Schrijver, H.H.E. van Zanten.

Unfortunately, that is not our path in neither current nor recent past farming methods. Ever since the Green Revolution in the 1950's, a movement focused on improving and renovating agricultural practices, we have been overworking the soil through over-tilling and heavy use of pesticides and fertilizers to meet the market demands. As a temporary solution, fertilizers and pesticides can help maximize crop output and resilience. The most common, and arguably best fertilizer in promoting crop maximization through chemicals is a nitrogen-based fertilizer. Naturally, nitrogen is the most vital nutrient for plant growth as it is the major component of chlorophyll production. In a sense, this can be great considering that plants can struggle to produce chlorophyll with shifting weather patterns. At the same time, however, this process can be very delicate. When the natural nitrogen cycle is interrupted and disturbed by the heavy use of fertilizers, the soil can become densely acidic which then leads to soil compaction and erosion. When compacted, soil nitrification can decrease by up to 50% thus leading to less absorption of nutrients by plants, and therefore less plant growth.[12] Overtime, the soil becomes infertile and eventually useless.

In addition to the use of heavy fertilizers and pesticides, the majority of our food comes from monocultural farmed land. This means that only one crop is grown on several acres of land for as long as the soil can possibly withstand each season. From an efficiency standpoint, this might make sense for maximization of a harvest. By growing a crop with exceedingly high demand, such as a commodity crop like corn, in a large high density plot with heavy fertilizers, then we expect to have much higher yields. Rather than growing a variety of crops in various areas, farmers tend to work more efficiently with their technology when there is only one specific crop to focus on and care for. This mass production ultimately makes the product

[12] Massah, Jafar & Azadegan, Behzad.

cheaper. Therefore, in the short run, the heavy use of fertilizers and machinery might be beneficial for a company's profit and efficiency.

However, the practice of repeatedly growing one crop in one massive area results in long term damage. When farms solely harvest one type of crop, there is no regenerative nutrient cycle in return. Naturally, crops are able to return lost nutrients back into the soil due to their complex root systems. However, due to demand, many farmers feel the natural cycle is just not fast enough. So, in an attempt to combat this lack of nutrients, farmers further the problem by adding a surplus of heavy fertilizers and pesticides. As the cycle continues, the crops become more resilient, and thus more and more fertilizers and chemicals are needed to meet the demands. Over time, the soil understandably becomes degraded. It is estimated that once topsoil becomes degraded enough, the crop productivity decreases by approximately 50-75%.[13] One way to break this cycle, or rather avoid the cycle altogether, is implementing the use of polyculture.

Polyculture is the practice of growing a wide variety of crops and cover crops to ensure that there is a sustainable nutrient cycle within the soil. Diversifying the crops over a given plot of land leads to increased biodiversity, which research has shown to benefit the soil's health thus resulting in a lack of need for heavy fertilizers. Cover crops, such as legumes, help restore the soil's natural nitrogen balance and promote carbon sequestration, the term used for keeping carbon in the soil rather than the atmosphere.[14] In addition to improved soil health, diversified land can store water in a more efficient manner, leading to a reduced need for heavy irrigation. Heavy irrigation wastes water and the excess water runoff can be harmful to surrounding ecosystems. By sustaining overall soil health as well as implementing proper water storage,

[13] Rickson, J.
[14] Massah, Jafar & Azadegan, Behzad.

polyculture practices have shown incredible improvement in yields, some studies showing even better results than short term monoculture.

It is not very common for farmers or agricultural companies to utilize polyculture, mostly because they usually only have stakes in a few major crops. They tend to choose the short term option of moving their lands entirely rather than picking up new and improved methods of farming that can take years to see positive results. As a response to this depletion of soil health, the farmers have turned to clearing out forests to use as new fertile cropland. Farmers see forests as an opportunity to utilize incredibly robust soil due to their typically untouched and diverse ecosystems. The trade-off for new agricultural land is the loss of beneficial biodiversity as well as watershed protection, and of course, carbon sequestration.[15] This is a crucial problem because carbon emissions are exponentially growing at such a dangerous rate. For context, "more than 60% of [all global] deforestation has been attributed to monoculture farming in hillside areas, where declining yields force poor people to rely on shifting cultivation" (FAO). This means that poorer people are forced to use the "spent" land that has been destroyed by monoculture while larger farming corporations are taking over the large forests.

Since farmers already have to move their land due to the "Greenhouse Effect", these inefficient farming practices are transported to a new piece of land, potentially releasing even more carbon into the atmosphere once again. Farming on these new frontier lands that have never been used for farming before poses the risk of an unimaginable number, over 177 gigatons, of carbon being emitted, especially if current practices are still utilized. For context, "this amount is equivalent to more than 100 years' worth of present-day carbon dioxide emissions in the U.S., and its release could accelerate global warming".[16] Considering this is only in relation to U.S.

[15] Hazell, P., & Wood, S.
[16] Hannah L, Roehrdanz PR, K. C. KB, Fraser EDG, Donatti CI, Saenz L, et al.

levels, one can only imagine these levels of carbon emissions on a global scale. As stated before, we cannot continue to risk losing our carbon sequestration entities more so than we already have.

Therefore, our current conventional farming methods need to be thoughtfully addressed. Releasing carbon and other nutrients through these industrial processes not only makes the soil weaker and eventually unable to grow crops, but it significantly adds to our atmospheric carbon amount, which is already at frightening heights. We already know that the sharp rise in carbon emissions will only lead to hotter temperatures that equate to less farmable land. As a result, farmers have to shift where they grow each crop. Our society has already used up a third of the Earth's terrestrial land area for food production with 25% already degraded.[17] This cannot sustain us for much longer as there is only a finite amount of resources and land on this planet.

With an increasing population, and consequently a growing demand for food, humankind cannot risk being in a position where we lose even more land and have less soil. Overall, the approach we should take is to stabilize the carbon release as well as limit the degradation of land. In order to stabilize the carbon release, we must shift our methods from over-tilling and heavy use of chemicals toward a more organic and diverse process. Evidence consistently shows that implementing a polyculture perspective rather than maintaining our current mass-monoculture system reduces the overall need for the heavier use of pesticides and fertilizers.[18] By implementing polyculture and cutting out chemical inputs in our systems, the natural sustaining nutrients in the soil would prevent us from needing to find new land to farm. Additionally, we would notably lessen our whole atmospheric carbon footprint and therefore hopefully slow the need to change regions of where we farm due to climate change. Making important changes to the current system of how we approach the land we cultivate can have lasting benefits beyond

[17] Sandler, Ronald L. Pg. 47
[18] Helming, Katharina; Daedlow, Katrin; Hansjürgens, Bernd; Koellner, Thomas.

just our land and food supply. However, the current agriculture system is built upon centuries of advancements in production efficiency, which makes it hard to truly envision vast global change.

The flaws in our food supply chain are strongly linked to our food waste problem along the supply chain. Annually, about one third of the world's entire food supply gets wasted or lost somewhere along the food chain. That is 1.3 billion tons of food which approximates to $936 billion wasted every single year.[19] Depending on a region's infrastructure and practices, we lose more food at different levels of the chain. The United States wastes between 30-40% of the food we produce. This is primarily due to growing our society's culture in rising demands for consumption, for lack of better words, over consumption.[20] The problem is not just some underdeveloped society problem but quite literally here on our own soil.

