
Economically, Ecologically and Socially Balanced

Agriculture Practices

in Northern California and New England

A masters thesis by

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Abstract

Food system stakeholders in the United States are becoming more aware of the ability of agricultural practices to meet what in this paper is referred to as the triple bottom line - economic stability, ecological balance, and social justice. However, the best agricultural practices to achieve this are not well understood or agreed upon by stakeholders. This paper is written in an effort to improve this understanding. I conducted a review of the literature available on existing agricultural practices, and identified diversification to be an essential component of any operation that aimed to achieve the triple bottom line. I explore the specific practices of a collection of farms in Northern California and New England that are considered to be diversified, focusing on their agricultural practices, marketing strategies, and community partnerships. Lastly I analyze the implications of the finding for how the farms are balancing the triple bottom line. I conclude that diversified farming can be an economically stable model, that strives to address ecological issues, and challenges certain cultural norms surrounding American agriculture.

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Part I - Introduction

International trade policies, federal Farm Bill policies and the United State Department of Agriculture (USDA), state agriculture departments, municipal policies, and a multitude of private for and nonprofit organizations all contribute to the American agricultural system. This network has created the most productive and efficient agricultural system in recorded human history. In what has become known as conventional agriculture, agricultural methods generally involve synthesized chemical fertilizer, large planting and harvesting equipment, concentrated animal feeding operations, employment of migrant workers, and mono-cropping. This model of farming, once uniquely American, now predominates globally. By prioritizing a consolidating number of large for-profit farms that can operate on a global scale, the cost per unit of production has decreased. This change is reflected in declining global hunger statistics. ^[8]

However, the negative economic, ecological and social consequences of conventional agriculture are measurable. First, it has become increasingly difficult for farmers who do not operate on this global scale to serve diverse populations. ^[33] Second, American agricultural practices often involve drastic changes to landscapes, and heavy dependence on fossil fuels, chemicals, and hormones, which can threaten the health of both the land and the consumer. ^[90] Third, large populations in the US have poor access to quality agricultural products, leading to some of the poorest health outcomes in the developed world. ^[58] Finally, this system is dependent on migrant workers, who often earn less than minimum wage. In effect, this agricultural labor practice is not working to create living wage jobs for Americans. ^[117]

Recognizing the shortcomings of conventional agriculture, both public and private organizations are supporting alternative methods that positively contribute to the economic, ecological and social welfare of agricultural system. The concept of a triple bottom line - economic stability, ecological balance, and social justice - is employed as an attempt to account for a holistic range of measures for improving

agricultural methods. This thesis intends to inform stakeholders who wish to better understand best agricultural practices, and explore how employing these methods can help balance the triple bottom line.

Part I presents the methodology used in writing this paper, and explores the existing literature on the topic of best agricultural practices and balancing a triple bottom line. Findings from the literature review are categorized as they pertain to economic, ecological and social measures. These findings form the basis of the criterion used to select the farms analyzed in this paper, which includes regionally based and diversified farms. Part II presents the agricultural practices, specifically farm design, soil management, growing practices, animal management, diversity and integration, on each of the selected farms. Then, marketing strategies and community partnerships are discussed. Marketing topics discussed include value added processing, farm stands, additional venues and non-agricultural activities. Municipal, state, federal, private, nonprofit and intra-farm collaborations are considered in a discussion on community partnerships. Part III analyzes the evidence that diversified, regionally-based farms contribute to the economic stability of the farm, improve ecological wellness, and afford a higher standard of working and living conditions for both employees and animals. It is found that the farms researched value community empowerment, and work to build on and contribute to local and regionally based assets. Food system stakeholders can support and advance these practices on municipal, state and federal levels by building land trusts, increasing state farm education, improving upon Supplemental Nutritional Assistance Program (SNAP) benefits, meeting the needs of varying scales of farms. Additionally, consumer investment in farms that utilize best practices is critical to the success of diversified farming.

Methodology

I will begin by conducting a two part literature review. The first part shall examine literature that has sought to evaluate farming practices by ecological, social, and economic measures. From this search, I shall generate a criterion upon which to identify farms. I then gather sources of information published by or about the farm. From these sources, I look for themes on how these farms operate, and discuss the

findings. Lastly, the information observed from the experience of these farms is analyzed based on their performance in balancing a triple bottom line.

Literature Review: Understanding and Identifying Best Agricultural Practices for balancing a triple bottom line.

Introduction

This literature review summarizes research concerning the measures employed to evaluate how agricultural practices contribute to the balancing of a triple bottom line, or their economic, ecological and social impacts. Economic measures include mostly farm profitability, and viability of the practice as a means to earn an income by the farm operator. Ecological measures involve flows of soil nutrients, water and atmospheric effects. Social measures involve the availability of the agricultural products to a range of demographics, and the welfare of the farm workers and animals. I shall begin by searching for articles that employ these evaluative measures. After selecting articles, I describe the evaluative measures, methods, and findings. I then summarize these findings. Lastly, I conclude by selecting criteria by which to search for best practicing farms.

Review Methodology

I initiated this search by selecting online databases from which to conduct the literature review. I selected Google Scholar, and three databases recommended by the Tufts research librarian as sources for agricultural literature: ProQuest Agricultural Journals, Food and Agricultural Organization, Food and Agriculture search database, and Pub-Ag Search. For each database, I found it necessary to customize searches, and select articles deemed relevant to the thesis questions, in that they discuss and analyze agricultural practices and their ecological, economic and social performance. Using Google Scholar, I used the search terms “agriculture practices” AND “United States” in the title of the article, and either one of the terms “measures” or “effects” in the title. This search yielded three results, two of which I deemed relevant to the study. On the ProQuest Agriculture database, I searched for “agriculture practices” AND

“analysis” OR “measures.” I narrowed the search to include only articles with the full text included, peer reviewed entries, and selected agriculture as the subject. This search yielded 46 results, four of which I deemed relevant to the study. On the FAO database, I searched using the term “best agricultural practices.” I narrowed the search to only publications in the United States, and English language prints. This search yielded 25 results, four of which I selected for relevance to my study. On the Pub Ag database, I searched for “best agricultural practices.” I narrowed the search to the articles published in the US, after 2006, and within the category “econometric models.” This search yielded 19 results, five of which I selected.

After reviewing the articles, I noticed that most related primarily to ecological measures, some to economic measures, and only one that worked with social measures. I proceeded to conduct a search specifically to locate more articles attempting to measure social impacts of different agricultural practices. I used the Proquest Agriculture database, and searched “agricultural practices” AND “social outcomes” AND “United States” as key words. I narrowed the search to article subjects “farms” or “humans” or “sustainability.” The search yielded 41 results. I selected five of these articles.

Economics

Paul and Nehring (2004) quantified patterns of farm size and diversity of activities on economic performance of agriculture production. They hypothesize that generally larger, more diversified farms are the most profitable. ^[84]

Scharber and Dancs (2016) examine literature that criticizes regionally based food movements. ^[91] These critics challenge the idea that in order to feed the world, agriculture must be managed and supported predominantly on a global scale. Scharber and Dancs (2016) demonstrate the economic principles that tend to be associated with advocacy for global agriculture, including competitive advantage, scale, trade and efficiency. They identify the shortcomings in the reliance on economic logic, including “a lack of evidence that competitive advantage and economies of scale are as critical to food system progress as

some authors contend, an excess of tradeoff thinking that assumes any cost can be offset by any benefit, a tendency to ignore or downplay costs relative to benefits, a focus on marginal changes to the exclusion of more systemic ones, and a disregard for the role of power in the food system. (p. 127)”^[91]

Ecology

In ecological terms, sustainable agriculture is perhaps the most commonly used phrase in the literature. Pimentel et al. (2011), Hendrickson et al. (2008), and Dalsgaard et al. (1995) all generally assume that sustainability is attained when atmospheric energy flows are stable, which allow biological life, including human life, to flourish.^[21, 50, 83] Hendrickson et al. (2008) defines sustainable agriculture as that which produces an abundance of resources for human consumption, while preserving the balance of ecological energy flows.^[50] Pimentel et al. uses the term ecological service to describe the interaction between sustainable agriculture and ecological balance. They recognize that fundamental biological knowledge, particularly energy flow ecology and soil science is important to understanding the environmental effects of different agricultural practices.^[83]

Another of the most commonly used terms related to ecological agriculture is “integration.” Sulc and Franzluebbers (2014) discusses agroforestry as an integration approach involving trees, which could be for timber, nuts or fruit, forages and other crops, and livestock or other animals.^[105] Paudel et al. (2012, p. 312) describes agroforestry as an “intensive land management deliberately intercropping trees and/or shrubs with crops and/or livestock in spatial or temporal arrangements.”^[82] They also highlight silvopasture as an integrated practice, involving trees and livestock. Alley cropping is another approach, integrating perennials with annuals. Helling et al. (2015) refer to buffer strips as an integrated method.^[48] Pimentel et al. describe the idea of integration to be selective yet inclusive, fusing elements of conventional and organic agricultural practices, evaluation and design technologies, such as Geographical Information Systems, and transgenic technologies when appropriate.^[83]

Literature concerning the management of sustainable farms often advocates for crop rotations. Helling et al. (2015, p. 47) discuss rotational grazing as “a method that utilizes repeating periods of grazing and rest among two or more paddocks or pastures.”^[48] Hendrickson et al., for example describes 2-10 year crop rotations of perennial pasture or hay, with 1-8 years of annual cash crops.^[50] Cover crops and forage crops as components of rotations can involve part season forage crops. Perennial covers can be suppressed, and annuals can be sowed in rotation. (Helling et al.)^[48]

Several fields of study are concerned with sustainable agriculture. The concept of an agroecosystem is referred to by Pimentel et al. (2011) as a view of farms as an ecosystem, part of a macrosystem, while consisting of many microsystems.^[83] Lovell et al. (2008, p. 328) discuss agroecology as a field developed in response to conventional agriculture.^[62] Similarly, permaculture is a set of design and decision making principles by which a growing body of knowledge has been practiced (Pimentel et. al).^[83] In all three fields, sustainability through integration is a central theme, and draw on indigenous and traditional wisdom. (Berkes et al (2000), and Stinner et al. (1989)).^[11, 97]

Scholars have used a number of methods to evaluate the environmental impact of different agricultural practices. Dale and Polaski (2006) explore methods to measure the impacts of agricultural practice on ecosystem services.^[20] They note that water quality, pollution, nutrient cycling, soil retention, carbon sequestration and biodiversity conservation are all measurable ecosystem services. They seek to build on this body of statistics by presenting a framework in which indicators can be interpreted. They explore a number of conceptual models and criteria for identifying best farming practices. They conclude that these ecosystem indicators can help target key environmental problems and opportunities for improvement across broad agricultural scales. Pimentel et al. (2011) looks into measures such as the percentage of photosynthesis products appropriated by humans, organic matter quantity, available water quantity and quality, nitrogen availability, and full spectrum biodiversity to identify sustainable agriculture.^[83] Hendrickson et al. outline a hierarchy to identify sustainable agriculture, beginning with agricultural

systems involved in two or fewer crops, increasingly involving greater biodiversity, integration, and precise management. ^[50] Dalsgaard et al. (1995) ranked farming practices based on the diversity in terms of number of species, the degree of by-product reuse, the productive ability to sustain environmental perturbations, and the capacity to produce resources. ^[21]

Chapter 14 of the FAO's World's Soil Resource report (2015) gives a detailed review of the measures for soil quality utilized in the United States. ^[31] They discuss how soil threats such as acidification, contamination, salinization, sealing and capping, compaction, waterlogging, erosion, nutrient imbalances, soil organic carbon changes and decreasing soil biodiversity are caused and/or measured. FAO (2015) discusses specific cases of soils being threatened, and the mitigation strategies imparted. ^[31] They chart a summary of soil threat status, trends and uncertainties in North America, and conclude that overall, significant progress has been made in recent years to reduce threats to soil in the United States. Action taken by farmers has contributed to this progress, particularly in their decreased use of tillage. However, nitrogen spill off from farms into waterways continues to be a threat throughout the US.

