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# Sustainable Rural Development: Is It Possible to Boost Rural Economies While Protecting the Environment?

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## Abstract

Amidst rapid depletion of our carbon budget, the need to change our practices to be more in line with Earth's limits has become important in every sector of our economy. From advances in renewable energy generation to the growth of urban gardening, people around the world are taking action to change the way they interact with our planet. However, growing concerns have been raised that protections for the environment will disproportionately harm struggling communities. For instance, rural communities in the United States already exhibit disproportionately high poverty rates, income inequality, and unemployment, as well as lower quality healthcare and public education. Accordingly, this research intends to understand some major social, economic, and environmental problems facing rural America and the ways in which they interact with one another, using that knowledge to inform policies that can encourage sustainable practices that will also enrich the rural quality of life. We looked beyond continuous growth while performing this research, focusing not on maximizing GDP, but on working within the planetary boundaries to ensure a proficient quality of life for all without over-exploiting natural resources. Utilizing these perspectives as well as successes from the case study of Costa Rica, we design policy measures to diversify rural economies, shift to sustainable agricultural production, and encourage community-ownership of renewable energy facilities. Ultimately, our findings show many possibilities to help strengthen rural economies while protecting the environment, but this research could be strengthened by further inquiries into ecosystem service payment programs, and possibilities to reintroduce other industries to rural communities.



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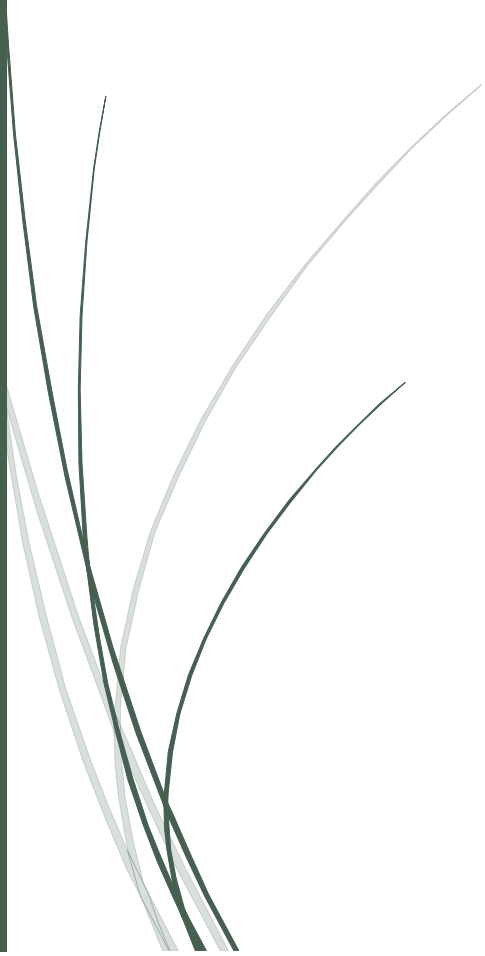

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Amidst rapid depletion of our carbon budget, the need to change our practices to be more in line with Earth's limits has become important in every sector of our economy. From advances in renewable energy generation to the growth of urban gardening, people around the world are taking action to change the way they interact with our planet. However, growing concerns have been raised that protections for the environment will disproportionately harm struggling communities. For instance, rural communities in the United States already exhibit disproportionately high poverty rates, income inequality, and unemployment, as well as lower quality healthcare and public education. Accordingly, this research intends to understand some major social, economic, and environmental problems facing rural America and the ways in which they interact with one another, using that knowledge to inform policies that can encourage sustainable practices that will also enrich the rural quality of life. We looked beyond continuous growth while performing this research, focusing not on maximizing GDP, but on working within the planetary boundaries to ensure a proficient quality of life for all without over-exploiting natural resources. Utilizing these perspectives as well as successes from the case study of Costa Rica, we design policy measures to diversify rural economies, shift to sustainable agricultural production, and encourage community-ownership of renewable energy facilities. Ultimately, our findings show many possibilities to help strengthen rural economies while protecting the environment, but this research could be strengthened by further inquiries into ecosystem service payment programs, and possibilities to reintroduce other industries to rural communities.

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## Introduction

Ever since the start of the industrial revolution, we have seen a great deal of changes to the way humans organize themselves and the way we treat the world around us. During this time, there has been a mass exodus from rural areas into cities, even the creation of what we now know as suburbs. Today, more than 80% of the U.S. population lives in urban or suburban areas. The result is that 97% of the land is populated by only 19% of the population (WorldBank). This was made possible by the large-scale mechanization of farming, allowing a single farmer or family of farmers to care for much larger farms. This mechanization has allowed more people to pursue life in the urban centers, but it has also led to a reliance on synthetic fertilizers and gas guzzling machines to grow the amount of food needed by the entire population of the country. Undoubtedly, this has led to a much larger problem, as synthetic fertilizers cause toxic runoffs from farmlands that cause water sources to be unusable, eutrophication of lakes, reservoirs, and even part of the Gulf of Mexico. Amidst all of this, there have been cries for change to the way that we develop our economy and how we treat the natural world around us.

For instance, since the Great Depression, when the idea of a Gross National Product was first developed, the overwhelming goal of each administration has been to pursue a growth of that GNP. Of course, GNP can be a really valuable tool for an economy that is struggling in an economic crisis like the Great Depression, allowing them to measure how much income has grown as a result of recovery policies, but the expectation for it to continue to grow indefinitely has created numerous problems, like overutilization of the commons, mass loss of biodiversity, and general lack of care for

natural capital and other non-renewable resources. This view that more money, more output, more everything is always good, forever, has been central to the study of economics for so long that merely arguing that there should be more than just that goal is enough to get one ostracized. However, using GNP, or today, GDP as the main indicator of how well an economy is doing fails to address many problems that are absolutely vital to understanding overall well-being within that economy. For instance, there is no measure of wealth distribution taken into account of GDP, so where the country's output is allocated does not seem to matter to those in pursuit of output growth. This has been quite evident in the US, where the past 40 years of neoliberal economic policies have seen the gap between the wealthy and the middle and lower classes grow significantly. The result is a system that prioritizes the pocketbook of the rich over collective wellbeing. This is especially true in rural areas, where cost of living has remained low, maintaining low wages, forcing family farmers to get involved with multinational agribusiness firms that sell them their seeds, fertilizers, pesticides, and any other additives for their farm.

During this same time period, farmers have had to use more and more fertilizer each year to obtain the same yields as the year before. The result has been a loss of soil fertility, even more runoff, and an increased dependency on agribusiness firms that already hold a dominant share in the market. The intensive agriculture that this trend has created has been detrimental to many ecosystems. For instance, the tall-grass prairie ecosystem that once covered the entire great plains now exists only in small pockets of protected public lands. The result has been a movement towards more sustainable methods of agriculture. In the US, we tend to see this with the growth of

organic foods, but this is far from the answer. Thus far, organics have been much more expensive than industrially grown food, leaving a significant financial barrier for many people to be able to eat more sustainably. In order to feed the country without overutilizing our natural resources, we will need to develop more cost-effective methods of sustainable agriculture. Luckily, these alternatives already exist, although many of them are more labor intensive or still in the developing stages, making it harder for them to become the dominant method.

Still, the focus on growth caused myriad other problems, like the overdependence on fossil fuels. While the danger of dependence on fossil fuels is no secret at this point, their utilization has yet to change substantially. In part, this is due to the amount of power than many fossil fuel companies hold over consumers, and at times over legislature thanks to extensive lobbying efforts. However, this is also due to the popular idea that renewable energy cannot keep up with growth of the economy because it does not create jobs like coal mining and fracking do. However, the transition away from fossil fuels towards renewable energy would certainly create a great deal of high paying jobs in production, manufacturing, maintenance, and construction of a new, smarter electrical grid. These jobs would likely be spread out around the country, but many of them would likely happen in rural areas, helping to boost those economies and potentially bring people back out of cities and into the countryside. For instance, with the growth of wind energy, there will be an increased need for wind turbine technicians, a job that requires relatively inexpensive education for a decent wage. Since wind turbines will largely be located in rural areas, alongside farmland, this will create jobs for people living in those rural areas. With better jobs for more people, there will be

increased spending in rural areas, helping to bring back rural towns that have practically become ghost towns over the last 50 years.

