Repeopling Agriculture: The Role of Field Labor in the Transition to Regenerative Practices

by

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A THESIS

Presented to the Department of Environmental Studies
and the Robert D. Clark Honors College
in partial fulfillment of the requirements for the degree of
Bachelor of Science

May 2025

An Abstract of the Thesis of

Max Springer for the degree of Bachelor of Science
in the Department of Environmental Studies to be taken June 2025

Title: Repeopling Agriculture: The Role of Field Labor in the Transition to Regenerative Practices

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Shortages of field labor present barriers for the adoption and continuation of regenerative agricultural practices. Field labor is a crucial piece of farming and is an issue for farmers regardless of growing method. For regenerative practices, a set of techniques focused on soil health and a possible solution to climate change, labor shortages are more acute. Ecological knowledge, experience and more labor are key to regenerative practices as they are used more as chemicals and machines are used less. Regenerative practices in agriculture represent a hope for growing food and fiber in a changing world, yet it is in need of people, knowledge and experience to come to fruition. This thesis aims to unpack this point, uncovering the key role labor plays in regenerative practices and in farming in general. After an understanding of agriculture's beginnings and the current state of farm labor, this thesis ends with a proposal based on four case studies to provide a way forwards for the adoption of regenerative practices.

Acknowledgements

First, I would like to thank Galen Martin for being my primary advisor through the journey of writing this thesis. Starting with nothing to ending with this paper would not have been possible without your guidance and support throughout this process. I am grateful to have you as my mentor and that we were able to explore this topic together! Secondly, I would like to thank Christopher Michlig for being my Honors College advisor. Your enthusiasm and wisdom have kept me going! I appreciate the time we spent on a walk early in my writing process as we fleshed out ideas and got the gears turning. Lastly, I want to thank my family, roommates and friends for being by my side throughout this entire project, your support meant the world to me. I want to express my gratitude to my sister and parents, thank you for always believing in me and helping me reach my goals.

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Introduction

"Another pair of hands would be nice," had been my recurring thought for the past four days, as I struggled against the cold metal of an irrigation pipe in the brisk morning air. The wheel line's pipe had been bent and sprinkler heads knocked out of alignment last year, and my boss had assigned one of the ranch hands and me to repair it. Having another pair of hands on the project was helpful as the sections of pipe were not easy to wrestle into place (see Appendix A). After one day's work, our boss had to split us up, moving the ranch hand to finish another project and for me to complete the repair alone. Not for the first time that year, a group project had turned into a solo one, and although it would not be easy, I had grown used to it. Compared to the year before, we had fewer employees with a "must do" list of equal length, meaning our labor was stretched extra thin. Despite that, it was still important to repair the wheel line as, once working properly, it could be used to water a section of one of our fields to encourage native grasses to come back and establish themselves before the inevitable coming of invasive species. At the end of my first solo day working on the project, my boss apologized to me about the lack of help, saying that she and the ranch owners were looking for new employees, but had not had any luck lately. She explained that the ranch was in a unique position as they were looking for hard working people who would be happy hammering out dented pipe in 35 degree weather, and also workers with specific knowledge and experience with regenerative agriculture.

This project was part of the Pine Meadow Ranch's transition to regenerative agriculture, a farming system focused on improving soil health and carbon sequestration. I worked for the new owners for two summers as they tried to heal and rebuild a 260 acre ranch that had been degraded after years of overgrazing. Encouraging the growth of native species or building organic matter in pasture soils through rotational grazing and planting cover crops are just some

examples of the practices the ranch was starting to enact. My position at the ranch as the "Agricultural and Land Management Intern" was important in this transition, as I was not only an extra set of hands to get projects done, but it was also my job to learn and research more about regenerative practices. And that I did, as I worked on experiments in regenerative practices and experienced their benefits firsthand as our pasture soils' health improved (see Appendix B). At the same time, I started to experience and understand some of the issues the ranch was having due to the implementation of regenerative practices. Exemplified by my experience trying to complete the wheeline project solo, I began to understand the difficulties in finding new labor on farms and that regenerative practices require more "hands" or labor.

My experiences also showed that regenerative practices had a learning curve and that it took time to invest in an employee and train them. In short, I realized that regenerative agriculture was the key to food and fiber production in a changing world while also being a more labor intensive and knowledge, experienced based set of farming practices compared to more conventional methods. This realization drove me to pose a question similar to the one my boss was wrestling with: Who will do the work required in regenerative agriculture? In other words, are labor and knowledge barriers to the implementation and continuation of regenerative practices in agriculture? And if so, what solutions are there to overcome this barrier?

This thesis aims to unpack this crucial yet largely unexplored aspect surrounding the implementation of regenerative agriculture, making the case for its importance and creating a framework for its solution. Issues of labor in agriculture are not unique to regenerative farmers, yet are more acute in many cases due to the number of hands in the field and the knowledge they require.

Drawing on an overview of agricultural history and a collection of case studies on regenerative practices and labor, I will end with a proposal of how to overcome the barriers that labor and knowledge pose for these practices.

Chapter 1: The Emergence of Industrial Agriculture

Every human needs food. This simple fact, when combined with the growth of our population over time, is the basis for understanding the creation and reliance of our species on agriculture. However, agriculture is a new invention compared to the 200,000 year old history of our species. Agriculture and the domestication of plants only began around 7000 years ago, establishing itself in areas like the Fertile Crescent (History of Agriculture). Yet, despite its short history, the advent of agriculture has had profound effects on our species, shaping almost every aspect of our world. No statistic points to this more with about 40-50% of the world's habitable land, or about five times the size of the U.S (about 50 million km²) used for agriculture, either cropland or pasture, in 2024 (Ritchie and Roser 2024). Only 1000 years ago, 4% of the world's habitable land was used for agriculture, about half the size of the U.S, highlighting our increasing reliance on agriculture and its spatial importance on our planet.

Figure 1: A Breakdown of Earth's Total Land Area

Agriculture can be understood as the area of livestock and crops combined, equalling an area of about 50 million km². Land used to feed livestock and for grazing far exceeds the amount of land used for growing food for humans (Ritchie and Roser 2024).

However, despite agriculture's historical and modern importance, our connection and reliance upon it have never been a complete defense against starvation or the collapse of civilizations. Many civilizations throughout history have collapsed despite having agricultural lands and farmers. What each collapse shares are problems arising from the management of agriculture's most important resource: soil. Besides the sun, no component of agriculture is more important to success than healthy soil. History and science both support this, linking the depletion of topsoil and fertility to the collapse of powerful empires such as the Romans and the Mayans (Beach 2006 and History of Agriculture). The Romans fell victim to a heavy reliance on the plow, with many agronomists recommending plowing three to four times a year. Despite some effective farming techniques like intercropping and spreading manure, excessive plowing slowly killed the fertility of Italian soils over about a millennium. Before Roman farmers could react, yields dropped, explaining why Rome was forced to move its grain production to the unplowed soils of Northern Africa. The erosion of topsoil is not the single reason Rome fell, yet the troubles of trying to feed a growing population from increasingly unproductive lands added to its end (Montgomery 62-63, 2007). Historically, agriculture was never able to eliminate famines or be the silver bullet for food production, as proven by failed civilizations and ever present global hunger issues, yet it is undeniable that the advent and our reliance upon agriculture has enabled the growth of our population and the flourishing of many societies (Larsen 2013). In short, agriculture has rooted itself in our civilizations, societies, and world, shaping the environment humans live in.