The literature in this review discusses a number of strategies used in agriculture practice that have been found to be ecologically beneficial. Pimentel et al. (2011) show that perennial root systems, and their high biomass production are key elements to retaining topsoil and nitrogen, as well as having other ecological buffering effects. ^[83] Paudel et al. (2012) found that perennial buffers, and silvopasture techniques maintained higher water retention, and soil microbial activity more consistently than where only annuals are planted. ^[82] Additionally, Helling et al. (2015, p. 886) contend that "perennial buffer strips help keep sediment, nutrients, agricultural inputs, and other pollutants from entering water bodies and reduce nutrients in shallow subsurface water flows. ^[48] In addition, they provide food and habitat for wildlife, lower local water temperatures, slow flood flows, reduce erosion, and produce economic timber or wood fiber products." Farmers surveyed by Ogunlana et. al (2006, p. 131) testified that alley cropping can increase yields, and swales reduce soil erosion and runoff. ^[78] Magdoff (2009) states that effective management strategies to improve the physical condition and nutrient availability in soil included the use

of cover crops, crop rotations, animal manure application, compost application and reduced tillage. [64] Helling et al. (2015, p. 884) cites the benefits of planting cover crops as “reduced erosion, increased soil organic matter, captured and recycled nutrients in the soil, increased biodiversity, suppressed weeds, managed soil moisture, and minimized and reduced soil compaction. Utilizing legume cover crops also promotes biological nutrient fixation that reduces energy use and decreases reliance on nitrogen fertilizers.” [48]

Some scholars have employed ranking systems to compare the ecological benefit of different agricultural systems. The criterion employed by Dalsgaard et al. (1995) rates methods related to conventional agriculture lowest, while scoring more integrated and diversified systems highest, due to increased stability under acute environmental stress, and the capacity to retain biomass and nitrogen. [21] Sulc and Franzluebbbers (2014, p. 22) reviewed the integration of animals and crops as a potential solution to environmental consequences such as “water quality, reduced groundwater supplies, depletion of soil organic matter, and excessive soil erosion, decreasing sedimentation of reservoirs and eutrophication of surface and marine waters.” [105] Ng et al. (2008) evaluate slope based hedgerows as a way to reduce runoff generation and to intercept eroded sediment from the upper slope so that soil fertility can be conserved. [76] Additionally, they contend that hedgerows can be pruned two to three times a year, adding green manure so that less external nutrient input is required. However, each study recognizes that to derive ecological benefits from these approaches, a high degree of managerial commitment is necessary.

Society

A hypothesis discussed in the literature is that globally based, industrial agriculture contributes to the disconnection of communities from their food, but also works against a broader sense of community. On the other hand, regionally based agriculture is seen to play an integral role in building community bonds. Obach and Tobin (2014) examine the extent to which community-based agricultural markets are associated with connection to community, volunteerism and civic and political activities. [77] They use the

term civic agriculture to represent this hypothesis. Civic agriculture participants are defined as Community Supported Agriculture (CSA) shareholders, shoppers at independent health food stores and cooperatives, and farmers market patrons. They found that those engaged in civic agriculture were more likely to be involved in local politics, and demonstrate higher levels of volunteerism than the general population.

However, scholars recognize that barriers exist in accessing these community based markets. Farmer et. al (2014) also surveyed community based agriculture consumers. ^[33] They found that participants are motivated by purported environmental and nutritional outcomes. They also identified a number of privilege variables associated with participation in farmers markets and CSA's. They conclude that though these venues often intend to reduce food insecurity, many people are financially unable to participate. Others have looked inversely at how individual and community determinants affect farm family well-being.

Arbuckle and Kast (2012) utilize a multilevel modeling approach to examine determinants of subjective quality of life for farm families. ^[8] Their findings support the notion that higher household income and community vitality improves farm family quality of life. Conversely, higher individual stress and economic dependence on farming is associated with lower quality of life. They conclude that increased investments in community development efforts are critical to farmer quality of life.

Some scholars have identified contrasts in language used to describe conventional agricultural practices with more ethically and ecologically considerate practices. Sanford (2010, p. 283) attests that social and health consequences have resulted from the environmental degradation brought on by industrial agriculture. ^[90] She recognizes that agriculture standards must be reevaluated, but that alternative concepts and practices are not being fully articulated in environmental discourse. She draws on cognitive theory to illustrate how language structures thought, and influences practice. She demonstrates how language associated with industrial agriculture pits dynamic man with machine as separate from a passive earth.

Alternative agricultural methods, such as organic agriculture, agroecology and ecological agriculture, tend to emphasize language that exclaims an interdependent relationship between man and earth. She concludes that discourse in agricultural practice has ethical implications, and the language used will determine which practices are conventionally accepted and supported.

Other social distinctions between the way US agriculture has been conventionally practiced, and a more just future for agriculture are being explored academically. Issues of gender and race discrimination have been widely recognized. Keller (2014) explores the challenges faced by women farmers in the US.^[56] Through interviews with farm operating women, the institutional, interactional, and symbolic obstacles faced are expressed. She notes of the insistence on the title of “farmer” as the core symbolic contest against traditionally gender normative labeling of farm women.

The scale of the migration patterns associated with US agriculture is widely discussed in the literature. Zahnister et al. (2011) explores the market for immigrant workers in US agriculture.^[117] They discuss the implications for having about half of all hired agricultural workers in the US as non-citizens, mostly from Mexico. They note that these workers are hired mostly in conventional agriculture systems that cannot be mechanized, such as certain fruit and vegetable harvesting. They demonstrate how large scale farm operators benefit economically from increases in H-2A permits granted, and thus have a stake in promoting further expansion of the program. Meanwhile, the economic welfare of these migrant workers decreases with the expansion of the program. In order to mitigate this loss in migrant welfare, the authors suggest that the viability of hiring US residents in agriculture can be increased by supporting farmer education and training, and authorizing insurance programs for farm workers.

Lastly, it is recognized in the literature that African Americans are underrepresented in US agriculture, trailing a legacy of racist agriculture policies and practice. Gilbert and Sharp (2002) focus on the the loss of black owned farms and farmland in the United States.^[41] Others such as Larson et al. (2009) explore

statistics that show how people of color are less likely access quality food, suggesting that these populations are far less represented as consumers of regionally produced food. [58]

Criteria Formulation

Due to the lack of a standard measure for identifying best practices, and the necessity in this case to select farms, I developed criteria. Much of the research measures environmental factors, so I shall use these findings as the starting point for formulating criteria. Though not mentioned in the literature, I notice that all types of agricultural produce can be categorized as annual or perennial crops, or livestock products. The majority of human and livestock calories are derived from annual crops. (60, 83] Annuals offer nutrition while stabilizing the soil and atmospheric gases. Animals also offer human nutrition, as well as nutrition for plants. When these are raised independently, as they often are in conventional agriculture, they contribute to an ecologically unbalanced system. Water, air and soil quality decrease. As a result, in order to maintain productivity, the use of environmentally taxing inputs, such as chemical fertilizers, pesticides, growth hormones for animals and dependence on fossil fuels increases. In contrast, the literature suggests that the effect of diversifying and integrating these three categories of species in an agricultural landscape can contribute to more stable ecological measures, and be less dependent on taxing inputs. Thus, I will standardize the search to target farms that agriculturally produce or raise products from annuals, perennials and animals for human consumption.

Given the regional nature of these farming practices, it is necessary to define a search area. I selected California and New England to begin the search, as these are places in which I am a regional stakeholder, having resided in these locations. I eventually narrowed this search further, due to the availability of data, to the San Francisco Bay area, Connecticut, Massachusetts, and Maine. I searched for farms within this region that raised or produced, and sold products from annuals, perennials and animals. I located 21 farming businesses that qualified under these search terms, and for which a significant amount of data existed. Additionally, I chose to include the Permaculture Artisans, a landscaping firm who designs and

develops diversified farms. Here is a list of farms included in the study, principal operators name, and location:

Table 1. Farm and operator name and location

Farm Name	Farm Operators	Farm Operators	Farm Operators	Location
Shamrock Green	Mick McGuire			Richmond, Me
Alewife's Brook	Jodie Jordan	Caitlin Jordan		Cape Elizabeth, Me
Goranson	Jan Goranson	Rob Johanson	Carl Johanson	Dresdon, Me
Emery Family	Leigh Emory	Timothy Buckelaw	Wesley Buckelaw	Westborough, Ma
Meadow Mist	Lauren Yaffee	John Moriaty		Lexington, Ma
Springdell	Paula Cruz	Jaimie Cruz		Littleton, Ma
Many Hands	Julie Rawson	Jack Kittredge		Barre, Ma
Tendercrop	Matt Kozazcki			Newbury, Ma
Crabapple	Tevis and Rachel Robertson-Goldberg			Chesterfield, Ma
Spring Brook	Frank Matheson Jr.			Littleton, Ma
Studio	Dorothy and Richard Wingate			Voluntown, Ct
Anderson Acres	Ronald and Michele Saltz			Kent, Ct
The Hickories	Dina Brewster			Ridgefield, Ct
Clover Nook	Deborah and Eric Demander		Lars Demander	Bethany, Ct
Stone Gardens	Fred and Stacia Monahan			Shelton, Ct
Noci Sonoma	Adjani and Aria Alpert			Healdsburg, Ca
Gospel Flats	Mickey Murch	Sara Hake	Don Murch	Bolinas, Ca
Eatwell	Nigel and Lorraine Walker			Dixon, Ca
Lockewood Acres	Ben Lyons	Denise Lyons	Emily Parsons	Vacaville, Ca
Everett Family	Rich and Laura Everett			Soquel, Ca
Fogline	Bruce Manildi	Caleb Barron		Soquel, Ca

Source: Author

For each farm, I performed a Google Search using the farms name and location. I collected links from the first twenty search results. I then examined each site, and extracted information that related to the farms products and practices, as well as statements made by the farm operators, or content written about the farm. The most pertinent information came from Facebook, Youtube

and Vimeo, blogs, farm websites, farm profiles and newspaper articles. Facebook posts give a timeline by which to observe the activities and seasonal nature of farm operations. The photographs are also rich sources of information. Some farms posted infrequently, a few times per year. Other farms posted nearly every day. YouTube and Vimeo video sources are sparser than Facebook sources, but they are richer in detail. The videos sourced range from short, non-narrated clips to full feature documentations. Most farms have websites, and most of these websites include substantial amounts of photographs and text. These farms have been featured in newspaper and blog articles as well. Note that the majority of the information from these sources is self-reported by the farmers.

Part II - The Triple Bottom Line

There is little data that directly quantifies the economic, ecological or social impact that these farms are having, or their performance in these three categories from the data gathered. However, there is a large quantity of information that describes the experiences of these farms, and the strategies they use to conduct diversified, regionally based agriculture. The information available in the sources can be generally categorized as farm history, mission statements, agricultural practices, market strategies and organizational partnerships. In the first section I explore information found regarding agricultural practices. In the second section, I discuss marketing venues utilized by farmers, and the types of organizational partnerships they form. Together, these sections detail the activities that are essential to operating a diversified, regionally based farm.

Agricultural Practices

Firstly in Part II, I shall discuss the information found regarding agricultural practices on the farms. Information is categorized as history, layout and design, soil management, growing practices, animal management, and diversity and integration.

History

By exploring the history of the farms selected for this thesis project, the reason for their current operations to involve diversification becomes clear. Below is the list of farms, and related dates of significance.

Table 2. Notable Farm Dates

	Farm Founded	Farm Continuously farmed since	Family operated since	Currents Manager began	Land first farmed
Shamrock Green					
Alewife's Brook	1957				
Goranson	1970		1985		
Emery Family	1901				
Meadow Mist	1987				
Springdell	1931	1931	1931	1981	1781
Many Hands	1982			1982	
Tendercrop	1986			1986	1613
Crabapple	2003				
Spring Brook		1713	1713		
Studio	1901		1963	1992	1753
Anderson Acres	1903			2011	
The Hickories			1936		1760
Clovernook	1765		1765	1988	
Stone Gardens	1998			1998	
Noci Sonoma	2013			2013	
Gospel Flats	1980	1980	1980	1980	
Eatwell	1997		1997	1997	
Lockewood Acres	2010		2010	2010	
Everett Family	2001		2001	2001	1890
Fogline	1905		1905		

Source: Author

As the graph shows, the age of these farms varies. Some farms have been in agricultural production since Europeans began occupying the land. One of Tendercrop Farms' properties was first brought into agricultural production soon after it was granted from King Charles II in 1613 to the Tuttle family. Some of these lands have been owned and worked by the same families for many generations. The land title for Spring Brook Farm was conveyed to the current owners' ancestors in 1714, while Clovernook began in 1765. Most of the pre-industrial farms were operated primarily as subsistence farms for familial needs.