This overproduction is a product of overworking usable agriculture land and implementing new technological advancements which we will see in the next chapter. Since farmers are trying to meet their company's demands in lieu of the market, they have to do whatever it takes to get the most output of their production. Unfortunately, this short-term approach comes at a cost. That cost is the poor practices to meet these needs leads to the harmful effects of climate change.

Chapter 2- The Rise of the Machine

Since 10,000 BCE, agriculture has been nourishing most of the world's population through a variety of cultivation methods. Gradually, civilizations around the globe discovered how seasons brought certain plants to grow and that they could redirect wild gathering into a more controlled cultivation with the help of stone tools which then evolved into the use of bronze and iron tools. During its time of formation, agriculture had a lot of power in forming

[19] Ishangulyyev, R., Kim, S., & Lee, S. H.
[20] Ishangulyyev, R., Kim, S., & Lee, S. H. (2019)

civilizations to work the farm and provide a stable food supply, typically around a water source such as a river. The shift from communities being hunter-gatherers to actually settling on a plot of land and working it themselves led to a multitude of social problems. We cannot function as proper humans if we are unable to sustain our bodies, so when those plots of land failed or struggled to produce enough food, social tensions arose, similarly to today's problem.

External factors such as extended droughts, floods, land degradation, and unpredictable weather patterns led to struggles in keeping up with efficient food production.[21] On top of physical factors such as these, early farmers had to develop productive methods in order to adapt to the rises in population. Despite these challenges, the domestic cultivation lifestyle was still favored compared to other food procuring methods. Since people experienced and enjoyed these growing agricultural communities and earned their mostly steady and secure food supply, more societies felt the urge to break from their traditional hunter gatherer lifestyle and join the agricultural business.

Along with the development of these booming agricultural civilizations, there also needed to be new technological advancements on the field in order to match the population's need for adequate food supply. Experiencing the problems with the way humankind traditionally farmed back then should have served as a lesson as to why the current agriculture industry may be failing. They failed to recognize the balance between maximizing yields but also staying within the land's boundaries. With the technological inventions of both irrigation and the plow around 6000 BCE and 3000 CBE respectively, civilization saw the productivity of agriculture grow but failed to realize the harm they were doing to the soil over time. Irrigation diverts water from nearby sources to the farmland when the weather and typical rainfall patterns do not

[21] Dow G, Olewiler N, Reed C.

cooperate which seems like a great temporary solution but should not be a primary method for growing crops long term. This helped civilizations expand where they farmed as they did not need close direct access to their water sources which thus only grew the industry. However, when excessive irrigation is implemented, evidence shows that it can cause water logging, excessive salt builds up, nutrient leaching, and can cause roots to not take to the soil as well as without.[22]

The plow turns the soil uplifting millions of nutrients in the soil below that can act as a natural fertilizer. This can be extremely helpful for areas that have less fertile topsoil but have an abundance of nutrients deep within the subsoil from millions of years of decaying organic material. But, when done too much, we strip all layers of the soil of the precious nutrients. The nutrients will typically be absorbed by the plants as they are intended to do, but the nutrients can also get swept away in other areas of the planet rather than in the food growing soil.[23]

These practices continued on for centuries until more alarm bells finally were rung in the mid 1800's by economist Thomas Malthus when he warned that population growth was at such a rate that it would overrun the rate of our food production. In his essay of The Principle of Population he says, "This natural inequality of the two powers of population and of production in the earth, and that great law of our nature which must constantly keep their effects equal, form the great difficulty that to me appears insurmountable in the way to the perfectibility of society".[24] He essentially refers to how our planet has boundaries that cannot be surpassed, or else humanity will be in grave danger. There must be a balance in ratio between the two and if

[22] Fleischer, Deborah.
[23] Helming, Katharina; Daedlow, Katrin; Hansjürgens, Bernd; Koellner, Thomas.
[24] Malthus TR.

we cannot meet that, he thus predicted that we would need to seek out even more risky temporary solutions to meet these growing demands.

Malthus' predictions eventually played out to be true and continue to be true to this day. Our demand is just too severely high to keep everyone fed. In the early 1900's, farmers and scientists knew they needed to develop a significant change, so they spent the next fifty years working on various solutions as an attempt to speed up production and increase the yields. The Green Revolution emerged throughout the 1950's through a variety of methods and tactics intended to boost efficiency.

This development stemmed straight out of the anatomy of what a farm has always been, a complex system. They have always seen their land as systems due to the complexity of interrelatedness amongst whatever they grow or raise and the resources used to keep it successful. This includes managing troughs or ponds and diverting that water to a specific piece of their land versus another. The system's only goal is to get food on consumers' table and profits in. Understandably, as time goes on, the technological advancements in agriculture are based on this systematic model of continuing the end goal of feeding people at all costs. However, as our population grows and thus demand grows, there was an incredible pressure on using any means necessary to meet these goals and it can lead to an imbalance of too much advancement on something intended to grow naturally. These advancements to achieve an efficient system introduced in the Green Revolution were specialization, mechanization, fertilizer and pesticide introduction, farm consolidation, and concentrating the food markets as a whole.

Specialization was originally intended to compel farmers to focus on and master one specific crop or animal. Farmers previously had one plot of land with several different kinds of animals and crops going year-round. But now with specialization, farmers can focus on the

specifics of cultivating one thing and cutting other tasks, such as feeding chickens and other livestock or worrying about a failing wheat plot. With this extra time on their hands, farmers were able to improve their skills in genetic selection which ultimately made their products bigger and more resilient overall. Through specialization, farmers found themselves incredibly efficient and able to scale up the size of their farms faster. The agriculture industry had found a simple yet effective way to maximize production in less than half the time using less resources and energy.

At about the same time, farmers began to gain access to new technological resources that would steadily increase their efficiency. The process of switching to specializing in just one product meant that farmers would essentially be repeating tasks over and over again, almost operating like an assembly line every day. As a result of this new routine, farmers were implementing different machinery in order to get work done more efficiently. Machines such as steam tractors and combines could take the place of five farmers' productivity in one day even back in the mid 1900's. This increase in productivity has only grown with further advancements in machinery such as bigger tractors, hydraulic systems, and even GPS assisted automation. Essentially, farmers are able to get significantly more work done with heavy machinery than with just by the hand of farmers. As a result of this breakthrough in the industry, the agricultural sector of the U.S. workforce decreased from 41% to 2% within the 20th century, however food was growing in ways that were never before seen.[25] Even though this may seem as a positive, constant heavy weight from tractors, combines, and wagons on the soil can lead to soil compaction which can strip the soil of nutrients more rapidly. When using 10–12-ton machinery during one season, productivity rates can decrease up to 15% without other soil degradation

[25] Dimitri C, Effland A, Conklin N.

factors in play. Essentially, when considering heavy machinery for farming, there is a tradeoff between producing more efficiently and losing product.[26]

This increase in efficiency was only compounded by the use of fertilizers and pesticides which made the plants much more resilient to any possible diseases or invasive weeds. Additionally, these advancements allowed plants to become better adapted to climatic changes. The practice of specializing in one specific crop and thus essentially falling into the now conventional practice of agriculture caused the reliance on fertilizers to particularly uptick as there were less invasive species to fight against. With the extra energy and immunity from fertilizers, plants are growing bigger and stronger than ever before.