In recent years however, a growing faction of economists have stressed the importance of looking beyond growth as it pertains to the well-being of the economy and the people participating in it. This idea is shared by economists from many different backgrounds, in large part due to these very issues, people have become more aware of the many ways in which our obsession with increasing output have been harmful, not only to the planet, but also to many of the people working within the system. However, this idea has yet to gain significant traction because many often fail to propose a new system, choosing instead to simply explain the problems with the current system of using GDP and a few other metrics to determine the health of an economy.

Luckily, as research progressed in this field, new models have been developed. One such model is known as doughnut economics, which was developed by Kate Raworth (2017). Raworth asserts that economics, as a discipline, must change on many levels, by asking bigger questions, focusing on improving human welfare, sustaining that alongside the environment, and take into account the many central household and ecological processes that are not valued under traditional economic analysis. In doing this, she developed a model known as the doughnut, which shows the safe and just space for humanity existing within the ecological ceiling of the planet, the point at which we put too much pressure on any of the planet's life sustaining systems. However, Raworth also argues that we should cover a social foundation, a point at which we can provide for every living person's needs. Combining these two constraints, we are left with a doughnut, represented in Figure 1.

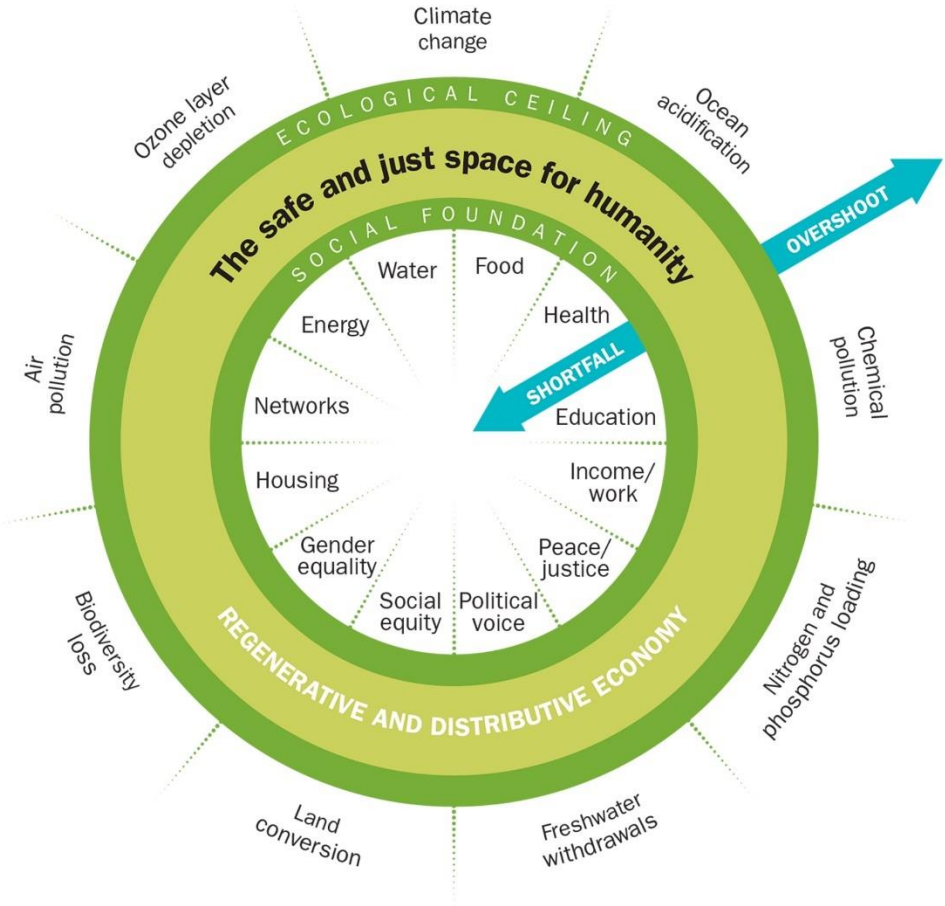


*Figure 1 (Raworth, 2017)*

This research will utilize many perspectives that relate closely to doughnut economics. Specifically, it delves into the environmental issues of biodiversity loss, nitrogen and phosphorus loading, and climate change. We also look at some of the societal shortcomings of energy, food, health, income, and social equity. However, it is also important to note that these issues become interwoven with one another, creating a complex web of problems. This theory is centered upon the belief that the role of the economist should be to look at humanity's long-term goals, and develop policy to make those goals possible (Raworth, 2017).

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The climate crisis that we are facing today is an issue that must be addressed by everyone, in nearly every career path, and incredibly soon. This is especially true for an economist. Just as Raworth argued, addressing the climate crisis will force us as a species to change the way we do business. As we are seeing that so much of today's environmental destruction happens at the hands of large firms rather than individuals, it becomes part of a modern economist's job to address the socioeconomic issues caused by the overexploitation of so many of Earth's resources. While environmental destruction is most visible in today's cities, where thousands of acres of land have been transformed into places only habitable for humans and rats, where large factories and powerplants pump chemicals into the air and water around them, and where the dependency on cars creates city-wide traffic jams and air filled with harmful emissions, it is also incredibly important to discuss the environmental destruction happening in rural spaces. For instance, it is estimated that as much as 10% of total greenhouse gas emissions can be traced back to the agricultural sector (EPA, 2019). At the same time, these rural communities are experiencing poverty rates almost 4% higher than urban communities in the U.S. (Farrigan, 2021). This discrepancy is only larger for people of color living in rural communities, with 30.7% of Black Americans in rural communities experiencing poverty, compared to only 20.4% in urban areas. All of this together begs the question: is it possible to promote sustainable developments like renewable energy and sustainable agriculture while also boosting rural economies?

## Historic Context

The past 200 years have seen the world go through many drastic changes. In many ways, these changes have improved human life, but with that, these changes

have also created new challenges, some of which threaten our very existence as a species. 200 years ago, the total population of the planet was just over 1 billion, now we are nearly 8 billion people on this planet (Desjardins, 2021). In this period of exponential growth, the world became much smaller in many ways, as people on opposite sides of the planet can communicate with one another with the press of a few buttons. This "shrinking" of the planet has made economies much more complex, where a single product may have pieces of raw materials coming from each continent, then manufactured in one country before being shipped overseas to be sold to end consumers. As such, it seems almost comical to treat the economy the same way that Adam Smith did when he wrote *The Wealth of Nations* in 1776. Beyond the way we treat the economy and markets, the changes of the last 150 years have also changed the way individuals live, the way they organize, how they interact with the natural world around them, and the way people view the future.

For the majority of this time, the global capitalist system has defined the way nearly every economy in the world functions. Just as Adam Smith argued, the market has been seen as an efficient way to allocate resources, wealth, and well-being. Early in this time period, until 1850, the market economy helped improve quality of life and increase average income. However, as technology continued to develop, environmental externalities, like air pollution and water contamination, started occurring, bringing attention to the potentially harmful shortcomings of a pure market. At this point in the Industrial Revolution, the ideas later expressed in the Coase Theorem were functioning fairly efficiently. When one person or firm was creating pollution, well-defined property rights allowed individuals and the community as a whole to push back on the polluter,

forcing them to pollute less, creating a socially optimal amount of pollution. (Hahnel, 2015). In the years following, there was little government intervention to environmental externalities, as the market was viewed as an efficient method to fix these externalities. However, improving technology and a lack of changes to property rights meant that firms began to win the advantage over individuals and communities, causing large-scale environmental damages across the country. This trend continued for some time before the creation of the Environmental Protection Agency (EPA) under the Nixon Administration.