Beginning after the turn of the century, a shift toward crop specialization and wholesale is noted. Manaldi Ranch, later Fogline Farm became active in agriculture in 1905 by the Manildi brothers, who timbered the plot, then grew fruits to sell in Santa Cruz by a wholesaler. In 1957, the Jordan's purchased land, and formed Alewife's Brook Farm. During the sixties into the seventies, the farm sold mostly cabbage, lettuce, and squash for wholesale to Hannaford, Carr Brothers, and other large local retailers. Beginning in the 1970's, the farms studied began to diversify, both in terms of what they raised and grew, and in their marketing strategies. After struggling in rice production, Don Birch of Gospel Flat farm switched to growing vegetables, and pulling crabs. When Paula Cruz took over Springdell Farm in the 1980's, she shifted away from wholesale, bolstered the farmstand, and diversified her animal and crop production. All of the newer farms in this study prioritized diverse production and marketing from the onset. The Everett family began their farm with the intent to adhere to agroecological principles, diversification being a key focus. Today, each of these farms share in practicing diversified agriculture.

Layout and Design

The spatial organization of the farms in this study is an important aspect in understanding how these farms organize activities as part of a diversified agricultural scheme. It is noteworthy to observe the range in the size of these farms:

Table 3. Farm Acreage

Farm Name	Acres in crop production	Cover/pasture	Total acres in agricultural use	Notes
Shamrock Green	2			
Alewife's Brook			90	
Goranson	40	12		8 in potatoes, 6 sweet corn, 10 diversified vegetables, 12 rotation cover crops
Emery Family			10	
Meadow Mist			6	
Springdell			65	
Many Hands				
Tendercrop			700	3 properties
Crabapple			185	35 actively farmed mostly pasture, 70 open, the rest wetland and forest
Spring Brook			400	
Studio	54		252	3 properties
Anderson Acres			240	
The Hickories	32	32	32	
Clover Nook	50			
Stone Gardens			24	
Noci Sonoma		6		
Gospel Flats	10	17	105	about ten acres total cultivated ground, 17 managed. four different leases
Eatwell			100	
Lockewood Acres			45	
Everett Family	50		838	
Fogline				

Source: Author

There is a distinction between total acres owned, total land in cover crop and pasture production, and total land in agricultural production. Information specifying the amount and uses of land on farms are not

available for all farms. From the list of farms examined, five are under 10 acres, eight are between 10 and 100 acres, and seven are over 100 acres. Two of the farms are over 700 acres. However, in several cases for farms over 100 acres, significant portions of land are preserved, and not active in agriculture. As stated by several farms, most of the land in agriculture is used primarily for pasture or cover crops.

The design of the built components of the farm are explained in the data sources. Most of these farms have a barn, though the size, purpose and functionality varies. Despite the lack of text to describe the barns, there are many photographs of the barn structures. In nearly all cases, the barn serves as the shelter for the animals, and often store hay and other crops. For instance, Crabapple farm explains “Vegetables are washed, packed, and stored for the winter in our soon-to-be solar-powered packinghouse barn. We use a walk-in cooler with passive root cellar cooling technology. Produce is cooled rapidly in ice-cold water to guarantee our customers receive the highest quality field-fresh vegetables.”^[16]

Moveable chicken houses, or chicken tractors, are widely used among the farmers examined. Anderson Acres and Meadow Mist are just two examples of farms that have used them.^[5, 71] Mobile chicken houses are said to be the standard answer to enabling chickens to feed themselves. Unimpressed with the aesthetics of available chicken tractors, Adjani of Noci Sonoma set out to design his own. The design process is described in his blog.^[75]

Greenhouses are almost universally used on New England farms researched, while some of the California farms have greenhouses. New England farmers praise the greenhouse for extending the growing season, which increases farm profits, and offers nutritional benefits to costumers through the colder months. The growing season extension allows farmers to both grow crops that they otherwise would not be able to, and to grow in succession by planting different crops in the same space at different times in the season, thereby increasing output. Emery Family Farm filmed their greenhouse installation process from beginning to end.^[13] They purchased a kit for self-installation. The video addresses several installation considerations such as materials, structural integrity, and labor requirements. The Wingate’s of Studio

Farm state that “the greenhouse is a life-saver to get seedlings started, while mitigating weather variability that can determine yields.”^[105] They state that “the greenhouse is abuzz from mid-February through May.” Tendercrop Farm notes that their greenhouse is active year round.^[107] In addition to their outdoor greenhouse, Anderson Acres has an indoor, grow-light greenhouse.^[5] The Hickories has a mobile greenhouse, built on a track.^[2]

Other season extension methods such as cover rows, or hooped low tunnels are used. Goranson Farm and Many Hands Farm utilize this technique.^[43, 65] Spring Brook Farm uses a greenhouse inside of a greenhouse to grow greens year round.^[93] Similarly, Shamrock Green Farm grows spinach year round despite being located in hardiness zone 5, by covering in high tunnels within greenhouses.^[70] Anderson Acres has also used low tunnels inside of high tunnels to keep greens through the winter.^[4]

The types of machinery and tools used on the farms varies, as does the degree to which machines are used. Larger scale vegetable producers tend to use more machinery. The tractor was the most common and complex machine discussed. Goranson farm managers express the constant push to become more efficient and scale up using farm equipment.^[43] They benefit from having Rob’s mechanical savvy. They have a greenhouse full of tractor attachments and other equipment. In the “Getting Farmed” storyboard, they show videos of their carrot harvester in use.^[37] They attest that this recent purchase completed what took hours of uncomfortable work in minutes. However, there was a learning curve. It took a few trials to figure out how to best utilize the machine. Meadow Mist utilizes tractors to pull plows, and has several attachment options.^[71] A video by The Hickories demonstrates how they prepare beds for potatoes by utilizing an attachment machine on their tractor that forms a hilled bed, and also lays down black plastic over the bed.^[82]

Information on irrigation systems were not well documented by the farms. However, examples of how farms interacted with and utilized water is mentioned, more often by California farms. The Lyons’s of

Lockewood Acres recognized that their water table was static at only 18 inches below the surface when they purchased the land, so they have prioritized care for their water supply. ^[61]

The Permaculture Artisans have carried out many water related projects. They utilize key line planning, which they describe as a broad acre design strategy, founded by P.A. Yeomans in the 1930s. ^[87] “The intention is to develop drought proof, water abundant landscapes and farms. Water is spread and sunk by moving it from existing collection points to new collection points, or from where water naturally concentrates to dry ridges and corners. Yeoman invented a plow that created distribution paths for the water with minimal disturbance to the soil. The furrows created by keyline plows infiltrate water, increase oxygen in the soil and boost plant root depth and development. This facilitates the movement of water to be stored higher on a landscape with a gravity fed system. Natural water collection and distribution areas become the driving force behind site layout and phased planning, allowing the land manager to reduce the need for irrigation and protect vital soil biology.” The Permaculture Artisans explain that their signature approach to water management “ensures that every drop of water is optimally used, while respecting the overall health of the watershed.” They have two decades of experience in designing and building systems that “meet the on-site water needs of clients, while supporting a healthy hydrological balance.” They also discuss water catchment design and explain that a 2000 square foot roof could catch nearly 30,000 gallons of water every year with 24 inches of rain in the year. They also state that storing rainwater prevents it from overcharging storm water runoff systems and bringing pollution and sediments to waterways. Designing and building roof water catchment and storage systems help make the most of water resources. They also install greywater systems, which take gently used water and recycle it for irrigation. Designing larger scale water filtration terrace and swale systems are also used. They repeat their water mantra, which is to “spread it and sink it,” as opposed to letting it runoff the property. ^[87]

Some of these farms have recently, or are currently involved in designing and building their farm structures. The Permaculture Artisans describe their standard permaculture design process. ^[87] It begins with a design consultation. They then send a design proposal which includes a base map, a conceptual

master plan, a plant list, zone map, and scheduled meetings. Next they conduct a land assessment and site analysis, observing energy flows, soil types and human access needs. Then the design team creates a conceptual master plan for the project using Computer Aided Design software, and present a scale drawing of the proposed landscape. Upon approval, the installation begins. ^[87]

The process of putting an old dairy property back into production is explained by the Wingate's. ^[104] They repaired a leaky barn roof, planted corn, and cleared brush from along the fence lines. Anderson Acres expanded last year by purchasing a new tractor, and opening and preparing a new field. ^[4] A few years back, when they purchased the land, they developed plans. Ron Saltz states that their goal was to turn the property into "a permaculture farm that makes the most of its soils and geography. It is too soon to say just what that will look like, but an initial vision would be to return it to some of the pre-colonial ecology: chestnut trees, fruit trees, berry bushes, and mushrooms. We are working with an integrative design firm, Regenesi, to create a schematic design for the property. Right now we are in the discovery phase, meaning everything is a 'sketch.'" ^[12]

Noci Sonoma is operational, but "will be in construction and design mode for the next few years." ^[75] They describe development activities on their blog. In the summer of 2015, they began planting their first crops, and designing their first garden. "We have been spending the days and nights designing, hiring, planting, and redesigning. The buildings are designed and the permitting process has begun with the county. The 15 gardens are laid out and cut into the ground, and several of the fields have already been planted. The new sheep home is built, as is the chicken home. One mile of deer fence and one mile of water piping are installed; 400 chickens have begun to lay eggs, producing 10 cartons per day. 16 pigs are grazing." In late August, they stated that the market garden was almost complete, and they were working on a fence for the front of the property and planting trees. They had been watering with sprinklers, but hoped to soon have drip irrigation. Ninety percent of the watering was taking place at night. The irrigation saves him a lot of time and water. In later blog posts, design considerations and plans for the fences and other structural elements are explained. ^[75]

The farms in this study utilize a range of strategies to maximize space. Whether they diversify intentionally, or in order to best take advantage of their landscape, the design and layout of their farms has implications for their financial success, as well as to meet self-imposed ecological standards, and to maximize the quality of life for their animals, and themselves as farm operators.

Soil Management

Rich information has been published by the farmers concerning their plans for managing the soil. Farmers state that the quality of the soil is essential to balancing a triple bottom line. They believe that the quality of their soil affects the nutrition and attractiveness of the produce at the market, and the ecology of their land.

Some farmers express that they have been fortunate enough to inherit quality soil. Rob Johanson of Goranson Farm believes he is farming some of the best farmland in Maine. ^[43] Nigel Walker of Eatwell Farm also praises the quality of the Central Valley soil he works. ^[24]

Most farmers are continually adding beneficial components to their soil, and have come up with a variety of ways to acquire those components. Noci Sonoma has advertised for compost. ^[75] They started a program to collect food scraps, meat and manure to recycle. Tendercrop farm invites neighbors to dispose of their Christmas trees on the farm, and then hosts a bonfire, and uses the biochar as fertilizer. ^[106] Julie Rawson and Jack Kittredge of Many Hands Farm honor the natural process of recycling of nutrients through decomposition, as they focus strongly on biological practices that prioritize proper soil mineralization and microbial health. ^[66] They use rock powders, vegetable meals, crop rotation, heavy mulches from their own hay, wood chips, corrugated cardboard, cover crops and animals in rotation with vegetables and fruits. Solarized beds with sheets of plastic are used, which kills weed seeds. They use brassica that has been wintered-over to aid in soil prep. When brassica roots are pulled out in the spring, an aerated soil is left behind. They will also upgrade their cover cropping practices with more in season

use of cover crop cocktails. This seed mix will include 10 or more species such as clover, sown in the pathways as an understory for brassicas, corn and other large or transplanted crops. They have been using tests and enhanced observation to determine the fertility needs. They work closely with their son, his wife and their Nutrient Density Supply Company. They associate the quality of their soil with the extended shelf life, stronger color and texture, and higher yields they have experienced with their crops. ^[66]

Tevis and Rachel Robertson-Goldberg of Crabapple Farm exclaim “compost is at the very heart of our farm. ^[16] Sinking our hands into a steaming windrow of compost in winter recharges my spirit – it’s the circle of life! We are lucky to be a popular drop-off site for line-clearing crew trucks and landscapers looking to unload leaves. We do not accept garden waste which may have trace herbicides, or leaves cleared from parking lots that may carry automotive fluids. Manure comes from our livestock and from other local farms that do not have the time or space for composting on their own. They also mention that CSA members are welcome to bring their household compost on pick-up days and we will return it to the land from which it came. They manage compost according to organic standards, allowing it to reach temperatures above 145 degrees, to kill off pathogens and weed seeds. They turn it every week or two, seasonally dependent, to keep the microbes working, resulting in a clean and rich product with which to fertilize their plantings. In addition to producing their own fertility on the farm, they use cover crops, conservation tillage techniques, and plantings attractive to beneficial wildlife with the intent to stimulate the local ecology and sequester atmospheric carbon. ^[16]

Jack Kittredge has written a paper published by the Northeast Organic Farmers and Gardeners Association (NOFA) titled “Soil Restoration, can biology do the job?” in which he discusses the issue of greenhouse gas emissions in relation to farming practices. ^[57] He details the basic components of soil, and how they interact during farming activities. He proposes that soil carbon can be stabilized by keeping soil planted, minimizing tillage, using cover crops, diversifying species, using crop rotations and avoiding chemicals. He discusses pasture, forest, and water management, as well as the use of biochar, crop selection and fungal considerations.