1.1 Agricultures Shifts

The evolution of agriculture from small subsistence farming villages to the giant agribusinesses of today can be defined by a few paradigm shifts. Agriculture in the Americas,

already established on both continents, was profoundly impacted by the Columbian Exchange, which introduced a wide range of new crops and animals from Europe. The Europeans introduced many new commodities such as sugar, wheat, cattle, sheep, and horses. These imported crops and working animals quickly came to define farming in the Americas. Rice and wheat flourished, enabling expansion, while cotton, tobacco, and sugar cane became the basis of the slave trade, beginning America's role as an exporter of agricultural commodities (Dease and McNeil 2024).

After the Columbian Exchange, the scientific and industrial revolutions sparked the next evolution in agriculture. Combining in England and coinciding with stagnant crop yields, scientists and industrial minds turned to increasing food production. Scientific studies and botany gave farmers a more complete understanding of nutrient cycles and what plants needed to grow, increasing their control over the land and crops. These advances led to a growth in fertilizer use to increase yields and widespread adoption of machines like the tractor and combine harvester, making farming much more efficient (History of Agriculture). As they became more mechanized and capital intensive, running a farm became more like running a business, and mass produced crops became commodities (Park 2022). In short, the industrial revolution gave farmers a powerful set of mechanical and chemical tools, beginning the hold these tools and strategies still have on conventional agriculture today.

Despite these advancements in understanding crops and the mechanization of farming, Malthus, in 1798, famously predicted that population would outpace food production and lead to famines in the 19th century. However, famines were averted due to the invention of the Haber Bosch process in 1913, a method of creating synthetic nitrogen fertilizer (Ritchie 2017). This invention married farming and artificial fertilizers together, enabling agricultural production to

keep pace with population growth. Synthetic nitrogen fertilizers are estimated to be responsible for supporting 42% of global births in the 20th century and led to the growth in population from 1.65 billion in 1900 to 7.4 billion in 2015 (Ritchie 2017). This marriage is further illustrated in figure 2, where the use of synthetic fertilizers climbs rapidly shortly after the invention of the Haber Bosch process (Qualman 2017).

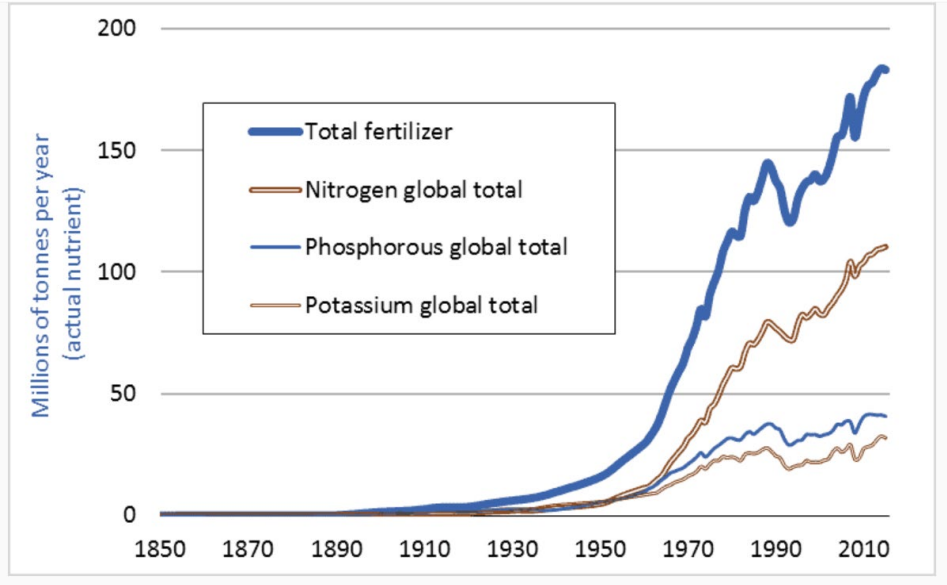


Figure 2: Global use of fertilizers split by type from 1850-2010

This figure explains the increasing demand and use of a variety of fertilizer types in agriculture. An increase in total fertilizer use coincides with the creation of the Haber Bosch process in 1913 and the Green Revolution in 1960-1970. Fertilizer use continues to rise after this point (Qualman 2017).

As synthetic nitrogen production increased dramatically, agriculture continued to evolve during the Green Revolution (1960s-1970s). This period is defined by hybrid crop varieties that produced more grain on less land and were more disease resistant, dramatically increasing yields (Spanne 2021). After receiving hybrid seeds, India and Pakistan averted wide-spread famine and briefly achieved agricultural self sufficiency. Hybrid seeds came with a new set of farming methods as the hybrid seeds needed fertilizers and irrigation to charge their growth and pesticides to protect them. This perpetuated agriculture's reliance on inputs of fossil fuels and

minerals to produce fertilizers and keep yields high. As shown in figure 2, a rapid increase in total fertilizer use coincided with the Green Revolution during the 60s and 70s, with usage continuing to grow (Qualman 2017). In short, the Green Revolution and Haber Bosch process set agriculture down the path of turning the energy embedded in fossil fuels and Earth minerals into the energy we eat as calories (Spanne 2021 and Global Alliance for the Future of Food). Furthermore, hybrid seed and chemicals displaced traditional agricultural methods, decreasing cultural practices and heritage seed varieties. The Green Revolution changed agriculture, shifting farming methods to rely on machines, chemicals, hybrid seeds and capital, leading to an increase in farming acreage and a decrease in the number of people involved in food and fiber production (Spanne 2021 and Global Alliance for the Future of Food). The number of farmers in the workforce has gradually declined over time, from farmers making up 27% of the work force in 1920 to about 1% today (Zynda 2022). The decline can be explained by changes in farming and an increasing reliance on machines and chemicals.

1.2 Agriculture Today

Today, agriculture is a global force commanding a vast portion of our planet's land, resources, and labor. It has reached this status because of our continued population growth, the Haber Bosch process, and the Green Revolution. Understood generally, this current system is successful as humankind produces more than enough food to feed the entire population (History of Agriculture and Kummu et al. 2012). Yet, there are many consequences for the health of humankind and our planet in how we have achieved this level of productivity and efficiency. First, despite producing enough food, more than 1 billion people around the globe, or 12.5% of the world's population, go hungry, and 1 in 3 people are malnourished (Kummu et al. 2012, Lewis 2024 and United Nations Environment Programme 2020). This is due to problems with

distribution, food storage, climate change, weather events, and food waste, contributing to around one third of the world's produced food being wasted and never eaten (History of Agriculture, Kummu et al. 2012 and United Nations Environment Programme 2020). Agriculture is facing, and contributing greatly, to the continuation of climate change and environmental degradation, affecting its ability to produce food. Unsustainable farming methods made popular by the Green Revolution such as heavy tillage, synthetic fertilizers and chemical pesticides have degraded soils, polluted waterways, destroyed habitats and put vast amounts of carbon dioxide and methane into the atmosphere fueling climate change (Kastner 2016 and Lynch et al. 2021). Agriculture and the global food sector accounts for about half of the world's greenhouse emissions and in the United States agriculture accounts for about 11% of its total emissions (Kastner 2016). In addition to carbon dioxide, agriculture emits other greenhouse gases methane and nitrous oxide, which are longer lived and more powerful, warming the climate faster (Lynch et al. 2021). In addition to climate change, changes in agriculture that started with the industrial revolution have led to powerful agribusiness controlling much of the sector. With farm control given to large companies and the disappearance of small, diverse farms, rural communities have gradually begun to shrink in population, are more likely to be impoverished, and suffer the most from farming practices, such as toxic chemical exposure from pesticides (Spanne 2021). In short, due to fueling climate change, failing to produce enough food, degrading the environment, and being ill equipped to handle our changing world, the current conventional farming methods face many challenges that are leading to new methods of agriculture and food production (Day and Cramer 2022 and Gosnell et al. 2019)