The EPA was tasked with helping protect the environment, particularly air and water quality (Meyer, 2017). The EPA typically governs polluters, companies, creating and enforcing regulations on how much they can pollute and how to maintain low levels of pollution. This process helped address the problems created by the rampant environmental externalities of large firms holding property rights and more power than the individuals impacted by their polluting. With the creation of the EPA, power shifted back into the hands of the individuals to control pollution created by factories, cars, and other large companies. Today, the EPA is largely viewed favorably, despite the fact that little has changed in the way they operate over the past 30 years. Even as science of climate change and the concrete measures that we can take to lessen its impacts has become more and more clear, the EPA has not gained any significant power, even losing some during the Trump Administration. This has made the need to increase the power of the EPA and other similar agencies incredibly apparent, as they have the potential to wield great power and create change in the landscape of environmental protection and lowering emissions.

## Urbanization

During this same period in the United States, there was a mass urbanization movement that has continued until today, where over 80% of Americans live in urban communities, compared to nearly 20% in 1920 (Ajilore, 2020). This mass exodus away from the countryside and into the major cities of the country changed the way the rural economies operated. For instance, small family farms started to become much larger, relying much more heavily on machinery to care for the massive swaths of land in their property. Moreover, the small towns that had been the staple of much of America, particularly in the Midwest, began to shrink, moving small businesses out and bringing in opportunities for larger retailers. Now, many of these towns have main streets that are mostly empty, with a new 'downtown' sector at a strip mall on the outskirts of town with their name-brand grocery store, gas stations, and other retailers. This has created a great deal of change within the smaller rural communities, as people had to fight over the few good jobs that still existed in their communities or uproot their lives to move to the city. For those that have stayed in these towns, they are now facing issues relating to their quality of life compared to that of someone living in an urban area.

Even though agriculture may not employ nearly as many people as it once did, the agriculture industry still controls the majority of the land in rural America, especially in the Midwest. Still, agriculture, food production, and related industries form major sector of the economy, accounting for roughly 5 percent of GDP in 2020 (ERS, 2022), all of which relies on the production of various agricultural goods. As such, it is important to look at how agriculture has changed since the industrial revolution. Those changes range from increases in average farm size to the mechanization of farming

methods to the addition of artificial fertilizers and have had lasting impacts on the rural way of life and the environment. The increase in farm size and use of machines allowed for the growth of urban areas, bringing people closer together, but it has also led to many adverse impacts on the environment. For instance, crop rotating, which was once a dominant technique, helping maintain and even enhance soil quality, is now considerably less frequently practiced, with farmers instead choosing to increase their fertilizer use, temporarily boosting soil fertility.

Today, the agriculture industry is responsible for roughly 10% of the greenhouse gas emissions in the country (EPA, 2019). These emissions come from many activities within agriculture, from soil maintenance to livestock manure. It is also important to note that the emissions related to transporting agricultural goods are not included in this figure, which would push emissions ever higher, especially considering that the average American's plate consists of food that has traveled at least 1,300 miles (Kimbrell, 2002). Seeing as the transportation is still almost entirely reliant on fossil fuels, it is clear that we need to grow more food locally to lower emissions related to food production and transportation in the near future. While some economists might argue that the market will fix this issue, leading to new technology that allows us to eat food from other parts of the country while decreasing emissions, considering the urgency of lowering transportation emissions, it makes much more sense to start growing more food locally, intervening in the market to provide incentives for local food production and consumption. This would also provide access to locally grown produce, which tends to be fresher, better for consumers, and could boost smaller farms.

## Agriculture Industry Changes

These drastic changes in the ways that farms operate has been driven in large part by two factors: mechanization of farming techniques and the economic concentration of the agricultural industry. The former is fairly simple, increased mechanization has meant that it takes less time to farm a greater area. These economies of scale meant that larger farms were able to be more productive, helping them expand more and more, leading to the increased average farm size that we see today. Over the last 40 years, the number of farms operating on over 1000 acres has doubled, even as total farmland acreage has decreased by 13 percent over that same time period (Union of Concerned Scientists, 2021). As for the economic concentration in agriculture, this can be characterized by the growth of agribusiness firms. Economic concentration occurs when some firms in a competitive market begin to take up more of the market share, thereby gaining more power over the market, prices, and profit margins.

In the agricultural industry, this has meant that average farm size has increased, the largest agricultural suppliers hold a dominant market share, and agricultural goods processors hold dominant market shares, especially at the local level. For instance, in the Midwest, the heart of pork production, farmers are no longer selling their goods directly to consumers, grocery stores, or butchers. Instead, farmers must sell their pigs to a middleman- a slaughterhouse or meat processing plant. Usually, their options are very limited because shipping hogs is costly, increases risk of dying, and often deteriorates the meat quality. Accordingly, most hog farmers have to sell their hogs to the nearest buyer, giving that buyer monopsony power over the local market

(Willingham, 2019). The power the buyer has over the local market allows them to undercut prices, forcing local farmers to accept lower profit margins for the farmers. This highly concentrated regional market leaves farmers struggling, consequently hurting the rest of the rural community due to decreased spending by a significant share of the rural population.

The buying power in agriculture is not the only thing being concentrated into only a few firms. The economic concentration of agriculture has also created incredibly lucrative markets for seeds, fertilizers, and other agricultural inputs. This is especially true for corn and soybean production, the two most common crops grown in the United States. In this market, nearly all seeds are genetically modified to have increased yields, pesticide resistance, and more drought resistant. As of 2015, just four firms controlled 85% of the corn seed market (Willingham, 2019). This oligopolistic market gives the sellers an advantage over the buyers, which, when combined with the price inelasticity of this market, means that farmers will pay ever increasing prices for their inputs. This market is incredibly price inelastic because many farmers are under contract to use specific products and non-genetically modified seeds have smaller yield despite higher inputs of labor. This concentrated market power has happened alongside an increase of 230% in the price of genetically modified corn and soybean seeds over only 10 years (Willingham, 2019). This directly contradicts how a healthy market should perform, where increased usage of a new technology should lead to a decrease in the price of that technology. Moreover, the lack of competition in these markets has been met with less innovation, meaning that genetic modifications are not progressing as fast as they could, and new farming methods and technology are hardly existent.

Even crop production has become highly consolidated, with fewer and fewer midsize farms (between 50-1000 acres) every year. As more and more farmland is consolidated, this tends to mean fewer people are working on farms, and even fewer owning them, as the only financially viable farms are those that are very large, far too much of an investment for the average farmer or aspiring farmer. This means that while many people are leaving farming as a profession, very few are able to enter the market. This has disproportionately hurt already struggling communities, like Black farmers, a group that once made up 14% of all U.S farmers, which now makes up only 1.6% of the population of farmers (Union of Concerned Scientists, 2021). The combination of losing people from underrepresented communities and significant barriers to entry has meant that there are very few new ideas in agriculture, thus little innovation or progress. Innovation is important to any industry, but especially for the agricultural industry given the challenges the industry faces over the coming decades. Even when innovation is able to overcome the industrial pressures in agriculture, there are very few opportunities for sharing ideas across the industry, making it harder for new, more sustainable farming to gain market share.

Despite the increase in corporate power in the agricultural industry, most government policies have continued to favor these large firms over the average farmer. While many would like to look to agricultural subsidies as beneficial for farmers, much of that money ends up in the hands of agricultural landlords, those that own the land, often people retired from a different profession, not the people working on the farms. For instance, reports indicate that taxpayers contribute over $600 million per year in agricultural subsidies that support industrial agriculture (Kimbrell, 2002). As much as $1

billion in agricultural subsidies went directly to people with permanent addresses in Beverly Hills, one of the richest communities in the U.S. (Goodwin, 2012). While these subsidies may not be intended to end up in the hands of the wealthy, those who own the farmland and rent it to other people who work the land, the mere fact that they are getting subsidies indicates that the subsidization of agriculture is not being distributed correctly. Additionally, these subsidies indicate that the price of crops produced under the industrial model is artificially low. Artificially low prices indicate that not only is industrial agriculture not as cheap as many believe it to be, but also that it may not be sensible to insist that any alternative agricultural methods be as cheap as the industrial model, leaving an opportunity for new ideas to thrive.