Eatwell Farms discusses their soil and growing practices: “We build our silty clay loam with compost cover crops double in gypsum. Animals are rotated through pastures. We use drip irrigation rows and sprinklers.”^[24] They use hand and machine cultivation, as well as intercropping, crop rotation and soil solarization for weed management.

A no-till approach is utilized on Many Hands Farm: “Our winter work brings us outside several days a week to prepare beds for the coming growing season. In our efforts to move to a no-till system we are covering beds with layers of cardboard, leaves/hay/or wood-chips, and IMO compost (indigenous micro-organisms). A backpack sprayer, which holds about 80 pounds, is used to spray a microbial drench to help break down the cardboard on beds covered last week as we begin to cover the next 3 beds in the field. As long as the weather permits, and we can keep up our cardboard supply, we'll continue to prepare beds in this way for spring planting.”^[66] They state that they reduce their carbon footprint on the farm by striving to make as many of their own soil amendments as possible. “Today we finished our last bin of farm-made worm castings, which we spread on the field prior to planting. Soon we will get another truckload of manure from neighbors Robinson Farm (an organic raw milk dairy), add some more worms, and wait for them to turn the manure into rich worm casting gold for our soil and plants.”^[65]

Many other variations of these techniques are used by the farms to manage and improve the quality of their soil. In summary, these activities involve a consideration for balanced macronutrient, micronutrient and microbiological components.

Growing Practices

The farms in this study express a high degree of transparency regarding their methods for growing crops and raising animals. These growing practices involve complex planning schemes to manage diversified production.

As noted by Springdell Farm, late December to early January is the time to plan for the following year's crop placement and rotation. ^[95] Their website details their seed selection process. ^[52] Studio Farm grows from certified organic seed and seedlings. ^[104] Many Hands Farm favors certified organic and open pollinated seeds, because of their higher capacity to grow strong rooting systems and thus enhance their genetic potential. ^[66] None of the farms mentioned the use GMO seeds. Crabapple Farm grows many heirloom varieties, selected for their adaptedness to their local climate. ^[16] They save their own seed from several crops and are breeding some of their own varieties. Gospel Flat Farm operators state that "planting a year of vegetables is a multidimensional puzzle, requiring awareness of the soil types, demand of products, plant spacing, days until maturity, weather patterns and the efficiency of cultivation and harvest." ^[46]

Farmers share their considerations when growing specific crops. Shamrock Green and Anderson Acres focus much of their efforts on producing a tomato crop, for instance. ^[4, 70] Goranson Farm focuses on winter storage crops, primarily potatoes, but also carrots, beets, alliums and gourds. They operated with 36 total tillable acres, of which eight acres are in potatoes, six in sweet corn and ten in diversified vegetables. They had 12 acres in rotation cover crops and green manure. ^[80] Succession planting is mentioned to be utilized on some farms, such as on Meadow Mist Farm. ^[71] These farms also managed a range of fruit-bearing shrubs and trees:

Table 4. Fruiting shrubs grown on the farm

	strawberry	grape	blueberry	black currant	raspberry	blackberry	nursery
Shamrock Green	x		x				
Alewife's Brook	x		x		x		
Goranson	x				x		
Emery Family	x	x	x		x	x	
Meadow Mist	x	x	x		x		
Springdell	x		x		x	x	
Many Hands	x	x			x		
Tendercrop	x		x		x		x
Crabapple	x		x		x		
Spring Brook	x	x			x		x
Studio	x		x		x		
Anderson Acres							x
The Hickories	x	x	x	x	x		x
Clover Nook	x				x		x
Stone Gardens			x				
Noci Sonoma							
Gospel Flats							
Eatwell	x	x					
Lockewood Acres		x					
Everett Family	x				x		
Fogline	x	x					
	76%	29%	43%	5%	57%	10%	16%

Source: Author

Table 5. Fruit trees grown on the farm

	apple	peach	Nectarine	plum	pear	citrus	maple	other
Shamrock Green	x							
Alewife's Brook	x							
Goranson							X	
Emery Family	x	x						
Meadow Mist	x	x						
Springdell	x							cherry
Many Hands	x	x			x			
Tendercrop	x	x	x					
Crabapple	x				x			
Spring Brook								
Studio		x			x			
Anderson Acres	x				x			
The Hickories	x	x					X	
Clover Nook								
Stone Gardens	x	x		x	x			
Noci Sonoma								
Gospel Flats	x							
Eatwell		x	x	x		x		banana, pomelo
Lockewood Acres	x	x	x	x	x	orange, mandarin, grapefruit, lemon, lime, guava		fig, pluot, persimmon, pomegranate, almond
Everett Family	x			x		lemon		persimmons
Fogline	x							
	62%	38%	18%	20%	29%	15%	10%	

Source: Author

Information on orchard production was not prevalent from farm data. Tendercrop Farm is in the process of planting trees, and restoring an old orchard on their newly purchased property. ^[107] Many Hands Farm shares how they planted two dozen apple trees in 1980, which are now fully productive. ^[66] Of these there are a dozen or more different heritage varieties. They state that last year was an exceptional year for apples.

The Permaculture Artisans discuss their “edible landscape design.” ^[87] They set out to build “resilient and abundant forests of food with varieties of sizes, harvest times, textures, flavors, colors, functions and life spans.” They integrate these edible plants with the hardscapes, water features and other aspects of the landscape. They also discuss their sustainable forestry and tree work. They can “help counter trends in the area of declining forests and soil erosion by employing techniques that mimic the beneficial disturbances observed in pristine forest ecosystems.” Their forest management plans include strategies for “managing biomass, the forestry understory, shaded fuel breaks, multigenerational stands and the canopy.” ^[87] They explain the “benefits of regenerative forestry, including increasing plant and wildlife biodiversity, decreasing fire risk due to reduced fuel load, increasing nutrients available to flora through rapid soil building, proliferation of beneficial fungal growth, increased water absorption, better access to recreational activities and mitigation of erosion.” They discuss their forest management methods, including “selective logging, which can increase overall health of the landscape.” They select dominant trees in a landscape to harvest. They have milling equipment that they can bring to properties to transform trees into usable lumber. ^[87]

Pest Management strategies range amongst the farms, though an integrated pest management approach was mentioned by several farms. Many farms, like Meadow Mist, do not use any insecticides, herbicides or fungicides. ^[115] Likewise, Studio Farms does not use any pesticides on their vegetables. ^[104] Several farms, such as Stone Gardens, mention their use of an integrated pest management approach that aims to mitigate the losses of crops by prioritizing the least invasive methods first. ^[100] Spring Brook does not use herbicides and employs integrated pest management strategies. ^[94] Eatwell Farms describes their

management of pests on peach trees. ^[25] They have trained three staff to prune the trees, which they say is an art and a science. They start by removing any disease, then move on to crowded areas, where branches will shade each other out. An open goblet shaped tree is preferred, so inward-facing branches are removed to let light and air in. This helps with disease control as well as ripening the inner fruit. As soon as the buds start to swell to a popcorn stage, they spray with raw milk that has been allowed to sour. This floods three buds with bacteria, which crowd out the two main diseases: botrytis and peach leaf curl. They tried the technique for the first time last year during flowering and it resulted in their best crop ever. This year they will apply raw milk three times during the season. ^[25] At Crabapple Farm, pest damage is minimized by growing healthy crops less attractive to hungry insects, trapping insect pests, and companion planting. ^[16] “When needed, we apply organic-approved plant or mineral based pesticides. We use trap crops and minimal spraying at the appropriate point in the pest life-cycle to have maximum impact.” Eatwell Farms conducts population monitoring, release of beneficial insects, habitat creation for beneficial insects, pheromone disruption, application of certified organic pesticides, and the use of resistant varieties for pest management. ^[25]

The variability of farming due to disease is expressed in the film *Uncertain Harvest*. ^[44] The film captures Goranson Farm in 2012, as heavy rains fell in June. Several of their crops, most notably their strawberries and potatoes suffered. Rob explains “these potatoes amount to about 30% of our income in a year's time, so it's really a critical crop for us, and certainly if the late blight gets in here and we lose control of it, these fields could go down in a week or two. This blight is an amazingly devastating disease. We're now scouting the field extensively, and I'll start a pretty rigorous spray program. As organic growers, there aren't many effective spray materials, but we'll try a couple. We'll use a tractor mounted spray machine.” In a scene filmed in the fall, the crew sifts through the soil. The potato crop was hit hard by blight, and yielded a low quantity and quality.

The farms mentioned in this section adhere to growing practices that meet some level of self-imposed ecological standards, though arguably cheaper and easier methods exist. This decision expresses their view that the economic bottom line is not supreme.

Animal Management

Animal raising practices were detailed in great breadth and depth in the sources. Though the scale, purpose, and approaches varied between farms, a few generalizations can be drawn. These farmers raise animals for economic means, but they are equally concerned for health and well-being of their animals.

The seasonal nature of animal husbandry is clear, with hay fed barn living in the winter, young spawned in the late winter and early spring, brought out to pasture in mid spring, and rotationally fed through the fall. The number and type of animals raised varied:

Table 6. Animals raised on the farm

	Chickens	Turkeys	Geese	Ducks	Pigs	Lambs/Sheep	Goats	Cows	Bees	Horses	Aqua
Shamrock Green	x		x	x					x	x	
Alewife's Brook	x	x									lobsters, clams
Goranson	x				x			x		x	
Emery Family	x								x		
Meadow Mist	x	x				x		x	x		
Springdell	x	x			x	x	x	x		x	
Many Hands	x	x	x		x			x			
Tendercrop	x	x			x			x			
Crabapple	x					x		x			
Spring Brook	x				x	x		x			
Studio	x				x			x	x		
Anderson Acres	x		x				x				
The Hickories	x				x	x	x		x		
Clover Nook	x					x		x			
Stone Gardens	x	x			x			x	x		
Noci Sonoma	1000				50	35					
Gospel Flats	500	x			x		x				salmon, crabs
Eatwell	1600		x					x	x		
Lockewood Acres	x	x			x	x	x	x	x		
Everett Family	x				x		x				
Fogline	x			x	x						

Source: Author

Notably, chickens were raised by every farm in the study. More than half of the farms had pigs or cows.

Nearly half had turkeys, lambs or bees. All of the farms raised two or more different species, and most raised three or more.

Farmers studied for this thesis explained the strategies they use to manage the animals, which mostly concerns feeding. They believe that alternatives exist to conventional practices, which tend to be ecologically damaging, and involve inhumane conditions for the animals. Meadow Mist has based their animal raising methods on the principle that animals can be used to restore the land, and that their inclusion in a natural habitat is beneficial. ^[115] Farmers feed grass to beef, cattle and lambs, and raise chickens cage free. They use only organic feeds, and use crop rotation, cover crops and rotational grazing patterns. They put a lot of animals in a small area for a short amount of time, which they say mimics the natural behaviors of grazing animals. By regularly moving the animals, no one area is overgrazed and killed. At the same time animal manure left behind nourishes the grasses and helps them re-generate.