In the few years between 1946 and 1957, the demand for fertilizers in the US doubled.[27] This increase in demand was caused by the widespread success of the utilization of fertilizers. Farmers were experiencing incredible returns just by simply using these products, so of course, more farmers would be getting on board to experience the same benefits. At the time, the majority of the farmers were either unaware of or simply did not care about the ecological and health-related consequences of these practices. Instead, they deeply valued profit and continued to use the methods which led them to see more products getting out and more profit coming in, regardless of the harmful outcomes on the environment and eventual poor outcomes their farmland would see in the future. Today, the United States uses, "900 million pounds of pesticides and herbicides, and more than 12 million tons of fertilizer (nitrogen, phosphate, potash/potassium), are used each year".[28] This huge amount of chemicals degrading our land

[26] Duiker, Sjoerd Willem.
[27] Lin B-H, Padgitt M, Bull L, Delvo H, Shank D, Taylor H.
[28] Sandler, Ronald L. Pg. 23

year after year can be hard to fathom, especially when we are seeing such great returns right away.

With the extra money coming from these greater yields, farmers had the ability to consolidate their land to create fewer but larger farms. The development of larger machines and the success of various fertilizers and pesticides made the shift easier to implement throughout larger areas of land while using less labor. Additionally, this new wave of consolidating smaller farms into larger farms was encouraged by the government. In the late 1950s, U.S. Secretary of Agriculture Ezra Taft Benson pressured farmers to consolidate their farms into fewer massive ones when he told them to, "get big or get out".[29] Essentially, this incentive established farmers to consolidate their land in order to promote higher yields of production. Government intervention and policy changes promoted economies of scale, produced on a greater scale for exponentially greater profit, and eventually resulted in the size of farms doubling and the number of farms decreasing by half. Today, half of all U.S based farms are over 1,000 acres due to this push for consolidation.

Consolidating this land naturally led the food market to concentrate itself as well. The diversity in market shares started to dwindle as mega food corporations started taking over entire markets of one product. Major corporations such as Tyson, PepsiCo, and Smithfield have either taken over or merged with smaller companies in order to gain a dominion over the price and production of certain products. For example, in the entirety of the U.S cattle industry, 82% of those annual sales go to only four large companies.[30] The main benefit for these companies to gain their control over the food market is their ability to achieve a lower price for consumers, thus leading to greater sales.

---

[29] Dimitri C, Effland A, Conklin N.
[30] James HS, Hendrickson MK, Howard PH.

However, along with the benefits for the companies, there are also a number of significant drawbacks. With such massive amounts of power, these food industries have the ability to make major decisions within the rest of the market, even though they may not be qualified nor necessarily representative of the rest of the producers. These multi-billion dollar companies are able to lobby governments and influence policies that are best suited to their company and its needs. This lack of connection, perspective, and oversight at the top of the system leads to a surplus of problems down at the farmer's level. When companies emphasize and focus all efforts solely on profit gains and maximizing output, the inequality in the system is bound to surpass manageable levels, and the system as a whole will eventually fail.

In order to not fail our planet and its inhabitants, we need to implement much more intensive regenerative farming methods. The basic four principles of regenerative agriculture are increasing soil fertility, biodiversity, water retention and cleanliness, and soil carbon sequestration. Many farmers across the globe are already implementing such methods and have been for centuries but we need to make it universally practiced.

One method that has grown in popularity for regenerative farmers is minimizing tilling soil or stopping the use of tilling all together. By doing so, this would help increase the soil vitality by allowing the soil to do what it does best, store nutrients. If someone were to grab a spoon and take a scoop out of the earth, they would find more nutrients and living organisms in that one scoop than there are people on the earth. Therefore, it is crucial to keep these communities thriving and undisturbed as best we can. When soils are able to establish themselves by feeding off organic matter, they are better resilient against plant diseases and are

able to prolong their nutrient cycle. Additionally, this contributes to the principle of sequestering the soil while also keeping soil vitality high. [31]

In order for a limited tilling practice to work even better, farmers cut out the use of fertilizers and pesticides extending beyond just disturbing the soil physically but also chemically. Since fertilizers are adding additional nutrients to the soil, the living system already established breaks down with these new factors entering their system, especially when heavy amounts are added and the soil loses its biodiversity altogether. By removing fertilizers, the farmers are allowing their soil's system to naturally regenerate and produce the nutrients it needs without collapsing its biodiversity.

The same goes for not using pesticides in that the farmers are avoiding the natural biodiversity collapse. Since pesticides are used to essentially kill off unwanted weeds and other harmful pests or insects. However, in most cases, they also kill the organic matter beyond just their targeted invaders. This includes many of the living organisms and nutrients that bring life to the soil's composition that is so valuable to regenerative farmers. By cutting out the use of synthetics, these farmers are also able to restore their water systems by not contributing to the chemical runoff caused by fertilizers and pesticides. Regenerative farmers do not mind the trade off of having incredibly vibrant soil compositions and having to deal with a few unwanted factors impacting their ecosystem versus barren soil. [32]

In an attempt to naturally introduce the same effects of fertilizers and pesticides, regenerative farmers have a variety of ways to bolster the soil's nutrient cycle. One way that also helps the principle of carbon sequestration is by using cover crops. These crops are not intended for harvest but rather to protect the soil from wind and erosion as well as provide a variety of

[31] Spears, Stefanie.
[32] Lin B-H, Padgitt M, Bull L, Delvo H, Shank D, Taylor H.

other benefits. Not only do they help further store the living organisms underneath, they also help feed them further and return nutrients without the disturbance of having to till or add fertilizers. After a farmer harvests their main selling crop, rather than leaving the soil empty, they plant a cover crop. Popular cover crops are typically grasses or grains such as alfalfa, rye, Sudan grass, or mustard. These crops perform the exact same function that synthetic chemicals can do naturally and without the degradation and other harmful effects previously discussed.

Additionally, regenerative agriculture relies heavily on polyculture, the diversification of the crops grown. Many farmers believe that crops are more collaborative than competitive as they work together in one cohesive system to survive. Therefore, many regenerative farmers will have a diverse variety of crops growing in a general area to mimic a natural ecosystem's biodiversity. Polyculture has been proven to limit the need of more conventional methods of using fertilizers and pesticides because of the resilience of that biodiversity. [33]

When these methods are all interrelated in one system, the farmer essentially is just promoting the land's own natural process. The elephant in the room is that these regenerative practices are much more tedious and thus less desirable for people trying to get food fast to meet demands and following the conventional methods of farming. However, these practices are incredibly damaging and if we don't make the transition to a more regenerative and sustainable farming method, there will be no food left to even meet the growing demands.

Chapter 3: Those Who Cultivate

In order to implement such practices, the boots on the ground, the farmers, must be aware of these issues and have full understanding of the impact that their superiors are imposing on them while also open to learning more about ways they can change the practices. Implementing

[33] Ibid.

farmers' direct involvement and gauging their desire to change their practices should be important factors for corporations to consider. These people are working first hand with the products, so they deserve to be given more credit and fair treatment as they are the true reason we are able to get food on our tables.

Farmers are the backbone of our food supply, yet we rarely ever think about them as the people who labored hard and tireless hours so that we can enjoy some of our favorite foods. It is often difficult to fathom every step of the food system, starting with growth and harvest and resulting in the fruits and vegetables we buy at the grocery stores and the vast power this process has on society. Yet, the agriculture industry accounts for over one-third of the Earth's population's livelihood, so logically, we should be dedicating much more energy and attention to them and on their say in shifting our agricultural system. Of those 2 billion people, about 72% of that population is working on small farms, each about 1 hectare or less. As discussed in the previous chapter, those farmers are now competing with and overshadowed by megafarm corporations that have consolidated their property. For context, these small farmers only control 8% of all of the planet's agricultural land.[34] Additionally, the megafarm corporations are not sending employees from their own offices to harvest their crops, but instead they are outsourcing cheap labor from elsewhere. Therefore, that small percentage of big agricultural stakeholders who hold 28% of all larger agricultural operations disproportionately represents the rest of the agriculture industry and farmer owned control, and thus indirectly dictating markets and standard labor procedure.