Still, alongside the growth of large farms, farmers also started using more and more artificial inputs in their cultivation process. Pesticide usage ramped up, as their usage lowered crop loss to weeds, bugs, and other pests. As there was more and more monocropping, it meant that crop fields were less biodiverse. In turn, this meant that they were also more vulnerable to diseases, pests, and droughts. Even within one crop there has been significantly less biodiversity, which means crops are all of the same variety of one species, providing predictable yields, but it also means there is less genetic exchange, which breeds resilience in a species population. Pesticides would be sprayed on entire fields, covering crops, making them more resistant to pests in the short term. However, the use of pesticides also allowed the few pests that would survive to breed, creating new pesticide resistant pests. In turn, farmers have to use more pesticides, different types of pesticides, and apply more frequently just to maintain the same yields. The agribusiness firms that create the pesticides in turn get richer, taking

more and more money from the farmers, as they would have to drastically change their farming methods to survive without the pesticides.

Pesticides are not the only artificial input in agriculture, fertilizers have also become incredibly important to the industrial agricultural model. The intense monocropping that exists in industrial agriculture means that all the crops in one field take the same types of nutrients out of the soil, without other species to add those same nutrients back to the soil. To combat this, farmers are forced to apply fertilizers, artificially adding the necessary nutrients to the soil. However, these fertilizers need to be applied fairly regularly, as they will be absorbed by the crops or run off into the groundwater. For instance, one study shows that up to 70% of the nutrients in surface water in the U.S. can be traced back to fertilizers (Altieri, 1998). This provides a perfect environment for large algae blooms, leading to the eutrophication, where oxygen levels in the water are critically low, of many bodies of water, even bringing nutrients from all over the Midwest and into the Mississippi River, flowing out into the Gulf of Mexico, where there is now a dead zone the size of New Jersey (Eutrophication…, 2012).

The eutrophication of many surface waters, including the Gulf of Mexico, is detrimental both to the environment and to the economy. For instance, the large dead zone in the Gulf of Mexico means that fishing opportunities on that portion of the coast are non-existent, destroying a major industry of the region. As a result, unemployment increases, and people are forced to change their diets. This may seem like an unimportant aspect, but it further contributes to the lack of local food production, increasing food transportation, and as a result, transportation emissions. Moreover, fishing often brings tourism, and the loss of fish in the Gulf of Mexico destroys that

tourism industry, making those coastal communities even more dependent on the fossil fuel industry that dominates much of the interior of the Gulf of Mexico. Refineries, plastic plants, and other petrochemical plants line the lower Mississippi River, dumping pollutants into the air and water, creating an area known as Cancer Alley, where cancer rates are roughly 15% higher than the national average (James, et. al, 2012). To make matters worse, these refineries and plants are almost exclusively located in and around already impoverished communities that are predominantly African American. This results in the most disadvantaged communities bearing the brunt of the negative externalities from these refineries and plants. In turn, this creates a cycle, whereby exposure to harmful pollutants makes it ever harder for people in these communities to get to a better place, forcing them to stay in a situation that is directly hindering their ability to find success, all while these plants continue to be incredibly profitable for their owners.

Each of these issues interacts with the others, causing a great deal more problems. The combination of many different types of economic consolidation in agriculture means that even as agriculture, food, and similar industries combine for 5% of total GDP, or roughly $1 Trillion, American farms receive only about $130 billion (Economic Research Service, 2022). Even within this figure, farmers are not capturing all of this wealth, as they still rely on agricultural inputs. Accordingly, economic consolidation contributes to a supply induced demand for agricultural inputs, farmers don’t have much of a choice over whether or not they will purchase inputs from agribusiness firms. Due to the prevalence of agricultural inputs, fertilizers run off into groundwater and surface water, emissions increase, and crops continue to be

transported around the world for processing, creating a cycle of harmful effects on the environment, all while still contributing to the exploitation of agricultural workers for the profits of a few firms.

While far from the only industry in these rural communities, agriculture, manufacturing, and mining are often viewed as the most important industries. Accordingly, any threat to these already hurting industries has been met with plenty of criticism. For instance, despite the mounting evidence that the fossil fuel industry is causing irreversible problems to the planet's ecosystems, rural America has a disinclination to move away from a reliance on fossil fuels due to its impact on mining jobs. Seeing how vital agriculture is to the overall success of rural communities, it is quite evident that any attempt to bring people, jobs, and money back to rural America will also require attempts to bring about a more just agricultural industry, both for the planet and for those employed in the industry.

While some crops grown in rural America are native crops to the Americas, like corn, tomatoes, and peppers, many others are originally from elsewhere, like Soy, which was originally cultivated in East Asia. Soy and other non-native crops may have been brought in purposely, but the increased exchange of goods, services, and natural resources has also accidentally introduced many species that have since become invasive. For instance, in much of the Western United States, areas that were once covered in sagebrush, bunchgrasses, and dry woodlands, the invasive *Bromus tectorum* has taken over. *Bromus tectorum*, also known as cheatgrass, native to the Eurasian steppe, grows much earlier in the spring than its native counterparts, encompassing large swaths of land previously home to native plants. This plant also

has more direct impacts on humans, as it takes over croplands, and increases risks of severe wildfires (Cal-IPC, 2022). This is far from the only invasive species in the United States, as many others have both direct and indirect on human life. Dealing with invasive species is no small task because if even a small population survives a control effort, they can expand rapidly to the same size they were. Combined with the recent realization that the use of pesticides can have harmful impacts on the environment, controlling invasive species is clearly an issue in need of urgent solving.

## Rural Equity

More recently in this time period, since 1970, income inequality has been on the rise in the U.S. For instance, in 2015, the richest one percent captured over 22% of the nation's wealth, almost as high as the peak of the gilded age. This goes to show how little it means to have a "growing" economy, as it is possible to have a rapidly expanding economy without improving the lives of the typical citizen. This problem is further exacerbated in rural areas, where the poverty rate is much higher than average. In these rural areas, many people work for small businesses or in agriculture, meaning they seldom receive health insurance as part of their employment benefits. This has created a massive uninsured population in the United States, especially concentrated in rural communities. Even for those in rural areas with health insurance, the type of care available is often very limited, as there are 39.8 physicians per 100,000 people in rural regions compared to 53.3 physicians per 100,000 in urban and suburban areas (Hing, 2014). This means that people often have to drive long distances just for primary care, and usually much farther for secondary or tertiary care.

This issue with rural health insurance is typically only made worse by the growing adverse impacts of agricultural inputs. For instance, while the increased prevalence of pesticides poses many health risks for agricultural workers that other people in the U.S. might not be exposed to, those workers are typically less likely to have health insurance, meaning they will have the burden of the entire cost of health care should they need it. For many of these workers, they simply cannot afford to receive the medical care they need, as the median income for agricultural workers is only $28,000 (ERS, 2022). This shows the need for significant change to agricultural practices, wages for agricultural workers, and health policy in the United States.

### Changes in the Energy Industry

Agriculture is not the only rural industry that has seen drastic changes since the industrial revolution. Virtually every major industry in rural America has been impacted by the technological innovations, urbanization, and societal change of the past 150 years. Mining, once a major industry throughout the country, now employs an ever-smaller portion of the population. In much of the American West, rural towns started as mining towns, mining for precious metals like gold, silver, and copper, as well as coal mining. In 1920, coal mining was the 12$^{th}$ most popular occupation, employing over 700,000 people. However, by 2018, only 50,000 people remained employed in coal mining (Berkman, 2020). Even as coal has continued to be a major source of energy production in the U.S., the industry employs a mere fraction of the people it did in its height. Many of these mining jobs are in rural, mountainous areas, and provided decent jobs in these communities for years, even if they posed many health risks to those working in the mines. As technology has improved, much of the mining process has

become mechanized, also becoming safer in many aspects. Increased mechanization has meant that there are fewer employment opportunities available in this industry, which was incredibly important to rural communities, even more so in regions not suitable for agriculture.

At the same time, it has become incredibly clear that coal cannot continue to power the country indefinitely. As is true with all fossil fuels, like natural gas and petroleum, we have a finite amount of these resources, which we are rapidly depleting. Moreover, burning of these fossil fuels is even more harmful to the environment than pesticide and fertilizer use are. Burning fossil fuels is the leading cause of greenhouse gas emissions, and has remained roughly stagnant since 1990 (EPA, 2021). Very few people deny the connection between the burning of fossil fuels and the climate crisis we are facing today, yet there is still significant pushback over the idea of banning fossil fuels.