Likewise, the Permaculture Artisans challenge the notion that farm animals put strain on ecosystems. ^[87] They argue that farm animals can benefit broader ecosystems by increasing fertility, biodiversity, weed control, improved water retention in soils and pest management. There is growing popularity among ranchers in the area of calculated intensive rotational grazing, known as cell grazing. They describe how in nature, “animals that graze stay together in tight packs, and intensively graze one area before moving on. The natural animal behavior of parcel occupancy can be mimicked by including multiple species in a grazing plan. One common combination is starting with cows, followed by poultry. Cows come first to eat, mow the grass and stomp down dead plant material that would otherwise oxidize and fuel climate change, while spreading fertility. Chickens follow afterward, disturbing the cow’s fertility deposits, eating parasitic larva that would otherwise be a health risk to the cows the next time they visit the pasture.” It is stated that all animals contribute to nitrogen, phosphorus and potassium, which increases in the soil. ^[87]

Many Hands Farm also utilizes controlled intensive grazing with frequent rotation. ^[66] They call the practice mob stocking pasture management. Their birds live in movable shelters, which they move to new range approximately six times per week. Their pigs live in half acre of woods and field edges, which they say is their ideal habitat. With daily moving of animals and poultry following beef, the pastures get a

positive balance of destruction and fertility followed by a long rest. The end product is highly fertile soil with pasture grasses high in nutrients. For six years they have been using whey as animal feed from a nearby cheese farm. They sprout organic grains of barley, oats and wheat for their laying chickens. Young chicks and turkeys start their life in a barn under brooder lights, where they are fed vinegar in their water for good health, sprouts for vitamins, leaves of comfrey plant for protein and micronutrients, and kelp for minerals. Laying hens have free access to kelp and oyster shells. ^[66]

Crabapple Farm also feels that livestock are an integral part of a sustainable system of agriculture in the region. Their livestock manager carefully rotates pastures, improving the land and raising healthy livestock. “Grazing planted forage crops are a key fertility building part of the crop rotation. Permanent pastures make use of land not suitable for crops in a way that benefits us, while providing a great habitat for wildlife.” ^[16]

Some farms work to grow their own feed. A clip from *Uncertain Harvest* shows Goranson Farms haying process. ^[44] They have a cutting mount, a gathering mount, and a bailer. Next, they drive a long bed trailer to collect and sort the hay by hand, which they then bring to their barn. The second floor of the barn has been designed to store hay. They lift the bales, and organize them. Springdell farm sends their livestock out to pasture during the warm months, but purchase feedstock for the winter. ^[95] Around 20 plastic covered hay bales are shipped to them around the new year. Many Hands farm uses only organic feed, and attempts to grow most of their own. ^[66] Stone Gardens farm demonstrates their hay harvesting method in a video, which involves a tractor pulling a mower, followed by a baler. ^[99]

Given that every farm in the study raises chickens, a large amount of information is available concerning chicken raising practices. Eatwell Farm chickens spend the first five weeks in the brooder house. ^[24] They are then sorted into males and females, and sent to separate chicken tractors. They move the tractor through the fields, which have a summer mix of cover crop. Chickens eat the crop residue as they move along. Chickens are moved every 2 weeks in the summer, and less frequently in the colder months. One

acre of cover crop accounts for 25 percent of the chickens' diet, 75 percent comes from purchased chicken feed. They design chicken houses to a height that gives them room to fly. The house protects them from predators such as hawks. Every 6 months they get 500 more chickens. They lay for two years, then get sent to a facility for processing. Because the farm is not able to process them in an affordable and desirable manner, they send them elsewhere. ^[24]

Crabapple Farm explains “Our chickens are raised with love, care and organic food from day one on our farm. We bring in breeding stock from respected hatcheries of heritage breed poultry such as Sand Hill Preservation Center and local breeders, and will be hatching our chicks on the farm this spring. Chicks are brooded in the Ice House Barn, close to the farmstead.” ^[16] They feed chicks a soy-free mix of organic grains, and they are treated to vegetable culls and fresh cut grass daily. Chicks have access to an outdoor paddock starting at a couple weeks of age. Quickly they learn to forage their own grubs and salad. “We never give our food production animals antibiotics or hormones in their feed. Our preventative health care program consists of healthy soil we dig from our fields, compost, and apple cider vinegar to introduce young stock to our native bacterial communities. Stress and minor ailments are treated homeopathically and with home-grown herbal medicine. Very sick animals would be treated with allopathic medicine to nurse them back to health, but would be sold to a conventional farmer once they recovered, as they would never again be organic animals. That has never happened, but we have a plan should someone get seriously ill.” ^[16] Crabapple farm keeps a mixed flock consisting of Marans, Welsummers, Buff Orpingtons, and several other breeds. This year they will be cross-breeding to hatch some home-grown Marans hybrids. Their hens enjoy the company of several friendly roosters, a couple mated pairs of guard geese, and their livestock guardian dogs. As soon as they are big enough to not slip through the fence, chicks are moved to the hill pasture, where they forage for food, eat soy-free, organic grains, and run around in a large safe area protected from predators. At night they sleep in a chicken coop wagon on perches. In the morning they lay eggs in clean straw in their nesting boxes. ^[16]

The Monahan's of Stone Gardens Farm raise chickens antibiotic and growth hormone free.^[100] They also have turkeys available for November and December ranging in size from 15 to 35 pounds. They process the birds on the farm.

Emery Family Farm explains that “Our organic pasture raised eggs are a beautiful array of colors and sizes, due to the range in breed and age of the chickens. We currently have Barred Rocks, New Hampshire Reds, Black Australorps, Araucanas and Golden Comets. Our hens are free to roam, scratch and peck in the pasture surrounding them. They are never treated with antibiotics and we only give them organic, GMO-free. They are protected from predators by a mobile electric fence and by the few roosters we have in the flock.”^[26] The birds are moved through the pasture in covered pens so they can live a healthy and comfortable life, where they consume large amounts of growing forage. “Our birds always have access to shelter, fresh air, clean water, healthy grains and pasture. The open floored coops are moved through the pasture daily to guarantee a healthful and clean environment. Since chickens cannot live on what they get from the grass and bugs in the pasture, we do supplement their diet with feed. Our meat hens are fed Green Mountain Feed, which is certified organic and contains no GMOs.”^[26]

Meadow Mist Farm has one chicken tractor for about 30 chickens.^[115] The structure is a 10ft by 12ft movable pen with open sides, a covered top and no bottom. Once or twice a day the pen is moved to a new plot of grass. The chicken manure left behind is rich in nitrogen and helps the grass regenerate. The pastures at Meadow Mist could support at least 2 -3 more chicken tractors and they are anxious to expand that part of their operation. In order to add more chicken tractors, they will have to use existing pastures which fall within a wetlands buffer zone. This story is further detailed in the market practices chapter.^[115]

The practices for managing larger animals similarly involves rotation. Studio Farm's cattle are raised on pasture using rotational grazing methods, without added hormones or antibiotics.^[104] Locally grown hay and silage is used to supplement their feed during the winter. Free-range pork is grown in a large woodland pen and fed an assortment of vegetables and plants from the gardens and grain. “Our pigs are

processed at a USDA inspected facility in Rhode Island, a 45-minute ride away. This facility is the same one used by “certified humane” growers and is respectful in its treatment of our animals. The carcasses are cut up and packaged at Westerly Packing, a USDA inspected facility that also makes terrific sausage. The meat market we use to smoke our bacons and hams is USDA inspected, and uses no nitrates in their processing.” [104]

Fogline Farm discusses their pig breed selection, which includes “a mix of Tamworth, Old Spot and Berkshire hogs. The Berkshires are known for being able to raise their young with minimal human intervention.” [34] They have been crossing these two breeds. Their fruits and vegetables are grown in rotation with their pastures, which they claim makes for fertile soil and low pest pressures. It is their mission to integrate animals into annual crop rotations to take advantage of the value-added fertility the animals provide. They also raise Cornish Cross broilers, who are key to their fertility program. Broilers are raised in low density chicken tractors and moved daily. [34]

Bee management is popular among farms evaluated. Emery Family Farms’ experience is detailed: “Our bees are an important part of our farm. They pollinate our fruits, vegetables and trees. We never “medicate” our bees and we never heat our honey. We believe in sustainability across our entire farm, and the health of our bees is the most important factor for us. If we have a great season and they have a surplus, only then do we harvest honey. The bees need at least 50 pounds of their own honey to survive the winter. We try to leave them more than that just to be sure. For this reason, we cannot guaranty honey every year, or the amount we will be able to sell.” [24]

Other animals are important on the farm. A few farms have worked with horse drawn tractors. Goranson Farm tried this for the first time last season, preparing about four acres. [42] They are looking to expand this operation. Springdell Farm operators ride on horses to drive cattle around the pastures. [95] The Hickories raises sheep, harvests the wool, and produces a number of wool products including mittens and blankets. Noci Sonoma highlights their Great Pyrenees guard dogs, which live in the barn on the farm.

In summary, from this information, a sense for some of the essential operational components of diversified, regionally based farms are highlighted. The layout and design of these farms varies, but many utilize structures such as greenhouses and row covers to extend the growing season for vegetables. Soil management is a primary concern of these farmers. Many have detailed plans and use multiple techniques for building the quality of their soil. The diversity of the farms is expressed in their growing practices, as they all grow a range of annuals and perennials and animals. These farmers raise animals in a tightly managed fashion, often utilizing rotational grazing. This strategy takes into consideration the nutrition and welfare of the animals, as well as the animals' impact on the soil. These findings support the notion that annuals, perennials and animals can be raised in such a way that all three benefit from one another. There are suggestions that this diversification and integration can serve a triple bottom line. Economically, these farms save on input costs by recycling and using less chemical and fuel dependent methods. The range of products they sell provides them with income through multiple seasons. Ecologically, diversified farm management strategies have been found to improve measures of soil and water quality and availability. How social factors are influenced by the farms in this study is less clear in the discussion of farming practices - aside from the preservation of the welfare of farm animals - but is further explored in the 'Discussion' section of this paper.

Markets and Partnerships

In this section, I will discuss the market strategies used by farms, and the organizational partnerships they have formed. These strategies and relationships break down into the following nine subsections: value added processing, farm stands, other market venues, non-agricultural activities, municipal collaboration, land trusts, state and federal collaboration, private and nonprofit partnerships and intra-farm partnerships. I found that the classification of these farms as diversified extends beyond production to include their marketing practices, and to an extent, to the community partnerships that they form. To begin, this chart outlines the marketing activities that farms are involved in:

Table 7. Markets Venues Utilized by the Farms

	wholesale	farm store	CSA	farmers market	online	pick your own	other	value adding kitchen
Shamrock Green		16miles from farm	yes	3 locations, 20,30 and 50 miles away				smoothies, pies
Alewife's Brook		on farm	yes	3 locations within 7 miles	ups delivery			lobsters, cider
Goranson	48% of sales, several accounts within 50 miles		175 shares in 2005	36%, 3 locations within 50 miles				maple
Emery Family	restaurants		limited	yes	paypall			
Meadow Mist		yes, but no set retail	yes			x		ciders, jams
Springdell	available	yes	200 shares, 3 sizes, 5 options					
Many Hands	cafe/restaurant		100 members, several options					applesauce
Tendercrop		3 locations within 40 miles.	yes					meats, pizza, pasta
Crabapple		seasonal		2 locations				
Spring Brook	another farm stand	yes	yes	2 locations				baked goods, honey, applesauce, preserves
Studio		half season	50 full shares, several other options	2 locations				
Anderson Acres	several accounts within 10 miles	yes	60 shares					
The Hickories	yes	yes	yes	1 location	yes	pumpkins		salsa, marinara, bloody mary mix, applesauce
Clover Nook		seasonal	yes			pumpkins		
Stone Gardens		yes	500 shares	3 locations				marinara, salsa, pickles, chicken
Noci Sonoma		yes	next year					pickles, salsa
Gospel Flats		yes					Mobile kitchen	full kitchen
Eatwell			yes	several locations within 70 miles	online store			
Lockewood Acres			yes	2 locations	online store	fruit		
Everett Family	restaurants and grocery stores	seasonal	50 shares	2 locations				cider, hard cider
Fogline			yes	5 locations				chicken pot pies,
%	24	81	90	62	29	20		

Source: Author

Value Added Processing

The degree to which these farms process their produce varies. Some are scarcely involved with processing, while others have storage and kitchen facilities that enable them to add value to their products. Shamrock Green recently moved their farm stand to a new location, which includes a full service kitchen. ^[70] This facility has enabled them to prepare smoothies, pies, and other prepared foods. Alewife's Brook recently expanded processing facilities to shell their lobsters. ^[1] This investment was made at the request of their customers, who expressed a willingness to buy more if the meat was shelled. Meadow Mist is active in several value adding processes, including preserving the berries they grow. ^[115] Tendercrop processes some of their meats, and they hire a butcher and have a meat smoker. ^[107] They also have the capacity to prepare other foods, such as pizza and pasta. Spring Brook prepares a variety of goods in their kitchen, such as honey, preserves, applesauce and baked goods. ^[94] Goranson Farm has a fully equipped maple syrup processing shack. ^[43]

Gospel Flat is unique in featuring the lifeboat mobile kitchen school: "A microcosm that combines the farm and our home kitchen workspace." ^[46] In collaboration with summer camp school classes and any other interested parties, they "host kids and adults alike to learn by creating and mapping their meals and surroundings." Growing up on the farm with various rusting historical artifacts at its margins, Mickey Murch set out to build a hospitable space out of what was lying around. He began by pulling what he found to be a World War II lifeboat, and welded it to a brush covered trailer to make the mobile kitchen. He gathered scraps from an aluminum fishing boat in fabricated windows and a lightweight roof superstructure. They also have a wood-fired oven at the farm stand. ^[46]

The farms mentioned above all extol value added processing for allowing them to sell what they pull from the ground, off the tree, or slaughter for a higher price. Thus, to them, investments in the equipment and facilities, and increased scale of production are sought after in order to grow the farm business.