Essentially, these disconnected big agricultural companies are able to maintain their control as the main decision makers in offices in big cities, but not in the actual rural areas in

[34] ILO Modeled Estimates, May 2018

which the food gets produced. This should be concerning for consumers as there is clearly no balance between the food supply chain and how we allocate our monetary resources for the greater good. For example, the sixth-largest economy in the entire world, that of California, produces, "over half of the fruits and nuts consumed in the US, and one quarter of the vegetables".[35] That is a staggering ratio of production for just one state in the United States. Between 1997 and 2003, the average Californian income increased by $1,500 and, in 2009 alone, California produced over $35 billion dollars in agricultural sales. Many experts speculate that California is a pioneer in the food industry using technological advancements never seen before, such as heavy irrigation techniques and breakthrough fertilizer and pesticides outlined in the last chapter.[36] These various advancements, as well as a booming return of investment, seems great on paper when we examine only the basic facts and figures and how much product was produced. Of course, businesses see this as a win but for how long will this metric and method of production stand before it collapses?

Behind the shroud of producing more food for this country and more profit for major food corporations', California also has the highest poverty rate in the US. With the returns we saw in the previous paragraph, one would think the California economy would be booming. However, in the agricultural world, the average *legal*[37*] farmer in California makes the equivalent of $8 per hour in an industry, $5 below the state's minimum wage, in an industry that has a death rate that is five times higher than any other heavy labor jobs in the state.[38] One can conclude that the average undocumented worker gets paid even less. Immigration politics and

[35] Patel, Raj. Pg. 74
[36] Ibid. Pg. 75
[37*] According to the U.S Department of Labor, it is estimated that half of California farmers are undocumented and over 90% are immigrants of some sort.
[38] Patel, Raj. Pg. 74

opinions aside, these illegal and legal workers are indeed here and contributing greatly to the system.

They attribute significant labor for major food corporations such as Tyson, Perdue, and Goya Foods just to name a few. A great example of their impact was proven in 2006 when hundreds of thousands of illegal immigrant workers went on strike just to show the extent of their impact on the system. Their significant impact was quickly proven after several processing facilities and plants were closed and staff was drastically cut down due to the financial strain of going just twenty-four hours without these farmers working. [39]

Seen as a rare occurrence, this strike shed light on not just the immigrants' impact, but also how little freedom they have to change terms of their employment. Both documented and undocumented workers struggle every day to make ends meet due to harsh working conditions. These include extensive hours with little break time where workers are bent over for the majority of the day. Farmers are consistently exposed to harmful chemicals such as the fertilizers and pesticides used daily that are proven to cause a multitude of health issues ranging from Alzheimer's to cancer due to the nitrates and heavy metals that make up the fertilizer composition. When used with the proper safety gear, the risk of these health risks from these chemicals decreases, but typically larger farming operations fail to update and properly distribute the necessary safety equipment. Additionally, they are used at an above average rate, so there is even higher risk. Despite such tough working conditions, farmers still receive extremely limited wages that are based on how much they can harvest rather than by the hours of their work.[40]

One of the most notable fertilizer companies, Monsanto, has been at the forefront of several lawsuits in regard to their harmful toxins used in their products. Typically, migrants have

[39] Patel, Raj. Pg. 78
[40] Natasja Oerlemans, Gérald Assouline.

struggled to enter the litigation sphere, as most do not have the financial stability or access to resources to seek out settlements for the damage done. This is mainly due to lack of access to education as well as a language barrier. Therefore, farmworkers in general are significantly underrepresented in most litigation cases against big agriculture pesticide companies and in their own strife for better working conditions in general.

However, in 2012, several legal and illegal migrant farmers in Indiana, who worked directly at an Indiana Monsanto/DuPont plant, sued the company for a variety of harmful working conditions such as high risks of heatstroke, dehydration, exposure to toxic pesticides, and even a "$4-per-acre piece rate they were paid". [41] This rare occurrence of migrants taking a big corporation to court only shed a small fragment of light upon how unsustainably our food supply chain operates. Not only are farmers forced to deal with exposure to such harmful toxins, but they are also stuck in an inescapable cycle due to their financial, and sometimes legal status constrictions.

This cycle only deepens their struggle with poverty and sustainably accessing the food they grow themselves. Since the majority of farms are in rural areas, farming communities often struggle with food security. In the 2000's in the United States, rural populations had an average rate of 13% of the population being food insecure while the national average was only 10%.[42] There is a common misconception that farmers live in one big farmers market and constantly have access to the food they grow. For a select few, this might be reality. However, as said in Chapter 1, the majority of farmland is monocultural focused and operated. Therefore, in an ethical sense, there's no reason for people to believe that farmers can survive on miniscule wages from growing one crop. Additionally, the lower population density of rural areas leads to a

[41] Neubert, Ainslie and Rushlow, Jennifer.
[42] Patel, Raj. Pg. 99

smaller market for supermarkets, thus making it difficult for low-income communities to access fresh and healthy food without having to travel long distances.

Travelling long distances for healthy food is not exclusive to just the consumer. Suppliers must also travel far and wide to supply grocery stores. Another deep flaw in our current system is that the food these populations buy in a generic grocery store will frequently be supplied from miles away, typically sitting many days in manufacturing facilities and in the long transport. Populations are dependent on farmers to get fresh food out efficiently, but how come we fail to take care of the farmers the same way they try to take care of our food? Significant industry changes need to be implemented to allow farmers to do their jobs more efficiently.

Sustainability does not only extend to sustaining our Earth but also how we sustain our people. Although the concept of treating farmers with dignity and respect should seem simple and self-explanatory, it is unfortunately not well-practiced, if at all. If we want to make a shift toward a sustainable food system, we must start giving our farmers the resources and incentives in order to do so. One way to promote farmer welfare is by giving them comprehensive healthcare standards. Even though farmers work in an incredibly injury and fatality prone industry, only 22% of farmers claim they have comprehensive healthcare to cover themselves in the unfortunate event something happens. [43] This can strain the safety net of not only the individual but also the company itself as losing workers can impact their productivity.

One way to minimize agriculture related injuries and fatalities is to provide better working conditions. Under the monoculture system, workers are typically paid depending on how much they produce. Understandably, this creates a very competitive and intense environment where farmers are working insane hours no matter the weather condition to meet

[43] *AMERICAN PUBLIC HEALTH ASSOCIATION*.

their product goals. Not only does this strain the human being cultivating, but also the land. To ensure a safer and more humane workforce, we must switch our farmers from the piece-rate system to an hourly wage at the least.

Additionally, agricultural companies need to put more pressure on USDA, EPA, and OSHA regulations. Of the over 100 OSHA health and safety regulations, only 6 of these regulations relate to farmworker health and safety despite it being one of the most dangerous occupations in our modern day. Ways to combat such poor treatment, companies need to implement livable conditions where workers are economically stable. This will create a healthier environment where farmers want to work rather than just work to barely survive. Farmers are prevented from applying more sustainable practices because of counteractive barriers from financial strains that do not allow them to progress.