Many people are hesitant to ban fossil fuels because they view it as an important bridge fuel, helping keep up with demand for energy while renewable energy production becomes more reliable and cheaper. There is also significant opposition to increased development of renewable energy production because it would cause a loss of jobs in fossil fuels extraction, transportation, refining, and burning. However, after seeing how quickly those jobs are being lost due to increased mechanization in the industry, it has become evident that moving away from fossil fuels could help create more jobs than it would destroy. Over recent years, this shift has picked up, with wind and solar farms popping up throughout rural America. These developments have been fairly successful, wind farms have been developed to coexist with farmland, allowing for multiple uses out

of the same piece of land, and solar farms, while land-intensive, have been successful, especially in drier areas, where they can exist on otherwise empty land. Moreover, these technologies are much cleaner for the environment, and have virtually no variable costs associated with them. For instance, once constructed, a wind farm needs very little maintenance and runs safely with no direct human interaction. This is both beneficial and harmful, because this makes renewable energy production very cheap, but it also means there are very few employment opportunities associated with renewable energy production once fully constructed. Still, the construction of these sites creates high quality jobs, and could continue to do so for quite some time renewable energy capacity increases.

## Case Study: Costa Rica

While much of this data has been specific to the United States, many of the same themes ring true in virtually every part of the planet. Around the world, rural communities are dying, causing small businesses to die as well. Moreover, throughout much of the world, the dominant form of agricultural production is very intensive on the planet, uses many chemical inputs, and breeds less resilient ecosystems. For instance, in Costa Rica, a country roughly the size of West Virginia, they produce more pineapples than any country other than the Philippines (FAO, 2022). This overwhelming concentration of pineapple, which is grown almost exclusively in a large monocrop, is also a leading cause of deforestation in Costa Rica. Despite this, Costa Rica has actually managed to encourage large-scale reforestation efforts across the country. Prior to European colonization, virtually the entire country was covered in forests, including tropical rainforests, cloud forests in the mountains, and dry forests in the

northwest of the country. Much of the country remained forested until the mid-20th century, when logging, agriculture, and developers started leveling forests to make room for large-scale farms. After only a few decades, less than one third of the country was forested. Shortly thereafter, the Costa Rican government introduced robust legislation protecting the existing forests and encouraging landowners to reforest their land, now, almost 60% of the country is covered in forest once again (Lewis, 2020). Much of this forested land is secondary forest, exhibiting far lower levels of biodiversity than primary forests do, but still contributing much more to building resilient ecosystems than extensive monocropping can.

Costa Rica, situated on the isthmus between North and South America, exhibits extraordinary natural biodiversity due to migration patterns of species from the north and south. This unique biodiversity, combined with the typically favorable tropical climate, yet slightly cooler than many neighboring countries, has drawn millions of tourists towards Costa Rica each year. Many tourists venture to Costa Rica for the opportunity to see exotic wildlife, like poisonous frogs, sloths, monkeys, and a myriad of different types of birds. Accordingly, the Costa Rican economy depends on tourists being able to see these animals, leading their government and many of their citizens to passionately protect biodiversity in the country. Still, in much of the interior of the country, the dominant form of agriculture continues to be incredibly intensive. Recently however, some developers have begun to adopt alternative forms of agriculture. For instance, in many rural tourist destinations in the country, there are small sustainable farms, combining sustainable agricultural principles like: polyculture; permaculture; agroforestry; and organic farming, with tourism to supplement income that might

otherwise be lost due to the inherent risks in the first few seasons after switching to a more sustainable method of agriculture.

## Costa Rican Energy Industry

Costa Rica has been able to build an electrical grid that runs on almost 100% renewables. Costa Rica may have some strategic advantages that allowed them to create a renewable electric grid before nearly every other country, but their success provides many valuable lessons on the potential we have in the United States to move towards an electric grid more centered on renewables. Costa Rica's electricity is mainly generated through hydroelectric power plants, which produce roughly two-thirds of the country's electrical energy (Thelwell, 2020). This dominance of hydroelectric power is made possible in part by Costa Rica's position in the tropics, receiving high amounts of rainfall that feed into the many rivers of the country. Accordingly, it may not be possible for every country to rely as heavily on hydropower as Costa Rica. Still, in more recent years, Costa Rica has developed more and more solar and wind farms. These farms tend to be located in the rural parts of the country, providing jobs, income, and cheap, clean power to rural communities in a part of the world where incomes are considerably lower than in the United States.

For instance, one small community in the north of Costa Rica has developed a small solar farm, operated by Coopelesca, a cooperative company aiming to provide consistent, clean power to the residents of rural Costa Rica. This cooperative has helped put power in the hands of the individuals that directly depend on the performance of the solar farm. While relatively small, currently only covering eight hectares, the solar farm supplies power for roughly 5,000 families in the area,

employing several full-time positions to monitor the farm, as well as others in the administrative levels of the cooperative. In order to keep the grass around the panels short, the farm 'employs' a flock of sheep that roam the rows of panels, mowing the lawn without the need for a lawn mower, further decreasing their dependence on fossil fuels. Moreover, having the sheep has also reduced the costs that it would ordinarily take to mow a lawn of this size. While this was one of the first solar projects in Costa Rica, its initial results have been very positive, leading to an expansion of these types of sites in the country. Should solar power generation expand in Costa Rica, it would provide many people with jobs, especially in the construction phase, where building solar power plants requires skilled and unskilled labor. Many of these jobs may be temporary, but they may bring people back to rural areas, helping small businesses, building more resilient communities in the process.

Interestingly, Costa Rica does not have a terribly high potential for solar power, in large part due to their climate of consistent rain and clouds. This provides an even stronger case for the potential that solar power has in the United States, specifically in the sunbelt states, where population density is very low, amount of sunlight is very high, and vast expanses of land are virtually void of all life.

Costa Rica has also developed a significant wind power sector, which today produces as much as 17% of total electrical power generation (Thelwell, 2020). Wind power is an especially interesting case, as turbines can be located in the same place as other types of activities. For instance, many wind turbines are located within grazing fields, owned by the electric company, yet operating on land owned by farmers. Leasing land out to an electric company so they can put a wind turbine there provides an

opportunity for many farmers to make some extra money without significantly harming their crop yields or lowering the size of their grazing fields. Wind farms also create many jobs, both in construction and in operation. Once operational, wind farms need to have several skilled technicians, as well as engineers to perform maintenance. These farms also create lower skilled jobs, like in monitoring the overall performance of the farm, security, customer service, and several others. If properly located, these wind farms can produce large amounts of consistent, clean power that is also generated all day long, unlike solar power, which can only be generated when the sun is shining.

As renewable energy production continues to ramp up around the world, it will likely also give way to new opportunities to combine productive activities. For instance, a solar farm could potentially be located alongside a sustainable agricultural operation, using spaces between rows of panels to grow crops that grow well with indirect sunlight, thereby increasing resiliency of the system, as even on days when there isn't much sunlight the farm can still be productive. In the case of the Coopelesca operation, it might be possible to use the land between the rows to grow a community garden, allowing families in the area to experiment beyond the dominant form of agriculture in the area. This opportunity is particularly interesting because it would allow the solar farm to continue to serve as an experimental space, but instead of experimenting with solar in the tropics, it could house an experiment on combining solar power generation with sustainable agriculture.