Farm Stands

Four out of five farms overall, and all but one New England farm operate farm stands. Most of these stands included products from other local farms and producers. Most have farm stands on the farm, though a few are set up outside the farm. More than half of these farm stands operated year round, while others are seasonal. Springdell Farm has stated that they value and prioritize direct sales to customers, which is made possible through their farm stand. ^[52]

The types of products purchased by the farms for sale at their farm stand can inform us about the range of producers that exist within each farm's region. Meadow Mist Farm lists their suppliers on their website, who deliver locally baked bread, root beer, cheeses, maple and coffee. ^[115] Tendercrop Farm has a selection of suppliers to round out the offerings at their stores. ^[107] Clover Nook Farm shows a breakdown of the products available at different times of the year in their farm stand. ^[51]

Gospel Flat operates a 24/7 honor system farm stand. ^[46] They recognize that some people are confused when they find the farm stand for the first time unattended with handwritten prices and instructions. “Our system forces the shopper to be aware, notice details and do math, and we know that eventually the seasoned vegetable buyer can make quick and easy stop at the stand on their way home at any time.” Their farm stand is planned and managed much like a meal. They spend their mornings harvesting anything that's fit to eat, then bring the produce to the stand. Self-service is valued, and they believe that the actual selling of produce requires nothing but faith. The vast majority of their customer base absolutely support the farm stand. The farm stand success has allowed them to sell more produce grown locally, mostly by young farmers, like those from Big Mesa Farm and Fresh Run Farm. ^[46]

Tendercrop features many prepared foods, some homemade at their farm store. ^[107] “Rotisserie-grilled chicken, sandwiches, hot soups, veggie wraps, and garden salads are made fresh daily at our farm. Our very popular homemade tomato salsa, basil pesto, artichoke spread, and assorted dips make perfect appetizers, while our delicious Asian noodles, and pasta and potato salads are a great side dish for any meal.” Tendercrop Farms states that they are famous for thier own fresh Thanksgiving turkeys and

prepared fixings. “From the mashed potatoes and gravy to the squash, cranberry sauce, and our delicious pies, we make your Holiday hosting a breeze.” Their farm store also features a gift shop. They recently opened a new farm store open in Wenham where they have the capacity to produce baked goods. Plants and flowers are offered, and steaks, chicken, ribs, turkey, flavored beef patties and sausage are sold year round. They also offer pre-marinated meats and poultry and a variety of prepared foods. ^[107]

As one of the most popular marketing venue for the farms studied, farm stands are a key infrastructural investment for diversified farms. Not only do farm stands allow farms to receive a higher return on their products, but the stands serve social ends. Springdell and Gospel Flat Farms express an outright preference to selling directly to customers. Goranson Farm explained the value of getting to know customers personally, and that the farm stand facilitates this interaction. ^[45] Also, as will be discussed below, farm stands can serve as places for activities other than sales. Given the economic and social benefit that farm stands promote, it is no wonder they are so popular.

Other market venues

The number and type of other marketing venues that the farms in this study are involved with further represent their embodiment of diversity. One quarter of these farms have wholesale accounts, and many sell to restaurants. Ninety percent of the farms have CSA programs. More than half of the farms attend farmers’ markets. The number of markets attended ranged from one to five. A few of these farms had an online sales venue. Some of these farms have pick your own options, where customers pick fruit or vegetables from the fields themselves. The regional nature of the farms is expressed in the proximity of these farms to their markets. The distance from the farm to the sales venue was never more than 75 miles. Few venues are over 50 miles, and most venues are under 25 miles away.

Across farms, a range of CSA programs are offered. Shamrock Green has flexible shares, in that shareholders can choose which goods they wish to have in their share from their farm stands offerings. ^[70] Goranson Farm offers five different CSA options. ^[43] They too enable shareholders to purchase anything

sold at the store with CSA credit. Many Hands offers summer CSA fruit and flower shares in spring and fall shares. ^[66] For the third year in a row they will be offering large share and medium share that will run for 22 weeks, costing \$650 for large shares and \$425 for medium shares. All their meat is organic except for their hams and bacon, because these must be processed at a facility that also processes non-organic meats. They note that they can accept SNAP benefits for their meat purchases. Springdell Farm offers several different types of shares, including meat shares, egg shares, flower shares and superfruit and super green shares. ^[52] The meat shares include a variety of cuts of pork, beef and chicken. A meat buyers club, where \$250 worth of credit can be purchased from the farm is available. Alewife's Brook is unique in offering community supported lobsterman shares. ^[1] Many Hands Farm offers summer CSA, and fruit and flower shares in the spring and fall. ^[66] They offer large and medium shares that run for 22 weeks. Shares include fruit in season. Studio Farm runs fifty 28 week shares. ^[104] Clover Nook Farm has a referral discount with their program. ^[51] Their CSA options include a farmer's choice share, and a line of credit share. Stone Gardens Farm declares that the CSA is a way for farm costs, and the risks of farming can be shared throughout the community by the members. ^[100] The Jordan's have stated that CSA investments give the farm operating capital early in the season, a time when the farm makes most of its investments. ^[1]

More than half of the farms undertake involvement with farmer's markets. Fogline Farm attends the most farmer's markets (five), though most of those who do participate in farmer's markets attend two or three. ^[36] Farmers markets can serve as pickup locations for CSA shares, increasing accessibility for consumers. Farmers express the value of farmers markets in that they allow farms to market themselves in population centers in the region beyond their immediate community.

As with the agricultural practices, marketing venues are diversified by farms. This strategy is captured by the farms as they explain their offerings: At the Lockwood Acres U-Pick orchard, "you will be able to pick the freshest organic fruit in the area directly from the tree. Create family memories that will last a lifetime by hand selecting from the many varieties in our orchard. This orchard was created to provide the maximum number of varieties of delicious fruit over the longest possible season. The orchard is newly

planted and as such will not be in production this year, with the exception of pomegranates which will be available in late fall and early winter. We look forward to providing U-Pick and CSA fruit shares in the future and the orchard matures.”^[61] A bimonthly breakdown of the products available at their markets and farm stands is listed on their website. Goranson Farm’s Market webpage gives a detailed description of their market venues, demonstrating the diversity and sales capacity of their farm.^[43]

With all of these venues, seasonality is a consideration. Some sell only in the growing months, while others sell year-round. The Jordan’s attest to the seasonal nature of their markets; despite having products to sell into the fall, attendance to their farm store drops around September.^[1] Goranson Farm focuses on storage crops, which allows them to sell throughout the winter.^[43] With a variety of fruit trees and shrubs, Springdell picks fruit from June through November.^[52] They plan to have early strawberries and cherries, as well as later peaches and blueberries, onto fall picked apples. This is an intentional strategy to extend the sales season.

Beyond the expressed preference for direct sales to customers by some farmers, little discussion was found as to why they utilized a diverse set of sales venues. Nonetheless, it appears true from this sample of diversified production farms that they must diversify sales, and that CSA’s and farm stands are the best way to succeed financially.

Non-agricultural Activities

Many of these farms host events, and offer services other than produce. These efforts help to promote the farm, and supplement its income. Noci Sonoma hosted a grand opening dinner party for friends and neighbors.^[75] Gospel Flat promotes agritourism, and are available for booking group activities.^[46] Eatwell Farms has hosted several harvest parties.^[24] Goranson Farm recently purchased a 12-person sleigh, and offers rides in the winter.^[42] Springdell Farm invites their customers to plant garlic. Tendercrop Farm hosts a number of holiday events, including horse drawn carriage rides.^[107] Spring Brook Farm has hosted events such as Easter egg hunts and gingerbread making contests.^[93] Anderson

Acres hosted a CSA kickoff party in the spring, and a harvest party in late October. ^[4] The Hickories holds a knitting circle at the farm stand. ^[110] Lockewood Acres hosts activities such as weddings and large dinners. ^[61] Last fall marked Clover Nooks 250th season. They hosted several events through the year including a talk on the history of their farm, and a buffet event. ^[14]

Some farms offer educational workshops, give talks, and publish written work. Crabapple Farm holds workshops, “placing a strong emphasis on skill based methods rather than technological fixes.” ^[16] They hosted a seed saving workshop last spring. Anderson Acres Farm has hosted a series of orcharding workshops. ^[4] In addition to their publication for the Northeast Organic Farming Association (NOFA) on soil biology, Jack Kittredge and Julie Rawson are frequent presenters for the association. ^[65] Jack and Julie will be traveling this winter to do workshops on agricultural carbon sequestration. In addition to their talks, they “welcome high school, college, church groups and individuals to come spend a half or full day at the farm participating in hands-on learning projects.”

This range of non-agricultural activities hosted by the farms serve both economic and social ends. Some of these activities provide an additional revenue stream for the farms and the family members, further diversifying their earnings. Also, these activities gather the community at the farm, facilitating social networking, and creating a sense that the farm is communal space, and more than simply a productive space.

Beyond marketing partnerships, these farms connect with a range of agencies, firms and organizations. In the public sector, farms interact with municipal, state and federal agencies, including agricultural extension schools.

Municipal Collaboration

A number of these farms noted ways in which they interacted with the municipal government. Caitlin Jordan has served as a town councilor in addition to farming. ^[1] Similarly, Leigh Emery has been on the

Westborough Board of Selectmen for eleven years. ^[26] The Saltz's of Anderson Acres Farm participated in procedures that led to a right to farm ordinance being passed in their town. ^[4] Clover Nook and Noci Sonoma have mentioned attending their town harvest festivals. ^[14, 75] An article featuring Meadow Mist Farm describes an interaction they had with the town conservation commission: "In an effort to expand their chicken operation, they would need to graze on land that was protected under a wetland buffer zone. They went before the Conservation Commission seeking a negative determination, which would officially exempt the land from Conservation Commission jurisdiction. Mgl310-04 is the Massachusetts statute that governs wetland buffer zones used in commercial agriculture. If the land is found to fall under this statute, it is exempt from local conservation commission oversight. Both the Conservation Commission and the farm owners are working with legal councils to understand the technicalities of Massachusetts agricultural law as it pertains to Meadow Mist." ^[9] The farm had many supporters.

The ways in which the farms and farmers in this study interact with and form partnerships with the municipality demonstrate the value placed on the services provided by both parties. It also suggests that farmers must diversify their roles in order to form the the community partnerships necessary to keep the farm running.

Land Trusts

On several accounts, farms are involved in land trusts. Tendercrop Farm collaborated on an effort to preserve their farmland, which included a river conservancy, a municipal government, and the state department of transportation. ^[92] Crabapple Farm is also under a land trust agreement. ^[109] The agreement was reached by the farm's previous owner. Spring Brook Farm is part of a network of preserved lands, orchestrated by the municipality, in which 40 endangered species are protected. ^[94] It is noted that from the time of Littleton's founding, land preservation was prioritized. John Moriarty of Meadow Mist states that around the time of the land purchase in 1987 there was little interest in preserving local agriculture. ^[115] Twenty-five years later, there is "greater appreciation for the remaining local farms and what they add

to an increasingly homogenized landscape.” To help protect its status as farmland, in 2007, the “Strafford Rivers Conservancy purchased a conservation easement on Tendercrop farm from owner Will Tuttle for \$2.79 million.”^[92] The city of Dover contributed \$1.195 million, along with \$1.34 million from New Hampshire Department of Transportation and \$155,643 from the Federal Farm and Ranchland Protection Program. “Praising the partnership between the Tuttle’s and city, state and federal agencies, Tendercrop Farm Operator Matthew Kozazcki plans to commemorate their contributions to the sustainability of local agriculture with a plaque at the Red Barn. Although he acknowledges the dominance of corporate farming in America and cannot foresee a return to a time when independent farmers produce all the food consumed in the New England region, Kozazcki still believes it is imperative for those who can to do their part to preserve the functionality of local farmland.” It is stated that not all farms that are sold off are turned into residential subdivisions or strip malls. With the best of intentions, more local land is put under conservation protections that take it out of agricultural use. “The land is being preserved for noble causes, like wildlife protection, but it could be used for increasing local food production. I believe it is a question of finding the right balance.”^[92]

Beyond the examples discussed above, it is unclear to what extent farms in this study are involved with land trusts. Thus, the significance of this type of partnership may be understated. Still, the potential for land trusts to preserve high value agricultural land may be key to the economic feasibility of diversified farming in the face of development pressure.