Governmental agricultural programs and policies are starting to reflect these systemic issues facing farms in the US. The most recent Farm Bill, the nation's largest source of federal funding

for conservation, has new policies to support farmers in a changing climate and actions to protect the environment (Friedman 2023 and Nature Conservancy 2024). In addition, the Green New Deal (GND), a proposed piece of legislation echoing the sweeping investments in infrastructure and public programs of Franklin Roosevelt's New Deal, is a powerful sign of governmental policies reflecting current trends in agriculture (Day and Cramer 2022 and Jordan 2019). The GND centers anthropogenic climate change as a major threat and aims all of its policies and programs on sequestering carbon while also supporting communities, individuals, and our planet in a just way (Day and Cramer 2022 and Jordan 2019). The Farm Bill and the GND hold much weight in directing the course of agriculture in the U.S and solving its issues. Both policies aim to address the problems in agriculture today, but they are both subject to bureaucratic processes and long wait times. Moreover, they run against the entrenched agricultural norms, supported by generations of tradition, money from large corporations, subsidies from the government, and climate change deniers. For instance, the Farm Bill is only changed once every five years, and the section on agriculture in the GND is noticeably thin (Carlisle et al. 2019 and Day and Cramer 2022). That said, any support from the federal government for conservation, sustainable, or regenerative practices addresses the current issues in agriculture and starts positive change.

Chapter 2: Regenerative Agriculture

Regenerative agriculture is a relatively new movement in food and fiber production and can be associated with other practices such as organic, restoration, climate smart, holistic management, and sustainable agriculture. Drawing upon these practices yet also distinctly its own, regenerative agriculture is centered around soil. Every aspect of its methodology is underscored with a focus on soil health and improving soil quality while producing food and sequestering carbon in soil (Cavigelli 2025 and Kastner 2016). It is based on science, evidence, natural systems, soil biology, and an understanding of soil as a living organism. Moreover, its approach draws upon systems thinking and holistic management, meaning farmers emphasize and build upon connections with the soil, climate, environment, and society to produce healthy food while regenerating the system at the same time. It is a way of thinking that is focused on recognizing, listening to, and following the ecological systems and connections inherent in food and fiber production (Day and Cramer 2022, Gosnell et al. 2019 and Kastner 2016).

Regenerative agriculture is unique in that it goes farther than merely keeping a system "sustainable," it aims to improve and revitalize the natural environment and systems which it is a part. Moreover, since regenerative agriculture's methodology is focused on the soil's ability to sequester carbon, it is a unique blend of a solution to climate change and an adaptation to it. Its practices represent a hopeful model as it can produce nutritious food and regenerate its surroundings while also pulling carbon out of the atmosphere (Day and Kramer 2022 and Kastner 2016). Not only focused on the natural environment, regenerative practices prioritize improving the lives of farmworkers, farmers, and rural communities while producing food (Gosnell et al. 2019 and Kastner 2016). Farmers practicing regenerative agriculture often experience increased yields and climate resilience, making profits higher and helping to improve

agrarian societies (Soloviev and Landus 2016). In short, regenerative agriculture is an idealistic and powerful methodology promoting harmony, focusing on improvements, and addressing many of the problems present in our current agricultural model.

Regenerative agriculture has a multitude of practices that have roots in agroecology and restoration agriculture. Learning from history with the fall of the Romans and Mayans, every regenerative practice focuses on building, improving, and caring for soil. Techniques present in agroecology and restoration agriculture, such as minimal tillage, spreading biomatter or compost, planting cover crops, diversifying crops, planned/rotational grazing, and the elimination of chemical fertilizers and pesticides are present in regenerative agriculture as well (Day and Cramer 2022, Gosnell et al. 2019 and Kastner 2016). When implemented, these practices build off each other, creating positive feedback loops that encourage continuation. In other words, investing in soil health by minimizing tillage or planting cover crops leads to a myriad of benefits for a farm's yield and resiliency, which leads to other practices like rotational grazing being introduced as well (Gosnell et al. 2019). Although regenerative practices have many benefits for farmers, only about 1.5% of all farms in the U.S use regenerative practices (Karas 2024). However, this percentage is increasing, as awareness and support for these practices grow as farmers suffer from changes in our climate and the drawbacks of conventional industrial farming.

2.1 Rotational Grazing

Rotational grazing exemplifies the core values of regenerative agriculture as it creates positive feedback loops, is based on ecology, and uses natural systems. Rotational grazing mirrors the role of predators in ecosystems by moving groups of herbivores across a landscape. Livestock is moved regularly to simulate this phenomenon, ensuring that stock is always on fresh

pasture and that no overgrazing occurs. Figure 3 exemplifies this idea, showing how grazed paddocks receive ample recovery time. As in nature, this practice promotes pasture health with deep rooting grasses, leading to healthier and carbon rich soil. This gives the farmer higher quality animal products as they are always in optimal grazing conditions (Diaz et al. 2009 and Rotational Grazing Resilience). To implement correctly and capitalize on its benefits, rotational grazing calls for specific knowledge of pastures, grass, and stock health plus more time to plan and manage moving livestock. This is in line with my own experiences practicing rotational grazing at the Pine Meadow Ranch (see Appendix C). I spent considerable time walking out in our pastures discussing forage quality and moving hot wire fences to create new paddocks for cattle. Thought, evidence and specific knowledge went into decisions on when to move cattle, labor was required to move them and we made mistakes moving the cows too early or late. However, due to rotational grazing and numerous other regenerative practices, we raised healthy cattle and started to heal our pastures.