## Sustainable Agriculture in Costa Rica

On the topic of sustainable agriculture, Costa Rica also presents many interesting cases of successful methods of producing high yields of high-quality crops in

a sustainable method. In Costa Rica, there are many different ways to produce food sustainably. One such method that is not terribly common, yet yields great results is agroforestry. Agroforestry in Costa Rica is practiced mostly by indigenous groups, such as the Bribri tribe of Southeast Costa Rica. Today, the areas just outside of the indigenous reserve are dominated by plantain and banana monocrops, yet the reserve itself maintains much higher forest cover, while also producing many different types of useful crops, from cacao (which can be sold to tourists), to beans, corn, rice, and many other staple food crops (Rousseau, et. al., 2021). The Bribri people have managed to create this robust system combining agriculture with healthy forests through the processes of agroforestry, which their tribe has been practicing in this region for thousands of years (Pelliccia, 2021). Their forests look like any other tropical forest to the unfamiliar eye, but they arrange different crops throughout the forest, planting fruit trees to make up parts of the canopy, creating an almost self-sufficient ecosystem. Maintenance is always necessary, but this system requires no artificial inputs, and significantly less labor than a typical monoculture. In turn, their traditional agroforestry helps increase food production while also promoting biodiversity, giving the Bribri people more time to focus on their well-being.

Additionally, as the Bribri reservation is located near a popular tourist area in Costa Rica, the tribe welcomes tourists who want to learn about their culture. Often, tourists visit the reservation for tours of the cacao forests. This relationship with tourism has been beneficial to the Bribri people, bringing in additional income, thereby presenting their people with new opportunities. This unique example has also helped keep the Bribri people connected with their culture, even as many other indigenous

groups throughout North and South America have been forced to assimilate into the culture of their colonizers. While their communities are among the most impoverished in the country, many Bribri leaders oppose changing their methods to make more money. Instead, they argue that their communities are better off because they don't experience harmful health impacts like those living near monoculture plantations further down the valley. They also argue their well-being is far more important than bringing in large profits, echoing some core ideas of doughnut economics, looking beyond GDP and beyond growth to create a harmonious society.

Elsewhere in Costa Rica, foreign 'developers' and locals alike are adopting other types of sustainable agricultural production. One other method is permaculture, an interesting type of agriculture that can be modified to fit any ecosystem. Permaculture systems are those that have the diversity, stability, and resilience of a natural ecosystem. The intent of this type of system is to copy natural processes as closely as possible, which will mean the entire farm will require very little maintenance. Permaculture has 12 main principles; observe and interact, catch and store energy, obtain a yield, apply self-regulation and accept feedback, use and value renewable resources and services, produce no waste, design from patterns to details, integrate rather than segregate, use small and slow solutions, use and value diversity, use edges and value the marginal, and use creativity and respond to change (Thinking tools… 2022). Following each of these principles will allow a permaculture farm to function to its full potential, absorbing energy, storing carbon, and promoting a resilient method of food production.

Important to note, in the very first step, the farmer should not be planting anything, instead observing how water, wind, sun, pollution, and wildlife interact with the landscape. Sometimes, this step requires an entire year of observation, and most farmers in Costa Rica can't afford to not plant any crops for an entire year. Accordingly, most farms in Costa Rica are not permaculture farms, even in cases where a family wants to produce more sustainably or want to lower their costs of production by decreasing their dependence on agrochemicals. The few permaculture farms that do exist are typically owned by expatriates. One such farm, located in the remote tourist area known as Monteverde, combines a nature preserve, ecotourist lodge, and permaculture farm into one property. This farm, Valle Escondido, is owned and operated by a U.S. American and Costa Rican family, with the goal of providing an affordable and hospitable ecotourism destination providing sustainable education and access to pristine forests. Their unique position in an ecotourism destination provides them with more resources than many other permaculture farms, allowing them to fund large projects, like the large greenhouses they hope to build soon.

At Valle Escondido, the vast majority of the property is either primary or secondary forest, with no human activity other than hiking happening. All the human activity happens in the areas nearest the hotel, including rows of vegetables in raised beds that are fed off of rainwater falling on the roof of the main building, a food forest fed from water used by laundry machines for the hotel, as well as many other features. The farm aims to produce enough food to supply all the food their restaurant makes, other than the crops they cannot grow in their climate, for which they hope to barter from their excess of the crops they can grow. While they would love to move to a diet of

exclusively food grown on their farm, the tourists will continue to expect foods they are at least vaguely familiar with, so they will always need rice, meat, and other staple crops. One of the most impressive parts of this farm is their compost system, they compost nearly everything, utilizing different methods of composting, utilizing microbes from the soils in the nature preserve to increase biodiversity in their soils, growing more resilient crops. Healthy soils then allow for high yields without the need for synthetic fertilizers, decreasing input costs, showing that permaculture can produce food inexpensively.

This project also benefits the surrounding community, as it employs people in hospitality, agriculture, and artisan crafts. Specifically, this provides opportunities for women living in this remote town, as many of the hotel's employees are women, working in housekeeping, reception, and in the restaurant. Some of these roles may traditionally be female dominated, but women are far more likely to be unemployed in these remote towns than men. By providing even a few jobs for women in the area, Valle Escondido helps bring new opportunities to those they employ, boosting their local economy, hopefully lifting people out of poverty over time. The farm also aims to help other farmers in the area, employing local farmers on their farm, helping to teach locals about the principles of permaculture, thereby encouraging others to adopt similar methods and become more resilient themselves. As insignificant as this may appear, the success of even small permaculture projects helps to prove that there is a future for low-input, low maintenance food production in our world. Moreover, it helps to show that sustainable food production can also create new opportunities in rural areas by creating a culture of sharing knowledge and valuing relationships with neighbors.

Permaculture and agroforestry are just two categories of sustainable food production, and positive results have been observed in many other categories of sustainable agriculture. While these examples have also used tourism to supplement incomes, sustainable agriculture projects can also be accompanied by conservation efforts. For instance, some farmers using sustainable methods dedicate a portion of their property to allow for complete reforestation, harvesting nothing from this section. This could be done in many different ecosystems, from wetlands to forests and from deserts to prairies, allowing for more native wildlife to coexist with humanity, both for personal enjoyment and out of respect for wildlife, even to provide privacy or to beautify otherwise unproductive land.

Many of these methods of food production are also very cooperative, farmers around the country share ideas, seeds, and crops based on what they have had success with. This is beneficial to the farmers themselves, as they have more resources, and people that are willing to help them when they have the time. Often, farmers form groups, joining together for large projects at each farm, reducing costs of constructing new projects, sharing knowledge, and something else. However, the way they share seeds should not be overlooked, as it facilitates the sharing of genetic material, increasing biodiversity, making their crops more resilient, and further decreasing dependency on hybrid seeds that can be very costly. However, none of these exchanges result in a financial transaction, meaning neoclassical economic theorists do not assign a value to them. In order to properly value the impacts that these exchanges have, we must look beyond the ways they contribute to GDP, instead looking at how they improve the well-being of those involved. In this case, adoption of

sustainable agricultural practices significantly improves well-being as it contributes to creating a cooperative society, lowers input costs, and improves air, water, and soil quality in the areas where farms exist. As agricultural inputs continue to be linked to negative health impacts for those in closest proximity to their application, these input free methods can also improve health outcomes in rural areas, allowing people to live longer, healthier lives.

Costa Rica offers many interesting perspectives on techniques for sustainable rural development, not all of which are equally applicable to the United States, yet they still demonstrate that, when done properly, rural development can be sustainable for the environment, the rural community, and the economy of the entire country. The remainder of this paper will focus on how this knowledge can be applied to the United States' context, as well as many other areas of potential for addressing problems in rural communities without sacrificing the environment that these communities rely on.

## Policy Recommendations

The problems facing rural America are incredibly complex, each of them weaving together with other issues, creating a network of wicked problems. In order to address any wicked problem, you have to discover and address the root causes of that problem. Doing this is still no simple task, there are countless possible solutions to a wicked problem, and it is often incredibly difficult to determine which solutions will be most effective at solving the issue because it is such a novel problem. This is the approach that we must take when it comes to increasing resiliency of rural economies. For instance, agricultural production is associated with high emissions of greenhouse gases, but that is not entirely because of the farmers themselves, it is due in part to the

economic concentration within the industry, as well as the nationwide dependency on carbon-intensive transportation. Moreover, due to the economic concentration of the agricultural industry, average farm sized has increased significantly, so there are fewer people living in rural communities, forcing many small businesses to shut down. The lack of small businesses in rural areas makes many of these communities unappealing places to live for those that have not already been living there. This creates a cycle that has been detrimental to rural America and requires an elegant system of policies and community buy-in to create long-lasting change.