State and Federal Collaboration

These farms describe their interactions with state agencies, namely certifying agencies, state agriculture departments, extension schools and local schools. Goranson Farm is certified through Maine Organic Farmers and Gardeners Association (MOFGA), which is the largest state organic certifying body.^[43] As mentioned, Many Hands Farm has been involved with the NOFA as presenters at their conferences.^[66]

Spring Brook was voted as one of the best places to visit by the state's department of tourism.^[94] They were visited by the state governor later that year. Also, owner Frank Matheson Jr. has been appointed by the governor to the state's board of Food and Agriculture.

Several farms form relationships with local schools. Springdell runs a hands on farming group session for teens three times per month.^[52] Spring Brook sells their beef to a local school district.^[93] Studio Farm had local kindergarteners hatch chicks. Clover Nook has presented about farming in assemblies at schools in town.^[14] Extension schools are very often connected with these farms. Springdell's Jaimie Cruz serves on the American Farm Bureau Federation young farmer and rancher committee.^[52] She has attended several conferences, including the New England vegetable and fruit conference sponsored by the cooperative extension systems of the universities of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, and Cornell University's.^[54] Researchers at UC Davis are studying populations of beneficial insects, of which Eatwell farm has been found to have an exceptionally high number.^[24] As former researchers at UC Davis, Ben and Denise Lyons of Lockwood Acres founded an incubator program, allowing young graduates to manage part of the farm.^[61]

Several of these farms mention interaction with federal agencies and campaigns. Emery Family Farm received a grant through the NRCS EQIP program to complete a greenhouse.^[26] Many Hands accepts SNAP for their meat shares. They are also certified by Baystate Organics, a USDA accredited certifying agency.^[67] Studio Farm interacts with the USDA via their meat inspection process.^[102]

The degree to which the farms in this study are connected to educational institutions suggests that diversified agriculture is born from and supported by academia. They are places where research is being conducted, and where students can practice, and in some cases find employment. In this way, the relationship between diversified farms and schools are building social and economic networks.

Private and Nonprofit Partnerships

As previously mentioned, many of these farms are connected with other local food system stakeholders, from other farmers, to processors and marketers. Springdell Farm works closely with a nearby farm with an orchard. ^[95] They visit the farm weekly during the harvest to collect fruit to sell at their farm stand. Julie Rawson's son works for a Farm Nutrient Density Supply company. ^[66] He is also very involved with the Bionutrient Food Association. Anderson Acres has used a local restaurant to prepare foods for events hosted on the farm. ^[4] They also work closely with a compost company. The Hickories has a relationship with a nearby Whole Foods, as they have invited their employees to participate in team building activities on the farm. ^[110] Goranson Farm has been involved with Bath Natural Market and the Portland Food co-op for more than wholesale. ^[42] For instance they participated in the coop's anniversary celebration.

Alewife's Brook received publicity a few years ago in the midst of a difficult financial situation for receiving help from local businesses. An article entitled "Alewife's Brook Farm in Cape faces upstream battle" explains that the Jordan family needed to raise funds in order to create a new roof on their farm stand so that their insurance would not be dropped. ^[79, 113] With the large up-front cost, the family farmers considered the prospect of taking on more outside work. Instead they made changes including increasing value-added processing of products to sell at their farm stand, and began to offer CSA shares. Amid these challenges, local businesses agreed to donate time and resources to help the Jordan's with their roof, and to scale up their business. Caitlin Jordan is quoted as saying "it really comes down to asking the community members to make an investment in their own community. Do they want the farm to continue, do they want my generation to keep farming and offering vegetables and lobsters, or do they want us to go do something else?"

Farms interact with nonprofit organizations in a number of ways. Rawson and Kittredge formed the Many Hands Sustainability Center, a 501(c)3. ^[66] They work with former prisoners and institutionalized youth, who have a difficult time securing employment. Alewife's Brook donates produce to a church run food pantry. ^[1] Anderson Acres donates food to a locally based food security organization. ^[4] Goranson Farm is involved with the Bath Freight Shed Alliance, a working group extending from the Bath Farmers Market.

^[42] Meadow Mist is participating in a soil carbon challenge organized by a local nonprofit, an international competition to measure how quickly land managers can turn atmospheric carbon into soil organic matter. ^[115]

The relationships formed by the diversified farms in this study with private organizations show the value placed on the services provided by the farms in the community. In some examples, the continuation of the farm depends on these relationships. As with other types of partnerships mentioned, the diverse social network contributes to the economic stability and capacity of the farm.

Intra-farm Partnerships

Many of the farms employ outside staff and conduct internships for aspiring farmers. Shamrock Green employs a few people year round at their store. ^[70] Tendercrop posted several jobs last year, including ones for cashiers at the store, a butcher, and part time workers in their plant department. ^[106] Anderson Acres posted a job for an office manager this year. ^[4] Noci Sonoma has hired a number of people, including a project manager to aid in the design and construction of their farm. ^[75] They also hire a crew of farmhands, carpenters, artists and architects. Permaculture Artisans have hired several people in the past year, including a book keeper, tool and materials manager, and a project manager. ^[87] Eatwell Farm has 16 full and part time employees. ^[24] Goranson Farm has several employees who have been working on the farm for over a decade. ^[43] They express gratitude for this commitment by their workers. They exclaim that tenured workers are more efficient, and a strong sense of community has developed. For all employees, they offer on farm room and board, as well as discounted farm produce. As of 2012, Goranson Farm was one of 37 farms in Maine that was completely financially supported by on farm labor and income out of over 8000 farms. ^[43]

Communication and division of labor among farm managers occurs to be a consideration. Spring Brook has an expert in animal nutrition as their livestock manager. ^[94] Goranson Farm's Jan Goranson and Rob Johansen explain in a video how they adopted their individual roles. ^[80] Jan took over the marketing

aspects of the farm, while Rob became more focused on production. The three managers of Meadow Mist have diversified their roles, one on marketing and annuals, one as the herd manager, and one as a mechanic. ^[115] Studio Farm states that their entire family takes part in the various aspects of managing the farm. ^[104] Lockwood Acres production of the 45 acre farms row crops are overseen by a farm manager. Meanwhile the couple are in charge of managing the livestock. ^[61]

Internship and apprenticeship programs are managed by several farms. Many Hands Farm has had a number of farm apprentices over the years. ^[66] Since 2007, they have been building their staff. As mentioned, they reach out to hire formerly incarcerated individuals, and make a priority to train and hire recovering addicts. Additionally, they offer opportunities for shareholders to barter labor for produce. Lockwood Acres works with an exchange program to hire an intern, and they hire a seasonal apprentice. ^[61] Goranson Farm also runs a farm incubator program, offering a holistic farm management experience. ^[44] Many apprentices have gone on to start their own farms, or become involved in other food related work. The Hickories has had seasonal apprentices from around the world. They also take a group of interns each year from a local high school.

In summary, the marketing strategies, and partnerships formed by the farms in this study express their diverse, and regionally based nature. Value adding facilities are an important aspect for several of the farms, allowing them to provide a wider range of services. Farm Stands are the second most popular market venue of the farms studied. In addition to allowing farmers to sell directly to customers, farm stands open a number of opportunities for generating revenue, and a place for other regional food producers to sell their products. All of the farms studied utilized more than one market venue, including operating CSA's programs, attending farmer's markets, filling wholesale accounts, establishing online stores and offering pick-your-own gardens. Most of the farms are involved with a number of non-agricultural production or sales activities which provide them with additional revenue and attracting a wider range of customers. Partnerships formed by the farms include municipal, state, and federal agencies

and departments. Land trusts are mentioned in several cases as the key to the preservation of the farmland. State agriculture departments, and agricultural extension programs within state universities appear to have strong relationships with the farms. A connection to other regionally based food producers is expressed in these findings. Lastly, the range of job opportunities available on the farms, and the division of labor on the farms shows the integration of different roles in managing the farms.

This information lends insight into the range of strategic models used by farms, and offers several suggestions for how they balance a triple bottom line. It cannot be determined from the data exactly how well these farms are performing economically. However, it is suggested that the more diverse the market offerings and partnerships formed, the more economically stable the farms will be. ^[4, 9, 10, 24, 44] Similarly, there is no way to determine how ecological these marketing strategies are, yet in terms of the impact of the distribution of their products, these regionally based farms produce food that travels few miles. Partnerships that form land grants have helped to preserve farmland, while the extension schools have proven to be a key to educating diversified, regionally based farmers. The findings suggest familial and community based social impacts. Though this information is based primarily on the perception of the farmers, or supporters of the farmers, there seems to be a sense that these farms are at the center of a rural identity for the communities in which they exist. The willingness of their customers to support them indicates the value placed on a more diverse and regionally based agriculture.

Meeting the Triple Bottom Line

Farms and Economics

With a lack of concrete financial data available from the farms in this study, a quantitative economic assessment cannot be carried out. However, the data suggests that these farms are fairly stable economically, but are not immune to difficult economic times. ^[1, 35, 37, 44, 47, 79, 80, 92, 109, 113] In this discussion, I will analyze the findings from the farm data, exploring the economic successes and challenges faced by diversified farms.

First, the longevity of some of the farms studied speaks to their economic resilience. As is shown in Table 2, some of the farms were founded over 100 years ago, and many more have operated continuously for multiple decades. Though these older farms were not always diversified, as is explained in the history chapter, their choice to diversify implies that there is economic merit to the business model, especially given that the model is not conventional. Newer farmers in this study, some of whom were educated as agriculturalists, chose to diversify. ^[16, 28, 61, 66, 72, 75, 100] This decision implies a belief that it is economically reasonable to diversify production.

There are a number of agricultural practices cited by farmers as ways to maximize profits in the diversified model. All of these practices have to do with using time, space and other resources efficiently. As is explained in the Layout and Design section, season extension techniques, most commonly greenhouses, are popular amongst New England farms. These structures are praised for providing economic benefits. In both regions, scale appropriate investments are of concern, as is implied later in the Layout and Design section. A tradeoff between money invested, and productivity is hinted at, as the level of mechanization varied amongst farmers. The mechanization of some processes are discussed to save a

significant amount of time, and facilitate larger yields. Meanwhile, smaller farms keep overhead costs low, and minimize the amount of mechanization.

The venues by which the farms in this study sold their products are widely discussed in the Market and Partnership chapters. CSA programs and farm stands are found to be the two most popular venues, as is shown in Table 7. However, all farms use more than one type of venue, and some use more than three. This finding suggests that farmers who practice diversified growing methods also find success financially when they diversify their marketing strategy, with the CSA and the farm stand being the most successful venues.

The farms in this study were mostly transparent about the process by which the products they grow and harvest reach consumers. Some of these processes are discussed throughout the Market and Partnership chapters in this thesis. Several farms, notably Springdell Farm, cite a preference for direct sales to customers, hence the popularity of CSA's and farm stands, and also farmers market attendance. Those who do source their products out to processing facilities, wholesalers and restaurants, are mostly interacting with smaller scale, regionally based and family owned businesses, as can be deduced from researching the companies mentioned by the farms on their websites and Facebook. This finding implies that diversified farmers have found financial success when they sell directly to customers, or work with small businesses to reach consumers. Also, given that several farms cite efforts to expand value added processing of their foods for economic reasons, as is discussed in the Value Added Processing section, it follows that value added processing is an important aspect to success as a diversified farm.

The section on Non-agricultural Activities discusses efforts to promote the farm, while bringing in new income. The commonality of on the farm non-agricultural activities, and the frequency with which farm representatives attend events off the farm, and host events on the farm, as is cited by farms on social media, suggests that a key to financial success as a diversified production farm must include non-agricultural activities. Also, several farmers in this study mention on social media, on their websites, and

in articles, as is discussed in the later chapters in Part 2 of this paper, that family income is earned off the farm as well as on the farm. This finding suggests that diversified production farming must in some cases be supplemented by outside earnings.