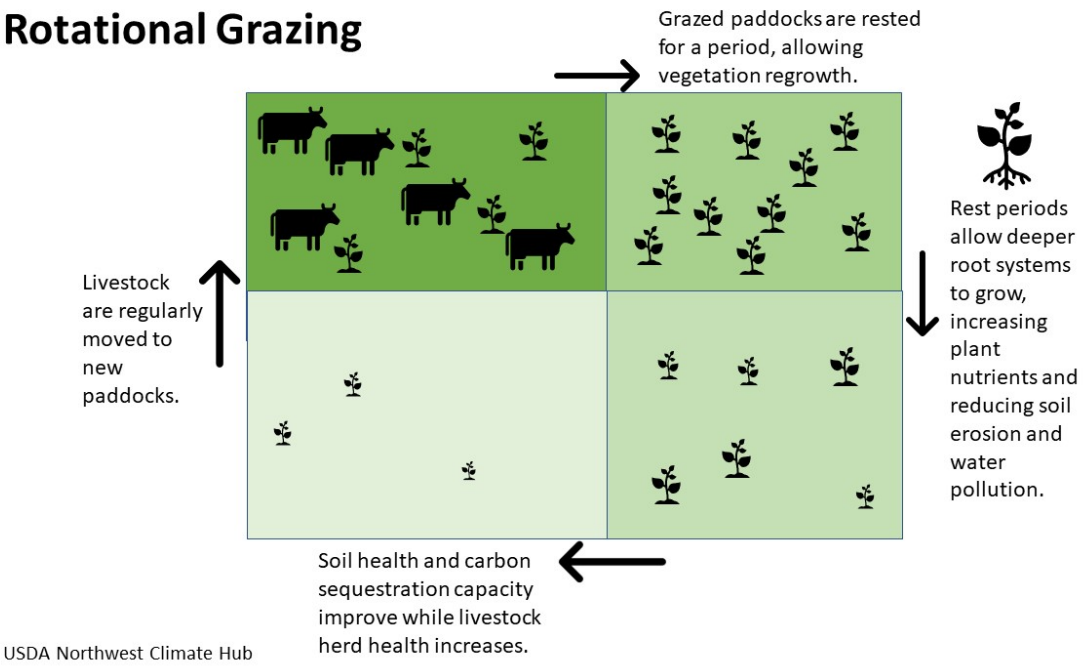


Figure 3: An example of Rotational Grazing

This diagram gives a visual representation of how these practices work, with the benefits of each stage explained. Deeper shades of green delineate the level of growth in a paddock and when it was grazed last (Rotational Grazing Resilience).

Rotational grazing explains some of the challenges for farmers and laborers, as it is different from common stockyard and rangeland methods of raising cattle. Furthermore, it exemplifies a common phenomenon in regenerative practices where labor and knowledge are substituted and required more as mechanization and chemicals are phased out (Carlisle et al. 2019 and Getz et al. 2008). As explained above, rotational grazing requires constant attention of cattle and specific knowledge on forage, grasses and soil which can require more labor and training. This labor and knowledge is needed as conventional methods of feeding forage to cattle with tractors or using fertilizers to grow hay and corn for feed are replaced with regenerative ones (Rotational Grazing Resilience). Similar to my own experiences, the Alder Springs Ranch in Idaho also practices regenerative rotational grazing and uses a method that underscores the

importance of labor and knowledge in this practice. Knowledge and experience from around 25 years of practice, much trial and error, and a dedicated crew is how they practice rotational grazing on a large scale. For their summer riders, they explain that long hours on horseback and living out with the herd are required to implement this method (Alderspring Regenerative). In short, rotational grazing exemplifies the core principles of regenerative agriculture while highlighting labor and knowledge as challenges that create barriers to its implementation.

Chapter 3: Labor in Agriculture

Working in agriculture as a laborer consistently ranks as one of the most dangerous jobs in the United States (Occupational Injury Rates 2023). Working in harsh conditions, dealing with heavy equipment, and constant exposure to chemicals, combined with little pay and no benefits, leads to a dangerous job with little upward mobility. Furthermore, farm labor is often seasonal, leading to a high turnover rate for employers and a life of movement for workers. Farm workers often live in rural communities, which can be small, poor, and receive little support from the government, furthering the issues faced by this group (Day and Cramer 2022). As such, agriculture in the US is currently facing a labor crisis, leading to issues in hiring, production, and profitability for farms (Funk 2023 and U.S. Farm Labor Shortage 2025). Yet, labor, whether it be from the farmer or hired labor, is the backbone of agriculture. This is especially true for fruit and vegetables, as all ten of the US's most popular fruits are picked by hand. Vegetables are not far behind, with seven of the ten most popular needing to be picked by hand (Estabrook 2020). Regardless of crop, labor is key for operating machinery, packing harvested crops, and driving transport vehicles. In short, a robust labor supply is needed in the fields to ensure crops are harvested (Estabrook 2020 and Funk 2023). Many farmers turn to machines to alleviate labor shortages, yet mechanization can only go so far. Machines still need humans to operate and service them. Expensive tractors and combines are often a major investment and only feasible for larger operations. Moreover, machines taking over the work of people usually comes with a higher reliance on pesticides and a more industrial, conventional growing method (Estabrook 2020). Regardless of growing method or level of mechanization, farmers need labor to harvest their crops and keep their farms afloat. Many growers put finding qualified labor or paying for labor as the number 1 issue they face in their farming operation (Estabrook 2020, Funk 2023 and

U.S. Farm Labor Shortage 2025). Figure 4 drives home this issue, highlighting a decrease in available labor for farmers. Figure 4 also explains farmers' need for workers as reflected by an increase in farm wages to attract labor (Monaco). Overall, labor is key to farming regardless of acreage farmed or practices employed on the farm.

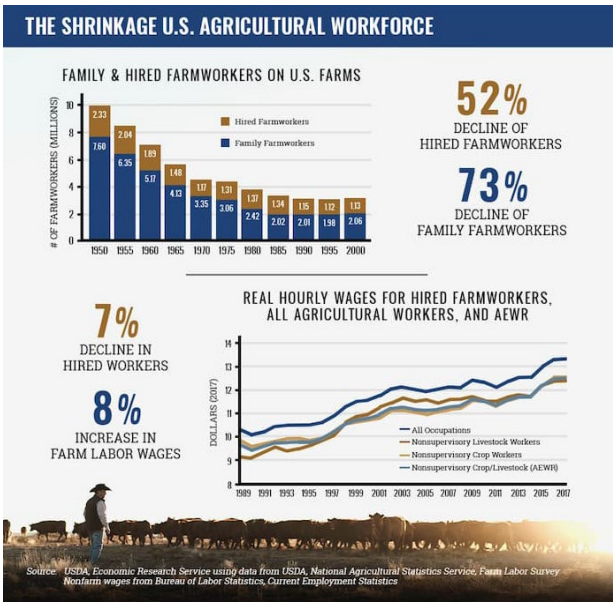


Figure 4: The Shrinkage of the U.S Agricultural Labor Force

USDA economic research and studies on the decline in farm workers in the U.S. Hourly wage data is also provided showing a contrast between fewer workers yet a growth in hourly wages.

3.1 H2-A Visas and Immigrant Labor

Due to labor shortages, American farmers have turned to immigrant labor and the H2-A visa system for labor. For many farmers in the U.S and especially in the southern states closer to the U.S Mexico border, this is where most farms get their workers. Surveys from both the National Agricultural Workers Survey (NAWS) and the National Center for Farmworkers Health have found that approximately 70% of the U.S's farm workers are foreign born with the overwhelming majority coming from Mexico (Fung et al. 2022 and Agricultural Workers Facts

2022) This statistic alone highlights the reliance that U.S farmers have on immigrants for labor. Moreover, around 45% of farmworkers are undocumented or lack proper permission to work in the U.S, creating a link between changes immigration and the availability of labor. The H2-A visa system links immigrant laborers and farmers, creating a legal avenue to work on farms in the U.S. However, changes in immigration policy, stronger border enforcement, changes to the Mexican economy and lengthy visa wait times all affect the availability of this labor supply (Farm Labor Shortage 2025 and Labor Challenges Agriculture).

Changes in presidency and subsequently immigration policy and border control can greatly affect the supply of labor in the U.S. The current political climate in the U.S is an example, as president Trump has signed executive orders furthering the deportation of undocumented immigrants, expanding the use of ICE and tightening security at the U.S Mexico border. This has led many farmers to rely even more on the H2-A visa system, backing it up as applications increse (Charlton 2025). Use of the H2-A visa has expanded rapidly over its existence as it saw a sevenfold increase in applied for and approved visas between 2005 and 2022. Despite its expansion, the H-2A system remains underutilized due to a number of issues for both workers and farmers (Labor Challenges Agriculture). For workers, the application period is about 60-75 days, with lengthy wait times if they want to reapply to work longer. Farmers have to provide paperwork proving that domestic workers and U.S citizens are unavailable for hire before they are authorized to connect with H2-A workers. Moreover, farms are required to provide housing and transportation support for H2-A visa workers, further adding time and money to an already costly process (Luckstead and Devadoss 2019). On top of it all, an improved Mexican economy with higher wages and no threat of deportation leads to fewer people attempting the dangerous crossing into the U.S or the lengthy H2-A process (Funk 2023).