As more of society becomes aware of farmers' unsafe and unethical working conditions, we need to better understand the disconnect between the top tier and the lower tiers of the system. "In most societies, the reality is that wealth and power tend to trickle up, not down".[44] Our farmers' population continues to dwindle, but our reliance upon them is only growing. Treating humans in a respectable manner is one small and simple step in pushing humans to also treat the Earth with respect, as we should. It is more pertinent than ever to find stable, sustainable security to continue the fight against food insecurity in our world.

Chapter 4: Band-Aids Don't Fix Bullet Holes

Luckily, there are sustainably and environmentally conscious people in this world who understand the need for radical change. Hence, a massive wave of new sustainable movements intended to chip away at the food system failures has continued to grow throughout the past

[44] Steel, Carolyn. Pg. 150

decades. These movements have gained major popularity in urban areas of the United States, where living sustainably is more attainable. However, the main premise of many of these ideas are based on individual actions people can take in their everyday lives, rather than focusing on systemic changes the major food corporations have the power of implementing.

Veganism, a movement that has grown insanely popular within the last decade, bases itself on the individual diet choice of cutting out all animal products, including meat, dairy, and eggs. Vegans have a variety of reasons as to why they choose to be vegan, ranging from care for animals' souls to opposing the environmental implications of the meat and dairy industry, and often a mix of both reasons. Those concerned with environmental implications hope to cut back on meat in order to reduce the carbon footprint caused by the meat industry. The veganism movement often has great intentions on revitalizing ecosystems. However, this imposes strain on crops that are in high demand for vegan alternatives to animal-based products such as soy and nuts. This strain is arguably not as harmful compared to the contemporary meat industry's impacts, although there are still harmful implications in a variety of sectors.

For example, the almond milk market, one of the most popular vegan alternatives to dairy milk, has grown 250% just from 2010 to 2015. [45] This sharp surge is due to the lesser carbon footprint that almond milk produces compared to dairy milk. However, in order to grow almonds to keep up with such a high demand, farmers need to impose heavy pesticide and water usage. This causes problems for the United States almond milk industry as 80% of all almonds are grown in California, a state known for their severe droughts and lack of adequate rainfall. To adapt to these conditions, farmers have to divert huge amounts of ground and surface water in order to keep their products thriving. In California, it takes approximately 15 gallons of water to

[45] Fleischer, Deborah.

produce only 16 almonds which only produces a little over two cups of almond milk.[46] Therefore, the growing demand in almond milk is causing dramatic and harmful pressure on the irrigation systems. To make matters worse, the demand also pressures farmers into heavily using fertilizers and pesticides that exasperates the ecological crisis discussed in Chapter 2.

Essentially, choosing to go vegan for this reason can sometimes be a trade-off, but not everyone has options to such choices. Recently, some major fast food corporations such as Burger King, Dunkin' Donuts, and Wendy's have all developed vegan alternatives for meat and dairy. They each have options for beyond meat and non-dairy milks, however these options come at an increased price. Despite the few accessible vegan fast food options, eating 100% vegan at all times is not possible for all communities. For starters, vegan options are not often found in lower-income communities or rural communities. When they are offered, however, vegan food and alternatives in grocery stores are more expensive than non-vegan food options. Although the vegan community urges everyone to attempt to go vegan for the many benefits the diet can have on the environment, this simply is not attainable for several communities.

Purchasing vegan products is a growing popular trend primarily in urban populations. This increasing demand forces supermarkets to put more plant friendly options on shelves in the cities rather than rural populations. In Houston, Texas, the fourth largest city in the United States, Texas' most popular grocery store, H-E-B has on average over 1,000 more vegan products on their shelves than at an H-E-B in the rural farming town of Brenham, Texas, just over an hour outside of the city.[47] The reason for this disparity is that rural communities like these rely on meat for agricultural profit and thus there is no demand for cutting out meat. Sure, this is primarily due to demand being higher in urban areas than in rural ones, but if veganism

[46] Fleischer, Deborah.
[47] H-E-B, LP 2020. Product Report.

were to really have the significant global impact that it intends to, it would need to make major headway into rural communities as well. Movements such as these need as much momentum as they can possibly get in order to elicit action by our corporations in order to make the most impact.

This disparity between rural and urban communities applies to access to organic food as well as vegan food. Organic food production does not use any chemical fertilizers or pesticides, which prevents runoff from damaging ecosystems as well as soil degradation. This process intends to foster a cycling of resources, promoting ecological balance, and conserving biodiversity." [48] The trend of organic food can be traced to a 1942 magazine started by J.I. Rodale titled *Organic Gardening*. He primarily advocated for soil fertility and not relying on inorganic synthetics to boost the soil rather than a holistic approach that included biodiversity and welfare which we see today. Now, the organic movement, "promotes environmentally, socially, and economically sound production of food, fiber, timber, etc." [49] It is intended to work more *with* nature to uplift all aspects of agriculture rather than work to control nature.

Organic food tends to stray away from big conventional agriculture productions and generally favored the independent small farmer when it began. However, now, bigger corporations are catching onto the trend and have brought more organic products to the market. Still, organic food sales only account for 2% in the entire US market. This does not fully correlate with the demand for organic food steadily increasing at about 10% annually worldwide.[50] Buying organic food is a beneficial individual choice one can make to eat healthier for oneself and for the environment, however like vegan options, it is not accessible to all people.

---

[48] Sandler, Ronald L. Pg. 33
[49] Singer, Peter, and Jim Mason. Pg. 199
[50] Ibid.

Organic farming costs quite a bit of money for a few reasons. Even though we seem to see more organic food on shelves, the percentage of certified organic cropland in the United States compared to conventional cropland is 0.7%.[51] This supply of organic crops does not meet the increasing demand of consumers and thus raises the price. Additionally, there is a huge cost with the organic certification process. In order to be certified organic, farmers must pay heavy fees to apply and receive inspections for potential cross contamination of conventional crops which is tacked onto the final product's price. Of course, they receive high returns to pay for the bigger labor costs, but they just cannot compete with conventional farming's prices and efficiency at this state in their movement's growth.

In addition to not being economically accessible, organic food is also not physically accessible to many. At the same H-E-B's, there were double the amount of organic food options in the urban Houston location versus the rural Brenham location.[52] This only furthers the argument of the disproportionate access to food options that could make the climate crisis better. If companies were to promote a more sustainable lifestyle in rural areas and be willing to decrease prices of these more expensive goods, then, there would be a significant impact. But until they do, it only chips away at a much larger issue.

Another movement that fails to really have bigger solutions to the broken system and can only be accessed by an affluent fraction of our society is the fair trade movement. In theory, fair trade food items seem great as they are marketed as seemingly ethical due to their promotion of living and fair wages for those who produce the products. Fair trade organizations are designed to pay living wages to farming communities who rarely see such profit. They intend to cut out any exploitation and uphold humane labor standards.

---

[51] Sandler, Ronald L. Pg. 38
[52] H-E-B, LP 2020. Product Report.

Typically, these organizations outsource these products from rural communities to which they have never been to. To ensure their products are fairly traded, they hire quality assurance auditors who are intended to keep check of farmers' wellbeing and upholding their rights as fair trade farmers. However, these auditors typically rarely visit farms, especially for larger fair-trade organizations, as they simply cannot check in on these farms all the time. Additionally, due to the distance of most of the fair-trade organizations' headquarters, there are blurred lines into what labor standards the auditors actually enforce. Because of this, there is a trend in auditors being "bought off" by land managers in attempts to try to put more product out without the expense of following ethical labor standards.[53]

Fair trade goods are just another inaccessible type of product for many as they are significantly more expensive than a generic product grown by an unknown and most likely exploited farmer. Fair trade can hide behind the facade of being this incredible social bolster yet the distance between farmer and organization allows for unjust labor and exploitation of those at the bottom of the food chain. Most people who buy fair trade do not know these implications and those that do know this factor of the industry believe that buying fair trade goods is better than buying the conventional because they believe it puts influence on the worse agricultural businesses to be more ethically minded.