Information regarding the terms of land trust agreements to which their farmland is bound is shared by some farmers, and discussed in the Land Trust section. The importance of these agreements to the economic viability of the farm amid development pressure is emphasized in these examples. This finding implies that such agreements can be critical to the protection of prime agricultural land on which a diversified farm can succeed. Information found in this study concerning land trusts also suggests that such agreements can lower the premium on access to land for agricultural uses, increasing the number of families that can take part in diversified farming.

The farmers in this study discuss the challenges of diversified farming, often involving dedication and skill, through the Agricultural Practices and Market and Partnership chapters in this thesis. Statements made by farmers, such as Eric Demander of Clovernook Farm, imply that financial success as a diversified farmer requires a lifestyle commitment, which involves long, strenuous work days, especially in the summer months. ⁽⁴⁾ Also, given the level of experience cited by most farmers, including the Demanders, who grew up farming, and the Lyons's of Lockewood Acres, who were educated as agricultural researchers, it is implied that a degree of knowledge and technical skill are keys to financial success in diversified farming.

As is expressed directly by Alewife's Brook Farm, and indirectly by several other farmers, a dependence on the trust and support of the communities which they serve is essential to economic sustainability. Given the nature of the sales venues utilized by the farmers, in which income earned in small increments, with CSA agreements as the exception, and given the regional nature of these venues, the research data supports the notion that rapport with the community is critical to the financial success of diversified farms.

Though no strong quantitative data exists to make generalizations about the economic performance of diversified agriculture, the data do support some qualitative results. The research suggests that diversified farming is a challenging economic venture, requiring great commitment and skill to succeed. Farms that diversify production must also have creative marketing schemes, and diversified income streams. They must find scale appropriate solutions, investing in equipment and infrastructure that can generate profitable returns. They benefit from relationships with other regionally based food businesses and organizations. Access to farmland by aspiring farmers, and preservation of agricultural land for diversified farming can be made feasible by collaboration with land trust organizations. Lastly, the data suggests that the presence and persistence of diversified farms, despite being non-conventional, indicates that there is economic merit to the business model.

Farms and Ecology

The degree to which the farms in this study adhered to methods known for having a preservative or rehabilitative effect varies. Given that there is no widely accepted measure for ecological outcomes, there is no way to quantitatively measure the performance of these farms. Still, the data collected suggests that most of the farms in this study are engaging in agricultural practices that are benefiting the ecology of the landscapes they manage, or at least working to build a better understanding for how to assess these effects, while avoiding processes that have been found to have explicitly negative impacts.

As mentioned above, the level of farm mechanization correlates loosely to the size of the farm, as can be inferred by comparing Table 2 with the descriptions of farm layouts, design and growing practices sections. In the Layout and Design section, it is discussed that some farms actively seek to minimize fossil fuel dependence, and thus make an effort to reduce mechanization. Other farms believe that the sum of their agricultural practices are ecologically beneficial, and mechanization allows them to achieve economies of scale, in turn benefiting the environment. The data express the variability in mechanization

amongst diversified farms, and the debate that continues over the ecological effect of mechanizing agricultural production.

The California farms studied share ways in which they are affected by and are responding to the water crisis, as is written in the Layout and Design section. Efforts to use water efficiently, including water harvesting and irrigation techniques are expressed in the data. Thus, it is suggested that diversified farms are playing an active role to address this ecological challenge.

The concept of integration of agricultural elements has been found in this research to be broadly defined. Examples of integration are mentioned throughout the Agricultural Practices chapter, and discuss practices that contrast with conventional techniques, which often involving mono-cropping, and a heavy dependence on materials sourced from outside the farm in order to produce agricultural yields. The farms in this study often integrate aspects of the farm, including soil building, animals and plant crops, allowing them greater independence from purchased materials. For instance, Crabapple Farm mentions a number of integration techniques, from their bed building, to their use of chicken tractors to feed animals while mineralizing the fields. This research shows that diversified farmers attempt to integrate elements of their agricultural operation to optimize ecological measures on their farms.

The Soil Management section includes entries from most of the farms in this study, with insight into their understanding of soil as the basis for life, and their intent and plans to build the capacity of their soil. Some of the practices include growing green manures and cover crops, and rotational grazing patterns of animals. Some, such as Many Hands Farm are working with researchers to quantify the presence of soil elements, and how their practices are contributing to changes in those elements over time. However, published results from these farms are few, and no standard method is used. Still, the farms in this study are actively attempting to improve the quality of their soil, and some are sites of pioneering research aimed at refining soil measurement techniques, and data collection that associates agricultural techniques with changes in soil composition.

Several farms in this study describe their pest management, and fertilization protocols. Those who did publish their methods, such as Eatwell Farms, subscribe to organic standards or higher. There is a strong sentiment amongst these farmers against the use of synthesized, non-organic pesticides, and excessive use of chemical fertilizers due to the negative ecological impact they have. Instead, these farmers prefer an integrated pest management approach, which is mentioned as a practice by nearly half of the farms. Such preferences are written in the Growing Practices section. Though it is unclear whether any of the farms use chemical fertilizer, the use of organic fertilizers and the integration of on farm sources to fertilize, including cover crops and animal manure, are most widely promoted. Though little quantifiable data exists to show the ecological effects of these pest management and fertilization practices, the data shows that diversified farmers tend to avoid the use of synthetics, choosing organic and integrated methods.

Based on the purported benefits of rotational grazing as a way to increase soil quality, some of these farmers, including the Permaculture Artisans are outspoken in challenging the notion that agricultural animals are bad for the environment. Rather, these farmers believe that animals can be an essential part of a balanced ecological system. By tightly managing the placement of the animals, essential nutrient cycling services can be performed, as is described in the Animal Management section. The research compiled from these farms suggests that diversified farmers value the inclusion of animals as part of ecological restoration efforts.

There is little quantitative data available from the farms studied to determine how diversified farming practices affect ecological measures. Still, several suggestive statements can be made based on the findings of this research. First, diversified farms tend to take an active role in addressing the environmental issues they face, such as the water crisis in California. They strive to quantify and build soil quality. To do this, many diversified farms integrate different aspects of their farm, in order to maximize independence from outside sources. They are often outspoken against the use of chemically based fertilizers and pesticides, preferring to abide by organic requirements, some meeting even more

ecologically rigid standards. There are a number of practices that diversified farmers implement to meet these standards. Most notably, many manage rotational grazing systems with their animals, which they believe to have an overall ecological benefit. Thus, they challenge the notion that agricultural animals are bad for the environment.

Farms and Society

There is no concrete or standard way to measure the societal contribution that diversified farms offer. However, the research data suggest that the farms in this study are contributing to society in ways that conventional agriculture does not. These farmers are often outspoken advocates of a cultural change that involves increasing the availability of healthy food and promoting awareness regarding health issues. Many of these diversified farmers also express an understanding for the interdependence between farms and the towns and regions within which they serve, and thus actively work to build a sense of community.

The farms in this study are outspoken about a number of issues related to agriculture, food and society. As is expressed on the websites of farms like Many Hands, there is a desire to create a cultural change, and give examples for the ways in which their work is serving as an alternative to the ills of the conventional system. This research shows that diversified farmers can also be activists in favor of changes to America's food and agriculture system.

The first aspect of cultural change that many of the farms in this study speak for is agricultural animal health and welfare. Most farms are explicit about their animal husbandry practices, including their intent to optimize the well-being of these animals, as is explained in the Animal Management section. By being transparent about their practices, and in speaking out against conventional practices through social media, these farmers are raising awareness of animal rights and their relation to human health. These data suggest that diversified farms are involved in a cultural change regarding the way agricultural animals ought to be treated.

In addition to being an ecological consideration, the farmers in this study also discuss the use of certain substances in agriculture as a social issue. As was mentioned, many farms speak out against the use of inorganic pesticides and fertilizers. Similar to their animal raising practices, they promote their methods as a working alternative to conventional methods. Their published online challenge to more conventional approaches has the potential to facilitate discussion. The data gathered for this project suggests that diversified farms work to raise awareness of ecological issues pertaining to agriculture, as well as demonstrating benign methods that can be substituted for the most damaging practices.

Given that many of the practices implemented by the farms in this study are alternatives to conventional methods, they are often not well understood. Additionally, some farms, such as Gospel Flat Farm in their discussion in the Growing Practices section, recognize that the level of skill required to manage the increased complexity that comes from diversifying is higher than with less diverse systems. However, several farms, such as Goranson Farm operate farmer training programs. Some are also connected with research institutions, like Everett Farm and their relationship with UC Santa Cruz, and are sites where data on alternative agriculture methods are being collected. The information gathered on these farms supports the notion that diversified farming is a complicated idea, and challenging to implement, but farmers are involved in research projects, and offer training intended to fill this knowledge and skill gap.

Farmer training programs and relationships with research institutions are just two examples of the types of social networks in which the farms studied are imbedded. These networks, as can be witnessed by viewing the websites and social media sites published by the farm, are vast and diverse. These farms have connections with a multitude of mostly locally and regionally based food related businesses and organizations, as is discussed in the second half of the Market and Partners chapters in this paper. They also work with municipalities, state agencies, and federal agencies. Still, the emphasis on local and regionally based networking is pronounced when examining the origin and nature of the organizations with which the farms in this study are partnered. As a strategy to build these networks beyond the

marketing and sales of their agricultural products, the farms in this study mention a range of non-agricultural activities in which they take part. By hosting and attending events and workshops, farmers seek to broaden their connections, while building a sense of community. This suggests that diversified farms build complex social networks based primarily within the communities and regions from which they farm.

As is discussed in the literature review, issues related to access to products from alternative, regionally based agriculture by marginalized groups have been raised by scholars. The data gathered in this research projects lends insight into how diversified farms are addressing these issues. First, women are well represented, as nearly half of the principal farm operators in this study are women. Additionally, many of the secondary operators and hired farm workers are women. This suggests that diversified farms are working to close the gender gap in agriculture. However, these data do little to support the notion that diversified farms are closing participation gaps in race and wealth. From observations made by examining photograph data, people of color do not have a presence around these farms. The recognition of racial inequity in access to the alternative food culture is not mentioned in the data. Likewise, with a few exceptions, there is no expressed intent by farmers to reach individuals and families of lower economic status. Thus, the research suggests that the products and culture of diversified farming remains largely inaccessible to the non-wealthy and non-white.

Limitations

There are a few noteworthy limitations of this study. First, the basis for the analysis of a triple bottom line is a broad idea that does not have a well-recognized or standardized measure. Thus, there is no objective way to quantify farm performance on these terms. Second, the method used to select farms in the study is based on the judgment from the literature review that farms that produce and sell products from annuals, perennials and animals will be able to balance a triple bottom line. This valuation is debatable. Third, the area of study, including farms in Northern California and New England, is limiting. Farms in other

regions are likely to utilize a range of strategies not captured in this study. Fourth, farms are selected based on the availability of online sources published by or about the farms. These farms must have some marketing savvy, and level of success. Diversified farms without an online presence were not selected for this study. Failing farms are not likely to have as much of an online presence. Thus, the data collected are likely skewed to represent the most successful diversified farms. Lastly, the lack of concrete economic, ecological and social data regarding the farms studied limits the strength of any support for or against their farming management practice. This lack of concrete data also complicates recommendations for the support of these farming practices by other stakeholders.

Conclusion

This thesis discusses farming practices that work to create a balance between economic, ecological and social measures, or what I refer to as the triple bottom line. I begin by introducing the issues faced in the United States related to agriculture, discussing the strengths and weaknesses of conventional agriculture in relation to triple bottom line measures. I then discuss the findings from a literature review, which searches identifying characteristics for balancing the triple bottom line through agricultural practice. I conclude that regionally based, diversified farms are the best suited to balance a triple bottom line. I contrast regionally based with conventional agriculture, which is predominantly globally based. This assessment is used to select farms for further investigation into specific agricultural management practices. Twenty-two farms were selected. Online information from websites, social media pages, videos, and newspaper articles was collected and analyzed. The findings are discussed in the second section. Agricultural practices are detailed in the first part of the section. Design, structures, equipment, soil management, planting and harvesting, and animal management strategies are discussed. Marketing practices and community partnerships are explored in the second part of the section. Processing, farm stands, other marketing venues, non-agricultural activities, public partners, and private partners are all discussed. In the final section, I discuss the findings from the farm search by analyzing how the farms measure in economic, ecological and social terms. The data suggest that economically, a diversified

farming model can be stable, though it depends on a strong regional and community based network. Ecologically, diversified farms tend to take action to improve measures by implementing creative methods, and working to quantify their efforts. Socially, diversified farms tend to build complex, locally based networks, with the intention to facilitate a cultural change, yet falling short of including certain groups.

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