With most of the farm labor force in the U.S coming from immigrants, problems with the H2-A visa system, changes to immigration policy, and fewer economic opportunities in the U.S significantly impact the labor supply for American farmers.

3.2 Issues with Farmers

Aside from labor, farmers themselves are struggling in the US. Farms have gradually expanded while the number of farmers and farms has declined, leading to small numbers of people controlling vast amounts of land. The latest National Census of Agriculture, conducted between 2017 and 2022, backs this up as the number of farms has continued to decline while average acreage has expanded. Between 2017 and 2022, there was a 7% decrease in the number of farms in the US. These large acreage farms control vast amounts of land and produce huge amounts of food explaining how the top 2% of farms control 42% of all farmland (2024). Moreover, many of these larger farms are operated by or fully contracted to corporations, further concentrating power and decisions to smaller groups of people and away from farmers.

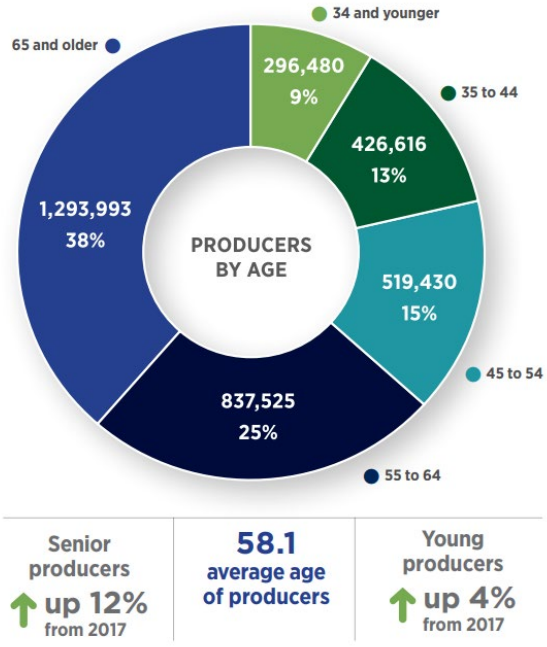


Figure 5: American Producers by Age

U.S farmers broken down by age showing the percentage of certain age groups. Senior and young producers growth percentages are provided as well as the average age of producers. The majority of farmers (greater than 50%) are above the age of 55 (National Agriculture Statistics Survey 2022).

The vast majority of the farmland in the U.S is owned and operated by an increasingly aging group of farmers. This is highlighted in figure 5 where the average age of U.S farmers is 58.1 in 2022. Other statistics such as 70% percent of farmland owned by farmers over the age of 65 underscores how most American farmers are on the brink of aging out (Greenhorns 2024 and Castillo and Simnitt 2025). According to the 2022 Agriculture Census, the demographics of farmers in the U.S skews male and white. However, this is slowly changing as the number of female growers is increasing overtime. Moreover, women are more likely to practice environmentally conscious and regenerative practices, signaling a change in agriculture (Anderson 2024 and Clark 2022).

Regardless of methodology, farmers and workers face many of the same problems, such as low wages, long hours, tough conditions and little support. In addition, farmers must contend with volatile markets, high equipment costs, natural or climate change-created weather events, and low profit margins (Carlisle et al. 2019). These factors contribute to low numbers of beginning farmers due to high barriers of entry and many farmers having to take on second jobs to stay in the green. Moreover, it is common for subsidies and support programs from the government to be the sole reason farmers are still working and farms are still operating (Kastner 2016). With little incentive to labor in agriculture or become a farmer, this vital workforce is shrinking. Exacerbated by climate change, immigration issues, the H2-A visa system, and a growing world population, the need for farmers and labor in agriculture will continue to increase.

3.3 Labor in Regenerative Practices

Labor shortages and small margins for farmers are common issues in agriculture, regardless of what method of farming a grower is practicing. Moreover, some growers using techniques, such as organic, sustainable, or regenerative, might experience some issues more

acutely and others less so. As previously stated, non-conventional practices often require more labor as chemicals and mechanization are substituted out. As such, labor shortages in these types of agriculture can be more detrimental when compared to conventional methods. Having a solid labor force is also important for farmers to have the ability to try out new practices and for innovation to happen. Although there can be benefits working in non conventional methods of agriculture, such as reduced pesticide and chemical exposure on organic farms, workers are still doing back breaking work in small, likely poor communities for little pay (Carlisle et al. 2019 and Day and Cramer 2022). Specifically with organic farms, problems with labor not being paid enough or living in substandard conditions are overlooked in favor of focusing on the environmental benefits of reduced pesticide use. Reduced exposure to chemicals can become the only change or improvement for workers switching from a conventional farm to an organic one, despite organic agriculture's image of being a challenge to conventional practices (Getz et al. 2008).

In regenerative agriculture, there is little information or studies on whether it is in a labor crisis. This partly has to do with regenerative agriculture being a new and evolving methodology in farming. Although conventional practices, which are less labor intensive when compared to non conventional practices, are having problems finding workers and regenerative adjacent practices like sustainable and organic agriculture are facing labor shortages as well, it is safe to assume that regenerative agriculture is as well. In short, whether grown regeneratively or conventionally, crops will rot in fields if there are not enough workers to harvest them. It is also important to point out that there needs to be more research on this specific subject in regenerative literature, as labor and knowledge are integral in these practices (Gosnell et al. 2019). In their work on transitioning to regenerative agriculture Gosnell et al. affirms that “more attention must

be focused on the “nonmaterial” aspects of agricultural transformation” (2019). Or that an understanding of new rotational grazing techniques or the economics of buying new equipment for new practices is important, yet the social human side of regenerative agriculture is also crucial. Gosnell et al. goes further explaining how “The affective and social dimensions of change have received increasing attention from scholars focused on climate transformation (O’Brien 2009, 2018; Adger et al. 2009, 2012; O’Brien and Wolf 2010; O’Brien and Sygna 2013; Veland et al. 2018; Marshall et al. 2019), but with little application to particular sectors, especially those where transformations are most urgent (but see Marshall et al. 2019; Gosnell et al. 2019)” (2019).

Chapter 4: Case Studies

I have made the case that labor is one of the urgent sectors that must be transformed. Agriculture, and especially non conventional methods, are facing a labor crisis affecting food and fiber production and limiting agriculture's shift away from conventional practices. In other words, labor is a particular sector that needs a richer, more complete understanding, as it is key to the adoption and continuation of regenerative practices. Regenerative agriculture is gaining traction as a solution to many issues in food and fiber production and climate change. Moreover, it has support, funding, and an increasingly large base of research on the affective components of its methodology. A key understanding in this research is that more labor is required in regenerative agriculture as machines and chemicals are phased out (Carlisle et al. 2019, Day and Cramer 2022, Getz et al. 2008 and Krause). The question I am proposing in this thesis stems from this concept as it aims to answer the question: who will be doing this labor, and how do we hire them? Or, where is the knowledgeable, experienced, and large labor force waiting to do the hard work that regenerative agriculture requires. After an extensive review of the literature on regenerative agriculture, I have not found a complete answer to this question. The literature points to regenerative agriculture as more labor intensive but often gives no guidance on how to hire and find labor. My question gets at the heart of the labor crisis facing all of agriculture right now and gives guidance on how to successfully switch to more labor intensive regenerative practices. Although there is no definitive answer to my question, there are examples of people and programs trying to answer it right now. Moreover, these examples provide a framework for answering my question. To paint a realistic picture of real world examples of my question, I will use a variety of examples on different scales from large organizations to individuals volunteering

on farms. I will summarize what is happening, how this issue is being addressed, and my suggestions to more effectively deal with the issue of labor in regenerative practices.