Of course, consumer influence from those who do have access to such options matters greatly in these corporations making changes. A large enough demand for more sustainable options can cause corporations to listen and make those changes. This new wave causing more people to go vegan, shop organic, and buy fair trade has had a positive effect on pressuring the food industry into shifting their focus into more ethical and environmentally conscious solutions.

---

[53] Goff, Sarah C. (2018)

However, these movements not only fail to address the strain put on the conventional plant-based or organic farmers and exploited workers but, we also cannot put the weight of saving the planet on a small fraction of the world. Those behind these movements typically like to blame those not following such environmental and social conscious ways of life. From their stance, they imply an expectation that everyone has the capacity to shift their lifestyle when in reality, not everyone can. Individuals can make great change with personal choices, but without support from major corporations who control the system as it is, these changes will not go very far. Therefore, large agricultural corporations that have dominion over the food supply chain must hold themselves accountable and take a more impactful stance. "The global food system excels at delivering to affluent consumers what they want, when they want it, at a price they are willing to pay."[54] It is totally feasible to shift from that mindset of pleasing a select few to producing food for an entire planet's population, but only if the most necessary people needed to make this change take the steps to do so.

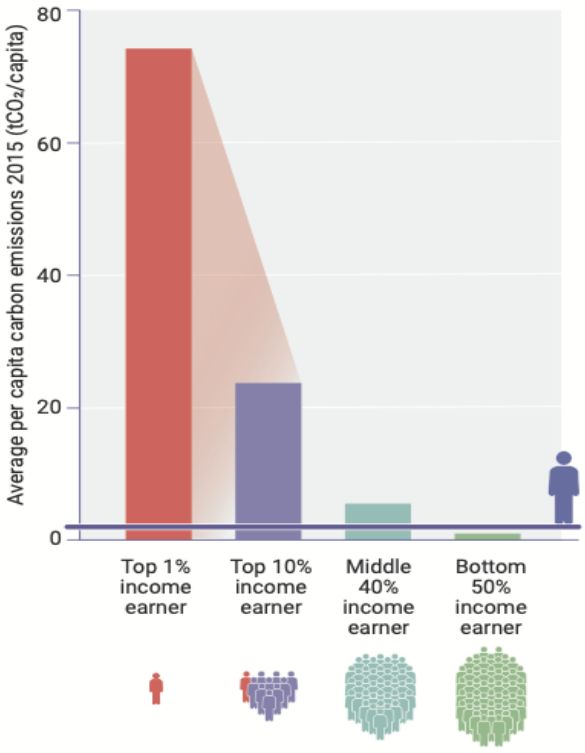

Figure 1

All in all, the reason these more individual, grassroots focused movements are only chipping away at the bigger problem, is because the largest contributors to the climate and ethical crisis we are facing is due to the top 1% of income earners, which includes many of these major food corporations' executives. As seen in Figure 1, there is not just a slight disparity

[54] Sandler, Ronald L. Pg. 36

between the top percent and the lower 90%, but an incredibly significant variation. According to this UNEP report, "the richest 1 percent would need to reduce their current emissions by at least a factor of 30, while per capita emissions of the poorest 50 per cent could increase by around three times their current levels on average".[55] These movements are taking the attention away from the real issue, that of addressing the individuals' at the top of society. Essentially, we need to start looking toward a corporate level rather than an individual level.

Chapter 5: Take the Boardroom to the Field: Business Practices for a Sustainable World

Even though these waves of new sustainable practices are growing in terms of popularity and necessary conversations about the way we treat our environment are finally being discussed, businesses need to address that, "our need to exist within planetary boundaries is clearer than ever, raising multiple questions about how we might live good lives in the future".[56] Before it is too late for both farmers and the planet as a whole, we need to take action to implement more sustainable business practices. The most productive and efficient way for that change to happen needs to come from the top tier of the system: major corporations.

To understand how big businesses work, particularly agricultural ones, there needs to be a focus on how society views food and agriculture. Many people are incredibly disconnected from the farming end of the supply chain since, on the other end, most major grocery stores make their food supply seem limitless and easily attainable. Businesses and society are still so interrelated, both knowingly and unknowingly, therefore the level of transparency within their relationship is important. As a capitalist society built on consumption, the business side pushes for cheap efficiency in order to keep prices low, customers satisfied, and profits high.

[55] United Nations Environment Programme (2020).
[56] Steel, Carolyn. Pg. 162

The major agricultural companies are able to achieve all of these goals because they pay lower wages to their lowest, yet arguably most important, tier of farmers. Businesses know that by nuancing the other end of the chain to the consumer, they can create a smoke and mirror effect on who really grows the food we consume. They do not care about the implications on the bottom end of the chain since profit maximization is the sole driver for a growing business. This profit maximization model acts like a vertical line graph, intending on a continuous growth upwards. However, is it ever questioned whether this linear model could collapse or reach a limit?

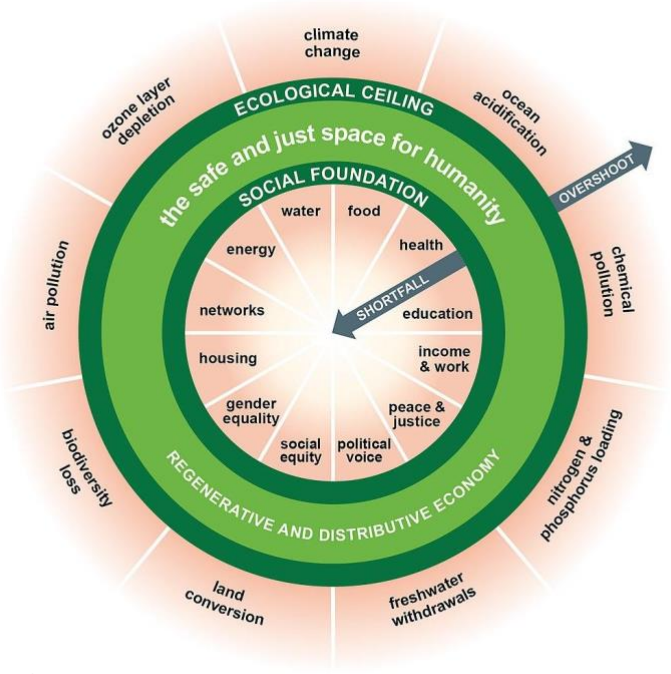

Figure 2

Some economists have questioned the straight line model and have come up with a new model, the donut economics theory shown in Figure 2.[57] The model is in a cyclical format to prove that this method can continue on for generations to come without the worry of collapse or unawareness of what happens at the end of the line. This model represents how we can stay within the boundaries of the ecological ceiling of overshooting climate change limits, biodiversity loss, and land conversion just to name a few. By staying within those boundaries,

[57] Raworth, K.

the framework bolsters the social foundations of keeping people fed and out of poverty whereas in a line, the social foundations get lost very early on. The opposition to such a model would argue that there can be no economic growth if we are continuously going around in circles. However, what is economically beneficial about decimating the land we grow our food upon? Donut economics essentially presents the argument that in order to keep our system successful and limit the risk of collapse, we have to carefully make decisions and act within the green lines, not exasperating on both the planetary and social boundaries.[58] Businesses and corporations who play a role in this system must find their "sweet spot", within the safe and just space for humanity, before it is too late.