Several important measures must be taken to improve competition within the agricultural industry. One such measure includes the creation of an Independent Farmer Protection Bureau (Willingham, 2019). This agency could be organized within the USDA and would be tasked with protecting small and mid-size farm operations. Moreover, the IFPB could be funded almost entirely by the largest agribusiness firms, setting modest fees for those with the largest market share. The IFPB would function primarily by overseeing and investigating competition within agricultural good markets, listening directly to complaints from farmers that notice anti-competitive practices (Willingham, 2019). Moreover, and IFPB should have the authority to enforce laws protecting farmers, ensuring that any failure to comply with new regulations is fairly addressed.

If organized and properly managed, the IFPB could also help introduce new anti-trust legislation, which is vital to addressing the economic concentration of agricultural inputs. Moreover, the IFPB has the potential to secure a fairer deal for farmers that have been most negatively impacted by the growth of agribusiness firms. However, in order for the IFPB to succeed, it must be backed up by effective legislation. For instance,

without stronger anti-trust legislation, the IFPB will have very little power to fight ever-growing agribusiness firms. Even if it is properly organized, the IFPB alone cannot address all the issues facing rural communities. Many other measures must be taken to address issues pertaining to the over-exploitation of the environment, a lack of rural jobs, and the dependency on fossil fuels.

Additionally, fairly simple legislations should be introduced to encourage greater biodiversity within individual plots of land and on a nationwide scale. As was discussed earlier, corn and soy represent a massive proportion of the total agricultural acreage in the U.S. This dependence on a few crops, which are typically grown monocultures that intensively use harmful inputs is not only bad for the environment, but it contributed very little to the food supply of the country. Much of the corn grown in the U.S. is used for either ethanol production or animal feed, neither of which are particularly productive. While corn grown for animal feed does feed into food that we eat, because corn-fed animals convert corn to meat, dairy, or eggs incredibly inefficiently, losing an estimated 5/6 of the food calories available from the original corn yield (Foley, 2013). Despite this, corn markets receive enormous federal subsidies, for crop insurance and direct payments. These subsidies effectively encourage the growth of corn, because farmers that see lower than average yields will get bailed out. While the idea of protecting farmers is incredibly beneficial, in this circumstance, it results in a sub-optimal system.

Accordingly, I suggest that subsidies specifically for corn or soy be abandoned, shifting those subsidies instead to farmers growing polycultures. By doing this, we can encourage greater biodiversity within individual fields, farmers will begin growing multiple types of crops alongside one another, which has been inextricably linked to

more resilient crops that require fewer fertilizers and pesticides. Moreover, these subsidies would be effective at encouraging more farmers to shift their methods of production because they will offset the risks that any farmer must take on to shift to a more sustainable method of production. In effect, this policy could be effective at decreasing dependency on agribusiness firms by creating naturally resilient crop fields, which will improve soil over time, lead to less runoff, and allow farmers to grow more crops that can be sold directly to consumers.

This moves us to another important pillar of effective policies for increasing rural resiliency, encouraging locally grown food. Locally grown food is not only fresher and less processed, but it is also associated with lower greenhouse gas emissions. Considering how far most food travels from the farm until it reaches our plate, the agricultural industry plays a massive role in the emissions of the transportation sector. While very little of this is associated directly with the final stage of transportation, from either a processor or a farm to the market, intermediate steps of transportation cause a significant increase in greenhouse gas emissions. As a result, locally grown and processed foods are typically far less destructive to the environment. However, there are not many marketplaces where farmers can sell their crops directly to consumer. Luckily, recently the U.S. started a program known as “Local Foods, Local Places” to encourage the development of more local food markets, including farmers markets, cooperative grocery stores, and community gardens (EPA, 2021). I recommend increasing the funding for this program, allowing them to reach more communities, setting up more markets, which the communities can then operate without federal funding once they have been firmly established. By increasing the reach of this

program, rural and urban communities alike can develop marketplaces for locally grown, sustainable food. These marketplaces are especially beneficial for smaller farms, for whom it is often less cost effective to transport their crops long distances. Further implementation of this program would be beneficial to family farmers, consumers, and the environment. Moreover, it can be used to bring small businesses back to struggling rural communities.

All of these policies would also be effective at helping to decrease average farm size. Large-scale farms tend to be the highest consumers of pesticides and fertilizers, because they require more artificial inputs and mechanization in order to care for a large farm. By decreasing pesticide and fertilizer usage, larger farms will not have the same competitive advantage as they once did and will require significantly more labor. This will lead the owners of many large farms to sell off parts of their land, keeping a more manageable plot. The resulting array of more small and mid-size farms will be more ecological, relying on fewer inputs, with more biodiversity, and increased resiliency to adverse conditions.

Furthermore, small and mid-size farms are also much more beneficial to the rural economy, they create more jobs with a more equitable distribution of income and can breed a community of knowledge sharing amongst farmers, strengthening the community as a whole. This exact theme can be seen in the case of Costa Rica, where regenerative farmers around the country organize groups to help each other with major construction projects, sharing seeds, information, and techniques. Through slow growth like this, these practices have gained legitimacy, and other farmers have flocked towards more regenerative methods of agriculture. This has resulted in more varied

diets because people will grow the crops their climate is best suited for, rather than those that are most lucrative to sell. Should this trend continue, becoming more mainstream on a global scale, it will likely lead to less economic growth in terms of GDP, but it is undeniable that it would benefit the vast majority of people, from the individual farmers and those living in their rural communities to the average family living in urban areas, because they will be able to eat a more diverse diet, grown from crops that add to their ecosystem rather than sucking every last nutrient out of the soil, all while being more resilient severe weather events.

These policies could be incredibly beneficial at addressing many of the environmental and economic issues seen in the agricultural industry if implemented. Still, they will not be enough to address all the major problems facing rural communities. For instance, helping out farmers can give them more disposable income, allowing them to spend money at local businesses rather than exclusively agribusiness firms, but a more diverse rural economy will protect against years where agricultural production falls, as well as creating jobs at different skill levels in many industries. Accordingly, I suggest we adopt policies to encourage the development of more renewable energy projects.

While renewable energy development has not historically been a major employer, that is predicted to change incredibly quickly. In response to both favorable market conditions and popular insistence of shifting to renewables, developments of renewable energy projects are starting to grow rapidly. With increased development, the renewable energy sector will create many more jobs. For instance, if the U.S. commits to decarbonizing by 2035, the growth of jobs in the sector would total roughly 25 million

over 15 years, with 5 million sustained new jobs (Griffith, 2020). These jobs would be scattered around the country, in major cities for some roles, but also throughout rural America, providing new employment opportunities in many rural communities, even bringing people into small towns.

One major problem with rural renewable energy developments is that the communities where the developments are located receive very few of the benefits. This is true around the world, but it is especially evident in the United States, where the vast majority of renewable energy developments are large-scale developments, often owned by utility companies or major developers. This results in very few of the jobs created by the development of these projects being located in the community, so little to no money from their development circulates into rural economies. Instead, money ends up circulating in major cities, even internationally. Even for landowners that lease a portion of their property out for the development of wind turbines, their compensation seldom makes a significant impact. For instance, in the UK, community funds provided by commercial developers amounts to roughly £5000 per megawatt, whereas community-owned projects can earn as much as £100,000 net profit per megawatt (Callaghan, 2014). This has certainly caused some resentment of renewable energy in these communities. Together, this shows that renewable energy alone is not enough to help rural economies. Accordingly, renewable energy must be combined with policy ensuring that rural communities benefit from their development.

In order to address this issue, I suggest the introduction of policy to increase community ownership of renewable energy projects. Renewable energy projects that are owned by the community in which they are located result in the revenues from their

development being circulated in the rural economy. Moreover, these developments create more jobs, which are also located in the rural communities, helping to diversify the economy and create jobs on many different skill levels. These community-owned developments have also been linked to lower transmission and distribution costs (Martens, 2022). This means that not only will these developments be more beneficial to rural communities, but they can also produce cheaper energy, benefitting people both in the rural communities and in urban areas. The problem is that community-ownership seldom comes naturally, it is usually more cost-effective for large developers than it is for a community to develop their own smaller renewable energy project. Accordingly, government intervention is required if communities hope to see the benefits of renewable energy developments in their area.