4.1 The Greenhorns

One organization and resource that is moving regenerative agriculture forward while giving training and resources to individuals to start their journey in agriculture is the Greenhorns. The Greenhorns is a community based learning collective located in Maine. Its goals are centered around training and supporting "young agrarians" or beginning farmers as they enter agriculture (About Greenhorns). When new farmers and workers enter agriculture, they catalyze change and create conditions for agricultural reform. This goal is based on the idea that farming is a crucial profession that must be supported and reinvigorated as food and fiber production sustains human life. Statistics support this goal; facts about the average age of farmers and the amount of degraded land due to unsuitable farming practices are used to explain its significance. To achieve this goal and reform agriculture, the Greenhorns focuses on community, sharing, and collective knowledge to educate and encourage new farmers to not only choose agriculture as a career but also practice sustainable and regenerative practices (About Greenhorns). This is done through a variety of media, from in person classes and workshops to films and radio, with information, resources, and anecdotes about non conventional forms of agriculture. Apprenticeships, internships, and online resources are all available through the Greenhorns and are driven by volunteer and community work, creating accessible resources for farmers locally or nationally. In short, the Greenhorns call for a shift in agriculture, a shift away from conventional, industry based production models to more community, regenerative based growing models that focus on connections between the land, farmers, and society (About Greenhorns). Creating avenues for new farmers and interested community members to start a journey in agriculture

fuels this shift and creates hope for the future. Specifically addressing labor in non conventional practices, the Greenhorns provide resources and opportunities for new farmers to learn about more Earth friendly practices and for them to get started in agriculture. Moreover, they create a space for more people to enter agriculture as educated, experienced labourers ready to work. As a farmer or laborer, they sustain and grow the amount of people involved in food and fiber production and encourage farmers to hire interns and create more opportunities to enter into non conventional forms of agriculture.

The Greenhorns build off the power present in a community and use the collective knowledge in it to educate and inspire young individuals to enter into agriculture. Analyzing this organization in terms of my question and answering who will do the labor needed for the switch to regenerative agriculture, the Greenhorns contribute to its answer. Their goal of getting more people involved in food and fiber production and pushing non conventional techniques as the future of agriculture is addressing the issue of finding labor in regenerative agriculture. Although they do not specifically mention regenerative agriculture, they explain how they teach agroecology and believe that changing agriculture requires a more holistic based approach, two points embedded in regenerative practices (About Greenhorns). The Greenhorns are focused on changing agriculture and cultivating a knowledgeable group of people to work in it. However, they do not specifically mention labor or that the practices they are teaching will require more labor due to the phasing out of machines and chemicals. Cultivating more people to work in agriculture is the organization's mission, with the people they train likely to labor in some form of non conventional agriculture (About Greenhorns). Although they are working to answer my question by educating and increasing the number of farmers, the Greenhorns should mention the labor issues present in switching to non conventional practices and address this issue in their

workshops, cultivating a group of educated farmers and laborers ready to take over the work of machines and chemicals.

4.2 The Rodale Institute

The Rodale Institute practices, supports, and encourages regenerative organic agriculture. In line with regenerative agriculture, the version that the Rodale Institute researches and educates in is combined with the idea that regenerative practices should be organic as well. The foundational components of improving human and environmental health in regenerative practices are bolstered by the organic movement and stopping the use of chemicals in farming (Regenerative Organic Agriculture). In educating farmers and researching new techniques in regenerative organic practices, the Rodale Institute tackles its mission of creating a resilient food system that improves the health of the Earth and all of its inhabitants. Workshops, consulting, free resources and a farmer training course encourage farmers to switch to new practices and growers already practicing. They have a vast array of educational tools, from online to hands-on, that create a space for farmers to learn and become curious about regenerative practices. Moreover, the institute has the longest running organic versus conventional side-by-side comparison trials in the United States (Farmer Training Programs). Their educational resources and claims about regenerative agriculture are backed by studies often done on their farms and cited in agricultural research worldwide. Furthermore, the Institute emphasizes social justice and climate change as key issues that can be solved when switching to regenerative organic practices. They emphasize the connections between the regeneration of the environment and how human systems connected to the farm must improve as well (Farmworker Fairness). Improving the lives of farmworkers, producing nutrient rich food, and supporting rural communities are principal concepts the institute backs up with study and public policy.

Despite the Rodale Institute propelling and supporting regenerative agriculture into the future, I struggled to find information on labor and an answer to my question. Much of the focus is centered around training and educating new and existing farmers, with few resources for the farmer to find educated workers and guidance for laborers on careers in agriculture. The institute's goals surrounding people in agriculture are farmer focused and mention labor only in regards to workplace safety and rights, and not as a needed part of the transition and continuation of regenerative practices (Rodale Institute Farmer Training). Moreover, the only mention of how non conventional practices require more labor is in a section making a call for consumers to volunteer at organic farms (Make a Difference). There is no section explaining the current labor crisis in agriculture and how that specifically impacts high labor non conventional practices like the ones they are advocating for. Adding to that, the institute does not address the findings that regenerative and organic practices require more labor than conventional ones (Carlisle et al. 2019, Day and Cramer 2022, Getz et al. 2008 and Krause). The institute's five year strategic plan sets goals about people in agriculture, with a focus on how to support them and the communities they live in. However, there is no mention of labor, or who will do the work required in regenerative organic agriculture, the practices they are encouraging (5-Year Strategic Plan). As I mentioned, the institute does provide many resources for farmers and is focused on how to support them, which is something I can not necessarily critique, as more farmers running, managing, and owning farms is important. Yet, I have made the case that regenerative agriculture needs more than just farmers; it needs a strong base of educated and willing laborers to do the grunt work of weeding or picking that these practices require. In short, the institute does much to further the regenerative movement through research, policy, and consulting, yet needs to bolster its studies, awareness and focus on labor in the practices that they teach.

4.3 WWOOF

Farmers use formal and informal organic based volunteer programs and organizations to substitute raising labor costs and the availability of workers. World Wide Opportunities on Organic Farms (WWOOF) is a program that connects farmers and people worldwide who want to live and work on a farm. It is based on the idea of sharing and growing organic practices, cultural exchange, and educational opportunities where workers receive room and board for free but no monetary compensation (How it Works). WWOOF and other programs like it are centered around organic/sustainable agriculture, supporting farmers, and can help alleviate labor issues. At the same time, WWOOFing is a form of volunteer tourism and can be used by many people more as a means to travel rather than as a laborer on a farm. In other words, the stated goal of educating WWOOFers on ecologically conscious farming techniques can be overshadowed by tourist opportunities and a chance to travel cheaply (Deville et al. 2016 and Terry 2014). In reality, WWOOFing is both a chance to travel and experience a different type of tourism and an opportunity to learn about ecological farming practices. However, the level of engagement on learning about the farming practices differs with how the farm operates and the WWOOFer themself.