As discussed throughout this thesis, the food and agriculture industry has continuously failed to successfully meet the planetary boundaries of nitrogen loading causing climate change, land conversion, chemical pollution, and in the case of monoculture, biodiversity loss. Through the agriculture industry's unsustainable practices along the supply chain, their current model has clearly negatively impacted the social boundaries of food security, income, health, and water. Therefore, in order to meet the needs of the crisis for feeding nine billion and reversing the environmental implications of the current industry model, those mega agri-businesses need to pivot their methods.

The common misconception of such a drastic pivot is that it will be costly for businesses. However, there is strong evidence that heavy short-term investments in "greener" and more sustainable practices can actually lead to bigger returns in the long run. For example, the well-known spice company, McCormick has been making significant investments in greener practices throughout the past few years. In 2019, they released a series of sustainable goals that have

[58] Raworth, K.

already shown significant returns in one year. Through practices of investing in new seedlings for farmers to diversify their land, providing free education for some of their low-income farming communities, reducing their carbon footprint by 8%, and reducing overall waste by 63%, McCormick has already seen a 3% growth in revenue in just one year. [59] This global multi-billion dollar company was able to realize that they needed to seriously rethink their approach to producing food as concern for both the climate and the Earth have been growing throughout the past 5 years especially.

Companies as large and well-known as McCormick have proven that they have the power to create change. One of the ways to get there is to take different business approaches to achieve such a significant pivot in the way their companies operate. The first step, as outlined in Andrew Winston's *The Big Pivot,* is to fight short-termism. Organizations have to scrap the ideology that short term milestones are all that matter. Not only does it skew market returns, but it puts an immense amount of pressure on cutting financial and legal corners to meet big corporation's profit goals. There needs to be a balance of keeping a bigger vision in mind while employing short term milestones as an indicator of success, such as the 3% growth from McCormick in just one year. This idea is much easier said than done, and "the core of the challenge is the relationship between companies and their investors, be it public shareholders or private-equity owners".[60] Companies with sustainable goals need to somehow convince their shareholders that the purpose of their company is beyond solely profit, despite the challenges this might bring about in a capitalist society where profit determines most things. By broadening their perceptions that focus on larger issues, business can extend to a bigger group of stakeholders and ultimately become more profitable.

[59] McCormick and Company (2019)
[60] Winston, Andrew. Pg. 96

To do so effectively, companies must also set science-based goals that can prove they will make environmental changes that simultaneously produce benefits for them in the form of significant returns. Most agricultural business leaders are actually incredibly out of touch with their areas of business. Most founders and current c-suite executives have little to no experience with agriculture or food. They are typically business people with one goal: to make as much profit as possible. If businesses were to bring in people who not only comprehensively understand agricultural and food systems, but also understand the consequences of environmental degradation, they would have a clearer approach for setting accurate and feasible science-based goals. Combining the science side with the business side will result in profit maximization within the planetary boundaries thus staying within the donut economics model and mitigating the risk of collapse.[61]

In order to successfully do so, we must put a value on natural capital such as our soils and water usage on the farms. By assessing these values that may not have technical value in the traditional market, we are able to gauge risk and hotspots of where certain natural capital is either at risk or being successful. This would promote an efficient way for a company to decide whether they would need to allocate certain resources or not. Doing so would put a company ahead of market volatility and in a position to make more cost effective decisions for the long run.[62] More options and ways of thinking would arise by collaborating with environment experts beyond the company's traditional infrastructure. As an industry so connected to the environment, the food production industry needs to understand their dependence and allocation of natural resources and act in ways that do not lead to the depletion of such resources.

[61] Winston, Andrew. Pg. 125
[62] Pirson, Michael. Pg. 85

There are several practices currently operating that prove that businesses can apply this new framework directly in order to create a regenerative and profitable system on the land. Development of new approaches and ideas can only go so far if they are not implemented and acted upon. Big agri-businesses have the power to change the current "bottom up" way of farming to a "top down" method.

A feasible way to ensure this change is to shift our innovation from max profit and yield to maximum productivity, therefore switching to more regenerative agriculture practices. Practices such as decreasing the use of pesticides and fertilizers, limiting use of heavy machinery to prevent soil compaction, and diversifying the land areas of various crops have all proven to increase overall soil health and reduce the need to deforest or move to new agricultural land. Studies have shown that, "increasing the productivity to 95% of their maximum yield, primarily by means of improved water and nutrient management, could increase global yields by 58%".[63] By limiting their approach of farming methods by using less intense methods, farmers could actually do more with less. Unfortunately, this would be a big and costly short term risk due to having to essentially overhaul all operations, transition equipment and machinery, and learn brand new practices. Therefore, it would be unrealistic to suggest that these low-income farmers should immediately switch to regenerative agriculture.

However, a successful shift to regenerative agriculture is estimated to result in up to thirty gigatons of CO2 sequestered from the atmosphere by 2050.[64] So, business leaders must now return back to the question of if valuing natural capital is worth the current risk. Corporations are faced with the necessary option of using their power to make effective change. In the long run, it can be easily argued that regenerative farming methods are indeed successful.

---

[63] Sandler, Ronald. Pg. 54
[64] Ibid. Pg. 58

Additionally, by cutting out the costs of chemical usage and heavy machinery on the land, companies will find themselves with extra spending within the immediate period of time that could potentially be used for collateral if switching a few areas of land ultimately fails.

Most importantly, the food industry would become resilient for future generations to come. There would be less risk in losing usable agriculture land which would ensure that farms are in the best possible position for any potential crisis or disaster. This matters because, as our population expects to grow, we need to be able to meet the demands for the future. We currently do not have a limit threshold that allows us to comfortably have any sort of risk without losing significant amounts of food and/or usable farmland. If we focus on ensuring the health of our soils and increasing healthy yields of food, we might actually be able to efficiently feed the growing number on this planet.

In order to make such a drastic environmental change, those working the land deserve humane treatment and safe working conditions in order to carry out a productivity maximization. According to a 2009 Gallup study, companies that had high employee engagement and dignified compensation and conditions showed "16% higher profitability, 18% higher productivity, and 25-49% lower employee turnover".[65] Food industries often experience a shortfall in valuing their "lowest" employees of farmers. Therefore, they need to provide higher compensation for the work that farmers do, potentially through utilizing the extra money they previously used for excessive chemical usage. With a more dignified compensation, farmers would be able to live a healthier life overall with greater access to better food and less exposure to harmful toxins. Paying employees fair and livable wages and respectfully valuing them as employees and people provides the company with more potential to manage long term challenges.

[65] Winston, Andrew. Pg.147

In order to achieve all of these goals and effectively engage both shareholders and stakeholders in the long term, a company's governance structure needs to revolve around four aspects: incentives, education, transparency, and collaboration.[66] Incentivizing, in both monetary and non-monetary ways, would give employees the opportunity to acquire resources such as financial gain or improved status within the company. For example, when McCormick incentivised some of their farmers to switch to regenerative agriculture by offering higher returns directly to farmers and funding education for their family members, they were able to reap the benefits of more profit due to the increased popularity/demand of regenerative products. These benefits were only attainable due to the attribute of providing education for employees to get them to understand *why* they needed to be sustainable.[67] Implementing various learning programs trickles into their farming communities and allows them to experiment with what works for them and their land as well as significantly improve on their practices.