Many different types of policies could prove effective at addressing this issue, but none have been as effective as the approach taken in Germany. In Germany, high feed-in tariffs meant that renewable energy development was more attractive to community groups than it was to utility companies or other large developers. Still, anticipated returns were high enough that the average citizen was excited to invest, leading to over 50 percent of renewable energy projects being owned by the community (How to…, 2013). In the United States, similar policies could be implemented to make renewable energy a more attractive investment for community groups and individuals. While incentives already exist for small-scale developments, like household rooftop solar developments, which are highly subsidized in many areas, these benefits disappear for mid-size developers, as many community-owned developments would be scaled. By introducing a generous feed-in tariffs for mid-size wind energy developments, those with

up to 50 MW capacity (Dodd, 2013), we can encourage more community-ownership of renewable energy generation. Mid-size projects are not only more viable for a community organization to fund, but they are also more practical for their needs. Similar policies can be implemented in regard to solar and geothermal developments, with adjustments according to the average scale of each type of power generation and competition in the markets for each of them.

As a result of increased community ownership, renewable energy can begin to boost rural economies. Just as Coopelesca, the community-owned solar project in Costa Rica helped to produce cheap electricity for their rural community, this policy can help to increase rural resiliency. The benefits of community ownership don't end their though. Community-owned developments like Coopelesca also help to lower demand for electricity, because unlike major energy firms, they aren't focused on maximizing profits each year. Instead, they can focus on providing substantial power for their community, meaning they are more likely to push for more energy efficient homes, infrastructure, and appliances. This then further reduces costs for the community, as they will likely reduce their energy consumption.

Moreover, while renewable energy development is currently predicted to create as many as 25 million jobs over 15 years (Griffith, et. al., 2020), the total could end up being even higher as a result of increased community ownership. With more community ownership, the renewable energy generation market will be incredibly decentralized. Accordingly, individual community groups may hire their own administrative personnel. Thus, instead of having a singular company administering wind farms in different parts of the country, with one main administrative office, these offices would be scattered

around the country, working with one another, because they are all connected to one grid, but each of them working for their own community group. The result would be a higher proportion of sustained jobs, jobs that will exist indefinitely, even long after construction of an entire new grid is over.

Even if community-owned developments are an attractive investment as a result of favorable feed-in tariffs, they will still need funding. While some funding can certainly come from the community itself, it is important to note that the communities these would benefit tend to be those that are struggling, so it may be difficult even for those interested in developing a community-owned wind farm to get enough funding for it. To address this, additional funding should be allocated to interested communities by the Department of Energy. Some of the funding should come in the form of grants, which will only be available for community organizations that have already secured substantial funding from their members. This will effectively reward organizations that have strong community buy-in, so the development will be something that the community is in favor of. Additional funding can be allocated in the form of low-interest loans. This will allow a program encouraging community ownership to continue, bringing some revenue back to the government, making it possible to continue to fund these projects without having to significantly increase taxes.

Community-owned renewable energy projects can be a useful tool to create substantial growth in rural economies, helping to bridge the gap in quality of life between urban and rural areas, but it may not lead to growth for the entire economy. Increased community ownership will certainly lead to lower profits for major energy producers through the loss of market share, decreased energy costs, and increased

energy efficiency. As a result, these policies may not be effective at creating economic growth as represented by GDP growth. In fact, they may cause GDP to decline, all while improving the quality of life for nearly everyone involved, further demonstrating the inadequacies of GDP to represent the health of an economy and the people participating in that economy. As such, the undeniable benefits of these policies, as well as countless other possibilities help to strengthen the argument of moving away from GDP and constant growth and towards the Doughnut Model, prioritizing meeting the basic needs of everyone without over-exploiting the planet in any way.

## Conclusion

The envrionmental and economic policy of the next few years will prove to be vital to our chances to mitigate the worst impacts of climate change. According to the IPCC (2022), global greenhouse gas emissions must peak by 2025 and decrease by 40% by 2030 if we hope to limit warming to only 1.5C. The problems posed by climate change exist far beyond global warming, though. Different parts of the world may face incredibly different changes dues to climate change. For instance, some areas may see much more rainfall, while many of the world's deserts are predicted to grow substantially. As a result, many of our economic systems will need to adapt to the changes that we will see. Seeing as the Global North is responsible for the majority of historic greenhouse gas emissions, leading emitters, like the United States, must also take responsibility and take action to mitigate harmful impacts of these practices.

For instance, since the Industrial Revolution, the United States economy has been reliant on fossil fuels. From the first boom of oil exploration to the development of the Model T car, making cars accessible to the general public, our reliance on fossil

fuels has only grown. Since then, fossil fuels enabled the urbanization and suburbanization movements of the 20th century, through the development of highways as well as the mechanization of farming. Through the mechanization of farming, the doors were opened to the growth of monocultures, pesticide and fertilizer use, and genetic modifications for crops. As a result, our ecosystems have become fragmented, with many of them rapidly disappearing, and our crop fields have become less resilient dues to losses in biodiversity.

Not only has this fossil fuel focus caused many environmental problems, but it has also contributed to many of the economic issues facing rural America. For instance, while fossil fuel exploration was once a leading employer in Appalachian towns, where coal mining was a dominant profession, today, even those jobs have become highly mechanized, leaving rural towns with high unemployment levels, strangling small businesses, and enabling large firms to concentrate market power in these areas.

In response to many of these issues facing rural America, this research proposes several policies to help bring rural communities back to life while encouraging a rural future with strong, diverse ecosystems coexisting with agricultural production. Some of the most important policies include those to promote sustainable agriculture, based on many ideas taken from the case study of Costa Rica, as well as those encouraging renewable energy developments to focus on their community. For instance, by creating an Independent Farmers Protection Board, we can safeguard against economic concentration in agricultural good markets, shift funding away from the industrial model, and encourage developments of smaller farms, which are more ecological and beneficial to the local economy than large farms.

However, this research could be expanded upon in many ways. One area in need of more research is the intersection of sustainable agriculture and indigenous perspectives. In the case of Costa Rica, the history of sustainable agriculture within the Bribri tribe has been an important resource for many other people pursuing sustainable agricultural production in the country. The ideas perfected by the Bribri over generations have helped to create diverse opportunities for sustainable agriculture catered to different parts of the country. This same type of exchange of ideas appears far less common in the United States. Accordingly, further research should be performed regarding the role that indigenous knowledge can play in helping to encourage sustainable agriculture in the United States. Not only would this help decrease risk factors for shifting to more sustainable methods, but it can also prove useful to reintroduce diversity to the farming community in the United States.

Furthermore, this research focuses on the country as a whole. As a result, more specific research should be done on the regional and local level. Not only do rural communities in different parts of the country have different types of agriculture, but they also have vastly different ecosystems and potentials for renewable energy developments. Accordingly, some aspects of this research will not be relevant for every community. In the case of rural tourist towns, potential to combine agrotourism with sustainable agriculture may be much greater, just as was observed in the case of Costa Rica. Accordingly, more specific research as the topic pertains to certain regions may prove to be incredibly useful in informing more local policy measures.

Lastly, regardless of how effective the proposed policy measures are, those measures alone will not be enough to promote strong rural economies into the future. In

order for these policies to be effective in the long-term, they must also be met with some level of rural population growth, fueled by a development of more rural jobs. This can come from many sources. For instance, just as we have seen the growth of some rural towns throughout the Covid-19 pandemic, the growth of remote work, as well as the development of more satellite offices in rural communities could effectively accompany the developments described in this research. Not only could this prove beneficial to struggling rural communities, but it can also help to alleviate some housing issues in the larger cities of the country. However, people are unlikely to stay in rural communities long-term unless there is also access to quality education for their kids. Accordingly, the policies proposed here should also be accompanied by policies that will help to increase funding for public education around the country, including in rural communities.

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