WWOOFing is a unique example of an organization and group of individuals that is addressing labor concerns in organic and regenerative agriculture. It is centered around volunteering and not full time labor, yet can be an important tool for farmers looking to find more labor, specifically in non conventional methods (see Appendix D). WWOOFing addresses the labor crisis facing non conventional farms by connecting farmers with a cheap and enthusiastic labor source that they can screen themselves. This gives farmers many more hands and alleviates upfront labor costs that can be too much for most farms (Seltz 2023 and Terry

2014). On the other hand, some have critiqued volunteer labor like WWOOFing as diminishing the incentives of finding long term and full time employees on farms (Carlisle et al. 2019). Moreover, most WWOOFers have little experience in farming and must be trained and supervised which can cause issues for farmers constantly retraining new workers (Terry 2014). Moreover, information and studies on the program's success in having people enter agriculture after their experience on the farm is unknown. WWOOFing is decentralized with countries and regions having their own websites and the educational aspect of the program is left up to individual farmers with little oversight (Seltz 2023). The program does boast over 100k WWOOFers sent to farms in 53 different countries, yet more data on the length of stay of volunteers and if WWOOFing is a pipeline for more people to become farmers or laborers would be useful in determining its effectiveness in solving labor issues in non conventional methods of agriculture (WWOOF Network). Overall, WWOOFing does provide a platform where farmers can find low cost labor to alleviate labor shortages in non conventional agricultural practices and could be an avenue for more people to become farmers or laborers (Seltz 2023 and Terry 2014).

4.4 Land Grant Colleges

Regenerative agriculture and college courses about its implementation and practices are taught at land grant colleges and universities in the United States. Land grant colleges were founded on the premise of researching every component of agriculture and farming, from animal sciences and sustainable practices to supporting rural communities and agribusiness (Land Grant Institutions 2025). It is crucial to understand how regenerative practices are taught in land grant colleges and higher education in general. Courses and degrees in regenerative agriculture grow the practices and increase the number of people entering agriculture. Moreover, they could address the question of who will do the labor required in non conventional methods. Supported

by the USDA and the Sustainable Agriculture Research and Education program (SARE), land grant colleges are teaching more classes on agroecology and sustainable agriculture. Sustainable agriculture programs and workshops in land grant colleges have grown, as well as other national programs like the Sustainable Agriculture Education Association (Jacobsen 2012). These are encouraging developments, as although sustainable practices and regenerative practices are not the same, more sustainable agriculture programs mean more farmers and researchers have more climate minded and environmentally friendly degrees to bring into farming.

More educated people entering agriculture strengthens the labor force in farming, and this new workforce could assist in the growth and continuation of regenerative practices. That said, programs about regenerative agriculture and specifically addressing labor in non conventional methods are not as common as programs on sustainable agriculture. Regenerative agriculture is a relatively new and evolving set of practices, making it hard to create curriculum and courses around it. For example, Oregon State University and Colorado State University, both land grant colleges, study regenerative practices, do workshops promoting their practices and hold educational lectures. Yet, neither school offers regenerative agriculture as a major or minor for a student to graduate with a degree in (Degrees and Programs and Find Your Major). California State Chico and Mount Wachusett Community College are two regular universities pioneering regenerative agriculture, with Chico having a center for regenerative agriculture and Wachusett offering courses specifically on regenerative practices (Center for Regenerative Agriculture and Regenerative Agriculture Certificate). In short, while courses on regenerative agriculture in land grant colleges and higher education in the U.S. have room to grow, any educational resources that promote non conventional practices in farming and increase the number of people entering agriculture assist in solving the labor issues in regenerative agriculture.

Therefore, increasing federal funding for land grant colleges to grow their regenerative agriculture programs and create curriculum about labor in non conventional methods should be a focus in the future.

Chapter 5: A Way Forward

The Greenhorns, Rodale Institute, WWOOFing program, and land grant colleges are all positive and important forces in changing current agricultural practices. They are discussing, researching, and moving regenerative practices into mainstream agriculture in a variety of different sectors, from volunteer work, education, and community learning. While the examples I have described and analyzed support regenerative and non conventional methods of farming, they do not specifically address the question of who will do the work required in regenerative practices. Every example discussed above mentions farmers first, how to support them and educate new ones, and while that is important, as we do need more farmers, farms practicing non conventional techniques still need labor. In short, my biggest critique of current rhetoric, research, and programs around regenerative agriculture is that they are too focused on the farmer. The Rodale Institute and other organizations like it (Sustainable Agriculture Research and Education, Soil Health Institute, and Noble Research Institute) all have educational resources, training programs and advocate for policy changes that assist farmers in switching to regenerative practices. While more regenerative growers and people in agriculture are positive, the underlying question of where this increasing number of farmers will get the labor that their practices call for remains unaddressed. However, the Greenhorns and the WWOOFing program offer methods for alleviating these labor needs in regenerative agriculture. With the Greenhorns providing hands-on learning opportunities taught by professionals and aimed at increasing the number of people entering into agriculture, a new work force experienced in non conventional techniques could do the labor required in regenerative practices. More directly, the WWOOFing program connects farmers in need of labor with people ready to work, creating a solution for labor issues. While these examples could do more to directly address the labor and education

needs of both farmers and laborers when switching to non conventional practices, they all increase the number of people entering agriculture. More people, either working in or researching regenerative practices, grow the methodology and the possible number of people able and interested in working in it.

5.1 The Proposal

Based on my assessment of the labor issues in agriculture and how these issues impact regenerative practices, I have formed a proposal based on a combination of formal and informal methods. Formal research based organizations like the Rodale Institute and SARE are key in solving labor issues as they can conduct studies on human resources, fund educational programs for workers, and influence policy. These organizations could quantify key components of how to get more people working in regenerative agriculture, training employees on regenerative techniques, and guidance on building a supportive and non-exploitative work environment for laborers. Combining formal, policy, and research heavy components with more informal and localized solutions would work together to complement each other, as informal methods in this case can work immediately.

Growth in informal programs like WWOOFing could provide immediate solutions to regenerative growers in need of labor. The network that WWOOFing creates of farmers in need of labor and people ready to work ensures non conventional growers sustain their businesses and can harvest their crops. Moreover, organizations like the Greenhorns that focus on community based and hands-on learning educate the workforce entering agriculture on non conventional techniques. Knowledge and experience are crucial in non conventional practices as chemicals and machinery are phased out, emphasizing the importance of educational centers. Principles of ecology and a deep understanding of the larger environment a farm is located in are major

components of holistic management and non conventional methods and must be taught to laborers (Carlisle et al. 2019 and Day and Cramer 2022). Organizations educating laborers like the Greenhorns complement programs like WWOOF, where WWOOFers could receive more of an introduction into non conventional methods. This could lead to more volunteers and WWOOFers on farms choosing agriculture as a profession and the amount of people educated in non conventional practices. In short, I am proposing a combination of formal and informal solutions, where the overarching concepts of understanding labor in regenerative practices can be researched and supported by large organizations like SARE while the immediate needs of growers can be addressed by programs like WWOOF and the Greenhorns.