Furthermore, there needs to be a heightened level of collaboration between the upper executives and those actually cultivating the land. This organizational support can bring integrity and trusting relationships to the company. These two factors are vital to ensuring transparency with shareholders and stakeholders. By cutting across organizational lines to improve productivity from the broader level of perceptions, those stakeholders will see the holistic development the company is working toward and thus be more incentivized morally to buy into the company's mission and goals.

Broadly shifting methods on the global business scale can cause more of a trickle down effect on local food systems, benefitting both businesses and farmers. Of course, there are sustainable actions everyone can take on their individualized and local levels in attempts to

[66] Pirson, Michael. Pgs. 98-99
[67] McCormick and Company. (2019)

improve the food system and the environment as a whole, such as going vegan or buying organic and fair trade. There are many sustainable popular food trends such as supporting farmers' markets, the local food movement, and the farm-to-table movement that can make an impact on a smaller level, yet these are usually only accessible to urban and wealthier communities which cannot make the significant impact we need to feed our growing population in the future.

For complete global food system change, we need to think on a much larger scale to update and improve our current food system. In a capitalist society, those with the most power are unfortunately not those on the local levels, but rather the major corporations and industries that have obtained trillions of dollars. These same corporations in power have been exasperatedly adding to our environmental and social issues. In order to achieve concrete change, blame cannot be placed on only the individual consumer while corporations continuously get away with exploitation and mass environmental harm.

To put it frankly, we are running out of time to save the world. Companies must stop saying they are shooting for a goal to limit emissions or go green in X number of years. They must stop cheering on those following sustainable lifestyles and putting up a facade that they care when all they place value in is the money in their pockets. They have the means to make a more immediate impact. For our future, for our children, and for our planet, they better start putting in the work to generate real change.

Bibliography

Broad, Garrett M. *More than Just Food: Food Justice and Community Change*. Oakland, CA: University of California Press, 2016.

"Climate Change: Atmospheric Carbon Dioxide." *NOAA Climate.gov*, 14 Aug. 2020.

Duiker, Sjoerd Willem. "Avoiding Soil Compaction." *Penn State Extension*, 9 Apr. 2021, extension.psu.edu/avoiding-soil-compaction.

Dimitri C, Effland A, Conklin N. The 20th Century Transformation of U.S. Agriculture and Farm Policy. *USDA ERS*. 2006.

Dow G, Olewiler N, Reed C. *The Transition to Agriculture: Climate Reversals, Population Density, and Technical Change*. Simon Fraser University; 2005.

FAO, IFAD, UNICEF, WFP and WHO. *The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets*. Rome FAO. 2020

Fleischer, Deborah. "Almond Milk Is Taking a Toll on the Environment." *UCSF Office of Sustainability*, Green Impact Group, Jan. 2018.

Godfray, H. C. J., J. R. Beddington, I. R. Crute, L. Haddad, D. Lawrence, J. F. Muir, J. Pretty, S. Robinson, S. M. Thomas, and C. Toulmin. "Food Security: The Challenge of Feeding 9 Billion People." *Science* 327, no. 5967: 812–18. 2010.

Goff, Sarah C. "Fair Trade: Global Problems and Individual Responsibilities." *Critical Review of International Social and Political Philosophy*, vol. 21, no. 4, 6 Nov. 2018, pp. 521–543.

Hannah L, Roehrdanz PR, K. C. KB, Fraser EDG, Donatti CI, Saenz L, et al. The Environmental Consequences of Climate-Driven Agricultural Frontiers. PLoS ONE 15(2): e0228305. 2020.

Hazell, P., & Wood, S. Drivers of change in global agriculture. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, *363*(1491), 495–515. 2008.

Helming, Katharina; Daedlow, Katrin; Hansjürgens, Bernd; Koellner, Thomas. "Assessment and Governance of Sustainable Soil Management." Sustainability 10, no. 12: 4432. 2018

"Improving Working Conditions for U.S. Farmworkers and Food Production Workers." *AMERICAN PUBLIC HEALTH ASSOCIATION*, 7 Nov. 2017.

Ishangulyyev, R., Kim, S., & Lee, S. H. (2019). Understanding Food Loss and Waste-Why Are We Losing and Wasting Food?. *Foods (Basel, Switzerland)*, *8*(8), 297.

James HS, Hendrickson MK, Howard PH. Networks, Power, and Dependency in the Agrifood Industry. In: James HS, ed. *The Ethics and Economics of Agrifood Competition*. Dordrecht: Springer Science-Business Media Press; 2013:99-126.

Lin B-H, Padgitt M, Bull L, Delvo H, Shank D, Taylor H. *Pesticide and Fertilizer Use and Trends in U.S. Agriculture*. 1995.
L. Schreefel, R.P.O. Schulte, I.J.M. de Boer, A. Pas Schrijver, H.H.E. van Zanten, *Regenerative Agriculture – The Soil is The Base*, Global Food Security, Volume 26, 2020.

Malthus TR. *An Essay on the Principle of Population, Volume 1*.; 1798.

Mann, Charles C. "Can Planet Earth Feed 10 Billion People?" *The Atlantic*, Atlantic Media Company. 24 Jan. 2018.

Massah, Jafar & Azadegan, Behzad. Effect of Chemical Fertilizers on Soil Compaction and Degradation. Ama, Agricultural Mechanization in Asia, Africa & Latin America. 47. 44-50. 2016.

McCormick and Company. "Purpose Led Performance Progress Report." 2019.

Natasja Oerlemans, Gérald Assouline. *Enhancing Farmers' Networking Strategies For Sustainable Development.* Wageningen, The Netherlands, Journal of Cleaner Production,Volume 12, Issue 5, 2004. Pages 469-478.

Nath, Tapan Kumar. *Monoculture Farming : Global Practices, Ecological Impact and Benefits/Drawbacks*. Global Agriculture Developments. Hauppauge, New York: Nova Science Publishers, Inc, 2016.

Nuebert, Ainslie, and Jennifer Rushlow. "Monsanto's Roundup Litigation in 2020: Restitution for Migrant Farmworkers ." *Vermont Journal of Environmental Law*, 2020.

Patel, Raj. *Stuffed and Starved: the Hidden Battle for the World Food System*. Brooklyn, NY: Melville House Pub., 2012.

Pirson, Michael. *Humanistic Management Protecting Dignity and Promoting Well-Being*. Cambridge, United Kingdom: Cambridge University Press, 2017.

Raworth, Kate. "A Safe and Just Space for Humanity: Can We Live within the Donut?" *Oxfam International*, 22 July 2014.

Rickson, J. *Mechanisms of Soil Erosion/Degradation*. Burleigh Dodds Science Publishing. 2018.

Sandler, Ronald L. *Food Ethics: the Basics*. London: Routledge, Taylor & Francis Group, 2015.

Singer, Peter, and Jim Mason. *The Ethics of What We Eat*. Melbourne: Rodale. 2007.

Spears, Stefanie. "What Is No-Till Farming?" *Regeneration International*, 15 Oct. 2018.

Steel, Carolyn. *Sitopia: How Food Can Save the World*. London: Chatto & Windus, 2020.

Thompson, Gabriel. *Chasing the Harvest: Migrant Workers in California Agriculture*. London: Verso, 2017.

Winston, Andrew S. *The Big Pivot: Radically Practical Strategies for a Hotter, Scarcer, and More Open World*. Harvard Business Review Press, 2014.

United Nations Environment Programme (2020). *Emissions Gap Report 2020 - Executive summary*. Nairobi.