This proposal is simple to accomplish and equitable, as it is about joining the support and educational resources already available to farmers to include the laborers they are hiring. The lens that focuses policy, educational resources and funds towards farmers must be expanded to focus on workers. My proposal leaves no one in the dust, ensuring laborers receive what they need to make agriculture a career. Education and resources must flow down to the workforce that help sustain them, ensuring the values of community development and equality built into regenerative practices are upheld. We must shift the way we allocate resources and focus on agriculture, including all that work and live in it. Farmers, laborers and rural communities directly benefit from changes in focus, while the environment and society as a whole indirectly benefits. More Earth friendly and regenerative practices in agriculture not only protects the spaces we all live in, but also ensures that we have access to healthy food and drinking water not contaminated with pollutants. Regenerative agriculture is about holistic and whole systems thinking, where every action is thought of in relation to the entire system they operate in instead of a simple input output based model (Day and Cramer 2022 and Gosnell et al. 2019).

In this thesis, I am making the case that the community pushing for and researching regenerative practices must grow to understand the key importance of labor and an educated workforce in successfully adopting and continuing these practices. Reliable and available labor is not a new issue in agriculture and it is clear that labor issues can be more acute for less machine and pesticide heavy non conventional forms of agriculture (Carlisle et al. 2019, Day and Cramer 2022 and Getz et al. 2008). That is why the issue of labor in continuing and expanding regenerative practices must be discussed and researched more, as it is one of the keys to the practices success. Moreover, that is why the proposal presented in this thesis is important in providing a solution to these labor issues. A combination of formal research based organizations and informal grassroots volunteer programs could provide the base of required labor and knowledge. In addition, the resources to grow, support and educate labor in regenerative practices already exist, the focus of these resources simply must be expanded from the farmer to the laborer as well. In short, this proposal is about using the resources already available to support labor, while sustaining and continuing regenerative practices through research and hands-on volunteer support.

5.2 Next Steps

The way forward proposed in this thesis should be the beginning and not the end of furthering the understanding and level of research surrounding labor in regenerative practices. In this thesis, I have identified the key components of labor and knowledge in the continuation of regenerative agriculture as largely unconsidered in the primary research surrounding these practices. I expected to find these components in regenerative discourse, as based on my personal experience on a regenerative ranch, I understood the struggles that labor can pose. Inspired by my personal experiences and based on a literature review, I have made the case that this missing

component is crucial to regenerative practices. In this paper, I wanted to bring awareness to this issue and the dearth of discourse about it. Another goal was to propose a solution and create a list of next steps. The focus of these next steps is on broadening understanding and support of regenerative practices to include labor. As mentioned above, this change is justified due to the imbalance of focus between farmers and laborers in regenerative discourse. This is represented in the primary literature, as many articles, such as Day and Cramer and Gosnell et al., focus on how and why farmers choose regenerative practices and the issues that they face. This was commonplace in my literature review, with most studies and scholarly articles discussing farmers and only mentioning or not even addressing labor issues. This imbalance of focus and resources is a key point for expansion and further study.

Further study and research should address the dearth of studies and consideration of labor and knowledge in regenerative practices. This would entail bolstering primary research with interviews, case studies, and surveys. If I had more time, the next step would be interviewing practitioners and laborers. Getting data from primary sources by asking specific questions to laborers about their experiences working on regenerative operations would illuminate the pros and cons of these practices for laborers. Questions such as: Did you switch to a regenerative farm from a conventional one, and if so, why, and if not, would you consider it? Could uncover important aspects of why laborers choose or do not choose to work in regenerative agriculture and how these aspects can be used to improve workers' experiences. Interviewing regenerative farmers on the challenges of finding and educating labor is equally important. Data from a wide range of operations could be used to quantify how much of an issue labor and knowledge pose for growers and how this issue affects their operations. In short, if I had more time, I would

engage with primary sources and use them to back up my findings based on personal experiences and my literature review.

The next step for further study and research would be the application of my proposal. The research in the previous step would support the application of my proposal, as it would highlight the importance of understanding labor. Pointing out that focus and research on labor is missing from regenerative literature, as I have done in this paper, combined with primary sourced interviews identifying labor as a challenge for regenerative growers, could be used to widen the focus of support and resources for regenerative practices to include labor. This next step would take these two points and create an argument for their consideration. This argument, bolstered by primary sources, would be sent to farmer focused regenerative organizations such as the Rodale Institute and SARE to advocate for change. Secondly, this argument would be published in regenerative journals to inspire writers and thinkers in regenerative discourse to study the importance of labor in these practices. Overall, regenerative practices require more hands and knowledge, making any next step that shifts focus towards laborers and brings awareness to their issues a way forward.

Regenerative practices and the holistic, nature based methodology they further fill me with hope in the face of a changing climate and world. I often felt this way, walking in a pasture on a sunny day and even hammering a dented pipe in the cold, because I believe that regenerative practices are the way forward. As our world changes, it is time to step into solutions instead of distancing ourselves from them. Regenerative agriculture is a solution, as it creates the way forward for the life-giving process of food and fiber production in a rapidly changing world.

Overall, that is what regenerative practices are about: healing ourselves, our planet, and the people involved in producing the food we all eat. The question I am asking is simple: Who will join me in entering the solution that is regenerative agriculture?

Appendix A

The Dented Pipe

One of the sections of dented pipe I was hammering out. This picture highlights the sprinkler head on the pipe and its size, showing that it would be easier to fix with two people.

Appendix B

Greening Pastures

This pasture has an experimental cover crop packed with pollinator and nitrogen fixing plants. This pasture greened up as a result of this experiment and its organic matter increased.

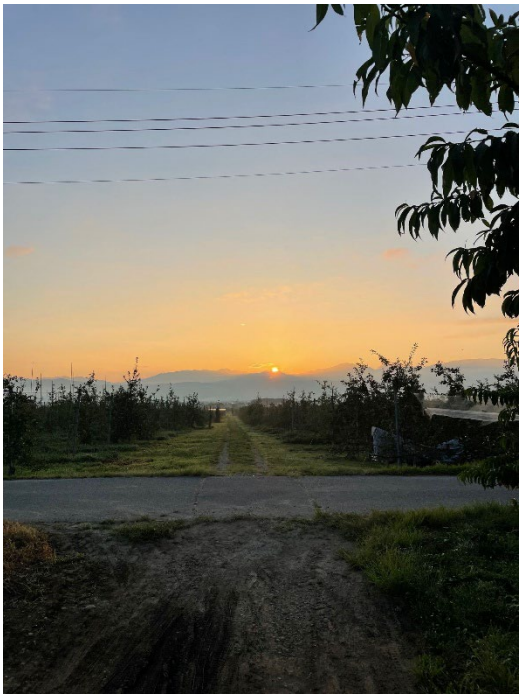
Appendix C

Rotational Grazing at the Ranch

Both pictures were taken as the ranch team and I moved the cattle to a new pasture. My boss, supervisor, and all of the ranch hands would gather to discuss how to move the cattle and the forage quality of the pastures. Moving the herd was difficult, as we needed all hands on deck to corral the cattle and we had to make sure we moved them at the right time.

Appendix D

My Experience WWOOFing



I did the WWOOFing program in the summer of 2024 in Nagano, Japan. It was a wonderful experience working on an orchard picking blueberries and peaches. The owners of the farm took time to teach me organic and ecologically conscious farming techniques. Over my three months on the farm, I learned that the labor myself and other WWOOFers gave to the farm was the reason they could stay in business. Labor was the farm's largest cost, and WWOOFing was a cheap way to find willing workers in a rural area. Both pictures were taken in peach tree orchards while working.

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